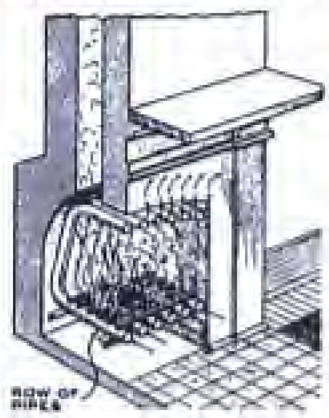
THE SURVIVOR

Volume 1 **By Kurt Saxon**

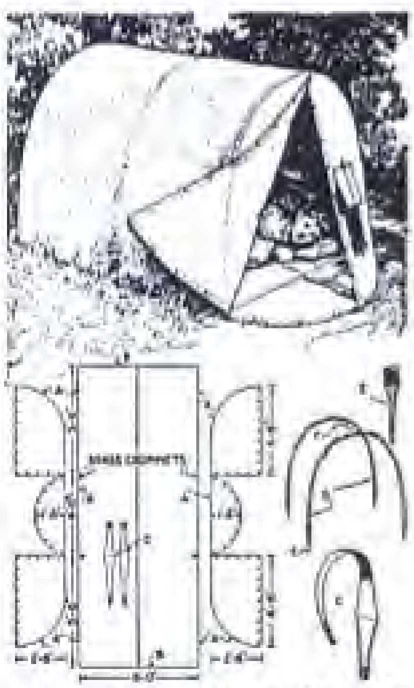
More Heat from the Grate



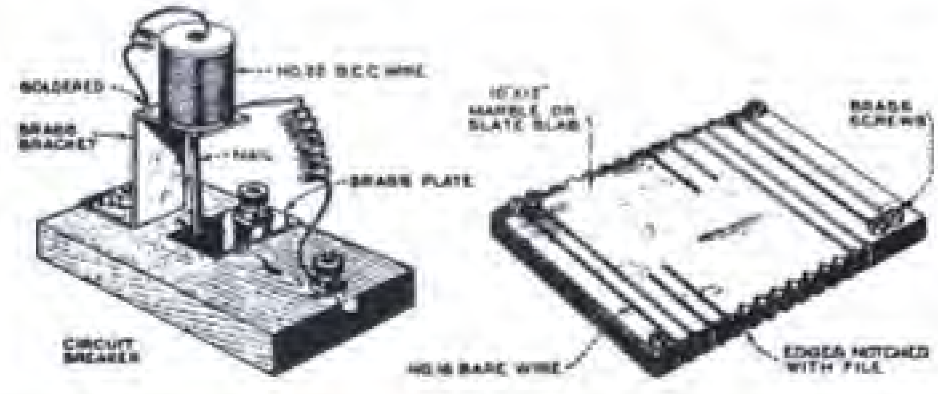
The Dish is Driven by a Small Battery Motor and Melted Sugar is Spun Out into Floss

JUST A FEW OF THE ARTICLES IN VOLUME 1

- MONEY MAKING AND SAVING FOR ALL
- TOY MAKING FOR PROFIT AND GIFTS
- MARIONETTES; COMPLETE COURSE
- CUT YOUR FOOD BILL. EAT BETTER
- THE HYGENIC COOKBOOK (1874)
- SOYBEANS FOR SURVIVAL
- RELOCATING. PLAN YOUR MOVE
- BAKING BREAD. ANYONE CAN
- SPROUTING SEEDS. NEVER HUNGER
- SURVIVING NUCLEAR WINTER
- GREENHOUSE, SIMPLE, PRODUCTIVE
- EARTHWORMS FOR FEED
- HOME WORKSHOP MANUAL (1930)
- MAKING A 1913 HANG-GLIDER
- BURGLAR-PROOFING YOUR HOME
- MAKING IMITATION GOLD & SILVER
- MECHANICS FOOT-POWERED COMBINATION LATHE
- SET UP YOUR OWN HOME FOUNDRY
- GLASS BLOWING AND FORMING

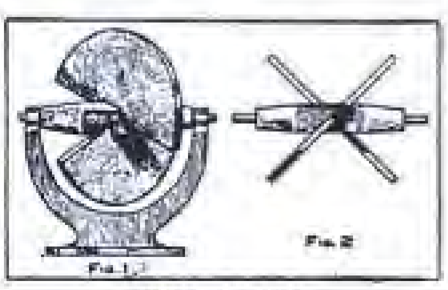


Stakes, Rope Braces, and Supporting Poles are Not Required for This Shoulder-Pack Tent, the Supports being Cut at the Camp

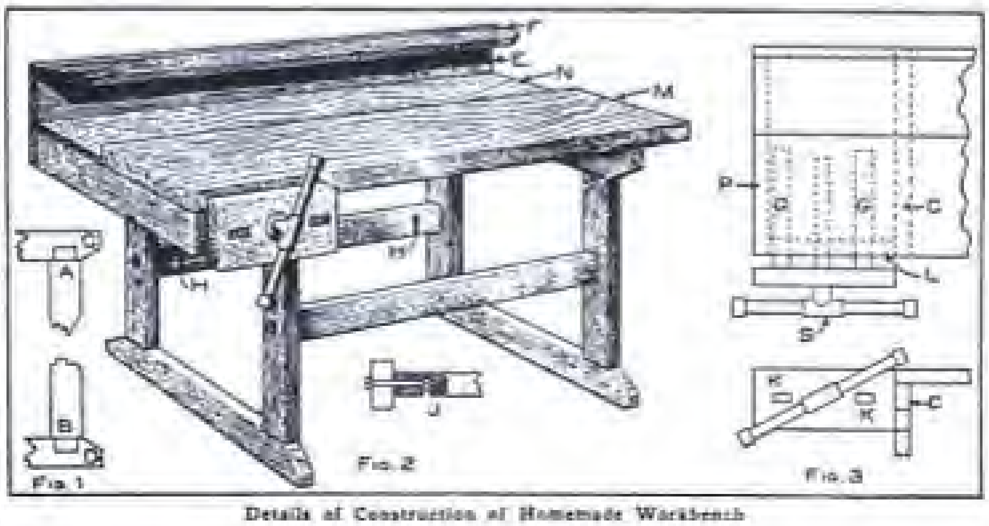


An Electric Insect Killer, Which Uses House-Lighting Current, and Has Been Found Very Effective. A Small Circuit Breaker Protects the Fuses in Case Too Much Current Flows

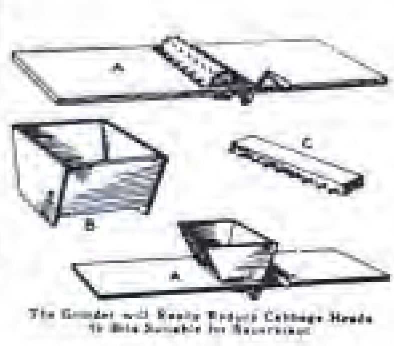
Slicer in Vegetable



Ruds in Any Wind



Details of Construction of Homemade Workbench



The Grinder will Easily Reduce Cabbage Heads to Bits Suitable for Sauerkraut

 THE SURVIVOR Vol. 1

THE SURVIVOR

Volume 1

By Kurt Saxon

How to Cut Bottles with Electricity

Popular Mechanics 1919

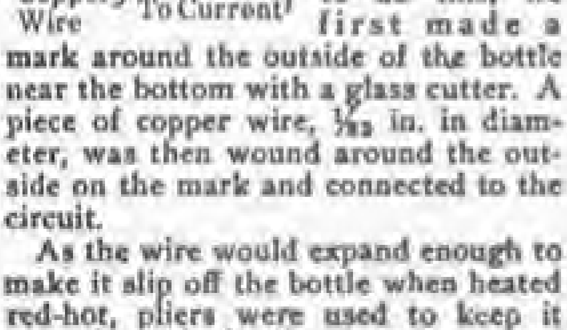
Performing an experiment in a laboratory, it became necessary to have some apparatus which we did not possess at the time. A bell jar could have been used, but this we did not have, and as a substitute we used a large glass bottle, 8 in. in diameter, with the bottom removed. In order to do this, we first made a mark around the outside of the bottle near the bottom with a glass cutter. A piece of copper wire, 1/32 in. in diameter, was then wound around the outside on the mark and connected to the circuit.

As the wire would expand enough to make it slip off the bottle when heated red-hot, pliers were used to keep it taut about the bottle when the current was turned on. A current of 110 volts and 5 amperes was run through the wire, heating it red-hot, and this cracked the glass exactly on the line marked by the glass cutter.

A Stationary Windmill

Popular Mechanics — 1913

A windmill that can be made stationary and will run regardless of the



Runs In Any Wind

Survival Is Looking After No. 1

By Kurt Saxon

Alarmists all around the country are promising disasters such as super inflation, famine, foreign invasion, the triumph of communism/fascism, nuclear war, etc. Unfortunately, they all may be right, even though their timing is wrong; we hope.

You have only to compare this year's food prices over last year's; this year's rise in the crime rate over last year's, etc. These things affect you directly. The quality of life is going down and the difficulty of maintaining a decent living standard is a greater worry to most Americans.

There are two main reasons for this which no political system can help. One is that the Age of Exploration and Development and the Industrial Revolution is over and the other is that the good crop weather, world-wide, is also over, maybe for centuries.

The Age of Exploration and Development began about 1500 and ended around 1950. From the beginning of that period the Earth was explored, mapped, annexed, developed and exploited. Its resources, animal, vegetable and mineral, were looted with little or no thought for future generations. As national industries grew to take advantage of the inpouring bounty from the hinterlands, living standards rose, enabling more people to survive and in turn to reproduce their kind. Human locusts spread over the Earth; born only to exploit, rape and destroy their own environment.

"Have more babies so we can clear more land." "Have more babies so we can mine more coal and metals." "Have more babies so we can keep the factories running." "Have more babies so we can take more territory from the hated enemy."

And then, about 25 years ago, the overall bounty ran out. Some of the natural resources became scarce a century ago. Some, like coal, may last another century. But in a general sense, the reason for existence for most of the world's population ended about 1950.

More babies are being born but there is no more land to clear. More babies are being born but mining is automated, needing little hand labor. More babies are being born but the world's factories are closing down. More babies are being born but cannon fodder, the uniformed ape, is too quickly a corpse to be worth arming. Automated killing is all the rage.

Human quality is in demand but is becoming harder to find. Human **quantity** is a drug on the market, a surplus. Governments don't create raw materials. Unions don't create jobs. So the Working Class—push, pull, lift—is increasingly without purpose. As the system breaks down, the erosion of occupations will worsen so that even specialists will be on welfare.

So with literally billions of people made surplus by the lack of easily accessable raw materials the idea of world-wide institutionalized welfare has set in. "We'll just feed them until technology creates new jobs," say the optimists.

But this is not to be. As the bounty of natural resources has run out, the world's bountiful harvests have also ended. The weather from 1930 to 1960 was excellent for crops. Unfortunately for the human race, this good crop weather was abnormal and had not occurred in the last 1000 years! Now it's over and there's no reason to believe this freakishly good weather pattern will return in our lifetimes; maybe not for hundreds of years.

Moreover, most of the agribusiness plants now grown were bred for the weather conditions from the 30s through the 60s. Bad seasons wipe them out and it would take years to replace them with the old foul-weather, low yield strains Granddad thrived on. Also, the present good-weather, high-yield plant strains depend on vast amounts of oil-based fertilizers few nations can afford today.

When bad weather hit Russia's 1973 harvests the ensuing wheat deal wiped out our surplus. Millions of acres here had been lying unused in the Soil Bank. Brought into cultivation, they have put off severe shortages here and made the effects of our own bad weather less noticeable. Without all that acreage to fall back on, Americans would be starving now.

With the world's worsening weather making increasing demands on our crops by other countries and our own weather getting worse, the end is in sight for the majority of humanity.

Of course, I haven't written this to upset you. After all, if you weren't interested in survival you wouldn't be reading this. So you aren't one of the doomed majority. You are already making plans to save yourself and your loved ones from the worst to come.

Now that you know that the game of Huddled Masses is over you can start looking out for Number One. Unlike the unprepared and the unthinking, you won't have to make the sudden choice between running away in a panic or just staying put in a totally non-survival area.

Let's say you decide to leave your present situation one year from now. You should be ready to leave before then if you have to but panic makes anyone a refugee. A year will put your survival program in its proper perspective.

If you can look at your program as simply a move to a more rural, less commercial area you've taken the panic out of it and friends and neighbors won't question your sanity or try to talk members of your family out of the move.

Naturally, this present advice is mainly for people living in major population centers. If you live in a town of 50,000 or more, it's too commercial to have much staying power after a social collapse.

Towns with under 50,000, in rural areas, have more contact with life's basics and can reorganize their populations if necessary. So a small town in a rural area is your best bet. A patch of land and a modest home just outside a village gives the greatest security. It won't cost you an arm and a leg and you'll get away from the image of the leather-clad, root grubbing savage some survivalists suggest.

A year's planning will help you find such a town and prepare to provide a service, food, craft or otherwise, which will make you an asset to the community.

You may want to get a few acres and live cut off from everyone. This is fine if you're well armed and a professional woodcrafter already. However, this is too great a change for most people. The inexperienced dreamer simply cannot survive alone.

Regardless of your choice, town, commune or small farm, you must choose an area about 100 miles from any major population center. It must also be several miles off any major highway. Refugees streaming out of New York or Los Angeles will clog the main highways and strip every home for miles each side of their route like irresistable plagues of locusts.

No matter how you might think you can steel yourself against pitiful refugees you must plan to live as far off their prospective routes as possible. This isn't as hard as you might think. More people are clogging the cities and only the intelligent ones are moving back to the land.

In succeeding issues I will concentrate on survival without savagery. You should live well while waiting out the storm. A year or less of practical study and application of a good survival program will help you to come through the worst ahead with strength and dignity.

direction of the wind is here illustrated. Mills of this kind can be built of larger size and in some localities have been used for pumping water.

Two semi-circular surfaces are secured to the axle at right angles to each other and at 45 deg. angle with that of the axle as shown in Fig. 2. This axle and wings are mounted in bearings on a solid or stationary stand or frame. By mounting a pulley on the axle with the wings it can be used to run toy machinery.

Irrigate with Tomato Cans

Popular Mechanics — 1913

The following is an easy and effective way to start plants in dry weather: Sink an ordinary tomato can, with a ⅛-in. hole ½ in. from the bottom, in the ground so that the hole will be near the roots of the plant. Tamp the dirt around both plant and can, and fill the latter with water. Keep the can filled until the plant is out of danger.

Absorbent Cotton.—Boil best quality of cotton with 5 per cent solution of caustic soda or potash for one half hour. Wash thoroughly and press out all water as far as possible, and immerse in a 5 per cent solution of chloride of lime (bleaching powder) for 15 or 20 minutes; wash with a little water, then with water acidulated with hydrochloric acid, then with water. Boil once more for 15 minutes with caustic soda solution, and wash with acidulated and plain water as before.

Acne, Treatment for.—1. Take rose water 3 oz., sulphate of zinc 1 dr.; mix. Wet the face with it, gently dry it, and touch it over with cold cream, which also gently dry off.

2. Pay strict attention to diet and habits of life, avoid rich, highly seasoned, indigestible foods, take ordinary tonics, and especially arsenic. The most efficient local application is a saturated solution of boric acid in alcohol, washing the face but once a day in warm water. Dry with a soft towel and apply the solution. This (the boric acid solution) may be applied three or four times daily. Rochelle salts in water are also a good external application.

Alaska Scenery.—Dissolve 476 gr. of lead nitrate in 1 fluid oz. of water; if the solution is turbid, filter it. Place the solution where it is intended that it shall remain, and drop into it 20 gr. of sal ammoniac, in long fibrous crystals. The result is "Alaska scenery."

Alcarrazas.—Spanish water coolers. These are made of porous earthenware, and cool water by their copious evaporation of the water, which filters through.

Compositions.—*Alcarrazas, Composition for.*—1. Sandy marl, 2 parts; brine q. s.; then knead in common salt in fine powder, 1 part. Bake the pieces slowly and lightly.

2. Good clay, 5 parts; fine siliceous sand, 3 parts; brine, q. s.; common salt, 1 to 2 parts, as before. Avoid over-firing.

HOW TO MAKE A HOUSEBOAT

Popular Mechanics 1919 By H. SIGLEY

THE houseboat shown is of the scow design, 6 ft. wide by 20 ft. long, with the cabin extending beyond the scow 1 ft. on each side. The scow tapers up at the forward end and is protected with a heavy sheet-iron plate so that the craft may be snubbed up on sandbars without danger of springing a leak, even though a submerged log be struck while running at full speed.

The power plant consists of a standard 4-hp. reversing gasoline engine which drives the paddles at their most efficient speed, 43 revolutions per minute through a 13-to-1 reduction. Cast-iron hubs, into which are inserted cold-rolled steel spokes, and wood paddles bolted to their ends constitute the propeller wheels. The cruising speed is about 4 miles an hour.

Two wide bunks, beneath which is locker space, provide sleeping accommodations for a crew of four. In the kitchen the motor and gearing are almost completely concealed under the work table. The cooking is done on a two-burner blue-flame kerosene stove, and the sink is provided with running water suitable for washing dishes, etc. This water is drawn from a 30-gal. tank on the roof, which is filled by a centrifugal pump driven from the engine shaft. A modern toilet room is installed, and an ice chest on the after deck will hold supplies and ice for a week's cruise.

The Hull of the Houseboat is Built on the Scow Type so That It can be Run in Shallow Water without Danger

An acetylene-gas lighting system is installed and is used to light both cabins and a searchlight. A heavy anchor of special design is manipulated by a windlass on the forward deck. A similar device controls the rudder.

Detail of the Anchor Windlass and Engine Gearing; Also the Deck Plan, Showing the Location of the Parts and the Arrangement of the Cabins

A GOOD MOUSE TRAP

When opening a tomato or other small can, cut the cover crossways from side to side making four triangular pieces in the top. Bend the four ends outward and remove the contents, wash clean and dry. Then bend the four ends inward, leaving a hole about ¾ inch in diameter in the center. Drop in a piece of bread or bacon and lay the can on its side and the trap is ready for use. The mouse can get in but he cannot get out.

You can safely release him in a cage, if you need a pet, or a good way from the house, by bending the ends flush with the sides of the can. He won't bite you and releasing him will do your karma good.

Almonds.—*Jordan almonds* are the finest and most agreeable, and are those ordered in the pharmacopœias. The next in quality are *Valentia almonds*, which, being excellent, and cheaper than the preceding, are commonly substituted for them in preparations. The other varieties of sweet almonds are inferior.

Bitter almonds are a variety imported from Mogadore, characterized by their bitter, nutty flavor, and possessing, when rubbed with water, the odor of peach kernels. They are chiefly used to relieve the flavor of sweet almonds, to flavor confectionery, liquors, etc. Their essential oil is used in perfumery, particularly toilet soaps. In a quantity, bitter almonds are poisonous.

Oil of almonds is obtained, by expression, from both bitter and sweet almonds, the expressed oil of each being equally bland and sweet. The essential oil of almonds is obtained from bitter almonds by distillation. It is highly poisonous.

Blanched Almonds.—Almonds from which the husk or seed coat has been removed. This is effected by soaking them in warm water until the skin can be easily removed by pressure between the thumb and forefinger. They are then peeled, rinsed in cold water, drained and dried. The last is done by either wiping them with a soft towel or by exposure to the air or sun. Unblanched almonds are scarcely ever used in preparations.

Alum, Burnt.—Heat the alum in an open vessel to 401° Fah., such as an enameled frying pan. Alum, in small pieces, one hundred and eighty-four parts. To make one hundred parts. Expose the alum for several days to a temperature of about 80° C. (176° Fah.), until it has thoroughly effloresced. Then place it in a porcelain capsule, and gradually heat it to a temperature of 200° C. (392° Fah.), being careful not to allow the heat to rise above 205° C. (401° Fah.). Continue heating at the before mentioned temperature until the mass becomes white and porous, and weighs one hundred parts. When cold, reduce it to fine powder, and preserve it in well stoppered vessels.

Alum Poultice.—Take of alum (in fine powder) 1 drachm; whites of eggs 2 in number; shake them together until they form a coagulum. Formerly much used in broken chilblains, chaps, sore nipples, chronic inflammation of the eyes, etc., applied on linen, and covered with a piece of fine muslin. This is the formula of the old Dublin Ph.; as also of the London Ph. of 1788.

Annealing.—For a small quantity, heat the steel to a cherry red in a charcoal fire, then bury it in sawdust, in an iron box, covering the sawdust with ashes. Let it stay until cold. For a larger quantity, and when it is required to be very soft, pack the steel with cast iron (lathe or planer) chips in an iron box as follows: Having at least half or three-quarters of an inch in depth of chips in the bottom of the box put in a layer of steel, then more chips to fill spaces between the steel and also the half or three-quarters of an inch space between the sides of the box and steel, then more steel; and lastly, at least one inch in depth of chips, well rammed down on top of the steel. Heat the whole to and keep at a red heat for from two to four hours. Do not disturb the box until cold.

Annealing Chains.—Get your chain to a cherry red or bright red heat (it need not remain in the furnace or fire afterwards), then bury in charcoal dust or fine ashes until thoroughly cold. Chains are generally made from "best best" iron, and are more liable to crystallization than more common iron would be, as it is purer.

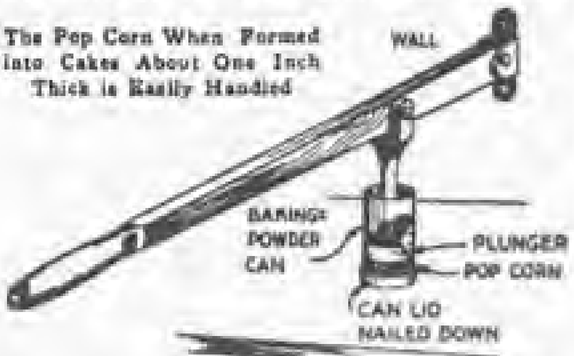
Annealing Steel.—It is now recommended as a good method of annealing steel to let it remain in the fire until red hot, as it heats more evenly, then take it from the fire and carry it to some dark place, allowing it to cool in the air until the dull red is no longer obvious in the dark, and finally cooling it off in hot water. This process is called the "water anneal."

Water Annealing.—First heat the steel to a red heat; let it lie until nearly black hot, then throw into soap suds. Steel treated in this way will be annealed softer than by putting it into the ashes of a forge.

How to Make Pop-Corn Cakes

Popular Mechanics 1919

It is very difficult to take a bite from a ball of pop corn, and it becomes more difficult as the ball increases in size.



The Pop Corn When Formed into Cakes About One Inch Thick is Easily Handled

As a large number of balls were required for a church entertainment I decided to make the pop corn into cakes. This was more easily accomplished than first imagined with the use of a cake-forming device as shown in the illustration. The body of the former was made of a baking-powder can with the bottom removed. The cover of the can was nailed to the top of an old table with its flange upward. A plunger of wood was made to fit snugly inside of the can and a lever, about 3 ft. long, attached to it and fulcrumed to the wall.

After the pop corn has been prepared with the sirup, it is placed in the can and compressed. The can is then lifted out of the cover and the pop-corn cake removed. This method offers a much better way to serve pop corn than in balls. In making the cakes, the can, cover, and plunger must be kept well covered with butter.

HOW TO MIX PLASTER OF PARIS

For the mixing of plaster of Paris, add the plaster gradually to the water. Do not stir it, just sprinkle it in until you have a creamy mass without lumps. Equal parts of plaster and water is the correct proportion. The addition of a little vinegar or water-based glue will delay its hardening. This is for items you want to mess with and add to after they would normally have hardened.

If you wish the plaster to set extra hard, then add a little potassium sulphate or powdered alum.

A HOMEMADE BLOWTORCH

Popular Mechanics 1915

The torch shown in the sketch requires no air pump. Instead of forcing a small stream of gasoline into a heated burner it converts the gasoline into gas in the chamber and blows a small jet of it through a very small hole into the combustion chamber.

A medium-sized and strong oilcan is used for the reservoir, the spout being cut off close to the screw part and a steel or brass tube, about $\frac{5}{16}$ in. in diameter, soldered to the stub end. The tube is bent as shown. A piece of wicking is drawn into the tube so that the upper end is within ¼ in. of the tube end. The end of the tube is then fitted with a piece of brass rod with a very small hole in the center. The hole is made in the following manner: Before the piece is cut from the rod, it is held in a vise and the sharp end of a scriber is carefully driven into the center. A little oil placed on the scriber point will keep it from sticking in the metal. Measure the depth of the hole and cut the rod off just above the point. File the end of the piece cut off with a fine file until the point of the hole is reached. This hole must be so small that light can be barely seen through it.

The combustion chamber is made of a piece of brass tubing driven over the end of the smaller tube on the spout. About ½ in. from the back end of the larger tube four or more holes are drilled to admit air to the gas.

Fill the can about three-fourths full of gasoline and allow time for the wick to become saturated to the upper end. Hold a lighted match to the rear of the burner, and the heat will convert the gasoline into gas which will then burn with a nice white flame about 1 in. long. The success of the torch depends altogether on the fineness of the hole in the end of the tube and the tight soldering of all the joints.

Anti-ferment.—A substance sold in the cider districts for the purpose of arresting fermentation.

1. It generally consists of sulphite of lime in powder, or a mixture of equal parts of the sulphite and powdered mustard.

2. Mix together ¼ lb. of mustard seed with 1 lb. cloves, and bruise them well without drying.

Use.—A portion of either of the above added to cider or perry tends to allay the fermentation, when it has been renewed. The second may be used for wine and beer as well as cider.

Caution.—In the above the sulphite must be employed, not the sulphate, which is quite a different article.

Aquariums.—A small and well proportioned aquarium might be about 20 in. long by 14 in. wide by 14 in. deep. Make the frame of stout tin; cut eight strips 14 in. long and four strips 20 in. long. They may all be about 1¼ in. wide; now angle them in pair of clamps, and you have the required number for the frame, i. e., four uprights at 14 in.; a piece across top and bottom at each end, 14 in.; and four pieces, 20 in., for top and bottom at sides; solder them firmly together, being careful to get the frame square. You had better strengthen the corners by angling some short pieces and soldering firmly over them; these will also hide the joints. These pieces may be fancifully cut, unless you intend to case the frame afterward. Having put the frame together, you should have a flange round the inside of the bottom part. Cut a piece of galvanized sheet iron, rather stout in substance, to fit. Bed it firmly in with red lead cement, red and white lead mixed like putty. Tack it here and there with solder to the frame. Before putting in the bottom make the holes and arrangements for fountain and waste, also runaway, and whatever you require. You may now put in the glass, 26 oz., or even 21 oz. will stand the pressure very well; but an accidental knock would be fatal. If you can use plate it will be much better. Bed it firmly in with lead, solder tabs of tin or copper close up at top and bottom. Clear away the superfluous lead, which will squeeze out between the frame and glass neatly, and let it set hard.—*Eng. Mech.*

Arbor Dianæ.—Being the materials for making a silver tree.

Directions.—Dissolve the crystals in the blue paper in a tablespoonful of water, and add the contents of the bottle to this solution and allow it to stand aside a little while, when it will form a silver tree in full growth.

Materials.—¼ dr. of silver nitrate wrapped in blue paper and 1 dr. of mercury in a small flat bottle packed in a one dozen powder box in cotton wool. Label "Poison."

Asphaltum Liquid.—1. Scio turpentine, 2 oz., melt; add asphaltum (in powder), 1 oz.; mix, cool a little and reduce with hot oil of turpentine.

2. (Wilson's.) Asphaltum, ¼ lb., melt; add of hot balsam of copaiba, 1 lb.; and when mixed thin with hot oil of turpentine. Both are used as black japan or varnish and as a glazing color by artists.

Baking Powders.—

1. Tartaric acid powder .... 8 oz.
Bicarbonate soda .... 9 oz.
Rice flour .... 10 oz.

A teaspoonful to every 1 lb. flour.

2. Bicarbonate soda .... 1 lb.
Farina .... 1 lb.
Powdered alum .... ¼ lb.
Carbonate magnesia .... ¼ oz.

Dry in oven separately. Magnesia may be put on the flour. Tartaric acid may replace the alum.

3. Bicarbonate soda .... 16 oz.
Tartaric acid .... 14 oz.
Carbonate magnesia .... 6 oz.
Farina .... 12 oz.

Rub through a sieve.

4. Bicarbonate soda .... 16 oz.
Dry tartaric acid .... 8 oz.
Rice flour .... 12 oz.

5. Dry carbonate soda .... 8 oz.
Dry tartaric acid .... 6 oz.
Carbonate magnesia .... 2 oz.

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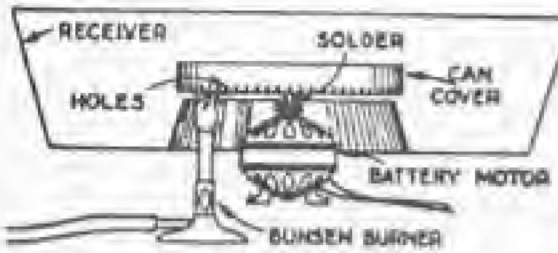
Make Up a Candy Floss Outfit

Popular Mechanics 1915

Every person is familiar with candy floss, made at stands on fair grounds, or carnivals, in an expensive whirling



The Disk is Driven by a Small Battery Motor and Melted Sugar is Spun Out into Floss

machine. It is not necessary to wait for a fair or a carnival to have a bunch of candy floss, as it can be made at home much quicker than making taffy candy.

The device for making the candy floss consists of ordinary things that can be had in any home, and usually a boy has a battery motor of some kind that will furnish the power.

Procure a tin pan, the shape of an ordinary dish pan and of medium size; cut a hole about one-half the diameter of the pan in the bottom and solder in a conical-shaped piece similar to a cake pan, allowing it to extend up inside about half the height of the pan. Fasten supports to the pan so that a Bunsen burner can be set under it where the flame will pass through the conical center opening.

Mount a small battery motor with its shaft vertical, pulley end up, and centering the conical hole, on a base, which supports the pan. Procure a can cover, similar to that used on coffee cans, and fasten it with solder to the pulley on the motor shaft, being careful to locate it centrally so that it will run smoothly.

Close to the bottom and in the rim of the can cover, make a number of small holes with a prickpunch, or other sharp-pointed tool. Wire the motor to the battery, and the candy-floss machine is ready for use.

Light the burner, start the motor, and pour a little granulated sugar in the revolving can cover. As the sugar is melted, it will be spun out in floss form through the small holes into the pan receiver.

The only thing lacking in these simple instructions for making candy floss is a paper holder for the floss. The illustration shows the boy holding the floss on a paper. This might be good enough in the home but if you are working an outdoor gathering you'll need something more substantial.

Paper cones for collecting and holding candy floss are manufactured and sold to fair concessions. I don't have a source at this time but it's just as well that you know how to make them yourself.

First buy a package of 8½x11 typing paper from the dime store. Then cut it lengthwise down the middle.

Next, take Elmer's Glue-All and spot it down one side. Then bend the lower opposite edge and just roll until the paper meets the glue and then smooth the cone so it's tidy.

You can make a couple hundred an hour.

After they are well dried nest them one in another and put them all in the oven. Bake them at 250 degrees for about 15 minutes. This will kill all the germs which will be on the cones even if you washed your hands before making them.

After 15 minutes in the oven, store them in plastic bags. Let the customers see them stored in the plastic while you are working so you will have their confidence.

To use, just stick the large end of the cone in the whirling floss and gather a large mass on its outside.

Most candy floss is colored. To color yours, simply have an eye dropper and some small bottles of cake coloring. Occasionally put a few drops of coloring in the whirling lid and you'll have an interested audience watching the different combinations of colors. Of course, you can use just one color if you like.

Turmeric powder................. 1 oz.

The soda and acid are properly dried before mixing, or the powder spoils by keeping. Preserve in stoppered bottles.

Barometer-, Paper.—1. Copper chloride, 1 part; nickel oxide, 3 parts; cobalt chloride, 4 parts; gelatine, 20 parts; distilled water, 200 parts.

2. Cobalt chloride, 1 part; gelatine, 10 parts; distilled water, 100 parts.

3. Copper chloride, 1 part; gelatine, 10 parts; water, 100 parts.

Paper saturated with 1 becomes green in dry weather; with 2, blue; with 3, yellow. In wet weather the papers are colorless.—*National Druggist.*

Beef, to Corn.—There are many recipes. We give one. To each gallon of water add 1½ lb. salt, ½ lb. sugar, ½ oz. saltpeter, and ½ oz. potash. Boil, skim, and when cold pour over the meat.

Beef Tea.—*Bouillon, for Dispensing.*—Concentrated extract of beef, 12 oz.; table salt, 3 oz.; essence or tincture of celery, 1½ oz. or 3 oz. respectively; powdered arrow-root, 1½ oz.; essence of orange or lemon, 1½ oz.; hot water, 3 pts.; if desired about 1½ dr. of tincture of capsicum may be added. Dissolve the extract of beef, arrow-root and salt in hot water; the other ingredients may then be added. Only a small quantity should be prepared at a time.

Beef, Iron and Wine.—Liebig's extract of beef ½ oz. av., ammonio-citrate of iron 256 gr., spirit of orange ½ fl. oz., distilled water 1½ fl. oz., sherry wine sufficient to make 16 fl. oz. Dissolve the ammonio-citrate of iron in the water, dissolve the extract of beef in the sherry wine, add the spirit of orange and mix the solutions.

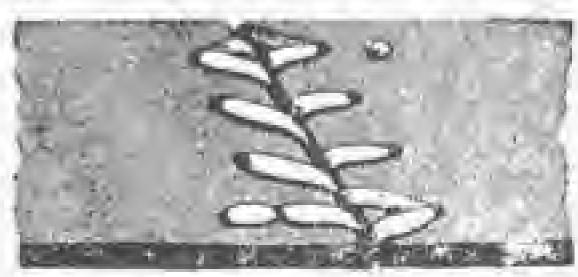
Beef, Iron and Wine for Soda Fountains.—Beef, iron and wine, 1 oz.; vanilla sirup, 3 oz.

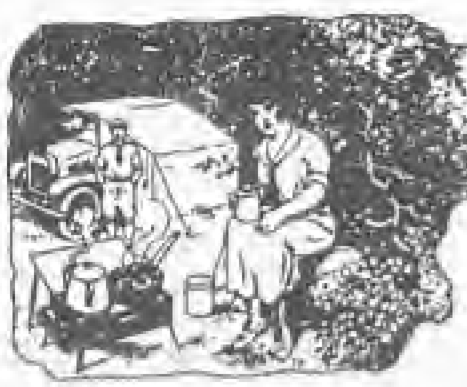
For Dispensing.—For 2 qts.: concentrated extract of beef, 2 oz.; pyrophosphate iron, ½ gr. (dissolve in ½ pt. boiling water). Add tincture curacoa, 2 oz.; tincture orange peel, 2 oz.; sirup, 12½ oz.; alcohol, 12½ oz.; solution citrate of ammonia, 2 oz.; sherry wine, 21 oz.

Bees.—1. Bees never attack when their stomachs are filled with honey or other liquid sweet. This is their normal condition when swarming, and therefore they are then harmless and also when returning laden to their hives. 2. Neither do they attack when thoroughly frightened. We frighten bees by blowing smoke among them, or by rapping rather violently on their hives. 3. When bees are alarmed in a hive by smoke or concussion, their first impulse is to fill their honey bags from their combs. 4. Bees in a hive that is constantly being rapped against will in a few minutes rush boldly out from among their combs into any empty skep or box set over them.

Belts, to Lace.

A correspondent in the *Scientific American* says: I send you a sample of belt lacing which I am using in my factory. It is far superior to any other way of lacing. It runs smoother on small pulleys, as it bends to fit them. To lace it, commence in middle or either side. If in





TOURING IN THE AUTO

By JAMES TATE

Popular Mechanics – 1925

The Land Cruiser

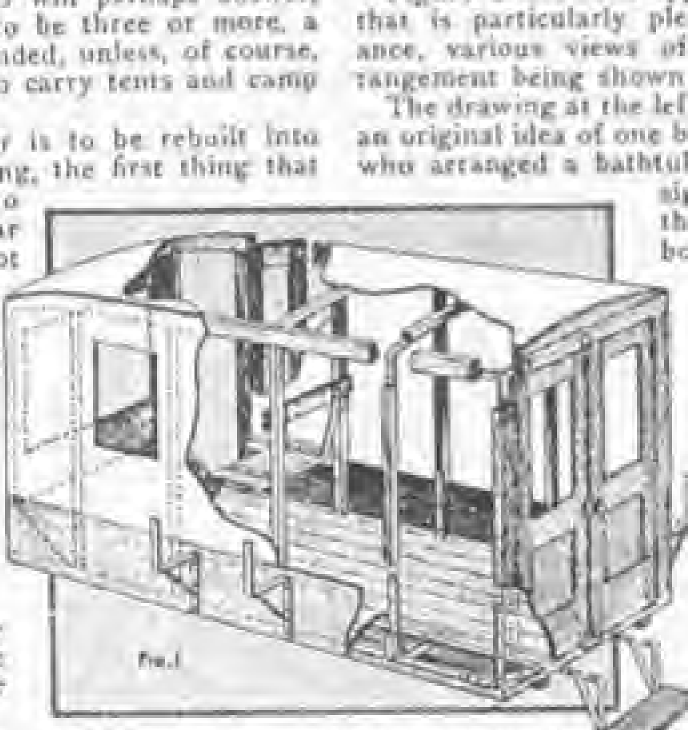
SINCE there are so many ways in which an automobile can be converted to touring purposes, and so many ideas of personal comfort and convenience to be taken into consideration, it is manifestly impossible to lay down any set rules and regulations for construction and arrangement. Much depends upon the size of the party that is making the trip; if there are not more than two, a touring-car chassis will perhaps answer, but if there are to be three or more, a truck is recommended, unless, of course, the party wants to carry tents and camp out literally.

If a touring car is to be rebuilt into a traveling dwelling, the first thing that must be done is to strengthen the rear spring, if it is not already stiff enough, to support the additional weight of the new body, without letting it down against the axle every time the car goes over a bump in the road, and it may also be necessary to lengthen the frame by one or two feet.

Next will come the construction of a body and here the builder gets his first opportunity to exercise his originality and ingenuity in devising new features that will add to his comfort on the road. Figure 1 illustrates a type of body that is easily built. It will be noticed that all corners are secured with body irons of various kinds and, if the owner is also the builder, he can have these made by "the village blacksmith" or buy them ready-made. Hardwood should be used throughout and the sides covered with plywood or heavy wallboard suitably waterproofed. Unless the owner is an experienced "hand" and has considerable skill, it would perhaps be better and ultimately more economical, to have the work done by a professional body builder. Also, for use on a popular make of light car, ready-made bodies for both passenger and truck chassis can be bought.

Figure 2 shows a type of automobile that is particularly pleasing in appearance, various views of its interior arrangement being shown below.

The drawing at the left, Fig. 3, shows an original idea of one bath-loving tourist who arranged a bathtub of his own designing underneath the floor of the body. During the daytime, and when not in use, the tub served to hold the "crew's" bedding and similar articles.



The Method of Framing the Car Body Is Here Illustrated. The Luggage Carriers Are Necessary for the Body Shown in Figure 6

At the rear of the car are tanks for water, and fuel for the stove used for cooking, as shown in Fig. 4. These tanks are placed in the corner on suitable brackets and held in place with straps, the space between them being taken up by a locker for toilet materials, or it may be used as a storage for cooking utensils. An alternative arrangement, by means of which a larger quantity of water could be carried, would be to mount a single tank horizontally in the corner against the roof; then again, the tank might be mounted on the outside, above or below the car.

It might here be mentioned that the presence of a door at the rear of the car will influence the interior arrangement.

Another view of the convenient interior of this car is given in Fig. 5; this shows the combination table and cupboard, locker, and stove. When not in use, the table serves as a door for the cupboard, and is raised to the position shown by the dotted lines when in use. The locker, which extends beyond the cupboard, serves as a support for the bed when it is opened out, as shown in Fig. 6, and, like everything else, this idea will immediately suggest variations of design and arrangement. The bed may be one of those folding ones best known as a "sanitary couch," fitted with wooden ends and suitably fastened to the body.

A more complete view of the interior

middle divide the string into equal lengths: if on edge, same as sketch, by fastening one end and running across and back. You will readily see its advantages. I suggest it so others may be benefited.

Bones, to Utilize.—The following plan has been suggested for utilizing bones: Place them in a large kettle filled with ashes, with about 1 peck of lime to 1 barrel of bones. Cover with water and boil. After twenty-four hours nearly all the bones will be soft enough to be pulverized by hand. The rest may have to be boiled ten or twelve hours longer. When pulverized they will be in the form of paste, and suitable to mix with other manure.

Calcium Sulphide, Luminous.—Calcium sulphide as used in the manufacture of luminous paint may be prepared upon the small scale by the following process: Boil for one hour 2½ oz. of caustic lime, recently prepared by calcining clean white shells at a strong red heat, with 1 oz. sulphur and 1 qt. soft water. Set aside in a covered vessel for a few days; then pour off the liquid, collect the clear orange-colored crystals which have deposited, and let them drain and dry on bibulous paper. Place the dried sulphide in a clean graphite crucible provided with a cover. Heat for one-half hour at a temperature just short of redness, then quickly for about fifteen minutes at a white heat. Remove cover and pack in clay until perfectly cold. A small quantity of pure calcium fluoride is added to the sulphide before heating it. It may be mixed with alcoholic copal varnish. Sulphides of barium and strontium also give phosphorescent powders when duly heated. Each sulphide has a predominant color, but the temperature to which it is heated has a modifying effect on the color. Calcine in a covered crucible, along with powdered charcoal, sulphate of lime, sulphate of barium, or sulphate of strontia; there is produced in each case a grayish white powder, which, after exposure to strong light (either sunlight or magnesium light), will be phosphorescent, the color depending on the sulphate used and the degree of heat employed.—*Pharmaceutical Era.*

Bread, Aerated.—Divide 3 lb. flour into two portions; mix up the first with water holding in solution 2 oz. bicarbonate of soda; then mix the second portion of flour with water to which 1 oz. of muriatic acid has been added; knead each mass of the dough thoroughly. When this is done, mix both portions together as rapidly and perfectly as possible, form the mass into loaves, and bake immediately. This bread contains no yeast, and is very wholesome. You can, if you prefer, use a baking powder such as the following:

Powdered cream tartar	20 oz.
Bicarbonate of soda	15 "
Flour	6 "

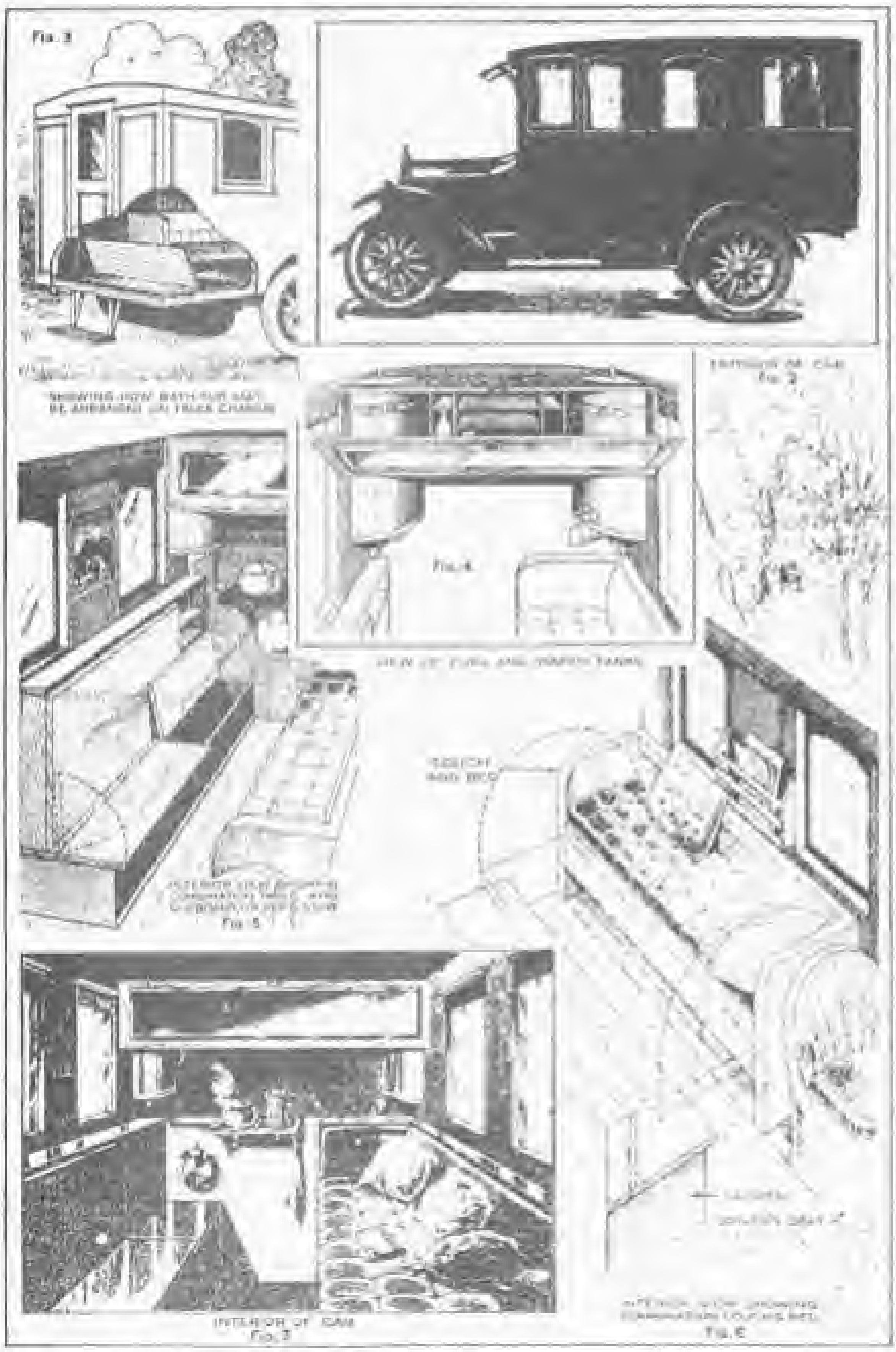
All well dried; mix thoroughly and keep dry.

Capsules.—These articles are usually prepared by dipping the bulbous extremity of a metallic rod into a strong solution of gelatine. When the rod is withdrawn it is rotated in order to diffuse the fluid jelly equally over its surface. As soon as the gelatinous film has hardened it is removed from the mould and placed on pins, furnished with suitable heads, and fixed on a cork table. When dry, the capsules are placed upright in little cells, made in the table to receive them, and the liquid with which they are to be filled is then introduced by means of a small glass tube. They are next closed by dropping some of the solution of gelatine on the orifices.

Gelatin Capsules.—Dissolve in a water bath 10 parts of gelatine; 2½ parts of sugar; 1½ parts of gum arabic in 30 parts of water. Take iron pins, the lower ends of which are pear shaped and slightly oiled, dip in this solution when it is lukewarm. When the gelatine films are congealed, detach them, and place in holes of the same size in wooden forms, to dry. The capsules are filled with the desired medicine and closed with a drop of the same solution.

Carbon Rods and Plates.—Carbon rods and plates of the finest quality can be made economically only by the use of expensive machinery and apparatus, such as pulverizing mills, hydraulic presses, and retorts or ovens; but the amateur, without a great deal of is shown in Fig. 7, which shows everything ship-shape, at it would be on the road, with the exception that the steaming pot on the "galley" range would perhaps be endangered by careless driving. This views shows how the oil stove is connected to the fuel tank. Also, like all the other ideas, the arrangement of the stove is susceptible of considerable elaboration, and shelves on either side of the stove would also add to the convenience.

An arrangement that furnishes a maximum of interior space and sleeping accommodations is afforded by a body of the type shown in Fig. 8. In this design, one or both sides are hinged to open up at the center, the lower half resting upon what during the day serves as a luggage carrier. Underneath the beds, which form comfortable seats when the sides are



Various Views of the Exterior and Interior of an Up-to-Date "Land Yacht." While the Present Arrangement Is Entirely Suggestive, It Will Be Found Very Practical and Will Afford a Maximum Amount of Space and Comfort, without Adding Too Much Weight

trouble, and with very little expense, can make carbon plates and rods which will answer a good purpose. The materials required are coke, wheat flour, molasses or sirup and water. The tools consist of a few moulds, a trowel or its equivalent for forcing the carbon mixture into flat moulds, tubes to be used as moulds for carbon rods, and ramrods for condensing the material in the tubes and forcing it out, and an iron mortar or some other device for reducing the coke to powder. Clean pieces of coke should be selected for this purpose, and such as contain no volatile matters are preferred. The coke is pulverized and passed through a fine sieve. It is then thoroughly mixed with one-sixth to one-eighth its bulk of wheat flour, both being in a dry state. The mixture is moistened with water (or water with a small percentage of molasses added) sufficiently to render it thoroughly damp throughout, but not wet. It should now be allowed to stand for two or three hours in a closed vessel, to prevent the evaporation of the water. At the end of this time the mixture may be pressed into moulds of any desired form, then removed from the moulds and dried, slowly at first, afterward rapidly, in an ordinary oven at a high temperature. When the plates or rods thus formed are thoroughly dried, they are packed in an iron box, or, if they are small, in a crucible, and completely surrounded by coke dust to exclude air and to prevent the combustion of the plates or rods during the carbonizing process. The box or crucible must be closed by a non-combustible cover and placed in a furnace or range fire in such a way as to cause it to be heated gradually to a red heat. After the box becomes heated to the required degree, it is maintained at that temperature for an hour or so, after which it is removed from the fire and allowed to cool before being opened. The rods or plates are then boiled for half an hour in thin sirup or in molasses diluted with a little water. They are again baked in an ordinary oven and afterward carbonized in the manner already described. This latter process of boiling in sirup and recarbonizing is repeated until the required density is secured. As some gases are given off during carbonization, it is necessary to leave the box or crucible unsealed to allow these gases to escape.

Catgut.—Catgut is the name applied to strings, made chiefly from the intestines of sheep, used for harp, violin, guitar and bow strings, hatters' strings, etc. It is said that the best strings are made in Naples, because the Italian sheep, from their leanness, afford the best raw material—the membranes of lean animals being tougher than those of animals in high condition. The same name is also given to a species of linen or canvas with wide interstices.

Cockroaches.—1. Borax is the best cockroach exterminator yet discovered. This troublesome insect has a peculiar aversion to it, and will never return where it has once been scattered. As the salt is perfectly harmless to human beings, it is much to be preferred for this purpose to the poisonous substances commonly used.

2. Mixture of red lead, Indian meal and molasses will be eagerly eaten by them and will soon exterminate them. Paris green, phosphorus, or arsenic are sometimes used, but are very dangerous. Borax, to which cockroaches have a great antipathy, will drive them away.

3. Scatter cucumber parings around the parts of the house troubled with these vermin.

4. Take 2 oz. carbolic acid and 2 oz. powdered camphor. Place in a bottle and let it remain until it becomes a fluid. Put the mixture with a small brush on the places where the roaches hide, which will bring them out at once. Then kill them.

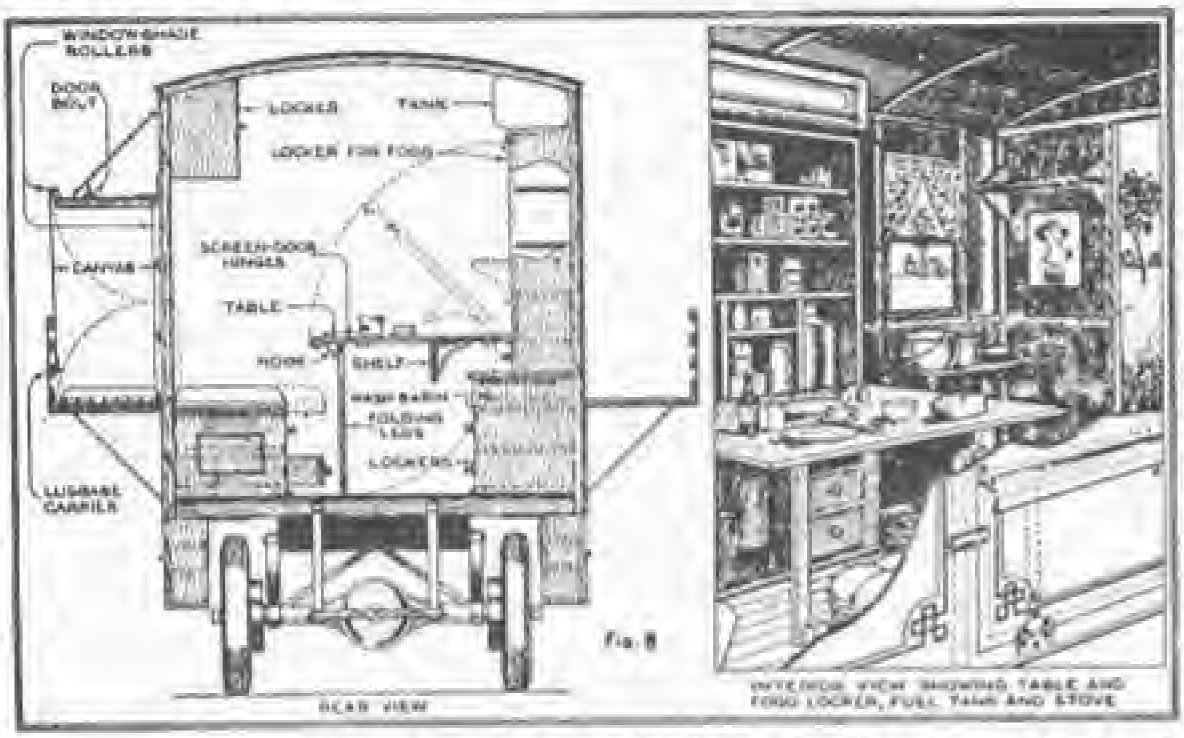
5. Borax sprinkled about the parts where they hide will effectually drive them away.

6. Corrosive sublimate sprinkled around the places which the roaches infest will kill them quickly. Be careful, however, with this substance.

5. Make a strong decoction of poke root. When the strength is extracted, remove the roots; mix the liquor with molasses, and spread it on large platters in the places they frequent. They may thus be slain by thousands. The boiled roots laid on your closet shelves will assist in keeping them away.

closed, provision is made for stowing clothing and other articles. With the sides in the open position, as shown in the drawing, roller curtains are pulled down at the side and across at the ends, to obtain the necessary privacy. Naturally, such an arrangement is more suitable for use in warmer parts of the country, although by altering the sleeping arrangements slightly, it could be used with equal satisfaction in any latitude and in any season.

The interior view shows the arrangement of the "mess" and "galley," the door of the cupboard, or food locker, forming a table when not in use as a door. By placing the stove on top of a cupboard, or chest of drawers, additional storage place would be obtained with no sacrifice of space. The hinged sides of the car are held in their open and closed positions by means of chains and bolts respectively, as indicated. Of course, every spare bit of space can and should be utilized for the storage of clothing, food, and supplies, and the ingenious builder, while profiting from the suggestions illustrated in these two types, will doubtless be able to devise any number of additional comforts and conveniences.



An Alternative Arrangement of the "Cruiser" Body, More Suitable for Use in Warm Climates: In This, as in the Other Design, Space is Conserved as Much as Possible

GLASS-CLEANING SOLUTION

Popular Mechanics 1913

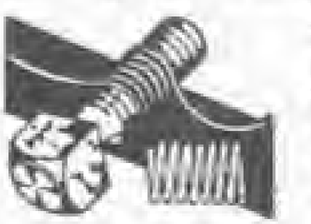
Glass tumblers, tubing and fancy bottles are hard to clean by washing them in the ordinary way, as the parts are hard to reach with the fingers or a brush. The following solution makes an excellent cleaner that will remove dirt and grease from crevices and sharp corners. To 9 parts of water add 1 part of strong sulphuric acid. The acid shpuld be added to the water slowly and not the water to the acid. Add as much bichromate of potash as the solution will dissolve. More bichromate of potash should be added as the precipitate is used in cleaning.

The chemicals can be purchased cheaply from a local drug store, and made up and kept in large bottles. The solution can be used over and over again.

Popular Mechanics 1919

Winding Coiled Springs

When a helical spring is needed badly, one can be made up quickly by winding the wire around in the threads of an ordinary bolt. An accurate spring can be formed, and the pitch between each coil will be exact for the entire length.



In removing the spring from the bolt, grasp the coil in one hand and turn the bolt with the other.

Staining Wood

A very good method of staining close grained woods is to use hydrochloric acid. The acid is put on with a plastic brush. The colors thus obtained are artistic and most beautiful and cannot be duplicated by any known pigment. The more coats applied the darker the color will be. This method has the advantage of requiring no wiping or rubbing.

Coffee, Substitutes for.—These are numerous, but the principal are the following:

1. *Rye Coffee. Dillenius' ditto. Hunt's Breakfast Powder.*—Rye roasted along with a little butter, and ground to powder. A good substitute.

2. *German Coffee. Succory ditto. Chiccory ditto.*—From succory as above. Used either for or mixed with foreign coffee. The most common adulteration of the latter.

3. *Rice Coffee.*—From rice, as above. A good substitute.

4. *Currant Coffee.*—From the seeds washed out of the cake left in making currant wine.

5. *Gooseberry Coffee.*—From gooseberry seeds, as the last.

6. *Holly Coffee.*—From the berries.

7. *Egyptian Coffee.*—From chickpeas.

8. *Rostin Coffee.*—From fenugreek seeds, moistened with lemon juice.

9. *[illegible] Coffee.*—From the seeds of the knee holly.

10. *Sassafras Coffee.*—From the fruit or nut of the sassafras tree, or from the wood cut into chips. Very wholesome. Much recommended in skin diseases, etc.

11. *Raspings.*—The raspings of the crust of loaves procured at the baker's. Equal to rye coffee.

12. *Beechmast Coffee.*—From beechmast or nuts. Very wholesome.

13. *Acorn Coffee.*—From acorns, deprived of their shells, husked, dried, and roasted. A good substitute.

14. *Beet Root Coffee.*—From the yellow beet root, sliced, dried in a kiln or oven, and ground with a little foreign coffee. A good substitute.

15. *Bean Coffee.*—Horse beans roasted along with a little honey or sugar. When removed from the fire a small quantity of cassia buds is frequently added, and the whole is stirred until cold. Said to be a good substitute.

16. *Almond Coffee.*—Rye or wheat roasted along with a few almonds. A very small quantity of cassia buds improves it. A good substitute.

Copper Powder.—Copper powder used in making amalgams is prepared as follows: Mix equal parts of a saturated solution of copper sulphate with hydrochloric acid, in this place a strip of sheet zinc, the copper is thrown in fine powder; this is washed with alcohol and dried as quickly as possible.

Coral, Artificial.—To 2 drm. vermilion add 1 oz. resin, and melt them together. Have ready the branches or twigs peeled and dried, and paint them over with this mixture while hot. The twigs being covered, hold them over a gentle fire; turn them round till they are perfectly smooth. White coral may also be made with white lead, and black with lampblack mixed with resin.

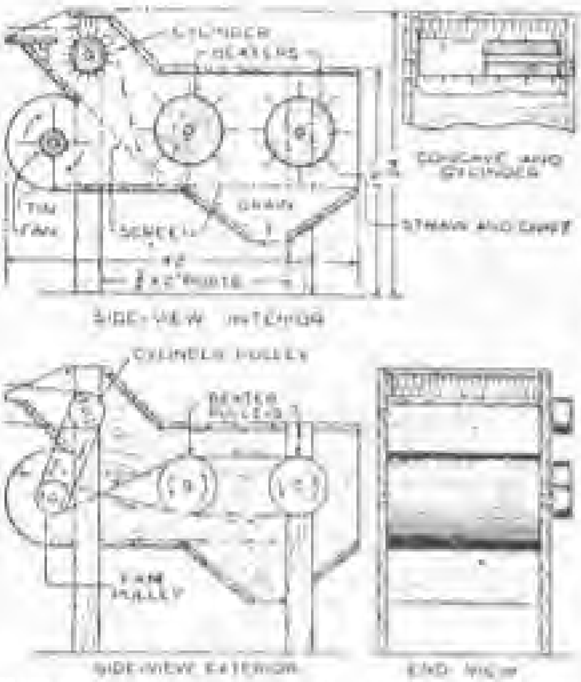
Corn, to Can.—Among fruits, etc., green corn is one of the most difficult to preserve by canning. The following is the method in use by many of the large canning establishments. The corn, after removing from the cob, is filled into the clean cans so as to leave no air spaces. These are placed in a large oven, or other airtight vessel, and subjected to hot steam under pressure. The harder the corn, the longer the exposure required to cure it; it is said that in some cases as much as eight hours is requisite, but usually much less than this. A large vessel of boiling water, in which the cans are immersed, may be used instead of the steam oven, but is not so effective. On removal from the oven or water bath, as the case may be, each can (they must be filled to the cover with fruit) has the cap with a very small hole tapped in its center immediately soldered on. As soon thereafter as the can stops blowing, as the escape of steam and air through the vent is termed, the hole is quickly soldered. This must be done before the air begins to enter. Other fruit is cured and canned in like manner—tomatoes rarely require longer than fifteen to twenty minutes steam curing. Where the pits are left in fruit a longer time is requisite to completely destroy all fermentative germs.

Crucibles, Black Lead. Mix 3 parts graphite and 1½ parts fire clay with water into a paste, press in moulds and dry; but do not

A SMALL THRESHER OF PRACTICAL USE

Popular Mechanics — 1919

Buckwheat, oats, wheat, morning-glory seeds, and other grains and seeds, were successfully cleaned with a model



Made as a Model, This Small Thresher Proved Useful for Various Grains and Seeds

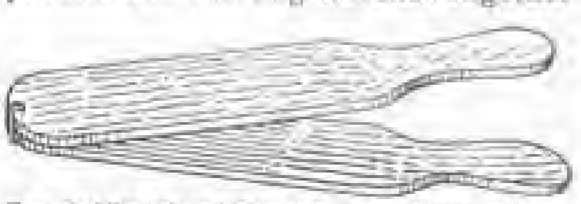
thresher of simple design which I made from materials picked up in and around the farm workshop. It is 24 in. high, 14 in. wide, and 3½ ft. long. For a cylinder, I used a roller, 3 in. in diameter and 1 ft. long. The teeth are nails driven spirally about the cylinder in rows that alternate with similar teeth in the concave, the nails being driven ½ in. apart. The fan consists of a small roller upon which four pieces of tin are nailed. The beaters are larger rollers, into which wooden teeth are set. To hold the cylinder, fan, and beaters in place, four posts and two crosspieces were used, as shown.

The power used is an 8-ft. windmill that I constructed, using a buggy wheel as the frame. The cylinder must be run at a fairly high speed, the fan nearly as fast, and the beaters may be run much slower; this is taken care of by the relative size of the pulleys. The screen between the fan and beaters must be of small mesh so that grain will not fall through into the fan chamber. The sieve through which the grain drops must be the proper size for grain, and can be varied for the different kinds of grain or seed threshed. It is better to put only the heads of grain into the thresher, as long straws twist about the rollers. The material to be threshed is fed into the cylinder in the usual manner, and takes its course as indicated by the arrows, the grain falling to the spout at the bottom, and the straw and chaff being blown out at the exhaust for it. Soft wood was used in the construction, ⅞-in. stock for the heavier pieces, and ⅜ or ½-in. stock for the other parts. The curved housing for the fan was made of tin. Leather or rope belts, fitted tightly, may be used. The power is applied on the cylinder pulley, hand or other power being suitable.—F. E. Brimmer, Dalton, N. Y.

A Lard & Fruit Presser

Popular Mechanics — 1915

A very simple but handy device for pressing out lard, juices for jelly, or fruit for marmalade, is made from two boards, each 18 in. long, 3 in. wide and ½ in. thick, formed into the shape of paddles and hinged together. The hinge is made by running a wire through holes bored in one end of the paddles and twisting the ends together



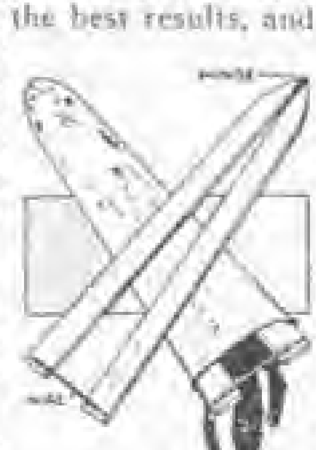
Two Paddles Hinged Together with a Piece of Wire Make a Presser for Lard and Fruits

as shown. This presser will save the hands from stains and other effects of the juices.—Contributed by Julia A. White, Glenburg, Pa.

Stretcher for Drying Small Fur Hides

Popular Mechanics — 1919

Small hides should be dried over a stretcher to give the best results, and the device shown in the sketch will be found useful for this purpose. It is made of two strips of ½-in. wood, hinged at the pointed end. Small holes are drilled into the upper surface at the other ends and adjustment is made by



means of a wire bent at the ends and inserted in the holes.—Elmer Tetzlaff, East DePere, Wis.

take hard in a kiln. This compound makes good small furnaces.

Crystal Ornament.—Ingredients: Alum, 18 oz.; water, 1 pt. Dissolve the alum in the water, boiling it in a close tinned vessel over a moderate fire, keeping it stirred with a wooden spatula until the solution is completed. When the liquor is almost cold, suspend a small basket, ears of corn, moss rose, hyacinth, or almost any vegetable specimen, by means of a small thread or twine from a lath or small stick placed horizontally across the aperture of a deep glass or earthenware jar, into which the solution is poured. The respective articles should remain in the solution twenty-four hours; when they are taken out, they are to be carefully suspended in the shade until quite dry. The whole process of crystallization is best conducted in a cool situation. When the objects to be crystallized are put into the solution while quite cold, the crystals are apt to be formed too large; on the other hand, should it be too hot, the crystals will be small in proportion. The best temperature is about 90° Fah.

Crystal Room Ornament, to Make.—Ingredients: Sulphate of alumina, sulphate of copper, sulphate of soda, sulphate of potash, sulphate of iron, sulphate of zinc, sulphate of magnesia, of each ½ oz., in separate chip boxes. Directions: Dissolve each of the salts in warm water in a separate tumbler. When dissolved, pour all together into an evaporating dish, and mix well with a glass rod. Place the dish in a warm place where it cannot be affected by dust, and where it is not liable to be agitated. When evaporation has taken place, the whole will begin to shoot out into crystals. Their color and peculiar form of crystallization will distinguish each crystal separately, and the whole together will display a very curious and pleasing appearance. Preserve carefully from dust.

Damaskeening. The figuration presented by the surface of steel and iron guns, small arms, etc., and also the plain brown or black surface of modern steel guns, is known as "damaskeening," and is produced by treatment with weak acids, which act unequally upon the different parts of the metal under treatment, the harder portions of the metal becoming covered with a thicker film of carbon than the softer portions. The color of these thin films varies from light brown to black, according to the more or less prolonged treatment with the acids. If the figuration is not sufficiently elaborate, owing to the metal not having sufficient fiber, and to the fiber being too straight and regular to produce the desired effect, it is customary for the makers of fowling pieces and other light goods to paint or stencil a pattern on the surface of the metal with the acid, and in this way the figuration can be made as effective as desired. The solutions largely used at many works are as follows:

1. For steel, sulphur, 1 oz.; tincture of steel, 1 oz.; nitric acid, 1 oz.; sulphuric acid, ¼ oz.; mercuric chloride, ½ oz.; copper sulphate, ½ oz.; spirit of nitrous ether, 1 oz.; water, 1 qt.

2. For iron, tincture of iron, ½ oz.; nitric acid, 1½ drm.; mercuric chloride, 1 drm.; copper sulphate, ½ drm.; spirits of wine, 3 drm.; water, 8 oz.

3. The solution used at Woolwich and Elswick for steel guns, etc.: Tincture of iron, 2 oz.; nitric acid, 1 oz.; copper sulphate, 1 oz.; spirit of nitrous ether, 1½ oz.; spirits of wine, 1½ oz.; water, 1 gal. This is a much better solution, works remarkably well; it is smeared over the parts, and when dry another coat is put on. This will produce a brown color; but if it is not dark enough, the operation must be repeated until the desired tint is obtained. Six coats are sufficient to make the surface black. The acid is then killed by washing with soda solution, and the surface rubbed with a hard brush or file card until smooth, after which it is rubbed with oily waste. For iron there is nothing better than mercuric chloride or antimony chloride, dissolved in water, with a little spirit of wine added to help it to dry.

Dextrine. British or starch gum. A soluble substance resembling gum, formed by the action of dilute acids at the boiling temperature, and by infusion of malt at about 160° F.

HOMEMADE ELECTRIC STOVE

By J. F. THOLL Popular Mechanics 1913

The construction of an electric stove is very simple, and it can be made by any home mechanic having a vise and hand drill. The body is made of sheet or galvanized iron, cut out and drilled as shown in Fig. 1.

Fig. 1

Each long projection represents a leg, which is bent at right angles on the center line by placing the metal in the jaws of a vise and hammering the metal over flat. If just the rim is gripped in the vise, it will give a rounding form to the lower part of the legs. The small projections are bent in to form a support for the bottom.

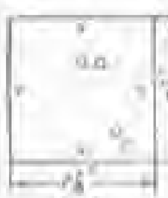


Fig. 2

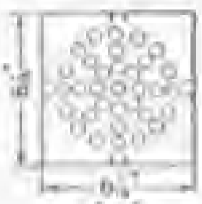


Fig. 3

The bottom consists of a square piece of metal, as shown in Fig. 2. Holes are drilled near the edges for stove bolts to fasten it to the bottom projections. Two of the larger holes are used for the ends of the coiled rod and the other two for the heating-wire terminals. The latter holes should be well insulated with porcelain or mica. The top consists of a square piece of metal drilled as shown in Fig. 3. Four small ears are turned down to hold the top in place.

One end of the coiled rod is shown

Fig. 4

in Fig. 4. This illustrates how two pins are inserted in holes, drilled at right angles, to hold the coil on the bottom plate. The coiled rod is 3/16 in. in diameter and 27 in. long. The rod is wrapped with sheet asbestos, cut in ½-in. strips.

The length of the heating wire must be determined by a test. This wire can be purchased from electrical stores. Stovepipe wire will answer the purpose when regular heating wire cannot be obtained. The wire is coiled around the asbestos-covered rod, so that no coil will be in contact with another coil. If, by trial, the coil does not heat sufficiently, cut some of it off and try again. About 9½ ft. of No. 26 gauge heating wire will be about right. The connection to an electric-lamp socket is made with ordinary flexible cord, to which is attached a screw plug for making connections.

Fig. 5

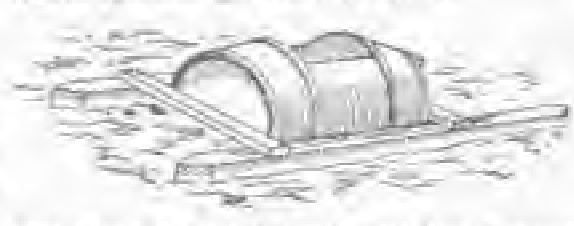
HOW TO MAKE A BARREL BOAT

Popular Mechanics – 1915

A boat that any handy boy can easily make is constructed of a barrel which is kept with the opening cut in one side up by two 4 by 6-in. timbers and two tie pieces, 2 by 4 in. The lengths of these pieces will depend on the size of the barrel.

A good watertight barrel should be selected and an opening cut in the center between the hoops, of such a size as to allow the body of the occupant room for handling an oar. The timbers are attached to the barrel with iron straps—pieces of old hoops will do. The two tie pieces are put across the timbers at the ends of the barrel and spiked in place.

The boat is to be propelled with a single, double-end paddle. There is no danger of the boat capsizing or the water splashing into the barrel.



Boat Made of a Barrel Which is Kept from Capsizing by Timbers Attached

on starch. It is also formed when potato starch is heated to 400° Fah. Used extensively in the manufacture of mucilages, etc. It resembles gum. Its name is derived from the action of its solution on polarized light; it causes the plane of polarization to deviate to the right.

Commercial dextrine, or "British gum," is obtained by heating dry potato starch to a temperature of 750° Fah. in sheet iron trays or revolving iron or copper drums, similar to those used in coffee roasting, whereby it is transformed into semi-transparent, brownish lumps, which are converted into a pale yellow powder by grinding between millstones. It is completely soluble in cold water, from which it may be precipitated by addition of excess of strong alcohol. Potato starch is generally used, but starch from other sources will answer. The best tests to ascertain its purity are to agitate briskly a few grains of the dextrine in a test tube with fifty times its weight of pure cold water; then set it aside for 10 minutes. Pure dextrine dissolves completely in cold water to a clear solution. If not all dissolved pour off the solution, add a little water to the residue, heat to boiling, let cool, and add a few drops of iodine water; a blue color indicates starch.

Dialysis.—Dialysis means effecting analysis by diffusion through porous septa. The apparatus consists of a wooden or gutta percha hoop, having a parchment bottom. It is used for the separation of all crystallizable bodies from all gelatinous bodies, etc. The substance to be analyzed is placed in the dialyzer, and floated on pure distilled water. It must be allowed to stand thus for at least twenty-four hours, when at the end of that time the crystalline substances will have passed or diffused through the parchment and dissolved in the water, leaving the gelatinous matter still in the dialyzer.

Diastase.—A peculiar substance, contained in malt, which effects the conversion of starch into dextrine and grape sugar. It may be procured from a cold infusion of malt, by adding alcohol, which precipitates it under the form of a tasteless white powder. In this state it is freely soluble in water. It appears from experiments that 1 part of diastase will convert 2,000 parts of starch into grape sugar. Malted barley is said to contain 1/500 part of this substance; yet this small portion is quite sufficient to convert the starch of the malt into sugar during the operation of mashing, provided this be properly conducted. The most favorable temperature for this conversion is 140° to 149° Fah.

Dip, Carbolic, for Stock.—Receipt for making a carbolic dip into which stock may be plunged for killing lice and mites. Use soft soap 1 gal., boil with 20 gal. of water up to a temperature of 140°, then add 1 qt. of crude carbolic acid; then cool down to 110° and dip the sheep or lambs; but for other animals, pour it along the back, so that it runs down the sides. Great care must be taken that it is applied to the brisket, under the shoulders and thighs. For the sheep scab mites the temperature should be 120°, and the scabs should be completely broken up by a corn cob.

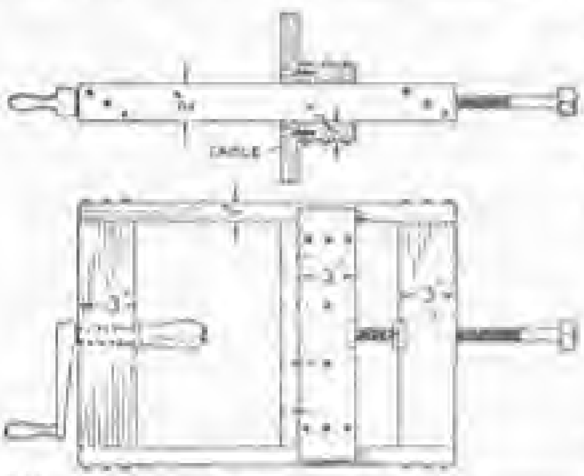
Drawings, to Trace.—If the paper upon which the tracing is to be made is soaked with benzine by means of a cotton pad, sopping it into the pores of the paper, the latter will become so transparent that the most delicate lines and tints may be seen more readily than through the finest tracing paper. Indian ink, water colors, or pencil take equally well upon paper thus treated, and [illegible] better than upon any other kind of tracing paper. Any kind of opaque drawing paper in ordinary use may be employed for this purpose, stretched in the usual manner over the drawing to be traced. The benzine rapidly evaporates, and the paper resumes its original opaque appearance without showing the slightest trace of the process to which it has been subjected. When large pictures are to be traced, the benzine should only be applied to a part of the paper at a time, in accordance with the progress of the work.

Emery.—*Emery Belts.*—Take emery or sharp sand, spread it out on an iron plate [illegible] heated to about 300° F. Apply to your straps or belts a rather thin coating of strong glue, then press it upon the heated emery or sand. Either

A HOMEMADE HAND DRILL PRESS

Popular Mechanics – 1913

The little use I had for a drill press did not make it advisable to purchase one, so I constructed a device for drilling iron and brass which answered all purposes. A broken carpenter's brace furnished the chuck, which was fastened to a ½-in. shaft having a detachable crank. The shaft turns in a



A Very Inexpensive Drill Press Frame Which Answers the Purpose Admirably

brass tube which is fitted tightly in a hole bored in the upright. The sliding part or table is forced up against the drill with a ½-in. machine bolt. The bolt turns in a square nut fastened in the opposite post. The end of the screw bears on a plate fastened on the under side of the table to prevent wear. A crank could be attached to this bolt so that it may be turned more easily.

The sliding or table part is made of a post similar to the end posts, but with guides attached so as to keep it in place. The holes for the chuck shaft and bolt should be bored on a line and exactly in the center of the posts.—Contributed by L. R. Kelley, Philadelphia, Pa.

Raising Cucumbers On a Trellis

Popular Mechanics – 1915

A novelty in cucumber culture, tried recently with great success, is as follows: As soon as the vines are about 18 in. long, stretch wire mesh 21 in. wide on poles alongside the row of plants and train the vines on the wire. The cucumbers will grow larger and the plants will require less care than when they are on the ground.

Perfume-Making Outfit

Popular Mechanics 1913

The real perfume from the flower is not always contained in the liquid purchased for perfume. The most expensive perfume can be made at home for less than 10 cents an ounce. The outfit necessary is a large bottle or glass jar with a smaller bottle to fit snugly into the open mouth of the large one. Secure a small piece of very fine sponge and wash it clean to thoroughly remove all grit and sand.

Saturate the sponge with pure olive oil, do not use strong oil, and place it inside of the smaller bottle.

Fill the large bottle or jar with flowers, such as roses, carnations, pansies, honeysuckles or any flower having a strong and sweet odor. Place the small bottle containing the sponge upside down in the large one, as shown in the illustration.

The bottle is now placed in the sun and kept there for a day and then the flowers are removed and fresh ones put in. Change the flowers each day as long as they bloom. Remove the sponge and squeeze out the oil. For each drop of oil add 2 oz. of grain alcohol. If stronger perfume is desired add only 1 oz. alcohol to each drop of oil.

Starting a Siphon

Popular Mechanics – 1915

Roll up a soft rubber hose tightly so that it will be flattened to force out all the air and drop one end into the liquid, then let the coil unwind as it falls down on the outside. The uncoiling causes a slight vacuum in the hose and the liquid follows it up and starts the flow instantly.

leather or cotton webbing may be used for the belt.

Emery, to Clean, See **Cleansing.**

Emery Cloth.—Apply a coating of thin glue and sift the powder on through a sieve. Have the emery sifted according to the fineness.

Emery Blocks.—These are prepared only on a scale which is beyond the amateur, but an excellent emery cake can be made by mixing emery powder with wax.

Emery to Fasten to Leather.—To fasten emery to leather, boil glue very thin, add a little milk, raise the pile of the leather and put on the glue with the brush. Then sprinkle on the emery and let it cool.

Emery Paste.—Mix the finest emery obtainable with a little suet.

Emery, Preparation of, for Optical Purposes.—Mix 4 lb. of flour emery with 1 oz. of powdered gum arabic, then throw the powder into 2 gal. of clean water. Collect the deposits at the end of ten, twenty, thirty seconds, etc., to sixty minutes. Use in the order of time in which they were precipitated, using the longest last.

Emery Strap.—The emery strap is made by brushing good strong glue upon the leather and quickly sprinkling the surface with flour of emery; when dry, the loose emery is brushed off. Crocus is mixed with a little oil and rubbed into the leather. Smooth on piece of glass.

Emery Wheels and Sticks.—Turn wheels from well seasoned pine, of the form desired; place emery upon an iron plate heated to 200° to 212°; coat the wheels with glue prepared as for uniting wood, and roll the wheels in the warm emery. After the glue dries, the surplus emery brushed off and another coating of glue is applied and the wheels are again rolled in the warm emery. The wheels should be allowed to become thoroughly dry before use. Prepare sticks of such forms as you may require, and coat them as directed for emery wheels, or attach to them paper by means of glue or paste.

To Make Emery Wheels.—Turn a wheel of pine, coat the wheel with good glue and roll it in emery which has been heated on an iron plate to 200° F. As one coat will not last long, several should be given.

Emery Wheels, to Remove Gloss of.—There are tools sold by the dealers in emery wheels that break up the surface or true it, when glossy or out of true. Hydrochloric or nitric acid will clean a metalized wheel. Swab the surface with the acid, let it lie fifteen to twenty seconds, and quickly wash the surface clean with water and dry.

Emery Wheels, to True.—Hold a piece of white chalk against the wheel while in motion. This will show you the high places. Then take a pick of the kind used to dress millstones, or make one of a file about five inches long, wedged in a stick like a miller's pick. Hack the chalked places and keep chalking and hacking, rubbing over with an old file each time before chalking, until the wheels true and the chalk touches all around.

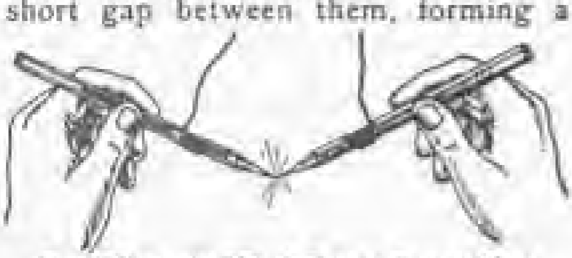
Emery Wire.—Oil the wire and sprinkle emery over it.

Engraving, Sand Blast.—Sand driven by an air blast of the pressure of 4 in. of water will completely grind or depolish the surface of glass in ten seconds. If the glass is covered by a stencil of paper or lace, or by a design drawn in any tough elastic substance, such as half dried oil, paint or gum, a picture will be engraved on the surface. Photographic copies in bichromated gelatine from delicate line engravings have been thus faithfully reproduced on glass. In photographic pictures in gelatin, taken from nature, the lights and shadows produce films of gelatin of different degrees of thickness. A carefully regulated sand blast will act upon the glass beneath these films more or less powerfully, in proportion to the thickness of the films, and the gradations of light and shade are thus produced on the glass. In the apparatus used air rises through a curved tube, carrying the sand up with it, which is thrown into the air tube by an endless belt of scoops arranged in the lower part of the angular box. The sand is carried up by the air and brought over and down the front air tube, where it discharges with great force upon the surface of the glass, which is contained within the front box and is carried by a belt gradually

FURNACE ELECTRODES OF LEAD PENCILS

Popular Mechanics – 1915

Furnace electrodes frequently consist of carbon rods, and if there is a short gap between them, forming a



Pencil Electrodes Which Furnish Intense Heat

break in the circuit, the current jumps across that gap, forming an "arc." The intense heat of the arc is used in fusing and melting metals. As large electrodes are necessary for use in furnaces where great masses of metal are melted, so small electrodes are adapted to finer or more delicate work, says Popular Electricity.

As the lead or graphite in a lead pencil is a form of carbon, it will make an excellent electrode for small work. Two ordinary lead pencils, costing only one cent each, may be used. They are first sharpened as if they were to be used for the usual purpose of writing. Then a small notch is cut in one side of each pencil, laying the lead bare at a point about 2 in. from the sharpened end.

A small copper wire is wound around the pencil and into this notch, thereby making contact with the exposed lead or graphite. By means of these small wires the pencils are connected to larger wires, which in turn are connected to a switchboard or source of electric-current supply.

At some place in the circuit there should be a resistance to prevent short-circuiting and also to control the strength of the current. As the wood sheath on the pencils offers sufficient insulation, they may be picked up, one in either hand, and no electrical effect will be felt by the person so doing. If the pointed tips are touched together, a fine little arc, not much larger than the tips of the pencils, will be formed. The temperature of this arc, however, is such that fine wires or small quantities of metal may be melted readily.

These little lead-pencil arcs may be used to fuse very small gold or silver wires, or platinum thermometers, or wires for tungsten or tantalum lamps. The bead or globule of molten metal formed on the end of a fine wire need be no longer than a small-sized grain of sand.

Waterproofing Matches

Dipping ordinary parlor matches into melted paraffin and permitting them to dry thoroughly will enable them to withstand water. The paraffin acts like a wax candle and is unaffected by the moisture. This should be of aid to campers and others who find it hard to keep matches dry.

Killing Mice & Rats

If you must kill these delightful creatures, use live yeast. They love it and it lives in their intestines, feeding on all the B vitamins in their food. This causes them to die of malnutrition in a short time. (A note to you; eat only nutritional yeast, never that to be used for baking or brewing).

Catching Insects with a Vacuum Cleaner

Moths around a front-door, or other light, are pests but can be good chicken feed. A cheap, secondhand vacuum cleaner is fitted with a funnel in its intake tube, which is hung just under the light. Moths and other insects come to the light and are sucked into the bag. Several pounds can be captured in a few hours.

A carry or drag-type vacuum can be used to debug the garden. A long extension cord will enable you to go after concentrations of aphids and whatever insects you can see. For this, you use the bare tube without the funnel. Simply pass the tube over the broad leaves and stalks and you can pick off what you don't want in your garden, leaving the goodies like ladybugs and praying mantises, etc.

It takes a little judgement and skill to get the bugs and leave the plants but you'll get the hang of it. More fragile plants have to be held in one hand while the tube is passed near the game. A pleasant hunt will save a lot of vegetables and also will add a great protein supplement to your chicken feed.

One fellow uses a vacuum cleaner to collect pollen. He sells ragweed and other hay fever type pollens to researchers. Other pollens are collected to pollinate plants not visited by bees. With the bees being killed off, this idea might become all the rage.

forward under the blast.

Face Paints, Grease Paints, Etc.—*White.*—Oxide of zinc, subnitrate of bismuth, and plumbate of alumina, of each 1 oz.; mix and make into a paste with almond oil (5 or 6 drm. required) and perfume with 12 min. of oil of peppermint, 12 grn. of camphor, and 1 drm. of bouquet essence.

Deep Bordeaux Red.—Oxide of zinc, subnitrate of bismuth, plumbate of alumina, of each 15 drm.; oil of peppermint, 12 min.; camphor, 12 grn.; carmine, 30 grn. (dissolved in 80 min. of water in ammonia); almond oil, a sufficiency. Perfume with 1½ drm. bouquet essence.

Skin Color.—Vermilion, 3 drm.; tincture of saffron, 2 drm.; powdered orris, 5 drm.; precipitated chalk and oxide of zinc, of each 20 drm.; camphor, 20 grn.; oil of peppermint, 20 min.; almond oil, a sufficiency. Perfume with bouquet essence, as in the foregoing.

Theatrical face paints are sold in sticks, and there are many varieties of color. Yellows are obtained with ocher, browns with burnt umber, and blue is made with ultramarine. These colors should in each case be levigated finely along with their own weight of equal parts of precipitated chalk and oxide of zinc and diluted with the same to the tint required, then made into sticks with mutton suet (or vaseline or paraffine, equal parts) well perfumed. By blending these colors, other tints may thus be obtained.

Fatty face powders have a small percentage of fat mixed with them in order to make the powder adhere to the skin. The following formula is taken from *Pharmaceutical Formulas*:

Dissolve 1 drm. anhydrous lanoline in 2 drm. of ether in a mortar. Add 3 drm. of light magnesia. Mix well, dry, and then add the following: French chalk, 2 oz.; powdered starch, 1½ oz.; boric acid, 1 drm.; perfume, a sufficient quantity. A good perfume is coumarin, 2 grn., and otto of rose, 2 min.

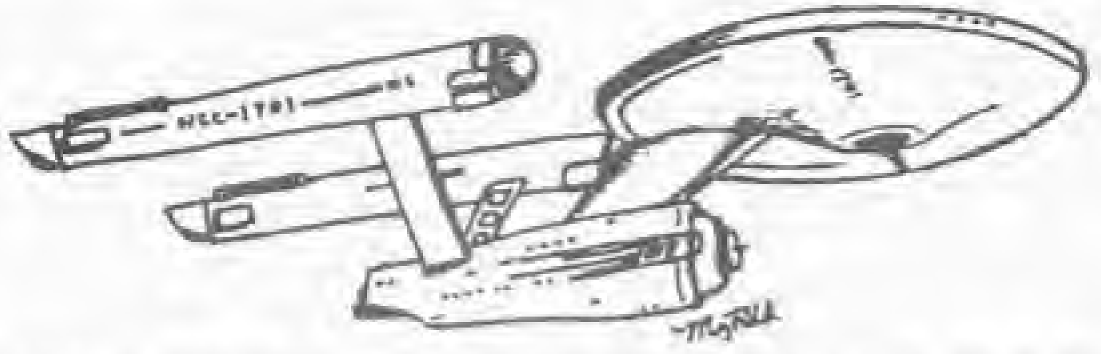
Nose Putty.—Mix 1 oz. wheat flour with 2 drm. of powdered tragacanth and tint with carmine. Take as much of the powder as necessary, knead into a stiff paste with a little water and apply to the nose, having previously painted it with spirit gum.

Nigger Black.—Beat the finest lamp-black into a stiff paste with glycerine and apply with a sponge; if necessary, add a little water to the mixture when using. Or you can make a "grease paint" as follows: Drop-black, 2 drm.; almond oil, 2 drm.; cocoanut oil, 6 drm.; oil of lemon, 5 min.; oil of neroli, 1 min.; mix.—*Formulas from The Pharmaceutical Era.*

Files, to Sharpen by Chemical Means.—Boil the files in strong soda and water to clean off all grease, oil or gum. Then dip for a few minutes in a bath of nitric acid 1 part, water 4 parts; the length of time being less on fine files, as your experience may suggest.

To Resharpen Old Files.—Wash the files in warm potash water to remove the grease and dirt, then wash in warm water and dry by heat. Put 1½ pt. warm water in a wooden vessel, put in the files, add 3 oz. blue vitriol finely powdered, 3 oz. borax. Mix well, and turn the files so that every one may come in contact with the mixture. Add 10½ oz. sulphuric acid and ½ oz. cider vinegar. Remove the files after a short time, dry, rub with olive oil, wrap in porous paper. Coarse files should be kept in the mixture for a longer time than fine ones.

Files, to Sharpen.—The files must be thoroughly cleansed in warm water containing a small quantity of potash, which readily removes all the grease and dirt. After they are thus cleansed they must be washed with warm water and dried by artificial heat. Next place 1 pt. of warm water in a wooden vessel and put in as many files as the water will cover, then add 2 oz. blue vitriol (sulphate of copper), finely pulverized, and 2 oz. borax, well mixed, taking care to turn the files over so that each may come in contact with the mixture. To the above mixture now add 7 oz. sulphuric acid and ½ oz. cider vinegar, which will cause the files to assume a red appearance at first, but they will in a short time resume their natural color. Then remove them, wash in cold water



OUR FUTURE LIES IN THE PAST

By Kurt Saxon

It is quite possible that civilizations greater than ours existed thousands of years ago on Earth. Moreover, I believe we are the descendants of people who left civilizations among the stars.

The further back you go in history the more complex and technical civilizations were. Egypt, Crete and Sumer had remnants of glories in their own past unexplained by today's scientists. Maybe ancient civilizations degenerated after cataclysmic polar shifts. Maybe they were brought down by surplus populations ignorant of their own science, technologies and the social laws of cause and effect.

What is important, however, is that whole peoples tend to forget technologies which made their ancestors great. From periods of riches and freedom, nations sink into periods of poverty and servitude. This is because they allow science and technology to pass from the intelligent and independent laymen and into the control of rulers, generals and gods.

Rulers, generals and gods have ever been the enemies of Liberty. They are always self-serving and destructive, plunging the mightiest works of superior men into ruin followed by ignorance and savagery.

Nearer our own time was Rome. Her degeneration led to the Dark Ages wherein Europeans even forgot the Earth was round.

Then let Rome serve as our example. She began with vigorous individualists who became legends even as they borrowed the legends of their own ancestors. The early Romans were small leagues of men who delegated authority only to the best among them. They kept the groups small enough so that every man could have his say and exert his will in matters of importance to himself and his family.

"And that's the way it was 200 years ago today."

Every man was conscious of and responsible for his local environment. He controlled his lifestyle and succeeded or failed depending on his own efforts along with the cooperation of his neighbors.

This simple system of strong individual responsibility applied even to the primitive agriculture of ancient Rome worked and even created a surplus. The surplus went to buy slaves so that the citizen was free to specialize. Free also were the congenitally unfit, who would have perished had there not been a surplus created by their betters and an even greater surplus created by the slaves.

As Rome developed and slaves took over most of the labor, the better citizens specialized in trade, manufacturing, etc., and soon knew nothing outside their narrow specialties. Then there were the masses of unskilled and useless rabble called "proletarians". They were useless mainly because slaves did most of the work. Also, since there was little work to measure a man by, the mental defectives and the psychotics reproduced their own kind unnoticed. Thus, in time, the citizenry of Rome was genetically devitalized past the point of no return.

Then there were the politicians. Now, a politician is a failure from birth. If a man can do anything, he settles in during his formative years either doing it or

and dry by artificial heat. When dry, sponge with olive oil, wrap in porous paper, and lay aside for use.

Filters.—*Filter, an Inexpensive.*—Use two stone pots or jars, as shown in the accompanying engraving, the bottom one being a water jar with side hole, if it can be procured; otherwise, if no faucet can be used, the top jar can be removed to enable the water to be dipped out. The top jar must have a hole drilled or broken in the bottom, and a small flowerpot saucer inverted over the hole. Then fill in a layer of sharp clean sand, rather coarse. A layer of finer sand, a layer of pulverized charcoal with dust blown out, then a layer of sand, the whole occupying one-third of the jar.

A Quick Filter.—Take a clear piece of chamois skin, free from thin places; cut it of the desired size, wash it in a weak solution of soda or any alkali to remove the grease, and rinse thoroughly in cold water before using. Tinctures, elixirs, sirups, and even mucilages are filtered rapidly. A pint of the thickest sirup will run through in four or five minutes. By washing thoroughly after each time of using it will last a long time.

Filter, Home Made.—To make a filter with a wine barrel, procure a piece of fine brass wire cloth of a size sufficient to make a partition across the barrel. Support this wire cloth with a coarser wire cloth under it and also a light frame of oak, to keep the wire cloth from sagging. Fill in upon the wire cloth about three inches in depth of clear, sharp sand, then two inches of charcoal broken finely, but no dust. Then on the charcoal four inches of clear, sharp sand. Fill up the barrel with water and draw from the bottom.

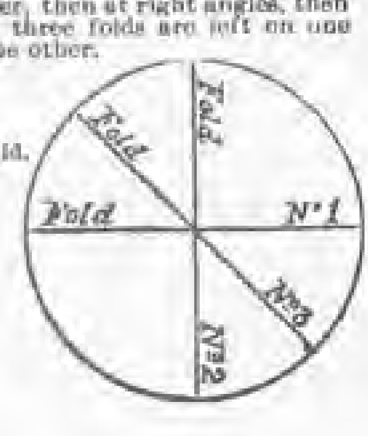
Filtering Stone.—K. Steinman, in *Tiefenfurt bei Gorlitz*, proposes filtering plates from the following mixture:

Clay	10 parts or	10 or	15
Levigated chalk	1	1	1
Glass sand, coarse	55	..	..
Glass sand, fine	..	25	65
Ground flint	..	30	5

The ingredients are mixed thoroughly in water, moulded, and hard burnt.—*Dingler's Journal.*

Filtration is the process of separating insoluble matters, precipitates, etc., by means of porous media which allow the passage of the liquids only; and is used for rendering liquids, as tinctures, etc., clear and transparent, and separating valuable precipitates. Filters are made of various substances, but those of unsized paper are well suited for all liquids that are not corrosive or viscid, and are in general use for pharmaceutical purposes. Filtration affords the best method of separating and washing precipitates. When filter papers become wet they are very tender and the liquid should be added gradually. To fold filter papers, fold first on its diameter, then at right angles, then open out so that three folds are left on one side and one on the other.

Filtration,
Fessenden's Rapid,
Fig. 1.



learning to do it. Thus, a good street sweeper is too valuable to run for office. This is left up to his inferior, who does so with a vengeance.

Roman politicians were mainly idle sons of the rich, often appointed as Army officers. If their Legionairs won a big battle for them they then got out of the Army's way and with their undeserved publicity sought and usually won political office.

With their political offices they favored the Military and the big land owners who were the agribusiness of that day. That's where the accumulated wealth and power was. The votes of the proletariat simply secured for the political pigs, their place at the public trough.

These ignorant aristocrats could better identify with the, by now, degenerate masses. They learned the language of the masses, promised them anything, gave them bread and circuses and inevitably the shaft.

They turned their sports arenas into nightmares of carnage known as gladiatorial combats. Such shows sickened vigorous foreigners but delighted the effete and worthless voters, the proletariat. The politicians competed with each other in who could put on the sickest shows; leopards raping women, lions eating children, etc. Therefore, the vilest politicians got the most votes.

The surplus population finally bankrupted the nation. Rome's barbaric neighbors, looted of their resources and crops, finally revolted and cut off Rome's supplies. So Rome came apart. The slaves left for their tribal lands. The free tradesmen and specialists, wiped out, wandered the known world looking for rich sponsors among the barbarians. The aristocrats were looted by the proletariat and the proletariat reverted to a barbarity more primitive than that of their ruined neighbors.

The Romans had libraries, teachers, philosophers. Why didn't the men of reason pull the state together? With Italy's resources used up, its croplands depleted, its Army units fighting each other as well as foreign invaders, its population an undisciplined, riotous rabble, how could reason prevail? Result? Almost a thousand years of Theocracy known as the Dark Ages.

In the U.S. machines are our slaves. Our most powerful personalities know practically nothing outside their narrow specialties, unless you count their expertise in sports events. The same goes for our corporation owned scientists. Our skilled workers are wholly dependent on a stable society with easily available energy and resources. They also know more about baseball and football than how to raise chickens. To learn how to maintain a survival homestead would be akin to treason. To doubt that the American way of life is eternal is unthinkable and altogether unpleasant.

Unemployment is rising. There are millions of first through the fourth generation welfare recipients and even thousands who are fifth generation welfare recipients. Our resources are depleted, our cropland is declining in productivity. There is drouth from the Dakotas down through Texas. California's present drouth is the worst in 72 years. Our foreign sources of supply are raising their prices and may soon refuse to sell their precious resources at any price.

Barring a nuclear war with the soon to be starving Russians, America's irreversable collapse should be apparent to anyone by 1980. By then it will be too late for city dwellers to go back to the land. All they will find will be armed Survivors treating them like the improvident, ignorant refugees they will be.

What is to prevent us from sinking into another Dark Age after the collapse of our own civilization? Given the same conditions as Rome, our savagery seems inevitable.

But we have an accelerating back to the land movement and the Romans didn't. Our Survivors know the extent of the collapse and can prepare, whereas the Romans had no TV or international news agencies. Also, our collapse will be quick enough so that this generation will experience it. Rome's final collapse was gradual over several decades so the individual really didn't know which way to jump until it was too late.

Had the surviving Romans reverted to the system of their vigorous and

FIG. 2.

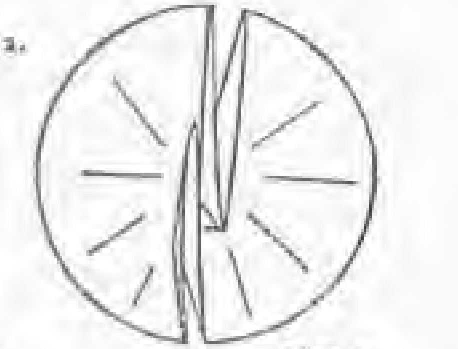
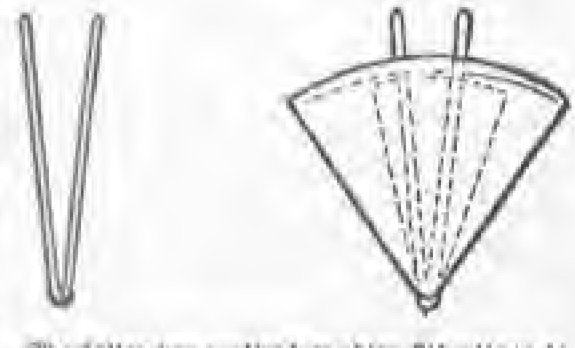


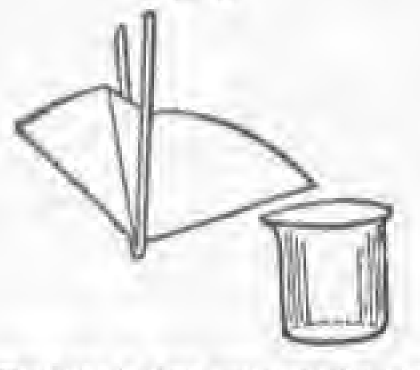
FIG. 3. FIG. 4.



The following method enables filtrations to be made very rapidly, and in such a manner that the precipitate can be readily removed. Use prepared filter paper only.

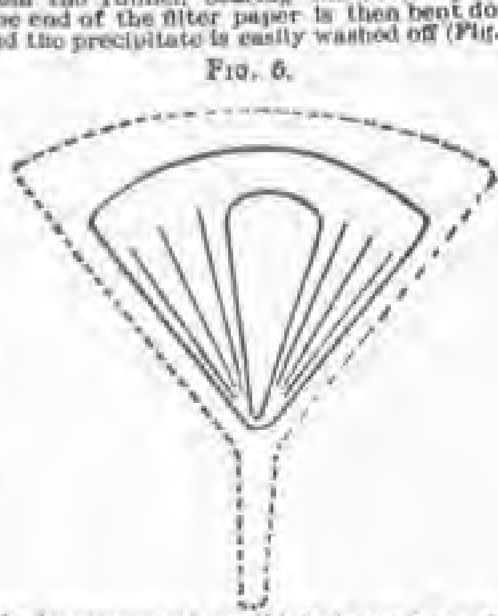
The filter paper is folded three times; folds Nos. 1 and 2 are toward the reader, No. 3 from him. The filter is then gathered (Fig. 2) and a piece of glass rod, bent at a very acute angle inserted in the cleft of the filter (Figs. 3 and 4), thus giving a filtration surface of nearly four times the usual one.

FIG. 5.



The filtration being complete, the glass rod is grasped by the projecting ends and lifted from the funnel, bearing the filter upon it. One end of the filter paper is then bent down and the precipitate is easily washed off (Fig. 5).

FIG. 6.



An improvement on this is to use instead of the glass rod a plate of glass (Fig. 6) ribbed on both sides. This renders the filtration very rapid indeed.—*Chem. News.*

creative ancestors, they could have built upon the ruins and there would have been no Dark Ages. The world of Star Trek would be a reality in our time. But they didn't. We must!

We can drop out and recreate the system of our own vigorous and creative ancestors. We can start with 19th Century science before it got away from the individual craftsman and innovator and was taken over by the accumulators of wealth and power. We can take up where our own ancestors left off in the development of sun, wind and steam power. Instead of letting the oil and utility companies sell us energy we can harness our own in community life-support systems. Throughout this paper, issue by issue by issue, you will see the possibilities for independence from the bigness which has put us all in so much danger.

We can survive, maintaining our vigor and developing our independent life-support systems. By developing our ancestor's science, and keeping it in the control of laymen, we can forever reject the beauracracy and Military-Industrial Complex which shattered Rome and is swamping Western Civilization.

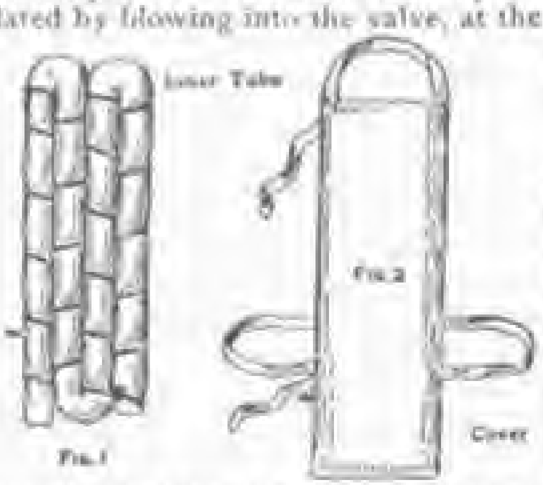
The world's cities will perish but there need not be another Dark Age. Instead, we can go from our Survival Homesteads on to the stars.

HOMEMADE LIFE PRESERVER

Popular Mechanics 1918

Procure an inner tube of a bicycle tire, the closed-end kind, and fold it in four alternate sections, as shown in Fig. 1. Cut or tear a piece of cloth into strips about ½ in. wide, and knot them together. Fasten this long strip of cloth to the folded tube and weave it alternately in and out, having each run of the cloth about 4 in. apart, until it is bound as shown in Fig. 1.

Make a case of canvas that will snugly fit the folded tube when inflated. The straps that hold the preserver to the body may be made of old suspender straps. They are sewed to the case at one end and fastened at the other with clasps such as used on overall straps. The tube can be easily inflated by blowing into the valve, at the same time holding the valve stem down with the teeth. The finished preserver is shown in Fig. 2.



Eggshell Funnel

Bottles having small necks are hard to fill without spilling the liquid. A funnel cannot be used in a small opening, and pouring with a graduate glass requires a steady hand. When you do not have a graduate at hand a half egg shell with a small hole pricked in the end will serve better than a funnel.

A Bug Powder

To secure a nonpoisonous roach and bug powder mix dry 3 lb. plaster of Paris with 2 lb. of sugar, then add 1 oz. of pulverized aniseed. The addition of a little corn meal will help to draw the pests.—

Popular Mechanics — 1915

RENEWING DRY BATTERIES

Dry cell batteries, if not too far gone, can be renewed by simply boring a small hole through the composition on top of the battery by the terminal, or each terminal, and pouring some strong salt water or sal ammoniac solution into the holes. This will make the battery nearly as good as new if it is not too far gone.

Pointed End on a Hoe

Popular Mechanics — 1915

The rounding end on the ordinary hoe is useless in many instances for getting under growing plants, to cut out the weeds and to loosen up the earth. I find that shaping the hoe ends as shown in the sketch is very effective in getting up close to a plant and under spreading vines.

Fleas, on Dogs and Other Animals.— Soap water, carbolic acid in dilute alcoholic solution, flowers of sulphur either used as a powder or mixed by agitation with water containing a little glycerine; dilute solutions of sulphate of magnesia—any powder or solution containing tannin, as dried sumac, tea and Persian insect powder. These are the least objectionable exterminators. A little of the carbolic solution may be mixed in with the soap water, and this used as a wash or sprinkled in infected localities. Flowers of sulphur contain sulphurous acid, which is fatal to the insect, but it must not be used on or near colored woolen fabrics, as it is liable to injure the colors. Sulphate of magnesia solution (in water) may be used as a wash. Sumac powder, etc., give excellent results. The sulphur mixture mentioned, or carbolic acid shaken up with about 20 parts of water, and sprinkled in the cellar, will soon depopulate the coal heap.

Fleas, to Rid Cellars of.—L. O. Howard recommends benzine. A safer method is to sprinkle the floor thickly with quicklime, or a good size bundle of fresh pennyroyal scattered over the floor will drive them out. If fresh pennyroyal is not obtainable get 2 oz. oil of pennyroyal, 2 oz. oil of sassafras, 4 oz. alcohol; shake together well in a bottle and spray around with an atomizer. Substitute sweet oil for alcohol, and the mixture rubbed on the hands and face will keep off mosquitoes.

Frosting of Cutlery, etc.— By etching the polished surface with acid. The articles are first heated to about [illegible]°, then a thin coat of beeswax is melted over their surface, and when this cools the design is scratched through the wax by a needle, the acid is then poured on the design, and may be prevented from falling off by a little wall of wax built around the design. Muriatic acid answers very well for etching. The time required for the operation is best found by a little practice, as the fine lines of the design take more time to etch than is required for the coarse ones. When it is decided that the etching is complete, with clean cold water thoroughly wash away all traces of acid and then with a little benzine remove the wax and polish with clean, dry chamois leather.

Fruit Juices, Preservation of.—Express the juice of any fruit; filter and pour into champagne bottles; fill them up to the bend of the necks; cork tightly and fasten the corks down with cord or wire; then put the bottles into a kettle; set them on a double sheet of coarse paper, placed on the bottom of the kettle, and pack the bottles loosely in with hay or cloths; then fill the kettle up to the necks of the bottles with cold water; place over a moderate fire and let boil for twenty minutes, then remove the kettle from the fire, allowing the bottles to remain in the kettle until the water becomes cold; then seal the corks and pack the bottles sideways in a cool, dry cellar. Prepared in this way, they will keep in a perfect state for a very long time. Fruit pulps are preserved in precisely the same way, except that they have about an ounce of finely powdered sugar added for each bottle of pulp so put up.—*Pharmaceutical [illegible].*

De Brevans, in "Manufacture of Liquors and Preserves," gives the following formulas:

Juices of Huckleberries, Barberries, Cherries, and Grapes.—Crush the fruit and pass the pulp through a horsehair sieve; crush the marc and grains and carry to the cellar. After twenty-four hours of fermentation filter and preserve. The juice of cherries is better when a mixture of black and red cherries is used.

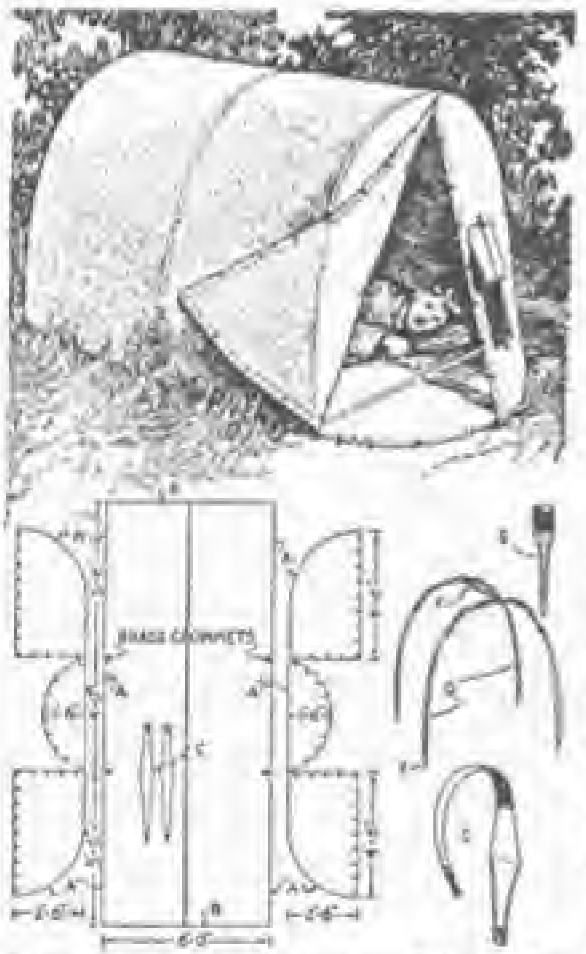
Orange and Lemon Juice.—Remove skin and seeds, crush the pulp and press, and mix with rye straw washed and cut fine, to assist the separation of the juice. Clarify by [illegible], filter, and preserve.

Quince, Pear, and Apple Juice.—Peel and rasp the fruit, taking care not to touch the seeds. Press the pulp, mixed with rye straw, washed and cut fine. Clarify by repose, filter, and preserve. The quinces should be fully ripe.

Raspberry Juice.—Crush the fruit and press the marc. The liquid is allowed to repose for one or two days, after which it is filtered. One-fifth of the weight of red cherries is sometimes added to the raspberries. Another process reported to have given excellent results is this one: The clarified juice is heated to boiling in a copper vessel and then poured into a dish. Meanwhile the bottles are provided with stop-

Homemade Shoulder-Pack Tent

AFTER sleeping under various kinds of canvas coverings and not finding any of them entirely to my liking, I made the tent shown in the illustration, which proved quite satisfactory. It is of light weight, easily set up or taken down, and when buttoned closely is practically rain, wind, and bug-proof. The cost of materials necessary for making it is comparatively slight. I use it not only as a sleeping tent but also as a carry-all in packing camping equipment. The canvas is supported by frames made of pliable branches cut in the woods.



Stakes, Rope Braces, and Supporting Poles are Not Required for This Shoulder-Pack Tent, the Supports being Cut at the Camp

The layout for the canvas is shown in the detailed drawings. The sections for the ends are made of three pieces, one for the ground and two, divided vertically, for the end covering. The ground section of the main portion of the tent and the covering are made in one piece, 6 ft. wide, joined at the middle, as shown. The adjoining edges A are sewed together and the edges B, which are set at the ridge of the tent, are sewed, after the other pieces are joined. Brass grommets are fitted in the canvas, as indicated, and the points of the supporting frames pass through them in driving the supports into the ground. The shoulder straps C are placed so that they are in position when the tent is folded, and rolled into a pack. Other equipment may be placed inside of it. The tent supports D are pointed at the ends E, and are twisted together at the top. The ridge pole F steadies them and holds the canvas at the middle.

To set up the tent, lay the canvas flat on the ground and place the supports, twisted together, through the grommets. Spring them into the ends of the canvas, and insert the ridge pole by springing it between the supports. The canvas is 8-oz. duck, and the fastenings used are snap buttons; buttonholes, buckles, or harness snaps may also be used.

MAKING A FIRE WITH THE AID OF ICE

Popular Mechanics — 1913

Take a piece of very clear ice and melt it down into the hollow of your hands so as to form a large lens. The illustration shows how this is done. With the lens-shaped ice used in the same manner as a reading glass to direct the sun's rays on paper or shavings you can start a fire.

Forming the Ice Lens

pers, and are then gradually filled, a space of about two centimeters in the neck being left empty; some alcohol is then poured upon the hot liquid, and the bottle is quickly stoppered, the cork being further secured as the liquid cools. The alcohol which evaporates into the empty space is sufficient for the preservation of the juice. The juice of fresh herbs may be preserved in the same manner. This process seems to be an entirely unobjectionable one. It is generally believed that many of the fruit juices as found in the market are usually preserved by means of antiseptics and anti-ferments, such as salicylic acid, boric acid, boroglyceride, sodium sulphite, peroxide of hydrogen, formaldehyde, etc.

Fruit to Crystallize.—The following process may meet the requirements: Make a sirup from 1 lb. of sugar and ½ pt. of water, stir until the sugar is dissolved, then boil quickly about three or four minutes. Try by dipping a little in cold water. If it forms a small ball when rolled between the thumb and finger it has attained the desired degree, known as the ball. Throw the fruit to be conserved a little at a time into this sirup, let it simmer for a moment, lift with a skimmer, draining free from all sirup. Sprinkle sugar thickly over boards or tin pans, place the fruit over it in a single layer, sprinkle over thickly with granulated sugar and place in the oven or sun to dry. When dry, make a sirup as before, and just before it reaches the ball degree add the fruit, stir with a wooden spoon until it begins to grain and sticks to the fruit. When cold, sift off the sugar and put out again to dry. When dry, place in boxes in layers between sheets of waxed paper. Keep in a cool, dry place.

Fuel, Economical.—Mix coal, charcoal, or sawdust, 1 part; sand of any kind, 2 parts; marl or clay, 1 part; in quantity as thought proper. Make the mass up wet into balls of a convenient size, and when the fire is sufficiently strong place these balls, according to their size, a little above the bar, and they will produce a heat considerably more intense than common fuel, and insure a saving of one-half the quantity of coals. A fire thus made up will require no stirring nor fresh fuel for ten hours.

Fulminating Powder.—*Prep.*—Niter, 3 parts; carbonate of potash, 2 parts; flowers of sulphur, 1 part; dry, and reduce them separately to fine powder, then carefully mix them. About 20 or 25 grn. slowly heated on a shovel over the fire, first fuses and becomes brown, and then explodes with a deafening report.

Furniture, to Take Bruises Out of.—Wet the part with warm water; double a piece of brown paper five or six times, soak it in warm water, and lay it on the place; apply on that a warm, but not hot, flat iron till the moisture is evaporated. If the bruise be not gone, repeat the process. After two or three applications, the dent or bruise will be raised to the surface. If the bruise be small, merely soak it with warm water, and hold a red hot iron near the surface, keeping the surface continually wet—the bruise will soon disappear.

Gelatin or **Gelatine.**—Animal jelly, obtained by the prolonged action of boiling water on the organic tissue of the bones, tendons and ligaments, the cellular tissue, the skin and the serous membranes. Glue and size are coarse varieties of gelatin, prepared from hoofs, hides, skins, etc., and isinglass is a purer kind, obtained from the air bladders or some other membranes of fish.

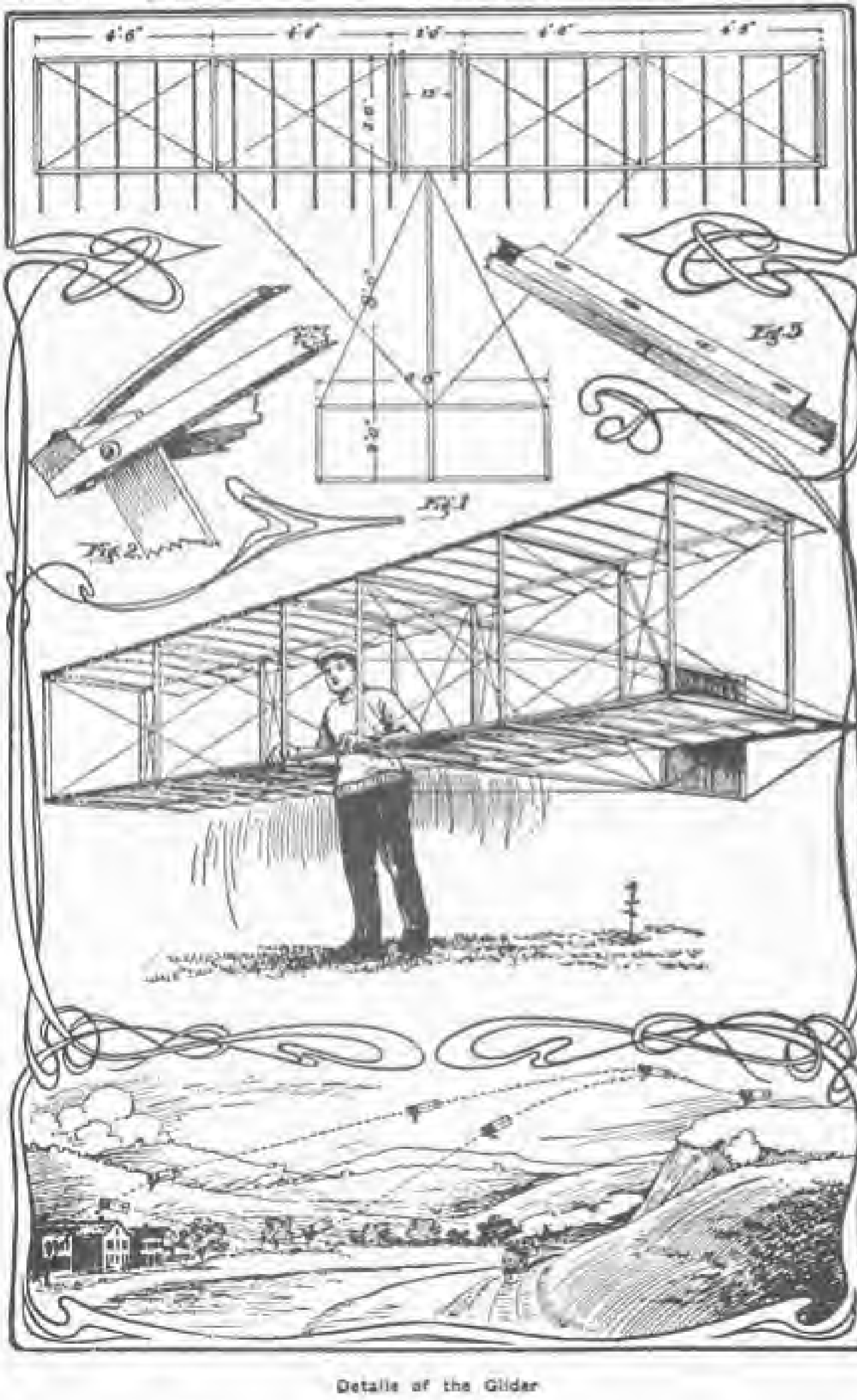
Gelatine, Bichromated.—Make a hot saturated solution of bichromate of potash in water, and in another vessel make a strong solution of gelatin. Then pour them together, stir well and allow to cool. The proportion of bichrome solution which is added varies according to the use. On exposure to the light it becomes insoluble, which is useful in many ways.

Gelatine Manufactured from Seaweed.—The seaweed, called by the native name of tengusa, is carefully washed and afterward boiled, so as to form a gluish decoction, which is strained off and put into square boxes. When cool it forms a stiff jelly, which can easily be divided into squares a foot in length. The manner in which the surplus water is removed is very in-

How to Make a Hang Glider

From Popular Mechanics 1913

A gliding machine is a motorless aeroplane, or flying-machine, propelled by gravity and designed to carry a passenger through the air from a high point to a lower point some distance away. Flying in a glider is simply coasting down hill on the air, and is the most interesting and exciting sport imaginable. The style of glider described in this article is known as the "two-sur-



Details of the Glider

geneous. The jelly prisms are exposed in the open air during a cold night and allowed to freeze. During the day the sun melts the water, which runs off, leaving behind what one might term the skeleton of white, horny substance, which is extremely light and easily dissolved in hot water; when cooled, it again forms a stiff jelly. This article can be applied to many purposes—for culinary uses, for making bonbons and jellies, for clarifying liquids, as a substitute for animal isinglass, for making moulds used by the plaster of Paris workers, for hardening the same material, in short, as a substitute for all kinds of gelatines, over which it has the advantage of producing a firmer jelly.

Gelatine Sheets.—Dissolve the glue or isinglass in water so that the solution when cold may be consistent. Pour it hot on a plate of glass (previously warmed with steam and slightly greased) fitted in a metallic frame whose edges are just as high as the water should be thick. Lay on the surface a second glass plate, also hot and greased, so as to touch every point of the gelatine while resting on the edges of the frame. By its pressure the thin cake is rendered uniform. When the glass plates have cooled, the gelatine will be solid and may be removed. It can then be cut into disks by punches, etc. It can of course be colored by adding suitable coloring material, aniline colors for instance.

Gun Cotton.

Gun Cotton.—It may be prepared in small quantities as follows: Mix 1½ oz. of pure dry nitrate of potash with 30 fl. dram. sulphuric acid, specific gravity 1.845, and, after cooling thoroughly, stir into this mixture carefully 120 grn. best carded cotton. As soon as saturation is complete, in about one minute—if proper care has been used—throw the cotton into a tubful of clean rain water, and change the water repeatedly until litmus ceases to show the presence of acid, then squeeze it in a cloth, and after being well pulled out, dry it cautiously at a temperature not exceeding 140° F. It is now explosive, and too much caution cannot be observed in handling it.

Hams, Curing. 1. Few persons understand the proper ingredients and exact proportions to make a suitable pickle for curing hams. This information will doubtless prove of value. The desideratum is to cure the meat so that it will keep in hot weather, with the use of as little salt as possible. Pickle made in the following manner, it is believed, will accomplish this:

1½ lb. salt—coarse or alum salt is best.
½ oz. saltpeter.
1 pt. molasses or 1 lb. brown sugar.
1 teaspoonful saleratus.

Let these be added to 1 gal. of water, and the amount increased in the same proportions to make the quantity required. Bring the liquor to a boil, taking care to skim just before it begins to boil. Let the pickle cool, and pour it over the meat until entirely covered. The meat should be packed in clean, tight casks, and should remain in the pickle six or seven weeks, when it will be fit to smoke. Green hickory wood is the best article for this purpose. Shoulders prepared in the same way are nearly as good as hams. This pickle is just the thing to make nice corned beef, or corned beef tongues, or any lean meat for drying.—*Valley Farmer.*

2. To 1 gal. water, take 1½ lb. salt, ½ lb. sugar, ½ oz. saltpeter, ½ oz. potash.

In this ratio the pickle can be increased to any quantity desired. Let these be boiled together until all the dirt from the sugar rises to the top, and is skimmed off. Then throw it into a tub to cool, and when cold, pour it over your beef or pork, to remain the usual time—say four or five weeks. The meat must be well covered with pickle, and should not be put down for at least two days after the killing, during which time it should be slightly sprinkled with powdered saltpeter, which removes all the surface blood, etc., leaving the meat fresh and clean. Some omit boiling the pickle, and find it to answer well, though the operation of boiling purifies the pickle by throwing off the dirt always to be found in salt and sugar.

3. Take a large cask (if possible one between 100 and 120 gal.), and after covering the bottom with salt, lay in a ham with the skin side to the

face" or "double-decked" aeroplane, and is composed of two arched cloth surfaces placed one above the other.

In building a glider the wood material used should be straight-grained spruce, free from knots. First prepare from spruce planks the following strips of wood. Four long beams ¾ in. thick, 1¼ in. wide and 20 ft. long; 12 crosspieces ¾ in. thick, ¾ in. wide and 3 ft. long; 12 uprights ½ in. thick, 1½ in. wide and 4 ft long; 41 strips for the bent ribs 3/16 in. thick, ½ in. wide and 4 ft. long; 2 arm sticks 1 in. thick, 2 in. wide and 3 ft. long; the rudder sticks ¾ in. square and 8 ft long; several strips ½ in. by ¾ in. for building the vertical and horizontal rudders. The frames for the two main surfaces should be constructed first, by bolting the crosspieces to the long beams at the places shown by the dimensions in Fig. 1. If 20-ft. lumber cannot be procured, use 10-ft. lengths and splice them, as shown in Fig. 3. All bolts used should be ¼ in. in diameter and fitted with washers on both ends. These frames formed by the crosspieces should be braced by diagonal wires as shown. All wiring is done with No. 16 piano wire.

The 41 ribs may be nailed to the main frames on the upper side by using fine flat-headed brads ⅞ in. long. These ribs are spaced 1 ft. apart and extend 1 ft. beyond the rear edges of the main frames, as shown in Fig. 1. After nailing one end of a rib to the front long beam, the rib is arched by springing down the loose end and nailing to the rear beam. The ribs should have a curve as shown in Fig. 2, the amount of curvature being the same in all the ribs.

The frames of the main surfaces are now ready to be covered with cloth. Cambric or bleached muslin should be used for the covering, which is tacked to the front edge, stretched tightly over the bent ribs and fastened securely with tacks to the rear ends of the ribs. The cloth should also be glued to the ribs for safety. In the center of the lower plane surface there should be an opening 2 ft. wide and 4 ft. long for the body of the operator. Place the two main surfaces 4 ft. apart and connect with the 12 uprights, placed in the corner of each crosspiece and beam. The uprights are fastened by bolting to the crosspieces, as shown in Fig. 2. The whole structure is made strong and rigid by bracing with diagonal wires, both laterally and longitudinally.

The vertical rudder is to keep the machine headed into the wind and is not movable. This rudder is made of cloth stretched over a light wooden frame, which is nailed to the rudder sticks connecting to the main frame. The horizontal rudder is also made of cloth stretched over a light wooden frame, and arranged to intersect the vertical rudder at its center. This rudder is held in position and strengthened by diagonal wires and guy wires. The horizontal rudder is also immovable, and its function is to prevent the machine from diving, and also to keep it steady in its flight. The rudders are fastened to the glider by the two rudder sticks, and these sticks are held rigid by diagonal wires and also by guy wires leading to the sides of the main frames as shown in Fig. 1. The two arm sticks should be spaced about 13 in. apart and bolted to the long beams in the center of the opening in the lower plane where the operator is to take his position.

The glider should be examined to see that the frame is not warped or twisted. The surfaces must be true or the machine will be hard to balance when in flight. To make a glide, take the glider to the top of a hill, get in between the arm sticks and lift the machine up until the arm sticks are under the arms as shown, run a few steps against the wind and leap from the ground. You will find that the machine has a surprising amount of lift, and if the weight of the body is in the right place you will go shooting down the hillside in free flight. The landing is made by pushing the weight of the body backwards. This will cause the glider to tip up in front, slacken speed and settle. The operator can then land safely and gently on his feet. Of course, the beginner should learn by taking short jumps, gradually increasing the distance as he gains skill and experience in balancing and landing.

The proper position of the body is slightly ahead of the center of the planes, but this must be found by experience. The machine should not be used in winds blowing faster than 15 miles an hour. Glides are always made against the wind, and the balancing is done by moving the legs. The higher the starting point the farther one may fly. Great care should be exercised in making landings, otherwise the operator might suffer a sprained ankle or

bottom, then sprinkle another layer of salt, put in another ham, etc., till the cask is full. A fluid is then made of the proportions of 3 gals. water, 4½ lb. salt, 2 lb. brown sugar, 1½ oz. saltpeter, 1 oz. saleratus. When this is skimmed, scalded, and has gotten cold, it is poured over the hams until it covers them entirely. They should remain in this pickle for from thirteen to fourteen weeks.

Hops and Hop Stalks.—In Sweden a strong cloth is manufactured from hop stalks. The stalks are gathered in autumn and soaked in water during the whole winter. The material is then dried in an oven and woven as flax. The buds of hops can be used as an esculent, and when boiled will do as a substitute for asparagus. The tendrils, when young, may be used in the same way.

Hydrogen.—By treatment of iron or zinc scrap with dilute sulphuric acid. This is the usual way on a small scale. On the larger scale it may be made by passing steam over red hot iron scrap.

Iron Surfaces, Lemon Juice on.—*The Scientific American* states that lemon juice gives an effective and elegant result when applied to cast iron surfaces. It turns the portion of polished cast iron to which it is applied to a bronze black, and when touched over with shellac varnish will absorb a sufficient amount of the varnish to preserve it. To many, lemon juice would seem to be a weak and ineffective acid for metal; but every one knows how quickly a knife blade of steel will blacken when used to cut a lemon, and the darkening of polished iron by the acid is very beautiful.

Iron, to Melt in a Moment.—Ingredient—Roll of sulphur.

Directions.—Heat a piece of iron (a poker will do) to white heat, then apply the roll of sulphur. The iron will immediately melt and run into drops. This experiment is best performed over a wash basin of water, allowing the melted iron to drop into the water.

Isinglass.—The best quality of American isinglass is made from the sounds of the hake. The crude material is collected during the summer and autumn, coming from Maine, New Brunswick, Nova Scotia, and Prince Edward's Island. The conversion of the crude material into the mercantile article takes place in winter. A low temperature is necessary in order to turn out by machinery the fine ribbons of isinglass, and ice water passes through the rolls. The total product is about 20,000 lb. Besides the use of isinglass for fining beer, etc., it is employed as a dressing or glaze for straw goods in the United States.—*Scient. Amer.*

Keys, to Fit.—When it is not convenient to take a lock apart to fit a new key, the key blank should be smoked over a candle inserted in the keyhole and pressed firmly against the opposing wards of the lock. The indentations in the smoked portion made by the wards will show where to file.

Lye, to Make Good.—Hickory ashes are the best for making common washing soft soap (when it is not desirable to use the potash lye), but those from sound beech, maple, or almost any kind of hard wood except oak will answer well. A common barrel set upon an inclined platform makes a very good leach, but one made of boards set in a trough in V shape is to be preferred, for the strength of the ashes is better obtained, and it may be taken to pieces when not in use, and laid up. First, in the bottom of the leach put a few sticks; over them spread a piece of carpet or woolen cloth, which is much better than straw; put on a few inches of ashes and from 4 to 8 qt. lime; fill with ashes, moistened, and tamp down well—tamp the firmest in the center. It is difficult to obtain the full strength of ashes in a barrel without removing them after a day's leaching, and mixing them up and replacing. The top should be first thrown off and new ashes added to make up the proper quantity. Use boiling water for second leaching. This lye should be sufficiently strong to float a potato.

Microcosmic Salt.—This salt is sodium-ammonium phosphate, with the symbol HNa NH₄ PO₄ + 4 H₂ O. To prepare, dissolve 6 parts sodium phosphate with 2 parts ammonium phosphate in hot water, and allow the solution to cool. It is used in blowpipe analysis.

perhaps a broken limb. The illustration shows two lines of flight from a hilltop, the glider travels on the upper line caused by the body of the operator taking a position a little back of the proper place, and on the lower line he changes his position from front to back while flying, which causes the dip in the line.

HOW TO MAKE A MINNOW TRAP

Popular Mechanics — 1913

Glass minnow traps that will give as good service as those purchased at the tackle store can be made without difficulty. If a trap should be banged carelessly against the side of the boat or some other obstruction and smashed, instead of spending several dollars to replace it, a half hour's time will turn out a new one just as good, says a correspondent of Outing.

A trap of this kind can be made from an ordinary fruit jar such as used in putting up preserves, either of one or two-quart capacity. A one-quart jar gives good results, but if the bait to be caught is of fairly large size, the two-quart size may be used. As the jars have the same style top they can be used interchangeably with one mouthpiece.

The mouthpiece is made of a round-neck bottle of which the glass is colorless and rather thin. If the neck of the bottle is cut at the right point, it makes a glass funnel that will just fit into the fruit jar. The funnel forms the mouth of the trap. Put the neck of the bottle into the fruit jar and mark the glass with a file where the bottle and jar meet. Make as deep a cut as possible with a file around the bottle on the mark and place two turns of a yarn string saturated in kerosene around just below the cut when the bottle is standing in an upright position. Set fire to the string and turn the bottle from side to side to distribute the heat evenly, then when the string has burned out, plunge the bottle in cold water and it will separate on the cut.

Bind some copper wire around the neck of the jar so that three ends will project ½ in. or more. These are bent down over the funnel when put into the jar, forming clamps to hold it in place. The copper wire can be bent many times in emptying or baiting the trap without breaking.

Two copper wire bands are tied tightly around the jar about 2 in. apart. They should be twisted tight with a pair of pliers and the ends joined, forming a ring for attaching a cord.

For catching "kellies" or "killies," bait the trap with crushed clams or salt-water mussels and for fresh water shiners use mincemeat or bread crumbs and do not spill any bait outside of the trap. Leave the trap down ten to fifteen minutes and when resetting it after emptying, put back one or two of the victims, as the others enter more readily if they see some of their companions ahead of them.

HOW TO MAKE BOOMERANGS

Popular Mechanics 1918

When the ice is too thin for skating and the snow is not right for skis, about the only thing to do is to stay in the house. A boomerang club will help to fill in between and also furnishes good exercise for the muscles of the arm. A boomerang can be made of a piece of well seasoned hickory plank. The plank is well steamed in a wash boiler or other large kettle and then bent to a nice curve, as shown in Fig. 1. It is held in this curve until dry, with two pieces nailed on the sides as shown.

After the piece is thoroughly dried out, remove the side pieces and cut it into sections with a saw, as shown in Fig. 2. The pieces are then dressed round. A piece of plank 12 in. wide and 2 ft. long will make six boomerangs.

To throw a boomerang, grasp it and hold the same as a club, with the hollow side away from you. Practice first at some object about 25 ft. distant, and in a short time the thrower will be able to hit the mark over 100 ft. away. Any worker in wood can turn out a great number of boomerangs cheaply.

Fig.1 Fig.2

Bending and Cutting the Wood

Mortar.—A mortar that can hardly be picked to pieces is made as follows: Mix equal parts of lime and brown sugar with water, and be sure the lime is thoroughly air slaked. The mortar is equal to Portland cement, and is of extraordinary strength.

Mortar, Impenetrable.—To make impenetrable mortar, mix thoroughly ⅓ of fresh unslaked lime with ⅔ of sand; and let 5 laborers make mortar of these ingredients, by pouring on water with trowels, to supply one mason, who must, when the materials are sufficiently mixed, apply it instantly as cement or plaster, and it will become as hard as stone. The lime used should be stone lime; previous to its use it should be preserved from the access of air or wet, and the plaster screened for some time from the sun and wind.

Mortar, to Make.—1. Mortar is composed of quicklime and sand, reduced to a paste with water. The lime ought to be pure, completely free from carbonic acid, and in the state of a very fine powder; the sand should be free from clay, partly in the state of fine sand, and partly in the of gravel; the water should be pure and if previously saturated with lime, so much the better. The best proportions are 3 parts of fine and 4 parts of coarse sand, 1 part of quicklime, recently slaked, and as little water as possible.

2. The addition of burnt bones improves mortar, by giving it tenacity and rendering it less apt to crack in drying; but they ought never to exceed ¼ of the lime employed.

3. When a little manganese is added to the mortar, it acquires the important property of hardening under water; so that it may be employed in constructing those edifices which are constantly exposed to the action of water. Limestone is often combined with manganese; in that case it becomes brown by calcination.

Khorassan or Turkish Mortar.—One part powdered brick and tiles, 2 parts fine sifted lime. Mix with water to the desired consistency, put on layers of 5 or 6 inches in thickness, between the courses of brick and stone. This mortar is used where great solidity is required in buildings.

Mortar, Waterproof.—Instead of slaking in the usual manner use a solution of copperas dissolved in warm water and use only fine quartz sand.

Mosquitoes.—1. To clear a room of mosquitoes, take a small piece of gum camphor in a tin vessel and evaporate it over a flame, taking care it does not ignite. A sponge dipped in camphorated spirits and made fast to the top of the bedstead will be found serviceable in the sleeping room. Decoction of pennyroyal, applied to the exposed parts, will effectually keep off these troublesome insects.—*American Pharmacist.*

2. A small amount of pennyroyal sprinkled around the room will drive away mosquitoes.

3. Burning a small quantity of Persian insect powder in a room is said to be efficient in driving away mosquitoes.

Mosquito and Gnat Bites.—Carbonate of lime, 10 grm.; water, 1 drm. It is said that a weak solution of carbolic acid—1 part in 50—used as a wash, will prevent their attacks.

To alleviate the unpleasant sensation caused by the bite of the mosquito, various remedies have been suggested. Among them are oil of cloves, ammonia, bicarbonate of soda, chloroform, thymol and ordinary soap. Doctors say, we have in our own experience obtained more relief from solution of cocaine, 4%, than from anything else.

Mosquito Oil:

Oil of tar	1	oz.
Olive oil	1	oz.
Oil of pennyroyal	½	oz.
Spirit of camphor	½	oz.
Glycerine	½	oz.
Carbolic acid	2	drm.

Mix. Shake well before using.

Nails, Memoranda Concerning.—This table will show at a glance the length of the various sizes, and the number of nails in a pound. They are rated from "3-penny" up to "20-penny." The first column gives the name, the second the length in inches, and the third the number per pound:

3-penny.	1 in. long.	557 per lb.
4-penny.	1¼ in. long.	353 per lb.
5-penny.	1¾ in. long.	232 per lb.

SECRETS OF WISE MEN, CHEMISTS

Making Imitation Gold and Silver

About 1965 I noticed the money freaks began coming out of the woodwork. They said paper money was no good and only silver and gold had any value and should be hoarded.

There's no arguing with these people because they're just right enough to make sense to themselves. Most of us know that paper money is backed by a Liberal psychotic's dream. It's a fraud and the more people realize it, the less you can buy with it.

But as long as there is some agreement as to the value which will be placed on paper money it is still more convenient than exchanging metal. Gold and silver prices fluctuate wildly and their value will be stated in paper dollars until there is no longer any agreement on a paper money value. When that time comes the Survivor will trade by barter only.

When there is no more trust in paper money who will re-establish the value of gold and silver? The same people who said paper money is good for you? The government economists, bankers, the strictly commercial manipulators who run conglomerates and would be hard-put to tell you what their factories produce? When they are gone, their standards will go with them, as far as I'm concerned.

I believe that Survivors will quickly come to agreements on the value of the products of their farms, hands and minds. For convenience, intricately made, vari-colored glass coins could be used, like wampum. They would be harder to counterfeit than paper or metal money, they would be pretty and could be used as jewelry or carried in the pocket. Such pretties have been used as currency far longer than metals or paper and were just as good as long as the agreement was there.

So if you have stores of gold or silver I advise you to trade it in for barter goods. An example is bullets, bullet components and bullet making outfits. With a bullet, you can defend what you have, take what you must have, or barter with other Survivors who already agree on the value of bullets. I believe bullets will be the main currency after the crash.

Anyway, if you know a lot of metal freaks and they won't listen to reason, you can give them temporary pleasure by enlarging their hoardes of gold and/or silver. They may as well contribute to your chances of survival than the chances of someone with real gold or silver. Besides, how do you, or most of them, know the bulk of their raw metal is genuine?

Some gold alloys are so good only a professional assayist can detect fraud. The average alloy looks like gold but is lighter in weight. The weight can be made up in ingots by drilling and filling the holes with lead, then pouring molten alloy in the remainder of the hole and smoothing. That way, imitation government sanctioned gold ounces can be turned out by the hundreds in your kitchen.

If you can afford the best imitation gold you must get a kiln which heats to 3080°F. to melt platinum or 2016°F. to melt gold. If you're willing to use lead cores for weight you can make do with a kiln which heats to 2000°F. to melt copper (1996°F.), the most common metal used in imitation gold and the hardest of the common ingredients to melt.

You can get kilns and crucibles through any ceramics shop.

Most of the formulas for imitation gold and silver are written in 19th century terms. I'll translate the first one as an example. But if you are really into reproducing the old formulas and processes you will have to order GRANDDAD'S WONDERFUL BOOK OF CHEMISTRY. It defines most of the old terms you'll meet up with and also tells you how to do the operations which are needed to accomplish your aims.

The first one is an oldie but a goody.

"The French process for making artificial gold is given as follows: Pure copper, 100 parts; pure tin, 17 parts; magnesia (magnesium oxide), 6 parts; sal ammoniac (ammonium chloride), ½ part; quick lime (calcium oxide, ⅛ part; tarter of commerce (cream of tartar/potassium bitartrate), 9 parts.

The copper is first melted and the magnesia, sal ammoniac, lime and tartar are then added seperately and by degrees, in the form of powder and the whole is briskly stirred for half an hour so as to mix thoroughly; then the tin is added by throwing it on the surface, in small grains and stirring until it is entirely fused. The crucible is then covered and the fusion maintained for about 35 minutes. The surface is then skimmed and the metal is ready for casting. It strongly resembles gold in appearance, resists many of the tests used for gold, and for many purposes it is an excellent substitute. It has a fine grain, is malleable, and takes a splendid polish. When tarnished, its brilliancy can be restored by a little acidulated water

6-penny,	2 in. long,	167 per lb.
7-penny,	2¼ in. long,	141 per lb.
8-penny,	2½ in. long,	101 per lb.
10-penny,	2¾ in. long,	98 per lb.
12-penny,	3 in. long,	54 per lb.
20-penny,	3½ in. long,	34 per lb.
Spikes,	4 in. long,	16 per lb.
Spikes,	4½ in. long,	12 per lb.
Spikes,	5 in. long,	10 per lb.
Spikes,	6 in. long,	7 per lb.
Spikes,	7 in. long,	5 per lb.

From this table an estimate of quantity and suitable sizes for any job can be easily made.

The relative adhesion of nails in the same wood, driven transversely and longitudinally, is as 100 to 78, or about 4 to 3, in dry elm, and 2 to 3 in deal.

Nessler's Solution.—Twenty-five grm. mercuric chloride are dissolved in 800 c. c. distilled water; 70 grm. potassium iodide are dissolved in 400 c. c. water, and the solutions are then mixed. 200 grm. potassium hydroxide. When it is dissolved and cooled enough water is added to make the whole 2 l. Now place in a dark closet, and before using add enough of a saturated solution of mercuric chloride until the red precipitate is dissolved; after filtering it is ready for use. It should now be of a light straw color

Nielo, or Nielled Silver.—The process somewhat resembles enameling, and consists essentially in inlaying engraved metal surfaces with a black enamel. The composition is made as follows: Put into the first crucible, flowers of sulphur, 750 parts, sal ammoniac, 75 parts. Put into the second crucible, silver, 15 parts; copper, 40 parts; lead, 80 parts. When this mixture is sufficiently fused, the alloy thus formed is added to the fused sulphur in the first crucible, which converts the metals into sulphides. The compound is afterward removed from the crucible and reduced to a fine powder. To apply the powder, it is mixed with a small quantity of a solution of sal ammoniac. The entire surface of the engraved silver work is covered with the nielling composition; it is then placed in the muffle of an enameling furnace, where it is left until the composition melts, by which it becomes firmly attached to the metal. The nielling is then removed from the parts in relief, without touching the engraved surfaces, which then present a pleasing contrast in deep black to the white silver surfaces. This process is only applicable to engraved work.

Nomenclature, Chemical.

Rules of Chemical Nomenclature.—1. Compounds of two elements, binary compounds, are named by placing the name of the positive atom first, then that of the negative, with its termination changed to *ide*.

2. Whenever the positive forms more than one compound with the same negative, numeral prefixes are applied to both constituents, the positive ending in *ic*, and the negative in *ide*.

3. Different compounds of the same two elements are also distinguished from each other by the termination *ous* and *ic* to the name of the positive element, *ic* indicating the higher combining power, and *ous* the lower. When there are more than two such compounds, the highest takes the prefix *Per*, and the lowest, *Hypo*.

The ternary compounds of chemistry are *Acids*, *Bases* and *Salts*.

1. Acids and salts are named like the binaries, from their constituents. The positive is placed first, and may have the same terminations as in the binaries.

2. The negative molecule which follows this takes its name from its characteristic atom, and ends in *ate* or *ite*; *ate* signifying more oxygen than *ite*.

3. Prefixes *Per* and *Hypo* are used same as in binaries.

4. Most acids are also named from the characteristic atom of the negative molecule. This name takes the terminations *ous* and *ic*, according to the relative amount of oxygen, and is followed by the word *acid*.

5. Bases are regarded as compounds of a positive radical with Hydroxyl (HO), and are called *hydrates*.

Chemists have found that all bodies, whether (any acid diluted with water)."

Dick's (1872) has two formulas for counterfeit gold. 3431 is so similar to the French method, published in 1922, I believe it was the original.

3397. Counterfeit Gold. Fuse together 8 parts platinum, 5 parts pure copper, 2 parts pure zinc, 4 parts tin, and 3 parts pure lead, using saltpetre, sal-ammoniac, and powdered charcoal as fluxes. This compound metal strongly resembles gold in appearance, and resists many of the tests used for gold.

3431. Oroide, or Artificial Gold. This material is manufactured largely in the United States into imitation jewelry and other articles, scarcely distinguishable from gold, except by the inferior gravity; and it is a matter of surprise to almost any one to learn that it does not contain a single grain of the precious metal. It is made by taking 100 parts of pure copper, 17 of pure tin, 6 of magnesia, 9 of tartar of commerce, 3.6 of sal-ammoniac, and 1.6 of unslacked lime. The copper is first melted, and the other substances (excepting the tin) added, a little at a time, and the whole well stirred for 30 minutes, so as to produce a perfect mixture, when the tin is thrown in and stirred round until melted. The crucible is then covered, and the fusion kept up for 25 minutes, and the scum taken off, when the substance is ready for use. It is malleable and ductile, and can be worked in any form, even into leaves like gold. The alloy may also be made by substituting granulated zinc for tin, but it will not retain its brilliancy so long as when tin is employed.

Then there is the formula from Secrets of Wise Men and Chemists, 1889, which was definitely swiped from Dick's.

Imitation Gold

An American has discovered a beautiful alloy, which has been most successfully applied as a substitute for gold. It is composed of pure copper, 100 parts; pure tin, 17 parts; magnesia, 6 parts; tartar of commerce, 9 parts; sal-ammoniac, 3.6 parts, and quicklime, 1.6 parts. The copper is first melted, then the lime, magnesia, sal-ammoniac, and tartar are added, little at a time, and the whole is briskly stirred for about half an hour, so as to mix thoroughly, after which the tin is thrown on the surface in small grains, stirring until entirely fused. The crucible is now covered and the fusion kept up for about thirty-five minutes, when the dross is skimmed off, and the alloy found ready for use. It is quite malleable and ductile, and may be drawn, stamped, chased, beaten into powder, or into leaves, like gold leaf, in all of which conditions it is not distinguishable from gold even by good judges, except by its inferior weight.

Imitation Silver

Combine by fusion 1 part pure copper, 24 parts block tin, 1½ parts pure antimony, ¼ part pure bismuth, and 2 parts clear glass. The glass may be omitted save in cases where it is an object to have the metal sonorous.

3428. French Silver. The new French silver is apparently an improvement on the old-fashioned German silver, and it is stated to be applicable to all the purposes to which ordinary commercial silver is applicable. It is composed of copper, 56 per cent., nickel, 40.64, tungsten, 2.6, aluminum, 0.56. It is a white, ductile, malleable, tenacious, sonorous alloy; its specific gravity is nine-tenths that of silver, its metallic lustre superior to that of silver, and its fusibility less, probably on account of the tungsten it contains.

And last is a bunch of gold and silver formulas for jewelers from Knight's American Mechanical Dictionary, 1872.

JEWELERS' ALLOYS.

	[illegible]	Copper	Tin	Zinc	Silver	Platinum	Arsenic	Antimony	Other
Blanched Copper (Mock silver)		16					1		
Imitation Gold (Hermstaedt's) (resembles gold in color and specific gravity)		[illegible]		[illegible]		16			
[illegible]		[illegible]		[illegible]					
Manheim Gold		[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]		[illegible]		[illegible]					
Mosaic Gold (Hamilton and Parker's Patent)		[illegible]		[illegible]					
Pinchbeck		[illegible]		[illegible]					
Mock Platinum	[illegible]			[illegible]					
[illegible] Metal	[illegible]			[illegible]					
[illegible]		[illegible]	[illegible]	[illegible]					
[illegible] Metal		[illegible]	[illegible]	[illegible]					
"		[illegible]	[illegible]				[illegible]		
"			[illegible]					1	
Martin's Patent, Aug. [illegible]		100		[illegible]	[illegible]				[illegible]
[illegible]		[illegible]		[illegible]					
Tombac (Malay, [illegible])		[illegible]	[illegible]	[illegible] (Lead)		[illegible] (Nickel)			
Red Tombac		[illegible]		[illegible]					
Mock Silver (Tonnar's Patent, 1856, England)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		1	

Mock Gold (Parker's, patented June [illegible]): cream of tartar, [illegible] oz.; [illegible], [illegible] oz.; [illegible] and sold [illegible] copper, [illegible] oz.; borax, 1 oz.; glue, 1 oz.; putty, 1 oz.

Mock Gold. A yellow alloy. Factitious gold.

	Copper	Platinum	Magnesia	Zinc	Tin	Nickel	Sal-ammoniac	Saltpetre	Lime	Tartar	Putty
Hermstaedt's (resembling gold in color and specific gravity)	[illegible]	16		[illegible]							
Parkes's patent	[illegible]			[illegible]		2		2		16	2
Hamilton and Parker's	[illegible]			[illegible]							
Pinchbeck	[illegible]			[illegible]							
Manheim gold	[illegible]			[illegible]	[illegible]						
Red tombac	[illegible]			[illegible]							
Oroide	[illegible]			[illegible]							
Prince's metal	[illegible]			1							
New formula	100		6		17		3.6		1.6	9	

Mock Silver. A white-metal alloy for jewelers.

	Copper	Tin	Bismuth	Platinum	Silver	Nickel	Zinc	Antimony	Lead	Steel	Aluminium
Tod Echter's (resembling silver)	73.71			2.4	8.26						
Pinchbeck? [illegible]	[illegible]					[illegible]	25.4				
White tombac	[illegible]										
Tonnar's patent	[illegible]					3	3				
Tutania, [illegible]	1	24						[illegible]			
Tutania, [illegible]		28						[illegible]			
Queen's metal		[illegible]	1					[illegible]	1		
Queen's metal	4	100	1					[illegible]			
Parisian white metal	69.8			0.7 (Cadmium)		19.8	5.5				
German white copper	88					8.75		2		[illegible] (Tungsten)	
Minargent	100					70					5

in the form of a solid, a liquid, or a gas, are either simple substances or can be resolved into simple substances, termed elements. These elements are represented by symbols, which are usually the initial letter or letters of their names. Different elements combine together in definite proportions forming an endless variety of substances, termed compounds.

Elements are classified into metals and non-metals, the former being distinguished by well marked properties, which are absent in the latter. The ultimate particles or atoms which compose any element differ in weight from the atoms of any other element, and the relative weight compared with hydrogen is termed the atomic weight.

Compounds are formed, as already stated, by the combination of different elements, thus: FeO represents oxide of iron, and MnO, oxide of manganese. In many cases two elements unite in more than one proportion, such as FeO, Fe_2O_3, Fe_3O_4, each of which requires a distinguishing name. There are several systems of nomenclature, but the simplest—for compounds containing two elements—is that of writing the name of the metal first, and the non-metal or least metallic element afterward, giving it the termination *ide*. When two non-metals combine, the one which is most unlike a metal is written second. Sometimes Greek prefixes are used for the element of the second position, such as *mono*, *di*, *tri*, *tetr*, etc., to indicate the number of atoms present.

Another system is to make the metal terminate in *ic* or *ous*. That compound which contains the greater proportion of the non-metallic constituent is distinguished by the suffix *ic* and that containing the lesser in *ous*.

Ozone, to Produce.—Ozone may be easily produced by means of an aqueous solution of permanganate of potash and oxalic acids. A very small quantity of these salts, placed in an open porcelain dish, is all that is necessary, the water being renewed occasionally, as it evaporates. Metallic dishes should not be used.

Pancreatin, to Prepare.—Cut the fresh pancreas of the pig, free it from all foreign matter and digest in ether, distill the ether from the filtered liquid and the remainder will be the pancreatin.

Papier Maché.—Paper maché is obtained from old paper and the like made into a pulp by grinding with milk of lime or lime water, and a little gum dextrin or starch. This pulp is then pressed into form, coated with linseed oil, baked at a high temperature, and finally varnished. The pulp is sometimes mixed with clay (kaolin), chalk, etc.; and other kinds are made of a paste of pulp and recently slaked lime. This is used for ornamenting wood, etc.

2. Pulped Paper Moulded into Forms.—It possesses great strength and lightness. It may be rendered partially water proof by the addition of sulphate of iron, quicklime and glue, or white of egg, to the pulp; and incombustible by the addition of borax and phosphate of soda. The papier maché tea trays, waiters, snuff boxes, etc., are prepared by pasting or gluing sheets of paper together, and submitting them to powerful pressure, by which the composition acquires the hardness of board when dry. Such articles are afterward japanned, and are then perfectly water proof.

3. A durable and inexpensive method of employing papier maché as a substitute for mattings, carpets, etc., is as follows: After the floor has been thoroughly cleaned, the holes and cracks are then filled with paper putty, made by soaking newspaper in a paste made of wheat flour, water, and ground alum, that is, to 1 lb. of such flour are added 3 qt. of water and a tablespoonful of ground alum, these being thoroughly mixed. With this paste the floor is uniformly coated, and upon this a thickness of manila or hardware paper is placed, or if two layers are desired, a second covering of paste is spread on the first layer of manila paper, and then the second thickness of paper is put on, and the whole allowed to become perfectly dry; on this being accomplished another surface of paste is added, succeeded by a layer of wall paper of any style or pattern desired. On the work becoming entirely dry, it is covered with two or more coats of sizing, made by dissolving ½ lb. of white glue in 2 qt. of hot water, and when this has dried, a coat of hard oil finish varnish.

Handy Paring Knife Made from Old Hacksaw Blade

Popular Mechanics – 1919

With a little work a hacksaw blade, or a portion of one, can be made into a paring knife that will prove very durable because of the excellent quality of the steel. Two pieces of hard wood should be cut into the shapes shown and riveted together with one end of the blade between them. After fitting a paper mold about the end of the handle from which the steel projects, melted lead is poured into it, to form a collar that will hold the parts firmly together. The exposed part of the saw can then be ground as desired.

A Serviceable Paring Knife Made from a Piece of Hacksaw Blade, and Details of Its Construction: The Handle and Blade are Held Together with a Rivet and a Lead Ferrule

MAKING ALKALINE WATER DRINKABLE

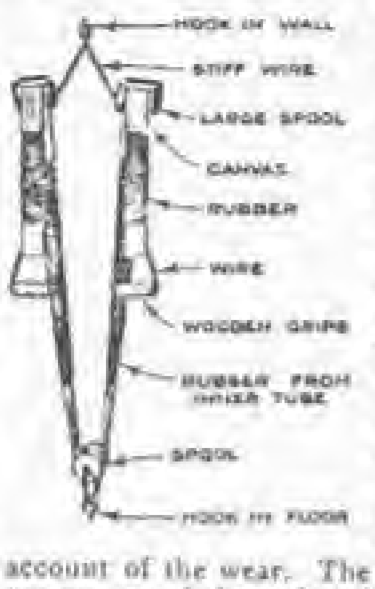
Popular Mechanics – 1925

Settlers in parts where the water is alkaline find it difficult to get water that is fit to drink, as it must be distilled or otherwise purified. The illustration shows an easily made condenser that is often used for this purpose, consisting of nothing more complicated than a length of iron pipe provided with a tee in the center, and passing through the roof of the house. The spout of a teakettle is connected to the tee by a short length of hose. When the water in the kettle boils the steam will issue into the iron pipe where it will condense into drops on the inside, the distilled water dripping into a pan.

A Homemade Exercising Machine

Popular Mechanics – 1925

Old inner tubes, and some stiff wire or iron rod, together with three large spools, are the materials used for making a home exerciser at insignificant expense.

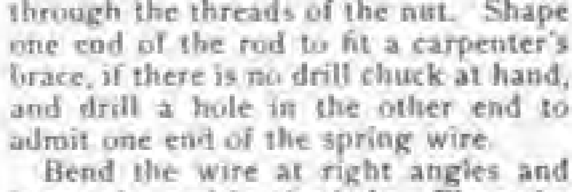


The rubber is cut into strips, 2 in. wide and of the length desired, two or more of the strips being cemented to each other, as may be desirable. Where the bands pass over the spools, canvas is used instead of rubber, on account of the wear. The pieces of canvas are sewed along the edges and turned inside out to make a flat tube the same width as the rubber bands. The ends of the rubber strips are covered with rubber cement on both sides, inserted into the canvas, and weighted down until thoroughly dry. The arrangement of strips, spools, and hooks is clearly shown in the drawing.

From Popular Mechanics 1915

How to Make Small Coil Springs

Procure a nut, having a small thread that will admit the size of the wire to be used in making the spring. Cut a



The Threads in the Nut Will Guide as Well as Coil the Spring Evenly

small notch to the depth of the thread where the thread starts, and procure a smooth rod that will pass snugly through the threads of the nut. Shape one end of the rod to fit a carpenter's brace, if there is no drill chuck at hand, and drill a hole in the other end to admit one end of the spring wire.

Bend the wire at right angles and insert the end in the hole. Place the end of the rod in the nut, which should be gripped in a vise, and turn the rod, at the same time seeing that the wire is guided into the notch cut at the start of the thread. The wire will follow the thread of the nut and make a perfect spring of an even opening throughout its length. Closed or open coils can be made by using a nut having the proper number of threads.—

4. Paper is pulped in a mortar (or pulping engine) and mixed with ordinary glue size thinned somewhat with hot water. Remove the pulp and let it partially drain upon a linen covered frame. Put a quantity of this into the mould under strong pressure, and let it remain until it becomes hard enough to handle. A counter mould is used in casting such thin sheets. Plaster moulds are too fragile. Casts in type metal or fusible metal are much better.

Potatoes, to Solidify.—Make a solution of 4 parts of sulphuric acid in 50 parts of water. Treat peeled potatoes with this solution for thirty-six hours. Dry the mass between blotting paper and subject to great pressure. By using very strong pressure, billiard balls have been made closely resembling ivory. The material can be carved and doubtless could be used for large types.

Potpourri, How to Make. — The never-failing delight of a rose (or potpourri) jar is known only to its fortunate possessor; yet it is so easy to prepare one, and, once prepared, so easy to keep it at the point of perfection, that the wonder is they are not more frequently enjoyed. The flowers should be gathered in the early morning, and tossed lightly on a table in a cool, airy place, to lie till the dew has evaporated; then put them in a large glass jar, sprinkling salt over ¼ in. layers of the flowers. This can be added to from morning to morning till enough flowers for the purpose have been gathered, letting them stand in the jar for ten days after the last are put in, stirring the whole every morning. Have 1 oz. each of cloves and allspice, coarsely ground, and as much stick cinnamon, broken and shredded fine; transfer the flowers to another jar, and scatter the spices, mixed together, in layers; cover the jar tightly, and let it stand in a dark place for three weeks, when the stock will be ready for the permanent jar. Whatever this jar is, be sure it is provided with a double cover.

Have ready ¼ oz. of mace and ½ oz. of allspice and cloves, all coarsely ground—or pounded in a mortar—half of a grated nutmeg, ½ oz. of cinnamon, broken in bits, 1 oz. of powdered orris root, and ¼ lb. of dried lavender flowers. Mix these together in a bowl, and proceed to fill the rose jar with alternate layers of the "stock" and the mixture of spices, etc. A few drops each of several essential oils—rose, geranium, bitter almond and orange flower are good—should be dropped upon the layers as you progress, and over the whole pour 1 oz. of your favorite toilet water or eau de cologne. This is sufficient to fill two quart jars, or one very large one, and it will keep for years; from time to time various sweet things may be added to it, as a few tuberoses or a spray of heliotrope. If the jar be left open for a half hour every day, it will fill your rooms with a delicate, indefinable spicy fragrance, very refreshing and delightful, and unlike any other perfume. The flowers chosen should be those having agreeable perfume, roses, pinks, violets, verbena, heliotrope, acacia, balm, lavender, etc.

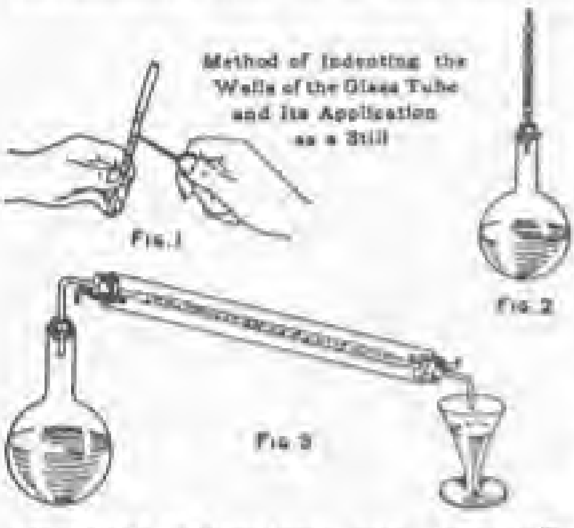
Pot Pourri. Spread thinly the fresh collected flowers on porous paper placed in shallow trays, and expose them to the sun or warm air until sufficiently dry, then lightly crumple them up small between the hands, and, the other dry odorous ingredients being added, with or without a little essential oil of the same kind as the dried flowers, thoroughly mix the whole together. Sometimes essential oils only are added to the dry flowers, but the fragrance of the product is then much less durable. As the basis of his finest dry pot pourri, the Continental perfumer usually substitutes either reindeer moss or ragged hoary evernia, in very coarse powder, for the dried flowers.

2. A mixture of odorous flowers, roots, gums, etc., varied according to the taste of the operator, either mixed together dry or in the fresh state preserved with salt. The following is a French formula: Take the petals of the pale and red roses, pinks, violets, orange flower, lilies of the valley, mignonette, heliotrope, jonquils, with a small proportion of the flowers of

Cooling Tube for a Laboratory Still

Popular Mechanics — 1915

A simple and very effective device to replace the cumbersome cooling or condensation coil of a still for the amateur's laboratory can be easily made as follows:



Method of Indenting the Walls of the Glass Tube and Its Application as a Still

Procure an ordinary straight glass tube of fairly large diameter and heat it in the flame of an alcohol lamp with the use of a blowpipe or in a Bunsen burner with a very reduced flame so that only a small spot of the tube is brought to a red heat at one time. Then, with a previously pointed and charred stick of wood—a penholder, for instance—produce a small recess in the wall by pushing the charred end gently into the glowing part of the tube. This procedure is repeated until the whole tube is thus provided with small recesses. The indentations should be made in spiral lines around the tube, thus increasing the surface that is in contact with the cooling water. The operation of making the recesses is shown in Fig. 1. The walls of the recesses should have a regular and uniform slant.

The tube thus produced can either be used as a rectifier (Fig. 2) above a vessel, for fractional distillation, because it will allow the most volatile parts to pass out first, or as a condenser (Fig. 3), the arrangement of which needs no explanation. The amateur will find it much easier to make this tube than to coil a very long one.

AUTOMATIC-CLOSING KENNEL DOOR

Popular Mechanics 1913

When the neighborhood cats are retired for the night and there is nothing more to chase, my fox terrier seems to realize that his usefulness


Diagram of Closing Door

for the day is over and begs to be put in his kennel that he may not bark at the moon as some dogs are apt to do. This necessitates my putting him out at a time when it may not be convenient. Frequently in stormy weather this is a disagreeable duty and I found a way to obviate it by making a trapdoor device for his kennel as shown in the sketch whereby he may lock himself in when he crosses the threshold.

The outer half A of the hinged trapdoor is made heavier than the inner half B by a cleat, C, and a strip, D, to cause the door to swing shut. The tripper stick E is set between cleats C and F to hold the door open. When the dog steps on the inner half of the trapdoor B, it falls to stop G, releasing tripper stick E (which is heavier on the top end H) to cause it to fall clear of the path of the trapdoor. The door then swings shut in the direction of the arrow, the latch I engaging a slot in the door as it closes, and the dog has locked himself in for the night. The latch I is made of an old-fashioned gate latch which is mortised in the bottom joist of the kennel. When releasing the dog in the morning the door is set for the evening.

Making Modeling Clay

Modeling clay is made by kneading dry clay with glycerin instead of water. Work thoroughly with the hands. Work in process, or finished, must be moistened every day or two and kept covered, to prevent evaporation, which would leave the clay hard and difficult to work.

myrtle, balm, rosemary, and thyme; spread them out for some days, and as they become dry, put them into a jar, with alternate layers of dry salt, mixed with orris powder, till the vessel is filled. Close it for a month, stir the whole up and moisten with rose water.

3. Pot-pourri is a mixture of dried petals of roses, violets, etc., mixed with 1-10 its weight of salt. The leaves of fresh roses, etc., are collected and dried on porous paper in the sun; as soon as dry they are placed in a jar in layers alternating with the salt. Powdered orris root and extracts and many other ingredients may be added according to taste.

4. This is a mixture of dried flowers and spices not ground. Dried lavender, 1 lb.; whole rose leaves, 1 lb.; crushed orris (coarse), ½ lb.; broken cloves, cinnamon, allspice, each 2 oz.; table salt, 1 lb.

5. Lavender flowers, 1 lb.; rose leaves, 1 lb.; cloves, ¼ lb.; cinnamon, ¼ lb.; benzoin, ¼ lb.; pimento, ¼ lb.; common salt, 2½ lb.; oil of lavender, 60 minims; oil santal, 60 minims; oil of geranium, 60 minims; oil bergamot, 120 minims; oil lemon, 60 minims; vanilin, 3 oz.; musk pods, 1 oz.; essence ambergris, ½ oz. Solids all ground.

6. Pot-pourri (for mixing with rose leaves).—Tonka bean, ½ part; cinnamon, pimento, 1 oz. of each; coriander, 4 oz.; benzoin, 5 oz.; orris root, 1 lb. Reduce to powder, mix, add ½ oz. muguet bouquet toward end.

Pottery, to Convert into Antique.—The way to convert modern pottery into the antique is to boil the former in oil and bury it in wood ashes. One will be astonished to find how quickly the new article will become in appearance a veritable antique.

Poultry Food.—There is a great similarity between the various poultry powders and foods. The powders are popularly supposed to increase the egg-laying power of hens. We quote a few typical formulas:

Powdered eggshell or phosphate of lime, 4 oz.; iron sulphate, 4 oz.; powdered capsicum, 4 oz.; powdered fenugreek, 2 oz.; powdered black pepper, 1 oz.; silver sand, 2 oz.; powdered lentils, 6 oz.

A tablespoonful to be mixed with sufficient food for twenty hens.

Oyster shells, ground, 5 oz.; magnesia, 1 oz.; calcium carbonate, 3 oz.; bone, ground, 1½ oz.; mustard bran, 1½ oz.; capsicum, 1 oz.; sodium chloride, 1 oz.; iron sulphate, ½ oz.; sodium carbonate, ½ oz.; sulphur, ½ oz.; beef, lean, dried and powdered, 10 oz.; fine sand, 10 oz.; corn meal, 20 oz.; linseed meal, 20 oz.

Reduce all to moderately coarse powder and mix well.

The above are formulas that are recommended by poultrymen, and pharmacists should not condemn them, even if they do seem polypharmic. Poultrymen have ideas of their own about the value of complicated formulas.—*American Druggist*

Quills.—*Prep.* Suspend the quills in a copper, over water sufficiently high to touch the nibs; then close it steam tight and apply four hours' hard boiling; next withdraw and dry them, and in twenty-four hours cut the nibs and draw out the pith; lastly, rub them with a piece of cloth and expose them to a moderate heat in an oven or stove. The quills prepared in this way are as hard as bone, without being brittle, and as transparent as glass.

Reagents, Chemical. Reagents are substances which effect a chemical change in the molecule. Only the best quality of chemicals should be used. Very minute directions for preparing reagents are given in Fresenius, but this list of reagents, with their proper strengths, is complete enough for ordinary qualitative work. The following are the principal reagents used by the chemist, with the proper strength. Distilled water only should be used in making up reagents. For the various synonyms of the chemicals, see the appendix. The alphabetical arrangement is disregarded, and the reagents are given in the order in which they should be placed on the laboratory table.

Sulphuric Acid.—Concentrated sp. gr. 1.84. Dilute should also be provided. To 5 parts water add 1 part sulphuric acid.

Hydrochloric Acid.—Concentrated sp. gr. 1.12, 24% acid is the usual reagent strength. Both concentrated and dilute should be provided.

THE KEY TO SURVIVAL

GRANDDAD'S WONDERFUL BOOK OF CHEMISTRY may be the key to the survival of the best elements of our society.

Many will survive because of weapons. The armed predators will finally waste themselves. But the armed protectors will guard the right people and things of value still left after the crash.

The self-reliant new peasantry will provide many bases and communities from which new, decentralized societies will spring up out of the ruins.

But the lay chemist, the amateur with imagination and idealism, will give the others the reasons for bearing up under the struggle. The chemist will not need to be armed, nor will he or she need to be physically strong or even physically whole. The only qualification will be a good mind and the motivation to create something good out of practically nothing.

Such a one will be treasured by any survival community. A set of formularies and a box of simple lab equipment, mostly homemade, will be the Open Sesame to the Survival Community of your choice.

Survival through a knowledge of Nineteenth Century chemistry will put the chemist in a relatively non-competitive position among survivalists. This is because so few people understand how easy it is to acquire a working knowledge of productive kitchen chemistry.

To most people, a chemist is a wierdo with a big brain filled with ten years of college indoctrination. He has a lab, paid for by a mindless corporation. He works on the fifteenth of 200 processes in a chain leading to a final product he doesn't really understand.

There are many such as this but a whole roomfull of them would be inferior to a lady survivalist who knows how to follow the directions in a cookbook. And our lady survivalist would probably not know how to cook if she had been brought up with the idea that a cook had to be a Master Chef trained in Paris from childhood.

It's these images of exclusiveness that keep intelligent people from tackling unfamiliar fields. How many kids would learn to tear down a car and put it together again if their only image of auto mechanics were Ford Motor Company engineers?

GRANDDAD'S WONDERFUL BOOK OF CHEMISTRY gives the laugh to the image of the corporate chemist with his head full of higher math and mysterious chemical symbols. A lot of its most practical knowledge was contributed by tradespeople who could hardly read. They renamed chemicals whose names they didn't know or couldn't spell. Some of their descriptions of processes can only be understood by a half-wit, they are so uncomplicated. (Most professional chemists are so warped by higher education they can't grasp simple concepts, believing there must be something more to a process, lest their education had been in vain. They can't believe practical chemistry can be so logical and simple).

Thus, a chemistry major out of M.I.T. might be confused by GRANDDAD'S WONDERFUL BOOK OF CHEMISTRY. And a layman who thinks chemistry is reserved for graduates of M.I.T. would likewise be confused by the book. But it is not the book which is at fault, but the attitudes of these two types, which bar them from the field of kitchen chemistry.

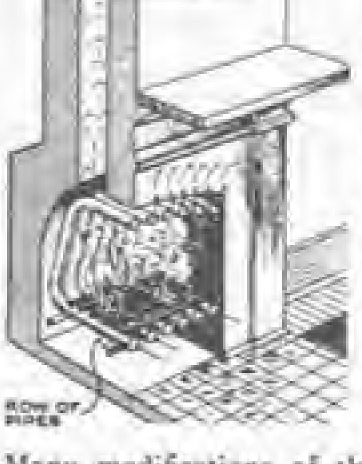
It's true that many of the terms used in the book are unfamiliar. But that is because they were used maybe hundreds of years ago by alchemists and amateur chemists working alone. They made up names for compounds for which others would make up different names, although the compound was the same stuff.

Because of this, GRANDDAD'S WONDERFUL BOOK OF CHEMISTRY has 91 pages of definitions of vague and obsolete terms so an old formula can be updated into modern terms in minutes.

From Popular Mechanics 1925

More Heat from the Grate

Complaint is often made that open fireplaces throw off insufficient heat. The drawing shows a novel idea for utilizing part of the heat that goes to waste up the chimney. A row of U-shaped pipes of fairly large diameter is arranged so that the cool air which enters the bottom of the pipes is heated and passes out of the opposite end into the room.



Many modifications of the arrangement shown are possible, the only rule to bear in mind being that the pipes should be spaced far enough apart at the top to avoid the possibility of interference with the draft.

Nitric Acid.—Concentrated acid should be purchased and diluted to sp. gr. 1.42, 32% acid.

Acetic Acid—Sp. gr., 1.04, 36% acid. This acid is called the No. 8 of commerce.

Ammonia.—Strong, sp. gr., 0.96. Keep in a bottle with a ground glass stopper.

Ammonium Carbonate.—Dissolve 1 part of the salt in 4 parts by weight of distilled water, to which 1 part reagent ammonia has been added.

Ammonium Chloride.—Dissolve part of the salt in 8 parts water.

Ammonium Sulphide.—Purchase of the right strength; it is an article of commerce.

Ammonium Oxalate.—Dissolve 1 part of the salt in 24 parts water.

Potassium Hydroxide.—Dissolve 1 part of the stick alkali in 20 parts of water.

Sodium Hydroxide.—Use about 1 part to 9 parts of water.

Potassium Carbonate.—Dissolve 1 part of the dry salt in 10 parts of water.

Potassium Iodide.—Dissolve 1 part of the dry salt in 20 parts of water.

Potassium Dichromate.—Dissolve 1 part of the salt in 10 parts of water.

Potassium Ferro-cyanide.—Dissolve 1 part of the crystallized salt in 12 parts of water.

Potassium Sulpho-cyanide.—Dissolve 1 part of the salt in 25 parts of water.

Calcium Hydroxide.—Slake lime by the addition of 6 parts water, after which add 30 parts water and allow to stand, decant the liquid and add 300 parts water to the residue, let the coarser particles subside, then pour the liquid containing the finely divided lime in suspension into a bottle and use the liquid.

Barium Chloride.—Dissolve 1 part of the salt in 10 parts of water.

Magnesium Sulphate.—Dissolve 1 part of the salt (cryst.) in 10 parts water.

Mercuric Chloride.—Dissolve 1 part of the crystallized salt in 16 parts of water.

Silver Nitrate.—Dissolve 1 part of the crystallized salt in 70 parts water. Another authority says to use 1 part of the salt in 20 parts of water. Keep in an orange colored bottle.

Lead Acetate.—Dissolve 1 part of the salt in 10 parts of water, and filter.

Ferric Chloride.—Dissolve 1 part of the iron in 15 parts of water.

Alcohol.—Use 95% alcohol.

Cobaltous Nitrate.—Dissolve part of the salt in 10 to 20 parts of water.

Sodium Sulphite.—Dissolve 1 part of the salt in 5 parts of water.

Potassium Cyanide.—Dissolve 1 part of the salt in 3 or 4 parts of water.

Potassium Chromate.—Dissolve 1 part of th. salt in 10 parts of water.

Potassium Ferricyanide.—Dissolve 1 part o. the salt in 12 parts of water; make as required for use.

Potassium Sulphate.—Dissolve 1 part of the salt in 12 parts of water.

Potassium Permanganate.—Dissolve 1 part o. the salt in 400 or 500 parts of water.

Carbon Bisulphide.—Use at the same strength as purchased.

Ether.—Use same strength as purchased.

Calcium Sulphate.—Saturated solution.

Copper Sulphate.—Dissolve 1 part of the salt in 10 parts of water.

Calcium Chloride.—Dissolve 1 part of the salt in 8 parts of water.

Sodium Carbonate.—Used largely in blowpipe work. Used as purchased; buy the C. P.

Ferrous Sulphate.—The solution of this salt does not keep well, so it should be prepared as required for use, by dissolving 1 part of the salt in 8 parts of water.

Sodium Borate.—Used in blowpipe work. Get the pure crystallized salt.

Sodium-Ammonium Phosphate.—This is the microcosmic salt. It is used in a dry state for blowpipe work.

Ferrous Sulphide.—Use as purchased.

Metallic Zinc.—Use the granulated zinc.

Potassium Chlorate.—Use as purchased.

Starch Paste is also used extensively. It should be kept in tin or a salt mouth, and only made up as wanted.

Sarsaparilla.—

1. Sassafras bark bruised	1	lb.
Licorice root bruised	7	oz.
Water	2½	gal.
Oil of sassafras	1½	drm.
Oil of wintergreen	2	drm.

 THE SURVIVOR Vol. 1

Burglar-Proofing Your Home the Poor Man's Way

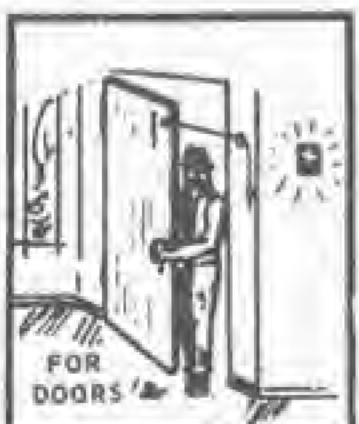
As conditions become worse, burglaries will increase. Poorer people will become victims of burglaries as food and other necessities are burglarized, whereas luxuries for resale have been the usual goals of burglars.

The most common burglar alarm is a dog. But the average dog is the smart burglar's best friend. This dog barks at cats, other dogs, passersby and anything else it can imagine. Its yelping actually hides the noise of the burglar's entry. Furthermore, the owner gets so used to the dog's crying Wolf that he pays no attention when the real Wolf appears.

Such a dog ought to be put to sleep. It's not worth its food and it could cost you your property and even your life. Get rid of it unless it is such a loving pet you can't. In that case, take it to the vet and have its vocal cords cut. To a dog, that's no worse than a tonsillectomy and it soon adjusts to its quietude.

If you don't already have a dog, get a Bisenji. A little larger than a Beagle, the Bisenji can't bark and is the most intelligent of the species. It has been bred as a hunter and protector since its first recorded appearance in ancient Egypt.

When the home is being visited by a burglar, the Bisenji will simply, sit there quietly until the fool has made his entry and then will tear him to pieces. Yet, this brainy dog is no problem to legitimate visitors.



For a mechanical burglar alarm, you should consider the cigarette pack sized alarms designed for women to carry in their purses against snatchers. A loop is around the woman's wrist and when the purse is snatched, a ring at the end of the loop is pulled from the alarm and a very loud, battery operated horn screeches continuously. Unless he knows no one is around, the snatcher will invariably drop the noisy purse without even opening it.

These little alarms can be placed strategically around the home as in the diagrams. They are cheaper, costing under $5, and just as effective as the more expensive anti-burglar systems. They are advertised all over and are generally carried by lock shops and auto supply stores.

My favorite anti-burglar device is the hydrochloric acid goody, described in THE POOR MAN'S JAMES BOND. I have adapted it to home protection and it is cheap and harmless.

First buy a gallon of hydrochloric acid, also called muriatic acid and swimming pool acid. It is used to kill algae in pools and can be bought cheaply in supermarkets in areas having swimming pools. You can also buy it in hardware stores where it is sold for cleaning excess grouting off tiled surfaces, cleaning cement, etc.

Hydrochloric acid reacts with aluminum to produce dark, noxious clouds of chlorine gas. They would be poisonous except that a person smelling it suffers so much in his nose that he will flee before inhaling enough to cause injury.

From a laundromat get some 12 to 16 oz. thick plastic detergent bottles. The reaction produces heat and the thinner plastic bottles melt before the reaction is complete.

Put about an inch of hydrochloric acid in the bottle. Don't be afraid of getting a whiff of the acid's fumes while you're working with it. When I talk before police rookie classes I demonstrate it by having the men walk through the gas reacting on the aluminum. I believe this would be a lot cheaper and better than the crowd control gasses they use. Anyway, as I said before, you couldn't stick around to sniff enough to hurt you unless you were tied up. So don't panic if you catch a whiff or two while making the devices.

Any aluminum will do for the reaction. It can be powder, grain, filings gotten by holding an aluminum pipe to a grinding wheel, shredded from foil or cut in pieces from a TV dinner tray. It must, however, be fine enough not to bunch up in the

Alcohol, 95% .... 2 oz.

Boil the sassafras and licorice in the water half an hour. Strain through flannel, then add the sirup. Dissolve the oils in the alcohol, and add them to the sirup. Agitate the mixture freely.

2. *Ayer's.*—Ayer's formula for making sarsaparilla.—

Fluid extract of sarsaparilla	3	oz.
Fluid extract stillingia	3	oz.
Fluid extract yellow dock	2	oz.
Fluid extract May apple	2	oz.
Sugar	1	oz.
Potassium iodide	90	grs.
Iron iodide	10	grs.

Mix them.

Slate, Artificial Writing.—Fine sand, 41 parts; lampblack, 4 parts; boiled linseed or cotton seed oil, 5 parts. Boil thoroughly together. Reduce the mixture by adding spirits of turpentine, so that it may be easily applied to a thin piece of pasteboard. Give three coats, drying between each coat; finish by rubbing smooth, with a piece of cotton waste, soaked in spirits of turpentine. Makes excellent memorandum books, etc.

Staining.—*Grasses, to Stain.*—All the varieties of grass are coated on their surfaces with a material resembling glass—a hard, impenetrable substance, and which is very visible on common cane. On this account it is with difficulty that the dyer can impart any great variety of color to such materials, and it accounts for the little variety of color that is seen in the straw hat trade. Were it not for this difficulty, it is more than probable that straw bonnets would be seen in all the colors of the rainbow. Although the colors are by no means bright, yet it is possible to stain grasses sufficiently for many ornamental purposes. Many of the grasses are so exceedingly beautiful in form that they are frequently gathered, and, when dry, are made up into pretty ornaments for the sitting room. If, however, some of the specimens are not artificially colored when grouped together, they have rather a somber appearance, owing to their sameness of tint. A little variety of color may be imparted thus:

Blue is given by dipping the grasses into a boiling hot solution of indigo in sulphuric acid.

A light blue can be given by diluting with water the above solution to the desired shade.

Yellow is imparted by steeping the grass in a boiling decoction of turmeric.

Red, by boiling shreds of scarlet cloth in water containing a little alum.

Green is imparted by placing the grass first in a hot solution of sulphate of copper, and then in a bath of common soda in water, and also dyeing the grass first blue and then yellow.

Black and slate colors are produced by first dipping the grass in a decoction of logwood, and afterward in a solution of sulphate of iron. Other tints are procured by varying the bath with prussiate of potash, chromate of potash, Brazil wood, archil, and many other chemicals.

Paper and Parchment, to Stain.—Blue.—Stain it green with the verdigris stain, and brush over with a solution of pearlash (2 oz. to the pint) till it becomes blue.

Green and Red.—Dissolve verdigris in vinegar, and brush over the hot solution until of a proper color.

Orange.—Brush over with a tincture of turmeric, by infusing an ounce of the root in 1 pt. 90 per cent. alcohol; let this dry, and give another coat of pearlash solution, made by dissolving 2 oz. of the salt in 1 qt. water.

Purple.—Brush over with the expressed juice of ripe privet berries; then go over the work several times with a decoction of logwood; when dry give a coat of potassium carbonate solution (1 drm. to 1 qt.). Cover evenly.

Yellow.—Brush over with tincture of turmeric. Add annatto or dragon's blood to the tincture. Brush over as usual.

Steel, Thin, to Perforate.—Holes in hard steel may be made with nitric acid. To apply mouth of the plastic bottle when the device is activated.

With the hydrochloric acid in the plascic bottle, put a couple of ounces of aluminum in two plastic bags, one nested inside the other. Then tie the mouths of the plastic bags over the mouth of the plastic bottle. Just make sure no aluminum falls into the bottle. Then tie a string to the end of the bags.

The reason for two bags is that the bags are so thin singly that one bag permits the acid fumes to escape. The best bags are those vegetable bags you find in rolls in the supermarket.

Put the bottle, with the bag hanging to one side, on some shelf in the room. Fix the string on the plastic bag to a nail directly above the bottle. Put a piece of cardboard under the bottle with a piece of black string tied to it and strung across the room about thigh level where an intruder would be sure to walk into it. Don't forget to put a plastic bucket under the place where the bottle will fall.

When the burglar walks into the string, the cardboard moves the bottle off the edge of the shelf and hangs from the plastic bag and dangles over the plastic bucket. The aluminum then falls from the plastic bag into the bottle. (Most likely, the burglar wouldn't even know he had tripped the device.) In about a half-minute the reaction begins and the gas fills the bag, accumulating quite a lot before the bag bursts. The room is immediately filled with gas and the terrified and tormented burglar gets out of there faster than he got in.

If you are home at the time you can just walk through the gas, breathing no more than necessary, and open some doors and windows. In a few minutes the place will be aired out. The plastic bucket will have caught the bottle when the bag broke so there is no mess to clean up.

As simple as it is, you really should test this before you set it and leave it. The most common thing that can go wrong with this device is that the aluminum is not fine enough and will bunch up in the mouth of the bottle instead of falling through into the hydrochloric acid.

One way of testing the principal is with large sized balloons. Buy a package of giant balloons, sold in supermarkets for 95¢ for 45 big balloons or 10¢ for one bigger balloon in the dime store. Put aluminum in the balloon and hydrochloric acid in the plastic bottle. Tie the balloon over the mouth of the bottle, otherwise the balloon will come loose and fly off.

Balloons would be ideal in every circumstance except the acid fumes corrodes rubber and makes balloons ineffective after about two hours. You could put a piece of plastic bag over the bottle's mouth, then put the balloon over that. Then when you wanted to use it you could punch in your finger, breaking the plastic but not harming the rubber. That way you could carry the device for hours before testing it. Of course, if you make it at home and carry it directly to the noisy bar or wherever you mean to test it, the rubber will still be good for about an hour.

When you are in the target area, put the device under your table or chair and upend the balloon so that the aluminum pours down into the acid. Then, get up and leave before the reaction starts. You can just move to another seat if you want to see the fun close up.

When the reaction begins, the balloon will expand, accumulating a tremendous amount of the dark gas. Then there will be a loud bang, the gas will fill the room and instant panic will be yours to watch and enjoy. Unless your victims are passed out from strong drink and debauchery there should be no injuries or damage and you can feel justifiably proud.

If you are going away on vacation the hydrochloric acid-aluminum device should serve, but possibly you want to teach the burglar a real lesson.

In this case, you would put sulphuric acid in the plastic bottle, a couple of ounces of potassium or sodium cyanide in the plastic bag. (The making of these cyanides is described in THE POOR MAN'S JAMES BOND).

After the bag bursts, sending the cyanide gas broadcast throughout the room, the intruder will drop dead as quickly and as surely as if he had tried to burglarize the San Quentin gas chamber. For this reason, you would not use this method while you were staying in the house.

When you return home and find a corpse on your living room floor you will really appreciate this clever device. Then remove all the parts of the device and lift the burglar's wallet and any other valuables and call the police.

I told all this to a police captain and he said there would be little likelihood of any charges against the householder. After all, you come home and find a burglar's corpse. Heart attack? O.D.? Even if they suspected; even if they knew you were capable of such a thing, what could they prove? You were out of town and he didn't belong in your home. If they somehow knew he was gassed, who gassed him and how, could never be proved.

it, cover the steel plate, at the place where you wish the hole, with a thick layer of melted wax; when cold make a hole in the wax of the size you want the hole in the plate; then put on one or more drops of strong nitric acid; leave it on for some time; wash off with water, and, if not eaten through, apply other drops of the same liquid, and continue this until the plate is perforated.—*Ironmonger.*

Stumps of Trees, to Destroy.—In the fall bore a hole in the center of the stump, about 15 in. deep, and 1 to 1½ in. in diameter. Put in about 2 oz. saltpeter, and fill the hole with water; plug it up tight. In the spring, take out the plug, pour in 8 or 10 oz. petroleum, ignite, and the stump will smolder, but not blaze, to the extremities of the roots, leaving only ashes. Dynamite is also extensively used.

Storm Glasses.—Dissolve 10 grm. of camphor, 5 grm. of saltpeter, 5 grm. of sal ammoniac, in 105 grm. of alcohol (90 per cent.) and 45 grm. of distilled water. After filtering, fill glass tubes 2 cm. wide and 50 cm. long with this solution, cork up well below and above, seal and fix on boards by means of wire, similar to barometers. The changes of the solution signify the following: Clear liquid, bright weather; crystals at bottom, thick air, frost in winter; dim liquid, rain; dim liquid with small stars, thunder storms; large flakes, heavy air, overcast sky, snow in winter; threads in upper portion of liquid, windy weather; small dots, damp weather, fog; rising flakes which remain high, wind in the upper air regions; small stars in winter on bright sunny day, snow in one or two days. The higher the crystals rise in the glass tube in winter, the colder it will be.—*Neueste Erfindungen und Erfahrungen.*

Styptics, Hæmostatics.—Substances which arrest local bleeding. Creosote, tannin or tannic acid, strong spirit, alum, sulphate of iron, and most of the astringent salts and other astringent substances, belong to this class. The following are a few preparations of this kind: *Hæmostatic Powder, Styptic Powder.*—

1. Alum (in fine powder)............ 1 part.
   Gall nuts (in fine powder)........ 1 part.
   Gum arabic (in fine powder)...... 1 part.
   Gum benzoin (in fine powder).... 1 part.

   Mix.

2. Guibourt.—
   Charcoal (in fine powder).......... 1 part.
   Gum arabic (in fine powder)....... 1 part.
   Resin (in fine powder)............... 4 parts.

3. Mialhe.—
   Alum (powdered)........................ 1 part.
   Gum tragacanth......................... 1 part.
   Tannin (tannic acid).................. 1 part.

Used to stop local bleeding, a little being sprinkled or pressed on the part.

Tattoo Marks, to Remove.—Make a mass, the consistency of dough, with salicylic acid and glycerine; apply to the tattoo marks and confine with a compress and strips of adhesive plaster for one week. Then remove the layer of epidermis over the marks and apply salicylic acid and glycerine as before. It may be necessary to repeat three time, but usually the second application removes the marks.

Tattooing, to Remove.—1. The operation is performed by applying nitric acid with the stopper of the bottle (a better instrument would be a glass rod pointed, to carry the acid), just sufficient to cover the stain, so as to avoid making a larger scar than needful, the acid to remain about one and a half minutes, until the *cutis vera* is penetrated and a crusted appearance shown, then washed off with clean cold water. In a few days after this treatment a scab forms, which contains the tattoo mark or stain; remove it, and should inflammation supervene, poultice and bathe with warm water. In this way the skin with the stain is not only removed almost painlessly, but the nitric acid at the same time, to a certain extent, seems to decolorize the stain. Of course large tattoo marks, greatly extending over the surface, must necessitate the operation being performed differently.

Simple Protection Against Muggers

You have probably seen advertized these goodies which answer yes or no when dangled over a board. They are usually a rod with a string attached and with a small weight hanging from its end.

To use, you just hold the rod in your hand with your elbow resting on the table and ask the Mystical Prognosticator a question. If the weight swings in a circle, your answer is yes, but if it swings back and forth the answer is no. It starts swinging in about a half minute and will definitely swing in a circle or back and forth, depending on your question.

Now, I need my questions answered the same as anybody else. Wanting to make my own Mystical Prognosticator, I bought a clear plastic (not white) Bic pen, some Testor's plastic cement, a one ounce fishing sinker and some nylon twine.

With a pair of pliers clamped to the metal point, I first pulled out the ink tube. Then I stuck a 16 inch piece of nylon twine through the pen shell. I then lapped the end of the twine over the shell opening and inserted the nozzle of the glue tube. After a good squirt of glue in the pen shell and cap, I put the pen cap over the shell, clamping the end of the twine securely over the end of the shell. I then snipped off the excess twine protruding out from under the cap.

Next I tied a large knot in the twine just above where the sinker would be to hold it near the end. Then I put on the sinker and tied a large knot there and also crimped the edge of the sinker hole with a pliars so it would not crowd its way over the knot and fall off. The finished item should be about 15 inches overall from the sinker to the end of the pen cap.

I carry my Mystical Prognosticator in my jacket or shirt pocket. A lady can sew

on such a pocket or wear only upper garments which have one.

Aside from answering many baffling questions, I find my Mystical Prognosticator is also a guardian against those who might harm me. All I need do when faced by an aggressor is grasp the pen cap and flick the sinker out at his head.

The human skull is a poor thing and a smartly flicked Mystical Prognosticator will cause the sinker to penetrate the skull with lethal force.

The aggressor would not be aware of his danger until too late, therefore, anyone can use it; even little old ladies, bless them. Being unaware, the aggressor's skill with a knife or even his reaction time with a gun, would be inadequate to protect him from one carrying a Mystical Prognosticator.

Lest some Liberal scum charge that the Mystical Prognosticator is a concealed weapon, I hasten to say, "pish and tush". Is a pet rock, removed from the pocket and hurled into the face of an attacker a concealed weapon? Rockey is only doing his job. Is a heavy ring of keys similarly used a concealed weapon? Nonsense!

The Mystical Prognosticator is a psychic revelator and its use against an attacker could only be regarded as defensive and incidental to its actual purpose. So don't fear the law in this instance.

A Hand Hoe

A hand hoe, especially adapted for weeding or cultivating small truck, particularly onions, can be made of a piece of hard wood, ⅞ by 1¾ in. by 4 ft. long, and a piece of old bucksaw blade. A blade, 18 in. long and 2 in.

Bucksaw Blade Attached to a Hardwood Handle

wide, bent into a loop is attached with bolts to the handle.

2. Dr. Variot, of the Paris Biological Society, advises the following method: Tattoo the skin, in the usual way, with a concentrated solution of tannin, following the original design. Then apply a crayon of nitrate of silver until the part tattooed with the tannin blackens. Wipe off excess of moisture and allow matters to take their own course. Slight pain continues for two to four days, and after two months the cicatrix which results will almost disappear.—*American Druggist*.

3. These are best removed by the following plan: Wash the part thoroughly with common dilute acetic acid. Half an hour later use—

Caustic potash........................	¼	grn.
Water..................................	1	oz.

After the lapse of another half hour, use—

Dilute hydrochloric acid..........	1	drm.
Water..................................	1	oz.

This should be repeated daily. Stronger solutions may be used, if they can be borne.

4. It is said that milk pricked under the skin in the same way as the ink was originally applied will change the blue color to red and finally cause it to disappear.

5. A writer in the *Chemical News* has stated that if the tattooing is performed with some carbonaceous matter, the marks can be made to disappear by being first well rubbed with a salve of pure acetic acid and lard, then with a solution of potash, and finally with hydrochloric acid. A dermatologist should be consulted if possible.

Terpine.—If oil of turpentine is left for a long time in contact with a mixture of nitric acid and alcohol, crystals of terpine form. By boiling an aqueous solution of terpine with a small quantity of sulphuric or other acid, terpinole is formed, and may be separated by distillation. It has the odor of hyacinths.

Transferring.—*Transferring Pictures, Prints, etc.*—In order to transfer prints of various kinds to glass, wood, etc., soak them for a short time in a solution of 10 parts of potassium hydrate in 90 parts of alcohol (more or less). This procedure is to soften the varnish in the printer's ink. After rinsing in pure water the print is placed face down on the plate which is to receive the picture or print, covered with a dry sheet and then pressed with squeegee or in a letter press.

Colored prints are painted over with a colorless, sticky varnish, pressed against the object intended to receive them, and, when dry, the paper is removed by rubbing cautiously with an aqueous solution of potash.

Some years ago a French typographical journal gave the following curious process for the reproduction of any printed design whatever—pictures, printed pages, etc. The paper to receive the reproduction is treated with the following, which is applied with a sponge, or, preferably, with a soft, flat brush:

Gelatine	10	parts
Ferric chloride	22	parts.
Tartaric acid..................	10	parts.
Zinc sulphate.................	10	parts.
Distilled water	400	parts.

Mix in the dark, and keep in a deep, orange-colored glass bottle (an ordinary bottle, tightly covered with a heavy, yellow-colored paper, and kept in a close pasteboard box, will answer). The coating should be applied in a dark place, and the paper dried in the dark. When dry, place the design on the coated surface, and bring into close contact. Place on a sheet of glass, cover with another, clamp together, and expose to the direct rays of the sun until the yellow cover of the surface of the sensitive paper is bleached to a white. Remove from light, and develop by leaving for three or four minutes in the following:

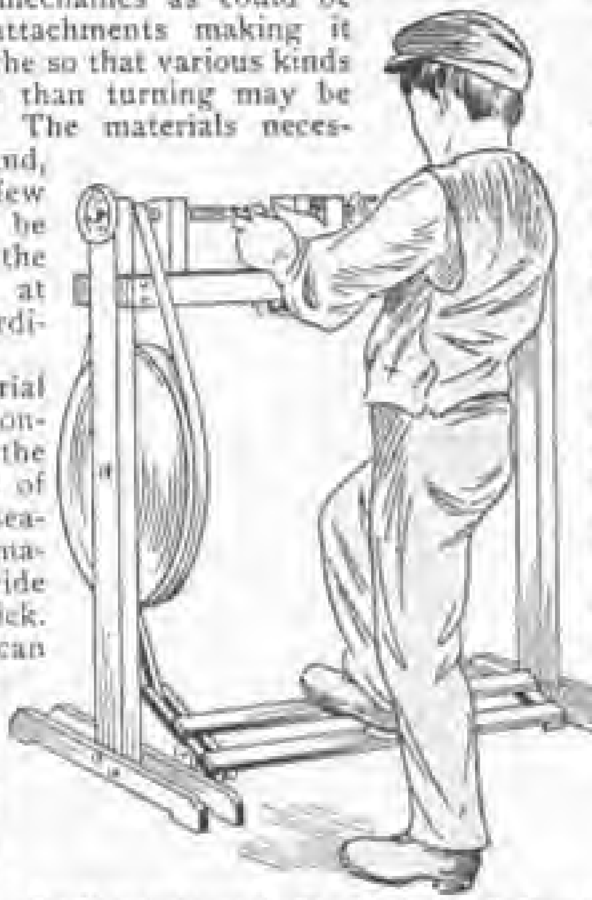
Gallic acid..................	2	parts.
Alcohol	7	parts.
Distilled water............	100	parts.

If left exposed exactly the right length of time, the lines will appear on a white ground of an intensely black color. If exposed too long, they will become more or less gray.—*Pharmaceutical Era*.

Amateur Mechanic's Combination Lathe

From Popular Mechanics 1913

The thing most desired by a young mechanic is a lathe, but the cost of these machines is usually too high to be considered by the average boy, and consequently he is hampered in executing more difficult work. The combination lathe shown in the illustration comes as near filling the wants of most boy mechanics as could be wished, the attachments making it more than a lathe so that various kinds of work other than turning may be accomplished. The materials necessary are few, and, outside of a few parts, it can be constructed by the average boy at home with ordinary tools.



The Main Ambition of a Boy Mechanic Is to Own a Lathe

The material used for the construction of the frame consists of either well seasoned oak or maple, 2¾ in. wide and 1½ in. thick. These timbers can be purchased surfaced on all sides, and they must be straight and true to size. The lengths to cut the pieces are given on the general drawing. The end standard at the headstock is cut to the full length so that the upper end is used as a bearing for the headstock spindle. A vise jaw, about 2½ ft. long and of the same kind and dimension material as the frame, is attached with screws made of bolts on the standard, at the tailstock end of the lathe. The feet are made of two boards for each standard, and are of the same material as the frame and ⅞ in. thick. After cutting the pieces to the right length, making sure that the ends are square, and boring the holes to receive the bolts snugly, they are put together, the horizontal pieces for the ways and feet at perfect right angles to the uprights. This will insure the parts running freely in the finished machine. All bolts should be supplied with a washer under both head and nut, and the nuts drawn up tightly.

The headstock extends 7 in. above the upper surface of the ways, thus making a swing of 12 in. One of the standards of the headstock is the extension of the lathe standard, as previously mentioned; the other standard being cut 9¾ in. long and attached with bolts between the ways in the same manner as the lathe standards are fastened. A block, 3 in. long, is fastened between these standards to aid in holding them rigid. The bearings for the spindle, which is a piece of steel, ¾ in. in diameter and about 9 in. long, are made in the upper ends of the standards in the following manner:

A 1¼-in. square is laid out on the upper end of each standard, with its center exactly over the center for the shaft, and the wood is cut out to make a square hole, which should be slightly tapering one way or the other toward the center of the standard, to hold the babbitt metal used for the bearing. A ⅜-in. hole is bored, vertically down from the upper end of each standard and in the center, to meet the square hole. This is used as a gate for pouring the melted metal in and later to make an oil hole. Prepare pieces of cardboard to hold the melted metal in the square holes while it cools, by cutting them about 2 in. square and making a hole in the center of each, ¾ in. in diameter. Two of these pieces are held between the two standards while the shaft is run through them and the square holes. Paint the parts of the shaft used in the bearing with thick white lead, or wrap it with one thickness of writing paper, then line it up perfectly parallel with the ways in both directions and tack the cardboard pieces to the standards. Place the remaining two cardboard disks on the ends of the shaft and tack them to the standards also. Place putty over all the edges and pour melted babbitt

Wood, to Transfer Prints to.—First varnish the wood once with white hard varnish, then cut off the margins of the print which should be on unsized paper. Wet the back of it with a sponge and water, using enough water to saturate the paper, but not so as to be watery on the printed side. Then, with a flat camel's hair brush, give it a coat of transfer (alcohol) varnish on the printed side, and apply it immediately, varnished side downward, on the woodwork, placing a sheet of paper on it and pressing it down evenly with the hand till every part adheres. After standing a short time, gently rub away the back of the print with the fingers, till nothing but a thin pulp remains. It may require being wetted again, before all that will come (or rather ought to come) off is removed. Great care is required in this operation, that the design or printed side be not disturbed. When this is done and quite dry, give the work a coat of white hard varnish, and it will appear as if printed on the wood.

How Newspaper Pictures can be Transferred.—Prepare a liquid by dissolving 1¼ drm. common yellow soap in 1 pt. of hot water, adding, when nearly cold, 3¼ fl. oz. spirits turpentine, and shaking thoroughly together. This fluid is applied liberally to the surface of the printed matter with a soft brush or sponge (being careful not to smear the ink, which soon becomes softened) and allowed to soak for a few minutes; then well damp the plain paper on which the transfer is to be made, place it upon the engraving and subject the whole to moderate pressure for about one minute. On separating them a reversed transfer will be found on the paper.

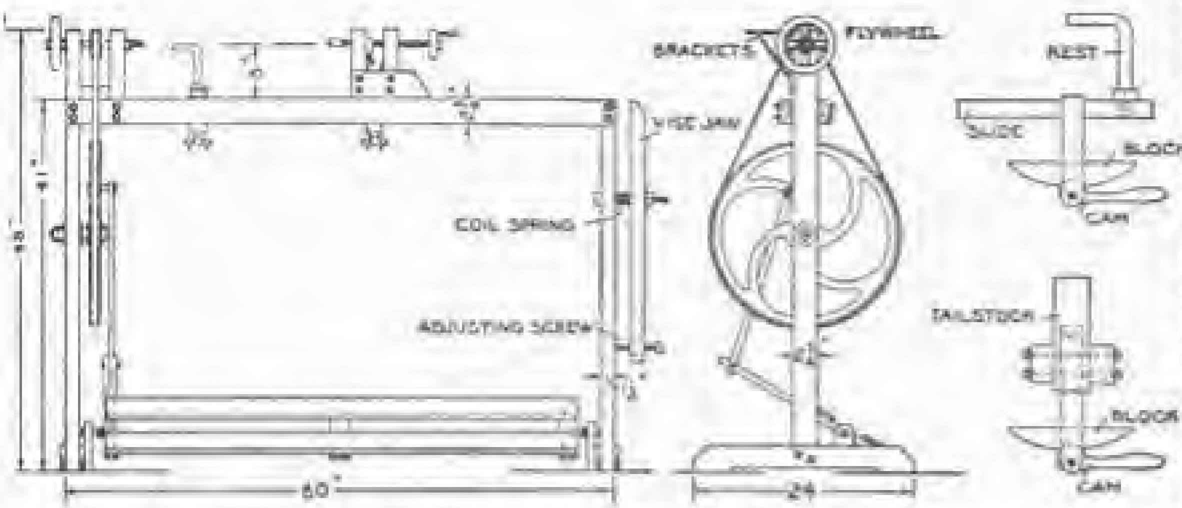
Vellum.—A fine kind of parchment prepared from the skins of calves, kids and lambs. The skins are limed, shaved, washed and stretched in hoops or other frames, where they are scraped and trimmed with the currier's fleshing knife, and next carefully rubbed down with pumice stone; they are lastly polished with finely powdered chalk or fresh slaked lime, and then dried. A green color is given with a solution of crystallized verdigris to which a little cream of tartar and nitric acid have been added, and a blue color with a solution of indigo. The surface is often finished with white of egg, and subsequent friction. The skins of sheep are commonly used for parchment, those of goats and wolves for drum heads.

Vermin, to Exterminate.

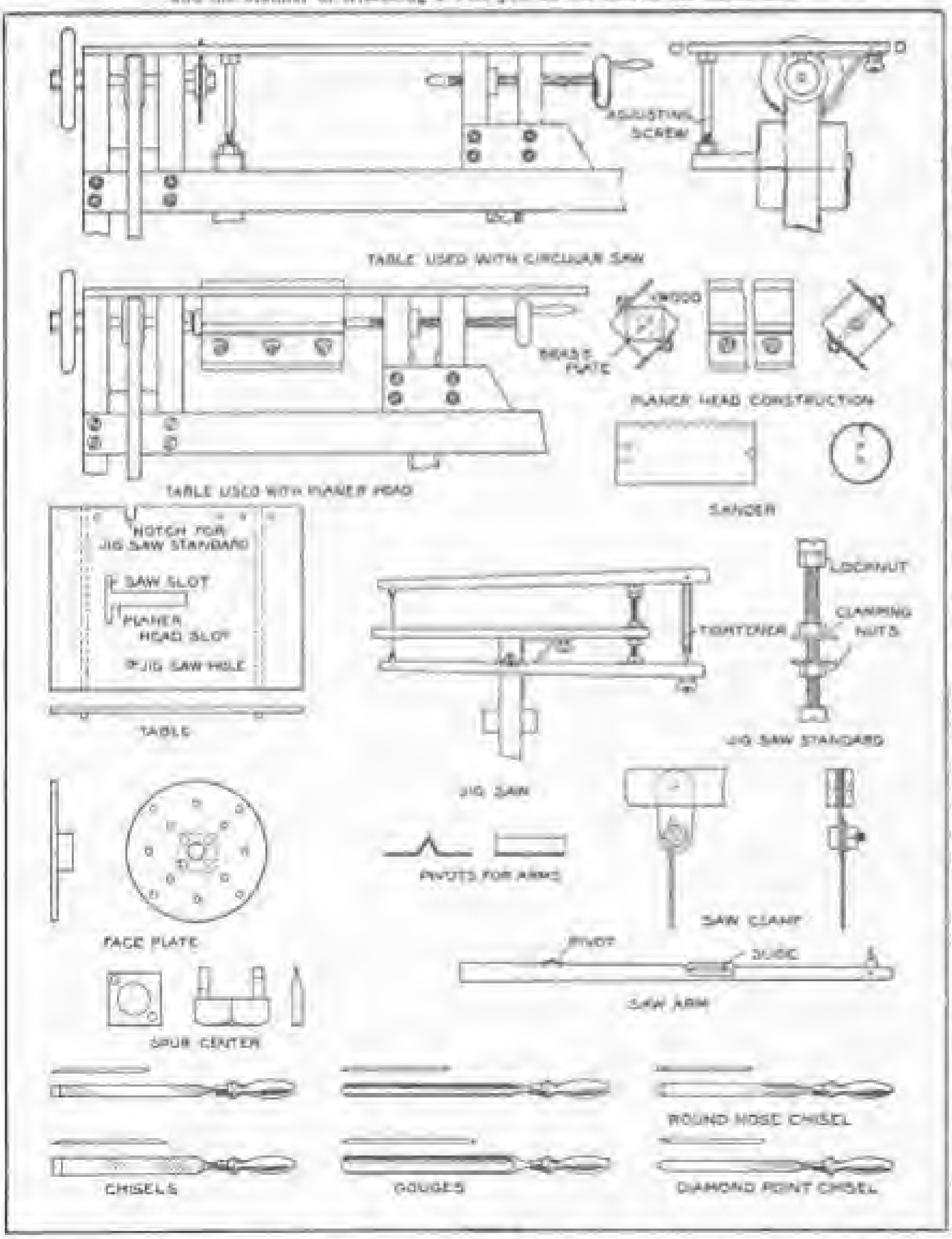
Vermin in Water.—Go to the nearest river or pond, and with a small net (a piece of old mosquito bar will do), collect a dozen or more of the small fishes known as minnows, and put them in your cistern, and in a short time you will have clear water, the wiggletails and reddish-colored bugs or lice being gobbled up by the fishes.

Vermin on Trees and Plants, to Destroy.—The solution obtained by agitating together a quantity of water and recently slaked lime, and permitting the mixture to stand for a few hours in a covered vessel, is said to be excellent for this purpose, and very cheap. It may be sprayed on and around the twigs, using a small syringe with a finely perforated rose nozzle. A decoction of the dried leaves of the sumac tree is also said to preserve vines and plants from the attacks of insects. The application must be repeated occasionally. Besides these, sulphur, alkaline sulphides, calcium sulpho-carbonate, etc., are used with satisfactory results.

End of section. The entries under W,X,Y and Z were of no interest or were covered elsewhere, such as under Yeast.



Detail of the Plain Lathe, Showing the Construction of the Clamp Devices for the Tailstock and Rest Slide, and the Manner of Attaching a Vise Jaw on the End of the Lathe Bed



Detail of the Various Attachments for Use in Connection with the Lathe for Sawing, Planing and Sanding, and the Shape of the Tools Used in Turning, Together with the Faceplate and Spur Construction

metal into the hole at the top. When the metal is cool, remove the cardboard disks and turn the shaft, first in one direction and then in the other, until it can be taken from the bearings. A ⅛-in. hole is then drilled through the metal in the top for an oil hole. The ends of the shaft should be threaded by a machinist, and nuts fitted to it and faced up true. The threads should be cut just long enough to allow the back of each nut to turn freely against a washer placed on the shaft against the standard. A split or solid pulley may be used, as desired, on the shaft between the standards. If a solid pulley is used, it must be slipped on the shaft as the latter is run into the bearings. The pulley is fastened to the shaft with a pin run through a hole drilled in them. If a small flywheel is attached to the outer end of the spindle it will aid in keeping a steady motion.

The same procedure is carried out in the construction of the tailstock bearings. The standards for this part are about 8 in. long and are bolted at right angles to and between two pieces that rest on top of the ways. The shaft is threaded full length, which should be done in a lathe by a machinist to get a true thread, and the melted metal run on it to make an internal thread in the bearing. A nut is run on the threads of the shaft between the standards, and provided with a small handle for use in locking the shaft when it is set on work between centers. A small handwheel is attached to the back end of the shaft, into the rim of which a handle is set to make the turning easy.

The faceplate consists of a disk of metal, 6 in. in diameter and ¼ in. thick, attached with $\frac{3}{16}$-in. machine screws to a ¾-in. nut. The disk is drilled in various places to receive ordinary wood screws. The faceplate should be made by a machinist so that the surface of the face can be turned true. The spur center is made of a ¾-in. nut, drilled in opposite corners for ¼-in. pins, 1¼ in. long.

The drive wheel for this lathe was taken from an old discarded washing machine. Such a wheel is a very common part of various kinds of machinery and usually one that will answer the purpose can be found in a junk pile. One from 20 to 24 in. in diameter will be about right. A ½-in. bolt is used for the shaft, which is run through the standard at the headstock end of the lathe from the outside, the threads being previously cut long enough to introduce a nut between the wheel and the standard for clamping the bolt in place. The extending threaded end of the bolt is then supplied with two nuts, one on each side of the wheel hub, and a short piece of pipe is slipped on, to make a bearing over the threads. One of the spokes is drilled and a pin inserted and fastened to receive the upper end of the pitman from the treadle. The wheel is adjusted on the shaft with the nuts on each side of the hub so that its face runs true with the pulley on the headstock. The wheels are connected with a 1-in. leather belt.

The treadle consists of a frame built up of boards and swung to the centers at both ends on ⅝-in. steel rods, for bearing pins, the bearings being made of wood standards with ⅝-in. holes bored in them to receive the pins. The pitman is made of wood, its length being determined by measurement of the distance between the crank pin and the treadle-arm end when both are at their lowest point.

The slide for the rest consists of a 1-in. square steel bar, about 10 in. long, having a hole drilled in one end and threads cut with a ½-in. tap. The rest used in this hole is made of a ½-in. rod, threaded on one end and bent at right angles on the other. The clamping device for the slide is made of two bars, 1 in. by $\frac{3}{16}$ in., fastened to the square bar and extending down between the ways with sufficient ends beneath to attach a wooden clamp block and cam with a handle. This construction is clearly shown in the drawing. If only a lathe is required, the machine would be complete as now described, but the other attachments illustrated will greatly add to its usefulness and the owner will be well repaid by making them.

Attachments

One table is used for the circular saw, planer head, sander, and jig saw, and it is attached on top of the headstock and tailstock standards with bolts, run through the back edge of the board and the ends of two brackets which are screwed to the back edge of the inner standards. Thumb nuts are used on the bolts to aid in making the change quickly. More than one hole is provided in the back edge of the board, so that the tailstock bracket can occupy the right position for the sander or planer head, as the case may be. The holes in the bracket ends should be somewhat larger than the bolt, to allow tilting of the table. An adjusting screw is substituted for the rest, so that the table can be raised or lowered to suit the work in hand.

The circular saw is 5 in. in diameter and should have fine teeth. It is placed on the spindle threads against the nut, and held there with another nut and washer on the end of the spindle. The table is attached over the saw, and the spindle is driven at a high speed.

The planer head is made of a wood block, 3 in. long and 2¾ in. square. A ⅜-in. hole is bored through one way near each end, as shown in the drawing, and two steel knives, with ½-in. holes coinciding with the ⅜-in. holes in the wood, are made and attached with their edges opposite or projecting diagonally from the corners. The holes in the knives being larger than the bolts, makes the knives adjustable for setting the cutting edges. These knives may be made from an old saw blade, ground to size and one edge beveled and sharpened. A brass plate, with holes to fit the spur center, is fastened in the center of the block, on one end, and the other is centered for the cup of the tailstock screw. The adjusting screw for the table is used to regulate the cut.

The sander is constructed of a wood piece, 9 in. long and 3½ in. in diameter. A groove is cut in one side of the rounding surface to admit the ends of the abrasive which may be fastened there with tacks.

An emery wheel can be used on the

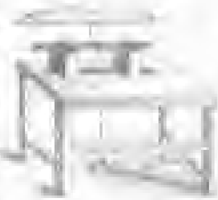
Other Man Powered Lathes

Pole-lathe. A lathe in which the work is supported between centers on posts rising from the bed, turned by a strap which passes two or three times round the work. The lower end of the strap is connected to the treadle, and the other end to a spring-bar on the ceiling. One of the centers is an iron pin, and the other is on a screw in the other standard. The rest is a rail or bar extending from one puppet to the other. The work is intermittent, the cutting [illegible] the treadle descends; the pressure of the foot being relaxed, the spring-bar raises the treadle, rotating the work in the other direction.

Fig. [illegible] shows the foot-lathe of the [illegible] people. The turner is shown making a [illegible]. The motion is reciprocating [illegible] [illegible] the hand is rotated towards [illegible] the chisel or [illegible] tool. [illegible] and the elasticity of the spring-bar [illegible] [illegible] the other direction and [illegible] into the [illegible] of the [illegible] [illegible].

The lathe of the [illegible] consists of two upright [illegible] driven into the ground at the [illegible] for holding the work, with [illegible] projecting [illegible]. The [illegible] held [illegible] and [illegible] forward by a [illegible] held in the left hand, and the [illegible] round the wood. Fig. [illegible] shows a pole and treadle lathe used by people of the Carpathian Mountains. The work is [illegible] [illegible] and rotated by the cord which [illegible] the end of the spring-pole with the treadle. [illegible]

Fig. [illegible]



Pole-lathe.

Fig. [illegible]

Lathe of the Carpathians.

Knight's Mechanical Dictionary 1872

Fig. 2880.

Pole-Lathe (Africa).

spindle in the same manner as the circular saw. Procure a wheel, 5 in. in diameter with a ½-in. face and having a lead center. The hole should be bored out and tapped to fit the threads on the lathe spindle, and to have the grinding surface run true, this work should be done in a lathe by a machinist.

The drawings show the construction of the jig-saw attachment. The standard on which the arms are pivoted is made of a ½-in. bolt, threaded for its entire length and with a groove cut in the head and nut to receive the arm pivots. A locknut is used beneath the notched nut to hold the adjustment. Two nuts and washers are used near the center of the bolt for clamping the attachment to the table. The pivots are made of sheet metal, bent and drilled as shown. The small projection at each end of the edge is raised slightly by hammering the corner of the metal. These projections prevent the arms from sliding sideways. The clamps for holding the ends of the saw blades are easily made of thin sheet steel, or brass, with a ⅜-in. bolt and washer at the end for the clamp. The tension of the blade is secured by a piece of wire, an eyebolt and a thumb nut, connecting the rear ends of the arms as shown. The frame is driven by the spur center. The pins are removed from the center and a ¼-in. pin is inserted in one of the holes so that it will project ⅝ in. The pin runs in a slot cut in a brass plate that is attached to the lower arm.

Very serviceable tools can be made of discarded files by grinding them to shape on the emery wheel. Always use a fine whetstone to finish the edge on a woodworking tool.

How to Make See-Through Mirrors

The FBI used the see-through mirror in "The House On 97th Street". Most guys who learn to make these mirrors claim they want them for surveillance of America's enemies, like the FBI and CIA. When you learn to make such a spy mirror you will probably run right out and buy a motel and a roll of film. I don't care what kind of sickie you are as long as you send me some of the prints.

First, you want the right glass. Window glass may not be smooth enough. You should go to your local mirror shop and buy a pane of glass prepared for mirroring.

To make the first of two needed mirroring solutions, dissolve five grams of silver nitrate (bought at your local photo supply store) in eight ounces of distilled water. Then add ammonia with a strength of 25 to 30%, drop by drop until the solution starts to darken. Continue dropping in the ammonia until the solution becomes clear again. Then add another four grams of silver nitrate and stir with a glass rod until it dissolves. Pour this mess into 20 ounces of distilled water and filter it through two sheets of filter paper into a bottle.

For the second solution, dissolve three grams of Rochelle salt crystals (sodium potassium tartrate) in one quart of distilled water and boil in a glass or porcelain vessel for two minutes. Then add three grams of silver nitrate and boil for two minutes more. Let the solution cool and then filter it into a bottle. (The solution bottles and everything you use must be super clean and non-metallic as any foreign substance could ruin the work).

When both solutions are ready, the silvering process can begin.

Clean the mirror glass thoroughly with the best glass cleaner and flood it with distilled water. Then hold the glass by the edges and pour off the distilled water. Then support the glass by the corners on four drinking glasses on a level surface.

Put melted wax around the edge of the glass to keep the silvering solution from running off. Put a mirror beneath the glass at an angle to permit observation of the reflection of the silvering process so that the silvering may be stopped at the right moment.

Mix equal parts of both solutions, stir quickly with a glass rod and pour immediately into the center of the glass so that it covers the entire surface. The right film of silver will deposit on the glass and the right degree of transparency will be obtained in from 5 to 20 minutes, depending on the degree of transparency wanted.

Then take the glass by the edges, tip off the solution at one corner and then flood with lukewarm distilled water and let it drain off. When the mirror is dry, put a coat of clear spar varnish over the silver deposit with a soft brush, being careful not to damage the delicate film. You can also spray it on and I don't see why a can of plastic spray wouldn't be just as good.

To further protect the silver film it is suggested you put on another pane of glass over the film and tape it around the edges.

To use, the light must be on the side of the mirror you want to see. The room you are in must be dark.

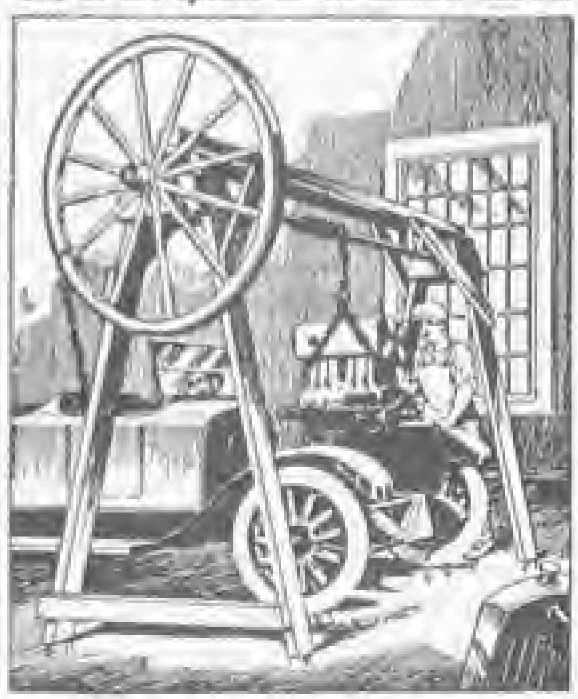
If the mirror is hard to see through, the silvering process has been continued too long or the light difference between the two sides of the mirror is not great enough. Some practice with small mirrors is advised before larger mirrors are made until you have the timing right.

The work should be done in a warm room of about 80°F.

Popular Mechanics 1925

Repair-Shop or Farm Hoisting Gear

For hoisting automobile engines from their chassis, lifting bodies, and other heavy work, an automobile repairman uses the hoisting arrangement shown in the drawing. The main structure is of wood, with a piece of heavy 3-in. pipe supported on wooden bearings, parallel with the horizontal crosspiece. An eyebolt, to which one end of the hoisting chain is attached, is fastened to the center of the pipe. An old wagon wheel is pinned to the outer end of the pipe and provides a means for turning the pipe and winding up the chain. This arrangement produces a powerful leverage. A holdfast for retaining the hoist in any position is provided by a short chain and hook fastened to the woodwork, the hook being slipped over one of the spokes in the manner shown.



This Simple Windlass Arrangement Consists of a Wagon Wheel Pinned to the End of a Piece of Heavy Pipe, Which Is Supported on Wooden Bearings

Iron straps, in addition to the bearings, are provided, for supporting some of the weight of the load on the pipe. The usefulness of this device is not confined to the shop. It will be found exceedingly handy around the farm, for lifting wagon tops, or other heavy work.

To Make Home-made Tallow Candles.

Tallow candles are made in two different forms; the mould candle is the easiest to make, but involves the expense of a mould made expressly for the purpose; the dip candle requires more trouble, but no apparatus to make it; the first cost, however, of a candle mould is fully compensated for by the superiority of the candles made by it over those made by dipping.

632. To Make Candle Wicks. The wicks are composed of cotton yarn (what is known as No. 16 is a good size for the purpose); for candles of 8 to the pound, about 40 threads, and for 6 to the pound, about 50 threads of yarn should be very loosely twisted together. The light from a tallow candle can be improved in clearness and brilliancy by using small wicks which have been dipped in spirit of turpentine and thoroughly dried.

633. To Make Mould Candles. The wicks are secured in the centre of each mould by passing over thin sticks, one of which is laid over the top of the mould (corresponding to the bottom of the candles), and the other against the bottom points of the moulds. The end of the twisted wick is fastened to the stick on the top of the mould, and is drawn by a piece of hooked wire, through each mould in succession, leaving a loop outside the bottom points of the mould; the loops are secured there by the bottom stick passing through them; the wicks are to be drawn tight and the last end tied to the upper stick. The melted tallow is then poured into the moulds and allowed to stand about 6 hours in a cool place, after which the bottom stick must be taken out of the loops, and the candles withdrawn from the moulds. The tallow should not be heated much more than is necessary to melt it.

634. To Make Dip Candles. Dip candles are made by looping a number of separate wicks over a rod, and dipping them into very liquid tallow, until the required thickness is attained, allowing the tallow which adheres after each dipping to set or harden before dipping again. Before the second dip, it is well to lay the wicks on a flat surface, and straighten them, and a suitable contrivance adopted for holding the rod while drying between the dips.

635. Tallow for Making Candles. A good tallow for candles consists of about ½ beef and ⅔ mutton suet. If required for summer use it will be improved by hardening according to receipts No. 639 or 640; it can, if needed, be so hardened as to have almost the appearance of stearine. (*See No.* 639.)

636. To Make Lard Candles. To every 8 pounds of lard add 1 ounce of nitric acid. Having carefully weighed the lard, place it over a slow fire, or at least merely melt it; then add the acid, and mould the same as tallow; this makes a clear, beautiful candle. A small proportion of beeswax will make them harder.

637. To Harden Tallow Candles. The following mixtures for hardening tallow candles are patented in England. The candles are successively and rapidly dipped, first in Mixture I., which consists of stearic acid, 50 parts; tallow, 44 parts; camphor, 3 parts; white resin, 2 parts; and gum damar, 1 part. When cool and hard they are dipped into Mixture II., which consists of stearic acid, 70 parts; tallow, 24 parts; camphor, 3 parts; white wax, 2 parts; gum damar, 1 part; and finally into Mixture III., which is composed of stearic acid, 90 parts; tallow, 5 parts; camphor, 3 parts; white wax, 2 parts.

638. To Harden Tallow by Capaccioni's Process. Melt 1000 parts tallow, and gradually stir into it 7 parts sugar of lead previously dissolved in water, being careful to keep the mass constantly agitated during the process. In a few minutes diminish the heat, and add 15 parts incense (powdered) with 1 part turpentine, keeping the mass constantly stirred as before. Then allow the mixture to remain warm until the insoluble parts of the incense settle to the bottom, usually several hours. By this process the sugar of lead so hardens the tallow that it yields a material very similar to stearine (stearic acid), while the incense improves its odor. It is said that tallow treated in this way, when made into candles, will not gutter or run.

639. To Harden and Whiten Tallow for Summer Use. Gently boil the tallow with the addition of a little beeswax, 1 or 2 hours a day for 2 days, in a suitable kettle, adding *weak* lye and skimming often; cut it out of the pot when cold, and scrape off the underneath soft portion, adding fresh but weak lye before the second boiling. The third day simmer, and skim it, in water containing 1 pound of alum and 1 pound saltpetre for each 20 pounds of tallow. When cold it can be taken off the water for use. Tallow thus treated will make good hard white candles for summer purposes.

640. To Harden Tallow for Making Candles. Use 1 pound of alum for each 5 pounds of tallow. Dissolve the alum in water, then put in the tallow and stir until both are melted together, then run in moulds. Candles made in this way will be as hard and white as wax.

641. To Harden Tallow with Resin. To 1 pound tallow take ¼ pound common resin; melt them together, and mould the candles the usual way. This will give a candle of superior lighting power, and as hard as a wax candle; a vast improvement upon the common tallow candle, in all respects except color.

Candles are of several varieties: —

1. *Paraffine*; obtained from the distillation of coal at a low heat, also from lignite, peat, and wood. Frequently combined in candles with sperm and stearine. See PARAFFINE.

2. *Spermaceti*. Usually of wax and spermaceti. These are molded.

3. *Composition*. Mixtures of spermaceti, tallow, with a little resin or wax, in various proportions.

4. *Stearine*. In June, 1825, Gay Lussac obtained a patent in England for candles made of the stearic acid of tallow, lard, or cocoanut oil.

The fatty acids are separated from the glycerine by caustic lime, the fat, lime, and water being boiled and stirred together until the mixture is fully saponified. The lime is then saturated by agitation with dilute sulphuric acid, which forms a solid sulphate of lime, and sets the fatty acids at liberty; the latter rise to the surface, and are decanted from the limy sediment. The traces of lime are removed by washing in dilute sulphuric acid and then in clear water. The oleic acid is removed by placing the mass in bags and subjecting it to heat and pressure in a hydraulic press. The solid stearic and margaric acids are farther pressed, purified, washed while in a heated condition, decanted, and run into molds.

5. *Tallow*. These are molded or dipped.

6. *Palm-oil*. This is obtained by bruising and boiling from the fruit of the oil-palm (*Elais guineensis*). It contains about 66 per cent of a solid white fat known as palmitine. The oil is bleached, compressed in woolen bags. The solid matter is melted, decanted, a little wax added, and run into the molds in the frames.

7. *Wax* candles are not easily molded, and are therefore prepared by pouring wax on suspended wicks; the cylindrical form being afterwards given by rolling hot between a wooden slab and a wet table.

Larger wax candles are made by rolling a wick into a sheet of wax, in a spiral of gradually increasing diameter.

Wax tapers are made by drawing a string at a regulated speed through a pan of melted wax.

The Reformation greatly decreased the consumption of wax candles and the keeping of bees. In the Castle of Wittenberg and its church 35,750 pounds of wax lights were burned yearly. In the beginning of the fourteenth century, wax and tallow candles were uncommon. Philip the Bald, Duke of Burgundy about 1361, offered to St. Antony of Vienne, for the restoration of the health of his sick son, as much wax as the latter weighed, and was held to have made a princely offer. In January, 1779, 14,000 wax candles were lighted at once in the celebration of a feast in the Electoral Palace of Dresden.

Candles which require no snuffing have slender wires twisted in with the cotton of the wick. When burning, the top of the wick turns outward in such a way as to enable the oxygen of the air to consume the charred substance, which it cannot do when in the middle of the flame.

Night-lights are short thick candles with small, thin wicks.

Machines are used for making candles with an inner core of soft or inferior material, such as tallow, and a coating of hard or superior substance, such as paraffine.

Sprout Seeds in Your Incubator

Popular Mechanics 1925

The value of sprouted oats as a green food for poultry has long been recognized, but the difficulty of obtaining or constructing an efficient sprouter has prevented many spare-time poultrymen from making use of the knowledge.

Any poultryman who owns an incubator that is not working during the winter months has at his command an efficient device for sprouting oats. The drawers are removed and extra strips are temporarily tacked to the sides of the incubator, on which the trays containing the oats are placed. The trays are single wooden frames covered on one side with screen wire or burlap. About an inch of space is allowed between each tray to permit a free circulation of warm air.

The oats are moistened and placed in the trays and the incubator lamp is lighted and adjusted to maintain a temperature of about 75° F. To prevent the oats from drying out, pans of water should be placed on the floor of the incubator and the grain sprinkled each day.

If the various trays are filled at intervals of a day or so, the poultryman will have a constant supply of green food for his flock.

In placing the additional strips that are necessary for supporting the trays, very small brads or nails should be used, as there will be very little weight upon the strips, and their removal will not then be so likely to mar the appearance of the incubator.

EATING GOOD BUT CHEAP TO SAVE FOR THE MOVE

In this article I will describe two foods which will save you hundreds of dollars during your survival preparation year.

First, you must run to your friendly Natural Food store and buy a hand-cranked grain mill: Corona or Quaker City are the standards.

Whole grain is the basis for economy in food. If you don't cook it whole or sprout it, you must have your own grinder.

From the Natural Food store you can buy wheat, corn and rye for about 20c a pound each. Try one pound of each grain. Grind it finely and mix all three in one batch.

This mixture makes fantastically delicious griddle cakes. I recommend first trying it out as mush.

Put four ounces or one cup full and a half teaspoon of salt in one cup of cold water and stir it a minute until there are no lumps. This is because if you pour the dry meal into boiling water it will be nothing but lumps. Pour the cold mix into two cups of boiling water and then lower the heat. Stir it a couple of minutes and set it off the fire and go do something else for a few minutes while it thickens and sets. (If you like fried mush, make it up at night and slice and fry it in the morning.)

Now you have over a pound of fantastically nutritious food. It is actually very tasty and is delicious with milk and sweetening or with salt, margarine and spices. It is very filling without being stuffy and you will have a feeling of boundless energy until lunchtime. This one course breakfast also saves time you can put to better use, like sleeping.

Such a breakfast costs only 5c. The average home breakfast costs 75c, or $273.75 for a year of breakfasts for one. Saxon's Super Mush, on the other hand, will give you 365 great breakfasts for only $18.25. That's a $255.50 savings. Think of all the goodies you can buy with $255.50.

If you have ids, feed them the same thing. Bribe them with part of the savings and you'll get little complaint. Also, since Saxon's Super Mush is more nutritious than the processed filth they've probably been eating, they'll feel better and do better in school.

Another convenience is sprouted mung beans. They are mainly associated with Chinese restaurants. But they are becoming quite commonplace among survivalists as they are so easy to work with, cheap and are more nutritious than any other vegetable you can buy.

They are not so nutritious as sprouted soy beans but are much easier to sprout.

Any harried housewife or lazy bachelor can sprout mung beans in the kitchen sink, just messing with them a few seconds every few hours and while they would be working around the sink, anyway. And after a few days, from a shot-glass full of mung beans, you'll have a wealth of tasty green vegetables for about 10c a pound.

If you made mung beans or other sprouts your main green vegetable you would save many dollars over a year. Also, you can buy ten pounds of mung beans for about $7.00 and keep them for months. This is convenient since it means less groceries to lug home.

To make your sprouters, save a couple of quart jars. Use cheese cloth, screen wire or a woman's stocking, held over the mouth of the jar with a rubber band. That's all the machinery you need.

Put about an ounce of mung beans in one jar and secure the screening material with the rubber band. Then cover the beans with cool water and set aside for about eight hours until they swell. Then pour the water off and rinse the beans well. Then turn the jar upside-down and leave it in or by the sink.

Every four to six hours, fill the jar with water through the screen and swish it gently while pouring it back out. This will not only irrigate the beans but will dislodge any mold spores that might have taken hold among the beans.

Grow them in a comparatively warm room as cold retards their growth and may even kill them.

Some people use the sprouts after three days, before the little leaves appear. Early sprouts are best eaten raw, plain or in salads. After five or six days the little leaves begin and these sprouts are best for cooking. You don't want to wait any longer to eat them as they become woody after the leaves appear.

I grow mine for cooking as five or six days makes for a much greater volume and weight of vegetables than if I were sprouting them for salad.

When they are just the size you like them, put them in a bowl and store them in the refrigerator. This stops their growth and they will keep very well for several days.

Depending on how much vegetable matter you want, you can start a jar every day or so. That way you will always have plenty on hand. It will only take a couple of weeks to learn how often you should start a jar of sprouts so there will always be enough.

You may not want to eat the little green hulls. You can easily get rid of them by flooding the finished beans in a bowl. The hulls rise to the top and can be poured off into the sink.

Pretzels

Make a dough of four cups of flour, 1 tablespoon butter, 1/2 teaspoon salt, a rounded teaspoon dry yeast, enough water to make a rolling dough. Let rest 20 minutes, then roll out and cut into strips and let dry a couple minutes. Shape into pretzels pinching ends together. Let stand until they begin to rise.

Make a solution of one level tablespoon of lye in a half gallon of boiling water or 2 tablespoons in a gallon (don't use aluminum pans). Put the pretzels in the boiling water. As soon as they come up to the top take them out. Drain, brush with beaten egg yolk, sprinkle with course salt or caraway seed. Bake on oiled baking sheet. Set oven as high as you can, 700 if possible and leave in there 2½ minutes, (10 minutes at 500). Take out of the oven, turn down to 400, set them back in and leave in until they are bone dry. Drying time varies a lot by how they are cut out, how thick they are. Break into desired lengths. Put into jar with tight lid and they'll keep.

Potpourris

Pronounced Popurree' (French)

Variate mixture to your liking.

1 tablespoon of two fragrant herbs such as rosemary, bay leaf, marjoram, cedar, mint or thyme.

2 or 3 teaspoons of cloves, nutmeg or allspice.

1 slice of lemon or orange peel, dried.

A few drops of peppermint oil or rose oil.

A fixative such as gum benzoin or gum storax purchased at your drug store.

Rose petals and lavender, lilac pinks or other combinations. The potpourri should be at least 4/5 of this.

Mix and cork tightly for 2 or 3 weeks.

Now, store in china or pottery with tight lid. Remove lid when you want to scent a room. Light deteriorates potpourri. So do not store in glass.

Toiletries for Pennies

Brand name family sized toothpaste, 7-oz., costs from $1.07 to $1.51.

Deodorant costs 66¢ for a 2-oz. stick to $1.99 and more for sprays.

Mennen aftershave, 4-oz., costs $1.14. Four ounces of Hi Karate costs $1.69.

Shaving cream, foam, costs on the average of $1.20 for 7 to 11-oz. cans.

Men's hair dressings cost from $1.17 for 6½-oz. to $1.59 and more for 7-oz.

Dippedy Do hair set costs $1.47 for 8 ounces.

If you have a family, a year's supply of several of the above really adds up to quite a bundle. A 7-oz. tube of toothpaste every week will drain from $55.64 to $78.52 from your survival budget.

The main ingredient of toothpaste is calcium carbonate—called whiting. You can order it through any house paint store. Over a year's supply of 25 pounds costs 12 cents a pound or $3.00. Enough honey to give it the right consistency would give you at least 30-lbs. of fine toothpaste for under $10.00. (You don't make it all up at the same time.) Instead of a toothpaste tube, use a plastic mustard or catsup squeeze bottle bought at the dime store. Keep it by the toothbrushes and upside-down.

Deodorants kill odor-causing bacteria and close the pores to stop perspiration. To make your own deodorant, just as good as the brand name stuff, buy a 16-oz. bottle of rubbing alcohol from the dime store for 46¢ and a 2¼-oz. box of alum at the grocer's for 20¢.

The alum closes the pores and the alcohol kills the bacteria, all for 9¢ for an amount you'd pay over $1.00 for and just as good. I took an old Secret roll-on bottle, 1.5-oz., and pried off the roller unit. I then filled it ¾ths full with alcohol and filled it the rest of the way with alum. Works perfectly. Shake well before each use. When the alcohol is used up put in a bit more alum and refill with alcohol. You can use any deodorant bottle or even a window spray bottle or you can use pads instead of a roll-on or spray.

Aftershave is simply alcohol, which cools the scraped skin and closes the tiny nicks and abrasions. If you want to smell pretty, buy Mennen or Hi Karate. But if you simply want the job it does, use your rubbing alcohol, 4-oz. for about 12¢ as opposed to 4-oz. of Hi Karate for $1.69.

For years I used plain facial soap for shaving. It does just as good a job as the foam types and the cost is not counted as you always have soap around. I later changed to an electric shaver, which doesn't really require any prep or aftershave and is more economical than buying razor blades in the long run.

For my hair, I use water and petroleum jelly, called vaseline. Eight ounces, a year's supply, costs 39¢ at the dime store. Why pay more?

Why should a woman use Dippedy Do or some other expensive hair setting gel when she has eggs in the refrigerator? All the stuff is is egg white. The egg white, separated and beaten with half its volume of rubbing alcohol, will give you a fine product, used just like the expensive brands.

With the above toiletries, you have been paying someone else to perfume and mess with some of your basic needs. The same principles apply to many other toiletries and cosmetics. Examine what you use regularly and see if you can't use its basic raw materials or substitute some other cheap compound to arrive at the same result.

Applying these money-saving hints to your family budget will save you many dollars in a year. This can also be a test to see if you are a serious survivor or just an empty dreamer.

THE ARROW CATAPULT—A SIMPLE BUT LETHAL TOY

Popular Mechanics 1915

The catapult shown in the sketch is one I constructed some time ago and found to be amusing and very inexpensive. The catapult consists of a small piece of dowel or pine, whittled into the shape of a handle, a screw-eye, an elastic band and an arrow. It is surprising how a well-balanced arrow will fly into the sky until lost to sight when propelled through the eye of the screw with a medium-strong elastic. A number of forms of this simple gun were made, but the one shown is the simplest and most effective.

The Eye of the Screw Serves as a Guide for the Arrow

Studying Your Survival Home From Afar

As a general rule, you should choose a small town of under 50,000 population. You may think a village of a few hundred would be even better. Maybe so, but I would want a pool of talent; manpower for defense, facilities for a mini-civilization to build up after the crash.

I would avoid tourist areas unless I were wealthy. Tourism is predatory and prices are higher as a matter of course. You will be paying motel rates even though you intend to stay.

Just be practical about a location. Forget Shangri-la and any romantic hideaways.

Once you've hit on a location that suits your finances, temperament and abilities, go to the phone company and order a phone book for the town or area of your choice.

Within a couple of weeks you'll get the phone book. Look up the local newspaper and send them $10 for a full or partial year's subscription.

Write their Chamber of Commerce for area maps and general descriptive literature.

If you are religious you should write the local head of the coven of your choice.

Invest a phone call to a local realtor and tell about the kind of place you want. A call from out of state will make that realtor's day. He'll give your case a lot more thought than if you dropped in on him.

In the local newspaper you will probably come across people who share your interests. Write to them for advice. They'll be flattered.

You must assure any contacts that you are not competing with them. Don't ask about jobs. Perfect a trade and take it with you. You will be self-sufficient and are bringing something, rather than attaching yourself to their public tit.

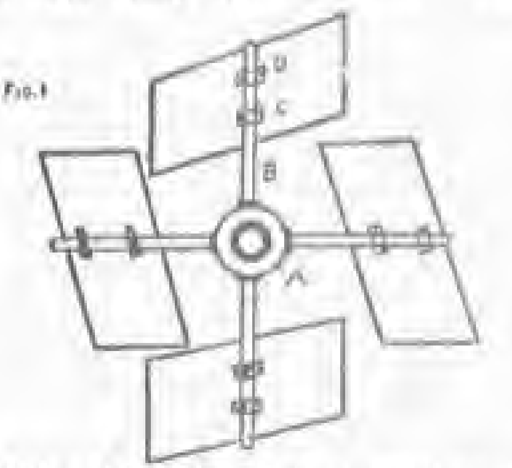
Build up your contacts and your knowledge of the area for about a year and moving there will be just like going home.

MAKE A ONE OR TWO HORSEPOWER WINDMILL OUT OF SCRAP

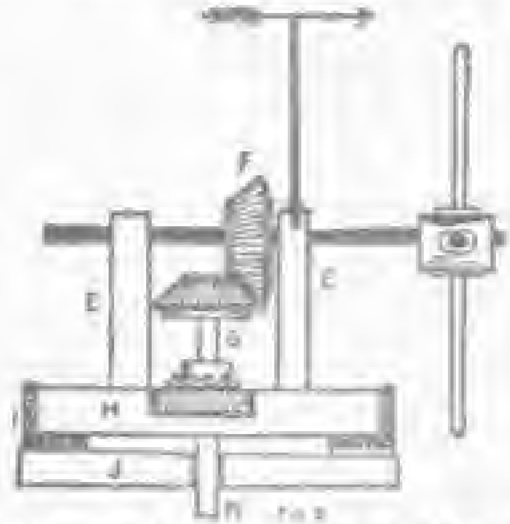
From Popular Mechanics 1913

A windmill for developing from ½ to 2 hp. may be constructed at home, the expense being very small and the results highly satisfactory.

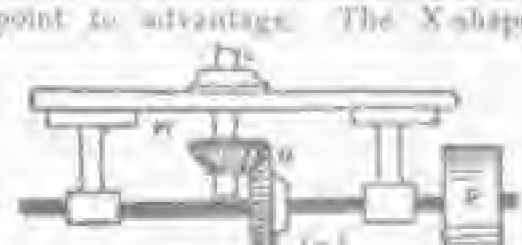
The hub for the revolving fan wheel is first constructed. One good way to get both the hub, lining, shaft and spokes for the blades, is to go to a wheelwright's and purchase the wheel and axle of some old rig. There are always a number of discarded carriages, wagons or parts thereof in the rear of the average blacksmith's shop. Sometimes for half a dollar, and often for nothing, you can get a wheel, an axle, and connected parts. Remove from the wheel, all but the four spokes needed for the fans as in Fig. 1. The same hub, axle and bearings will do. In case you cannot secure a wheel and shaft, the hub may be made from a piece of hardwood, about 4 in. in diameter and 6 in. long. A 2 in. hole should be bored through for a wooden shaft, or a 1½ in. hole for a metal shaft. The hub may be secured by putting two or three metal pins through hub and shaft. Adjust the spokes by boring holes for them and arrange them so that they extend from the center A, like B. The wheel is then ready for the blades. These



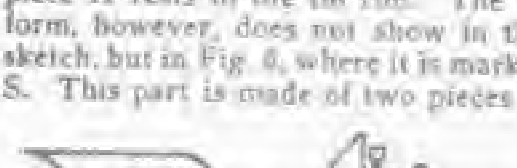
blades should be of sheet metal or thin hardwood. The sizes may vary according to the capacity of the wheel and amount of room for the blades on the spokes. Each one is tilted so as to receive the force of the wind at an angle, which adjustment causes the wheel to revolve when the wind pressure is strong enough. Secure the blades to the spokes by using little metal cleats, C and D. Bend these metal strips to suit the form of the spokes and flatten against the blades and then insert the screws to fasten the cleats to the wood. If sheet metal blades are used, rivets should be used for fastening them.



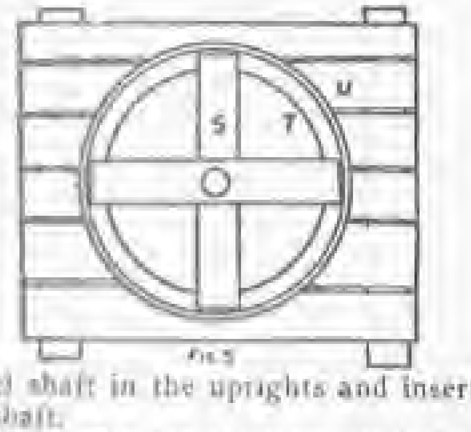
The stand for the wheel shaft is shown in Fig. 2. Arrange the base piece in platform order, (J). This is more fully shown in Fig. 5. On top of this base piece, which is about 36 in. long, place the seat or ring for the revolving table. The circular seat is indicated at I, Fig. 1. This ring is like an inverted cheese box-cover with the center cut out. It can be made by a tinner. Size of ring outside, 35 in. The shoulders are 3 in. high and made of tin also. Form the shoulder by soldering the piece on. Thus we get a smooth surface with sides for the mill base to turn in so as to receive the wind at each point to advantage. The X-shaped



piece H rests in the tin rim. The X-form, however, does not show in this sketch, but in Fig. 5, where it is marked S. This part is made of two pieces of



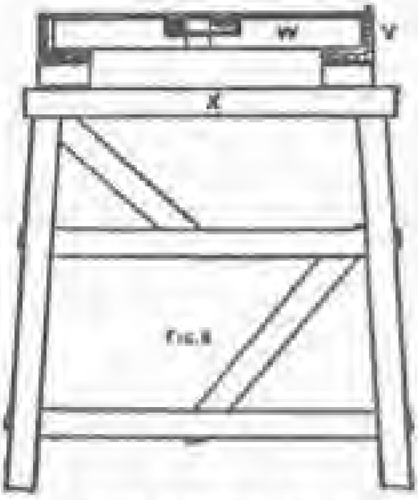
2-in. plank, about 3 in. wide, arranged so that the two pieces cross to make a letter X. When the pieces join, mortise them one into the other so as to secure a good joint. Adjust the uprights for sustaining the wheel shaft to the X-pieces as shown at E, E, Fig. 2. These are 4 by 4 in. pieces of wood, hard pine preferred, planed and securely set up in the X-pieces by mortising into the same. Make the bearings for the



wheel shaft in the uprights and insert the shaft.

The gearing for the transmission of the power from the wheel shaft to the shaft calculated for the delivery of the power at an accessible point below must next be adjusted. The windmill is intended for installation on top of a building, and the power may be transmitted below, or to the top of a stand specially erected for the purpose. It is a good plan to visit some of the second-hand machinery dealers and get four gears, a pulley and a shaft. Gears about 5 in. in diameter and beveled will be required. Adjust the first pair of the beveled gears as at F and G. If the wheel shaft is metal, the gear may be set-screwed to the shaft, or keyed to it. If the shaft is hardwood, it will be necessary to arrange for a special connection. The shaft may be wrapped with sheet metal and this metal fastened on with screws. Then the gear may be attached by passing a pin through the set-screw hole and through the shaft. The upright shaft like the wheel shaft is best when of metal. This shaft is shown extending from the gear, G, to a point below. The object is to have the shaft reach to the point where the power is received for the service below. The shaft is shown cut off at K. Passing to Fig. 3 the shaft is again taken up at L. It now passes through the arrangement shown, which device is rigged up to hold the shaft and delivery wheel P in place. This shaft should also be metal. Secure the beveled gears M and N as shown. These transmit the power from the upright shaft to the lower horizontal shaft. Provide the wheel or pulley, P, with the necessary belt to carry the power from this shaft to the point of use.

The tail board of the windmill is illustrated in Fig. 4. A good way to make this board is to use a section of thin lumber and attach it to the rear upright, E of Fig. 2. This may be done by boring a hole in the upright and inserting the shaft of the tail-piece. In Fig. 4 is also shown the process of fastening a gear, R, to the shaft. The set screws enter the hub from the two sides and the points are pressed upon



the shaft, thus holding the gear firmly in place. The platform for the entire wheel device is shown in Fig. 5. The X-piece S is bored through in the middle and the upright shaft passes through. The tin run-way or ring is marked T, and the X-piece very readily revolves in this ring, whenever the wind alters and causes the wheel's position to change. The ring and ring base are secured to the platform, U. The latter is made of boards nailed to the timbers of the staging for supporting the mill. This staging is shown in Fig. 6, in a sectional view. The ring with its X-piece is marked V, the X-piece is marked W, and the base for the part, and the top of the stage is marked X. The stage is made of 2 by 4-in. stock. The height may vary, according to the requirements. If the affair is set up on a barn or shed, the staging will be sufficient to support the device. But if the stage is constructed direct from the ground, it will be necessary to use some long timbers to get the wheel up high enough to receive the benefit of the force of the wind. Proceeding on the plan of the derrick stand, as shown in Fig. 6, a stage of considerable height can be obtained.

Popular Mechanics 1918

Catching Minnows for Bait

Instead of chasing the little fish up and down the stream to catch enough for bait, try putting a clean bit of shell in a wide-mouth jar and holding it in the water. The minnows will be attracted in great numbers, and it is an easy matter to dip them up. A bit of shell can be used also in a net. The white, shining shell seems to be a good lure for the little fellows.

FAMILY POWER PLANTS: THE ONLY SOLUTION TO YOUR ENERGY CRISIS

By KURT SAXON

While there is oil in the Middle East or coal in Appalachia, energy alternatives will only be a popular dream. When oil and coal run out or become too difficult and expensive to get from the earth, the populace will expect alternatives. But the promises of development will prove to have been empty.

The news media has been putting out greater amounts of propaganda about proposed government and industry backed energy alternatives.

Hitler's promises of secret weapons in the offing kept the people hopeful long after the war was lost. In the same sense, alternative energy propaganda is calculated to stave off the panic which would arise if the average Joe knew his way of life was going to grind to a halt within about five years.

When President Ford tells the public that energy alternatives are being developed, he is only passing on the wishful thinking he and other cloddish politicos have been given by our industrialists. Even intelligent politicians are willing to pass on these myths. They know that unless industry continues to monopolize the development and sale of energy, their brand of government cannot endure.

In their case and that of industry, dependence is the name of the game.

A handful of coal, oil and natural gas companies selling us all our energy ensures the centralization of one of the greatest blocks of wealth in Western Civilization. They are the sun around which we all revolve.

Without centralization, Industrial and Political power is impossible. The Politicians know this and will do their best to keep energy centralized, even if it means discouraging private adoption of alternatives.

On the one hand, Politicians talk of Industry's efforts to develop alternatives. Industry's efforts in this line are impractical at best and stupid at worst. One worst example is atomic energy. An example of impracticality is the proposed plans for utilizing geo-thermal energy, feasible only in certain areas which have hot springs, volcanos, etc.

Then there is the much publicized mountains of oil-bearing shale. This is located mainly in dry areas with hardly enough water for agriculture. Extracting oil from shale takes vast amounts of water. No water, no shale oil.

No matter what their proposals, Industry has no interest in developing energy they can't sell. Nor will one major industry put out a product which would ruin another major industry. This is not because of ethics but because of the interdependence which keeps the Industrial structure together.

Take the auto industry for example. They are stuck with the internal combustion engine. It is dirty, inefficient and dependent on fossil fuels. (Methane is not encouraged.) Without the internal combustion engine, Standard Oil would have never become a major world power.

The only suggested alternative to the internal combustion engine has been the electric auto. Such a beast uses much of its energy carrying all those heavy batteries. If you want to go farther than about fifty miles, you must either change the batteries or wait a few hours for recharging. And don't forget: the recharge energy would have to come from somewhere, probably from fossil fuels. The electric will not replace the internal combustion engine.

The internal combustion engine could be adapted to use Methane. That would just about put the oil people out of business unless they tapped every cow lot, sewer and garbage dump in their respective states. It still would not be economical for them or you (unless you generate your own methane) so don't expect it.

The auto industries could bring back and improve the Stanley Steamer if they had the billions to retool, which they don't. The improved steam car would be clean, cheaper to buy and run. It would be easier to maintain, putting most auto mechanics out of business, and last longer, since the steam engine is not subjected to the internal battering that plagues the internal combustion engine.

Steamers would not use gasoline or any other high-test fuel. Kerosene would do fine but Standard Oil wouldn't last long selling kerosene to Steamer owners, especially those who preferred Presto-Logs for fuel.

Now we come to the power needed to maintain private homes.

Wind power would save every householder quite a bit over a year. However, only a few areas are windy enough to provide all of a household's constant needs. So the investment by the householder in a commercial wind system is limited by its price, which is seldom low enough to compete with the Utility Company.

A firm in Australia puts out a fine wind-power plant which will electrify your home and store energy enough, hopefully, to last through calm spells.

This wind-plant costs about $5,000. Although it is probably worth it, the cost is too high and will not go down to where the average householder can afford it.

Yet, this is the only wind system publicized by the media. It is also the only type the Politicians and Industry recommend.

Then there is the solar water heater to be installed on the roof of your home. This would supply up to 40% of your heating needs, both for your rooms and for hot water. The prices quoted are from 20 to 30 thousand dollars. The media often describes this cozy home of the future.

You will see in the above two examples of privately owned energy sources that the prices are described as high. Too high, in fact, for even the average fanatical survivalist to afford. These prices are certainly not to be considered by the general public.

But these are what the Establishment hacks tell us are the alternatives to their energy. It's their way of saying that we can't afford alternatives so we had better support them in their efforts to develop and sell us energy.

These inflated quotes on privately owned energy alternatives effectively discourage the public from planning their own systems. At the same time, they give the impression that help is on the way as Government and Industry will finally shoulder the burdens we paupers could never cope with.

There are several reasons why neither Government nor Industry can implement alternative energy systems. First is cost. Prices quoted on the Australian wind system and the solar roof heater are for Union Labor and new materials. These costs would be mandatory on an official level.

A Government project would include about 20% loss from theft and another 20% loss from inefficiency. Since no private industry could finance a system which would supply energy to a sizeable town, it would have to be backed by a Government contract awarded to a private company. So it wouldn't matter much if the prime contractor considered himself an employee of the Federal Government or a self-employed contractor.

Our Government project would cost as much as such a system could possibly cost. I'm sure you can remember the great plane boondoggles where the estimates started with millions and climbed to billions by the time the planes were in the air, if they flew at all.

Then there is the cost to the user of the energy. Abundant fossil fuels are the cheapest sources of energy and are already too high for many. There would be no discussion of alternative sources of energy if fossil fuels were still plentiful and/or easily recovered. It doesn't matter who supplies your alternative energy. It would still cost you about double what you're paying now, if not more.

Climate and weather are very important in alternative energies, whereas with fossil fuels, this is not a consideration. Installations supplying whole areas with power would have to have a climate where the weather was consistent. This would make wind and/or solar energy systems impractical in many parts of the United States.

Even methane gas production depends on climate. The one-celled organisms which turn waste matter into methane must be kept warm. Without

Dry-Cleaning Mixture

An emulsion of gasoline and water is much used by dry cleaners for removing grease, tar, and paint spots from clothing. It is in the form of a thick, white sirup, which evaporates entirely and is not injurious to any fabric or color. The directions for preparing this emulsion should be followed out carefully.

Dissolve, in 1 qt. of boiling water, $\frac{1}{2}$ oz. of pure castile soap, and $\frac{1}{4}$ oz. of gum arabic. Allow this to cool, and then add 1 oz. glycerin, 1 oz. strong aqua ammonia, $1\frac{1}{2}$ oz. chloroform, and 2 oz. sulphuric ether. Shake well, and pour enough of the mixture into a quart bottle to fill it for $\frac{3}{4}$ in. On top of this, pour not more than $\frac{1}{4}$ in. of gasoline, and shake until creamy. Repeat the addition of gasoline, shaking each time, until full. The cleaning mixture will then be ready for use, and may be applied with a rag, or small brush.

If, on adding the first lot of gasoline and shaking, the mixture does not become emulsified, it proves that too much gasoline has been added. In this case, allow it to stand for a few minutes, and pour off the excess gasoline which comes to the top. Shake well, and add a smaller quantity of gasoline. When the bottle is half full, larger quantities of gasoline may be added at a time.

It is interesting to note that the more gasoline is added, the thicker the emulsion becomes, and if the addition of gasoline and shaking is prolonged, a semisolid jelly is formed, which will not run from a bottle.

If you eliminate the gum Arabic, glycerin, ammonia, chloriform and ether, you have napalm.

With drycleaning prices so high, this would be worthwhile to make for personal use and even for sale.

Gum Arabic and glycerin can be bought at any pharmacy. If they refuse to order chloroform and ether, you can make your own from simple processes in GRAND-DAD'S WONDERFUL BOOK OF CHEMISTRY, Nos. 4273 and 4280.

Both formulas call for rectified spirit, which is alcohol distilled so it has 16% water or less. Rubbing alcohol has 30% water. It can be distilled easily and should serve the purpose, since the stuff is to be used as a cleaning agent and not as an anesthetic. Even so, I don't think the poisonous substance put in rubbing alcohol to keep winos from drinking it would be dangerous as an inhalent.

supplementary fuel or cannibalizing methane already generated to maintain the needed temperature, the output would be too low to be worth the trouble. Commercial methane production would be greatly reduced or far more expensive in winter.

Public services, hospitals and larger businesses must have constant energy. A city can't just shut down because it's been drizzling and windless for a week or so. Nor can cities have backup systems to provide energy when weather is uncooperative. You have to keep your petroleum powered electric company on all the time or close it down altogether. You've got men working there who won't be employed by solar or wind power systems. They're professionals. They don't work part-time, being on call for when the wind stops and the clouds gather.

So, forget alternative energy systems which supply whole areas with power.

To the private householder, however, alternative sources of energy are cheap and eminently practical, no matter where you live. The cost of the materials would be about a tenth of the inflated quotes given by industry.

This is because you are expected to scrounge your materials from the city dump. There, you can get most of what you need free or for less than half the cost of new materials.

Instead of paying $5,000 for that undoubtedly *fine* Australian wind system, you can make one yourself for about $500. The main cost would be for batteries and electrical components. These can be picked up at any auto junk yard for very little, along with the needed gears. If you prefer a propeller type rather than a series of wide slats, you can pick up blades from your friendly used aircraft parts store, situated near most fields serving private planes.

As for those 20 to 30 thousand dollar roof solar heaters, all they are made of is 1/8th inch sheet plastic or glass, plastic tubing, plywood and odds and ends found at any junk yard. Two or three hundred dollars would pay for one just as good as theirs and only a millionaire half-wit would pay more.

For stove gas, three 55 gallon drum methane generators could be kept warm and odorless in the kitchen. They would supply all the cooking gas you would need with enough left over to power a generator on windless, sunless days.

You could feed one drum with all the garbage your family accumulates. Tap your septic tank, follow that cat, scoop up after the dog, use livestock manure, grass clippings, etc.

Use one drum for collecting. Let one sit with waste and warm water in it. Let the third one be used until its methane supply is exhausted. Then attach your stove hose to the middle drum and pour some warm water in the first drum.

The sludge from the exhausted methane drum is poured on the garden if you have one. Unlike new sewage, methane waste is all ready to provide plant nutrients without composting.

When the exhausted drum is emptied it can go to the end of the line and receive a new batch of waste matter.

My descriptions of wind, solar and methane systems are sketchy and not meant to be very informative on the subjects. What you need for the details is the Mother Earth News "Handbook of Homemade Power", $1.95 plus 50c for postage and handling from Mother's Bookshelf, P.O. Box 70, Hendersonville, N.C. 28739. This 374 page book is crammed with dozens of different systems harnessing every kind of power imaginable.

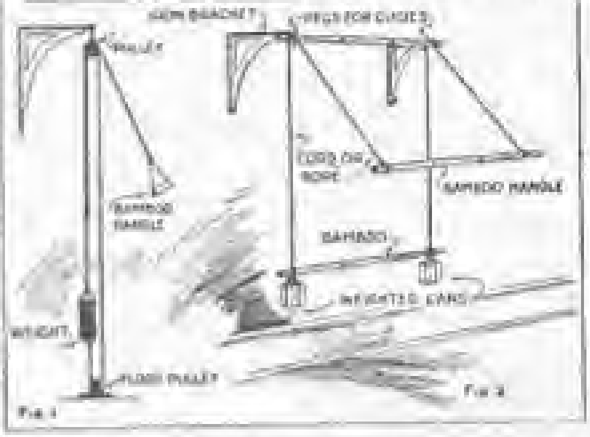
Most of these systems can be made from scrap and little new material. You can do the work yourself and you ought to. The reason is that you will have to maintain these systems so you might as well learn about them by making them.

With several systems installed at once, there is little chance you will be caught without energy. Since the systems are yours, you can activate or deactivate them at will.

And once you've bought the book on "Homemade Power" you'll understand that what is simple for a householder would be impossible for any government to implement. Government contractors don't use scrap. Nor do they work their

Pulley and Weight Exerciser Homemade in the Orient

Finding it difficult to obtain materials for the making of a gymnastic

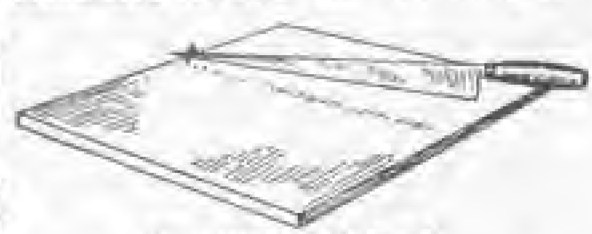


exerciser. I made one with makeshift parts, typical of this locality. Later I was able to get the necessary hardware and made an exerciser, as shown in Fig. 1, quite similar to those manufactured commercially. The original arrangement is shown in Fig. 2. I mounted a bamboo rod on two iron brackets fastened to the wall. Small pegs provided guides for the ropes, and the smooth surface of the bamboo caused little wear. Other bamboo rods were used for the handle and to support the weights. These were made by filling cans with sand, and tying them with cords. This arrangement was quite practical, but did not give the desired freedom of movement.

KITCHEN CHOPPING BLOCK

Popular Mechanics 1918

Cooks can slice, chop or mince vegetables and various other food rapidly by placing the little device, as shown, on a chopping board. It is an ordinary staple, driven in just far enough to allow a space for the end of an ordinary pointed kitchen knife to fit in it. The staple is driven in the edge of the chopping board. The knife can be raised and lowered with one hand, as



Knife Attached to the Board

the material is passed under the blade with the other. Great pressure can be applied and the knife will not slip.

men in their spare time without pay. Nor can they maintain these systems on an around-the-clock basis without pay. But to a householder, all these things would be a matter of course.

It's part of survival. You can do it but the Government can't. So when the Government and those who depend on it are gone, you will still be here.

COLLECTING FLIES FOR FEED & SANITATION

Insect pests have long been feared and hated. They have been attacked with poisons which have often proved to be more dangerous than the insects. Ecologists go on about safe, organic pesticides.

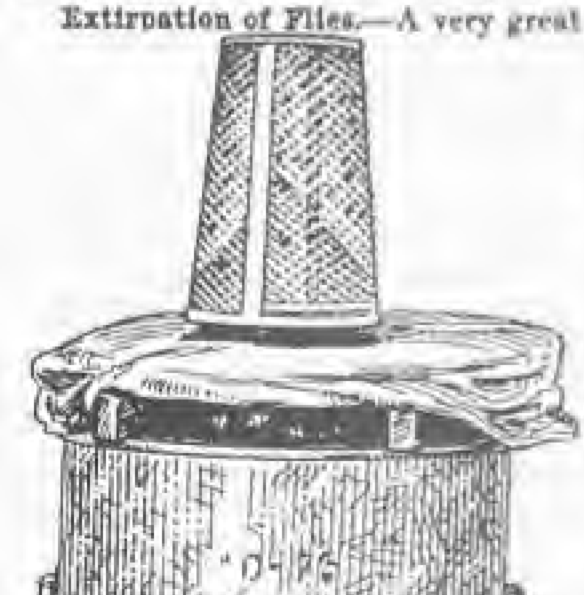
I disagree with both schools.

Insects are high protein and excellent feed for fowl. Where they are numerous enough to be a problem, they are also numerous enough to capture in large quantities. Don't waste them. Use them as feed.

On page 12 of the SURVIVOR 1 described the vacuum cleaner method of capturing insects. Here are methods for capturing flies. This 1908 article from "Household Discoveries" tells of a small boy who trapped about three bushels of flies in one summer. A man, using these methods purposely to trap flies, should double or triple the boy's record.

The flies could be turned into a screened frog pen if you are in the frog leg business. The trap can be immersed in a tub of water and the drowned flies can be fed to the chickens or even used as a major food for fish in a fish farm pond.

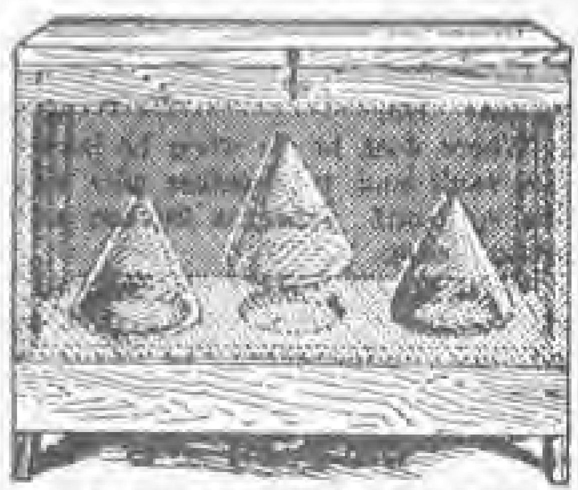
Extirpation of Flies.—A very great deal of attention has been drawn to this subject by recent scientific investigations and many practicable suggestions have been made since the publication of the first edition of this volume. The control of the house fly is now regarded as one of the most important of all sanitary problems. A nation-wide campaign to this end has been set on foot. It has been shown by actual experience during the last few years that the method of excluding flies from horse manure as elsewhere recommended, will greatly lessen the number observed in the locality. Several cities have adopted ordinances providing that the floors of stables shall be solid and free from cracks, and that horse manure shall be collected in tight cans or barrels, covered so as to exclude flies, and removed daily beyond the city limits. Some such means of depriving flies of their natural breeding places is the most essential step in the warfare against these pests. Any householder may greatly abate this nuisance by proper sanitary precautions on his own premises. And such means will be found very effective in localities where dwellings are fairly distant from one another. But since flies may come from considerable distances and bring with them infection from sources beyond one's control, it will still be found necessary to adopt preventive measures. In addition to those elsewhere recommended several ingenious methods of trapping flies in large numbers have recently been devised and may here be recommended.



Simple and very successful fly trap for a garbage can. Cloth curtain turned up to show cleats. It catches the flies outside the house. Flies enter the garbage can through the crack between the cover and the can, and also around the edge of the trap placed over a two or three inch hole in the can. After feeding they fly toward the light and come out this hole in the cover into the trap. (C. F. Hodge.)

Trapping Flies. — Prof. C. F. Hodge offers a number of practical suggestions derived from experience in catching flies in large quantities to feed bob-white and partridge chicks. His method is, in substance, to provide a number of large traps and either to bait them artificially with garbage and meat scraps in considerable quantities or set them at the flies' natural feeding grounds. The working principle of these traps is that a fly seeks its food entirely by smell and will crawl to it through any dark crack. Thence, after feeding, it will fly or crawl toward the light. Hence, if a suitable trap is placed over the garbage can or swill barrel, or in a room or shed in homes, hotels, restaurants or markets, in which waste matter is collected, the great bulk of the flies which are drawn to these feeding grounds from the entire locality can be captured and disposed of.

Small traps of wire net can be bought for about 10 cents apiece in most localities. Or they can be readily made at home of two pieces of ordinary wire netting. The outer may be of any shape and size desired. The inner is merely an inverted cone with an opening just large enough to permit the flies to crawl in. One or more of these traps may be attached to the lid of the garbage pail, swill barrel, or hog trough over a hole through which the flies may find their way into the trap after feeding. Lift the lid or cover of the receptacle a little way to admit the flies and hang something over the edge so as to keep out the light. Or a strip of burlap from an old potato sack may be thrown over the lid to keep the sun out.



Box fly trap designed by C. F. Hodge.

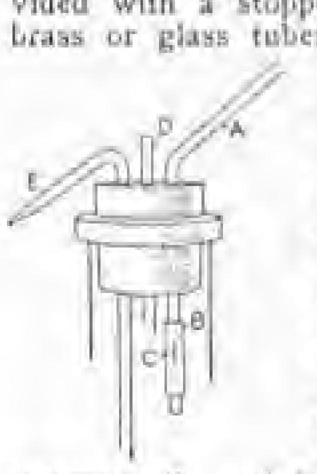
Or if there is no accumulation of garbage, swill or other natural feeding ground for flies in the locality, construct one or more large traps in the form of a screened box, as shown in the illustration. Artificially bait these by placing, in old tomato cans or other receptacles, meat scraps and similar refuse beneath the platform on which the traps are located. Bring the side boards below this platform nearly to the ground so that the space beneath, where the bait is placed, may be dark. The cones in the illustration may be readily made from pieces of ordinary wire netting. One small boy in Worcester, Mass., has a record of capturing about three bushels of flies in a trap of this kind during a single summer.

If the small woven wire traps are used, the flies may be killed by immersing them in boiling water.

Another ingenious method suggested by Prof. Hodge is to attach a small wire trap to the wire screen with which windows and doors are protected against insects in summer. Two small guide boards tacked on the screen lead the flies to a small opening near the top and thence through a hole in the screen into the trap. A similar trap may be attached to the inside of the same or another window and thus flies may be caught both "coming and going." This method is equally well adapted to the house and to the barn and stable.

Wash Bottle for Lab Use

A large-mouth bottle neck is provided with a stopper, having three brass or glass tubes as shown, the tube A being fitted with a thick piece of rubber tubing, B, stoppered at its lower end. A slit is cut at C, and allows the air blown in through the tube A to pass into the bottle, but will close automatically and hold the pressure within the bottle.



If the relief tube D is closed with the thumb the water is forced out in a steady stream through the nozzle E. The water will continue to run for some time after the lips are removed from the air tube, but the removal of the thumb from the tube D will stop the flow of water instantly.

DUTCH OVEN TYPE INCUBATOR

POWERED BY TWO BUCKETS OF HOT WATER A DAY

Secrets of Wise Men & Chemists 1898

Experiments with the incubator here given have been made all over the country. It is one that is in actual use, and has always given satisfaction. Having secured permission from the originator, we here illustrate it for the benefit of our readers.

To make this incubator get your tinner to make you a tank 15 inches wide, 30 inches long, and 12 inches deep, of galvanized iron or zinc, the iron being preferable. On the top should be a tube 1 inch in diameter and 8 inches high. In front should be another tube, 9 inches long, to which should be attached a spigot, as illustrated in Fig. 2. Having made your tank, have what is called the ventilator made, which is a box with a bottom but no top. The ventilator should be 8 inches deep, and 1 inch smaller all round than the tank, as the tank must rest on inch boards. In the ventilator should be four or six tin tubes ½ inch in diameter and 6 inches long. They should extend through the bottom, so as to admit air from below, and to within 2 inches of the top or a little less. Now make an egg drawer, which is a frame of wood 3 inches deep having no top or bottom, except that the front should be boxed off

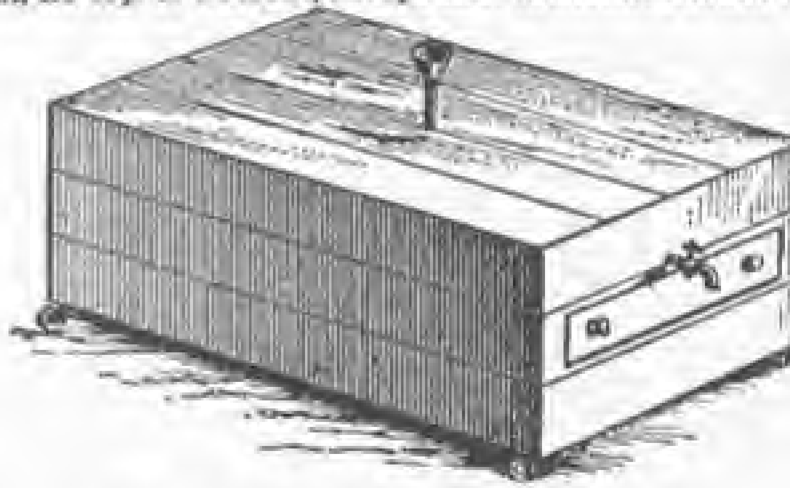


FIG. 1.—THE HOT-WATER INCUBATOR.

and filled with sawdust, which is covered over afterward with a piece of muslin to keep the sawdust from spilling. This box in front of the drawer exactly fits the opening in Fig. 3, when the drawer is in its place. Of course the egg drawer must be made longer than the tank and ventilator, in order to allow for this space which it fills in the opening, which

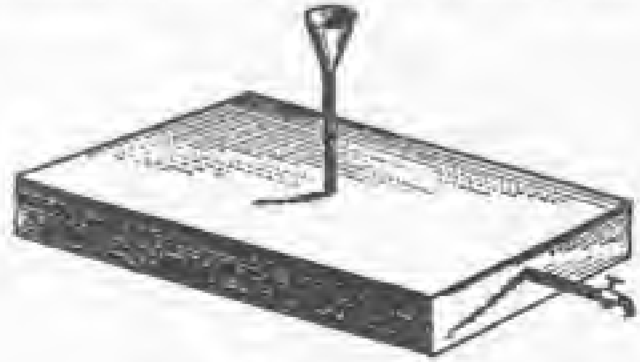


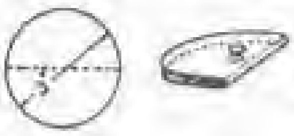
FIG. 2.—THE TANK.

Observe that the tubes on the top and the spigot are quite long, in order that they may extend through the packing of sawdust which is to surround it. This tank is to have a close-fitting covering (top and

Popular Mechanics 1915

A Whistle

Cut a circular piece of tin any convenient size, preferably 3 in. in diameter, and bend it across the diameter so that it will be in a narrow U-shape. Then drill or punch a hole through both parts as shown.

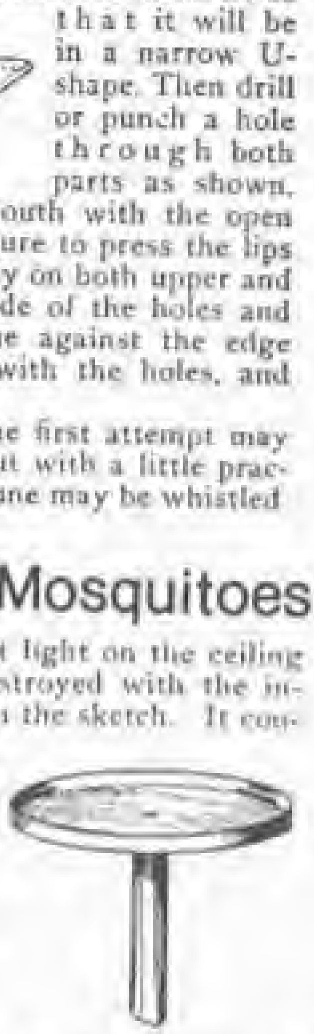


Place it in the mouth with the open edges out, being sure to press the lips on the metal tightly on both upper and lower pieces outside of the holes and to rest the tongue against the edge of the tin, even with the holes, and blow.

The result of the first attempt may not be a sound, but with a little practice any familiar tune may be whistled

Trapping Mosquitoes

Mosquitoes that light on the ceiling may be easily destroyed with the instrument shown in the sketch. It consists of a cover, such as used on jelly glasses, nailed to the end of an old broom handle. A little kerosene oil is placed in the cover and the device is passed closely beneath the location of the mosquitoes. They will be overcome by the fumes and drop into the fluid as soon as it comes under them.



Floor Push Button

An ordinary electric push button can be used for a floor push button by placing it on a bracket or shelf attached to a joist, as shown, and using a nail for the extension push. A ¼-in. hole is bored through the floor, also through a small piece of wood fastened beneath the floor, at the right place to direct the nail so that it will strike directly upon the small black knob of the push button. The nail

Push Button on Joist

should be just long enough to rest lightly on the knob.

From Popular Mechanics 1913

sides) of wood, to resist pressure of water. The bottom is not to be covered.

is the packing all around the incubator. The bottom of the egg drawer should be made by nailing a few slats lengthwise to the under side, or rather, fitting them in nicely, and over the slats in the inside of the drawer a piece of thick, strong muslin should be tightly drawn. On this muslin the eggs are placed, in the same position as if laid in a hen's nest, and it allows the air to pass through to the eggs for ventilation. The eggs can be turned by hand, marked for designation, or an egg turner may be made by fastening slats crosswise to one on each side

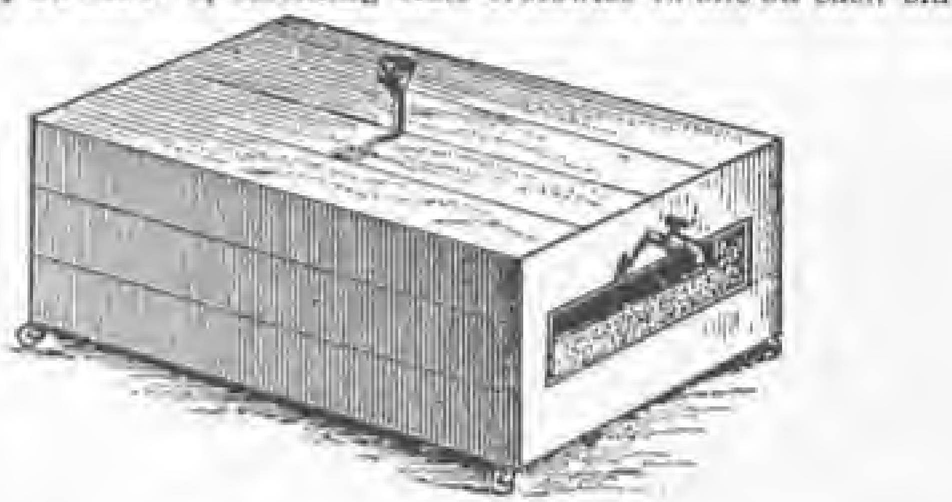


FIG. 3.—DRAWER OPENING.

Shows the thick packing, which is noticed at the opening. This extends all around. The front of the egg drawer (Fig. 4) fits in its place in order to complete the surrounding packing, when the incubator is closed, as at Fig. 1.

running lengthwise, something like a window lattice, and when the eggs are placed between these slots by merely pushing the frame the eggs will turn over, exactly on the same principle that an egg will roll when it is pushed by a block, a book, or anything else; but we believe the method is patented, and do not advise infringement.

Having prepared the tank, let it be covered with a box, but the box must not have any bottom. This is to protect the tank against pressure

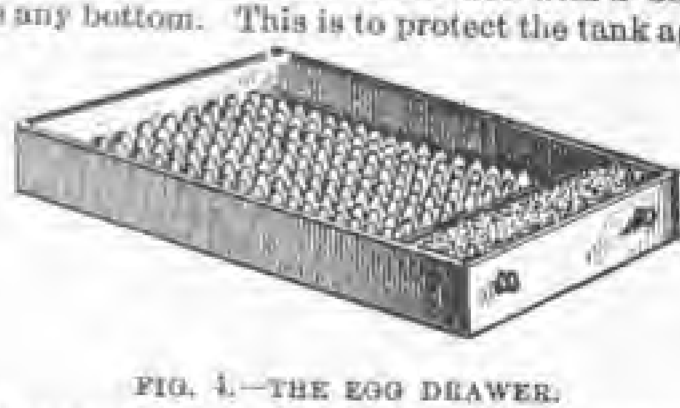


FIG. 4.—THE EGG DRAWER.

The space just in front of the eggs is the portion partitioned off to fit in the opening at Fig. 3. The egg drawer is therefore LONGER *than the tank and ventilator.*

of water on the sides, and to assist in retaining heat. Such being done, place your ventilator first, egg drawer next, and tank last. Now place a support under the tank and the box, or have them rest on rods, and as the weight of water will be great in the center, the iron rods should be placed crosswise under the tank every 6 inches. Now fasten the three

IMPROVING THE 11 SHOT SHOTGUN

They all laughed when I demonstrated my notorious 11-shot shotgun. After eight billows of single ought buckshot went ripping into the targets a hundred yards away, the handle tore away the wooden grip. Well, you can just imagine!

The grip had held up for several dozen firings but it just didn't have the structural strength to keep the gun on target for rapid firing. My only consolation was that the targets weren't shooting back.

The remedy was simple, however. I merely did away with the wooden grip and had the metal handle brazed to the metal slide mechanism the wooden grip had been attached to.

Also, the gun bucked upward at each shot, making the handle hard to hold. I had a metal hand guard welded to the bottom of the handle and the part brazed onto the slide mechanism. This holds the side of the hand so a sweaty palm will not cause the hand to slip off the handle.

To make the grip sweat-proof and easier to hold, I wrapped it with cloth bicycle handlebar tape.

From Popular Mechanics 1925

Planting Corn

It is much better to plant four rows of sweet corn 5 ft. long side by side than it is to plant one row 20 ft. long with as many plants. The former method will produce more and better corn than the latter, because there will be a better distribution of the fertilizing pollen, as, the rows being closer together, the wind will carry it between the rows. In a long single row, the greater portion of the pollen will be blown away without falling upon the silk to fertilize it and produce the corn. Each silk fertilized means more kernels of corn on the cob, and failure of proper fertilization causes bare spots upon them.

apartments (ventilator, egg drawer, and tank) together, with boards nailed to the sides and back and front (of course leaving the opening for the egg drawer), care being taken to drive no nails in the egg drawer, as it must move in and out, and should have a strong strip to rest on for that purpose. Having completed these preparations make a larger box to go over all three, so that there will be a space on the sides,

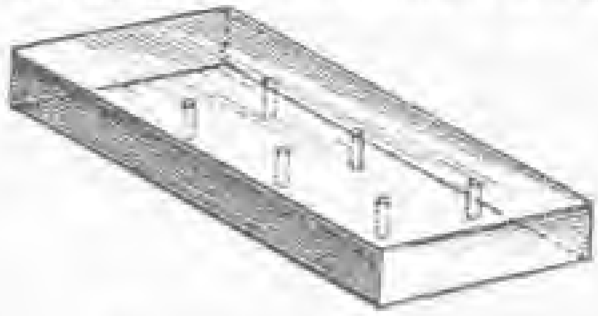


FIG. 5.—THE VENTILATOR.

The tubes admit air from below, which passes into the egg drawer above through the muslin bottom of the egg drawer to the eggs. The eggs rest upon the muslin, which is tightly drawn over narrow slats running lengthwise the bottom of the drawer.

back, front, and on top; but as the ventilator must be filled with sawdust to within 1 inch of the top of the tubes, it serves for the bottom packing. Make the outer box so that there will be room for filling all around the inside box with sawdust, and also on top, being careful to let the tube for pouring in the water come through, as also the spigot in

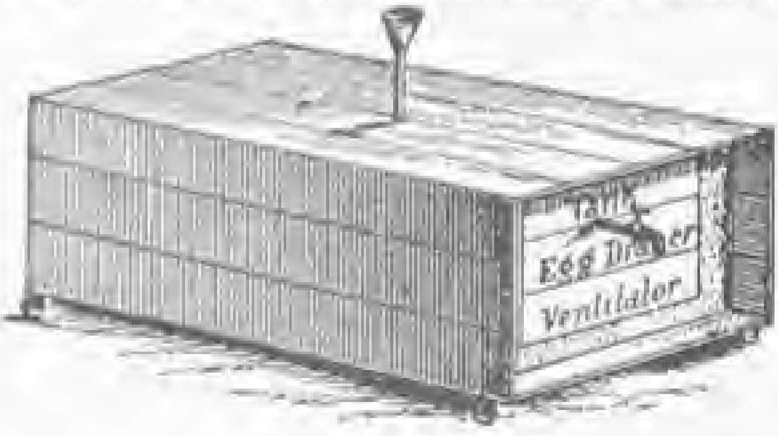


FIG. 6.

Here we remove the front of the incubator in order to show the positions of the ventilator, egg drawer, and tank. First the ventilator, then the egg drawer (which of course should be longer than the others in order to fit in the opening shown at Fig. 3, but which we did not do here in order to mark the places), and on the top is the tank. When the front is completed the incubator is seen at Fig. 1.

front. About 4 inches or so thickness of sawdust is sufficient, according to preference. The front of the incubator must be packed also, but an idea of how it should be done may be learned by observing the opening in Fig. 3, which is so constructed that the box in front of the egg drawer (Fig. 4) exactly fits into it, and completes the packing when the drawer is shut. The incubator should be raised from the floor about an inch, when completed, to allow the air to pass under and thence into the ventilator tubes.

The incubator being complete, the tank is filled with boiling water. It must remain untouched for twenty-four hours, as it requires time

A Garden-Bed Scarecrow

From Popular Mechanics 1915

A very neat and successful scarecrow for garden beds can be made as follows: A number of corks are pro-

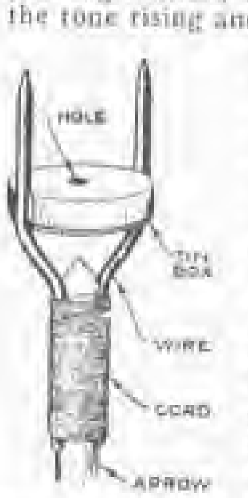
The Fluttering Feathers Attached to the String with Corks Scare the Birds Away

cured, and a feather is stuck in each end of them, as shown. These are tied to a string, spacing them from 1 to 2 ft. apart, and the string is hung over the beds. The slightest breeze will keep them fluttering, and no bird will come to rest on the beds.

A Whistling Arrow

From Popular Mechanics 1925

An arrow that will give a sharp and piercing whistle, when shot into the air, the tone rising and falling with the speed of the missile, is made as shown in the drawing. Two stout-wire prongs are bent as indicated and tightly bound to the shaft, the distance between the points being about 1 in. A small round tin box, of corresponding diameter, is obtained, and a hole, about ⅛ in. in diameter, is drilled through the center, care being taken to remove any burs or rough edges that might be around the holes. The box is placed between the prongs, to which it is held by soldering.—



during which to heat completely through. As it will heat slowly, it will also cool slowly. Let it cool down to 120 deg., and then put in the eggs, or, what is better, run it without eggs for a day or two in order to learn it and notice its variation. When the eggs are put in, the drawer will cool down some. All that is required then is to add about a bucket or so of water once or twice a day, but be careful about endeavoring to get up heat suddenly, as the heat does not rise for five hours after the additional bucket of water is added. The tank radiates the heat down on the eggs, there being nothing between the iron bottom of the tank and the eggs, for the wood over and around the tank does not extend across the *bottom* of the tank. The cool air comes from below in the ventilator pipes, passing through the muslin bottom of the egg drawer to the eggs. The 15x30-inch tank incubator holds 100 eggs if turned by hand, but less if the eggs are placed between slats. Lay the eggs in the same as in a nest—promiscuously.

DIRECTIONS.

Keep the heat inside the egg drawer as near 103 deg. as possible; the third week at 104 deg. Avoid opening the egg drawer frequently, as it allows too much escape of heat. *Be sure your thermometer records correctly*, as half the failures are due to incorrect thermometers, and not one in twenty is correct. Place the bulb of the thermometer even with the top of the eggs, that is, when the thermometer is lying down in the drawer. The upper end should be slightly raised, so as to allow the mercury to rise, but the bulb and eggs should be of the same heat, as the figures record the heat in the bulb and not in the tube. Keep a pie pan filled with water in the ventilator for moisture and keep two or three moist sponges in the egg drawer, displacing a few eggs for the purpose. Turn the eggs half way round twice a day at regular intervals. Let the eggs cool down for fifteen minutes once every day, but do not let them cool lower than 70 deg. No sprinkling is required if the sponges are kept moist. If the heat gets up to 110 deg. or as low as 60 deg. for a little while it is not necessarily fatal. Too much heat is more prevalent than too little. A week's practice in operating the incubator will surprise one how simple the work is. The tank will be troublesome to fill at first, but the matter will be easy after it is done, as it can be kept hot. Heat the water in two or more boilers, as a large quantity will be required, and pour it in through the tube on top of the incubator boiling hot, using a funnel in the tube for the purpose. Just at the time of hatching out do not be tempted to frequently open the drawer. Cold draughts are fatal. Patience must be exercised.

BROODERS.

An excellent brooder may be made with a tank of hot water, covered well, the same as the incubator. A piece of muslin or woolen cloth should be next the bottom to prevent burning the chicks. Keep the heat among the chicks at about 90 deg. Let the tank rest on inch boards with no opening under it, but in front; a fringe should hang in front for the chicks to run in and out under the tank. A little yard may be constructed of glass sash, something like a hot-bed. Feed the chicks four or five times a day, at first on hard-boiled eggs, chopped fine, giving them also a little milk, fine screenings, and millet seed. After they are a week old feed anything they can eat, but never feed meal in a raw state, as it should be scalded first. Keep a little sand, fine gravel, and bone-meal within reach of them all the time, and see that they are always

dry, clean, and warm. Do not crowd them, as the fewer the number together the better, and never have different ages together.

This incubator will hatch chicks, ducks, turkeys, or guineas, and we see no reason why it should not hatch the egg of the ostrich or anything else as well. Chicks hatched by incubators, if rightly cared for, do better than with hens, and are stronger and more vigorous.

We have endeavored here to embody all the answers to questions that we suppose may be asked. Should you be in doubt, read the directions carefully again. We trust that with the help of our illustrations our readers will have no difficulties in the way.—*The Poultry Keeper.*

Basic Crossbow Plus Arrow Sling

(Popular Mechanics 1913)

In the making of this crossbow it is best to use maple for the stock, but if this wood cannot be procured, good straight-grained pine will do. The material must be $1\frac{1}{2}$ in. thick, 6 in. wide and a trifle over 3 ft. long. The bow is made from straight-grained oak, ash, or hickory, $\frac{5}{8}$ in. thick, 1 in. wide and 3 ft. long. A piece of oak, $\frac{3}{8}$ in. thick, $1\frac{1}{2}$ in. wide and 6 ft. long, will be sufficient to make the trigger, spring and arrows. A piece of tin, some nails and a good cord will complete the materials necessary to make the crossbow.

The piece of maple or pine selected for the stock must be planed and sandpapered on both sides, and then marked and cut as shown in Fig. 1. A groove is cut for the arrows in the top straight edge $\frac{3}{8}$ in. wide and $\frac{3}{8}$ in. deep. The tin is bent and fastened on the wood at the back end of the groove where the cord slips out of the notch; this is to keep the edges from splitting.

A mortise is cut for the bow at a point $9\frac{1}{2}$ in. from the end of the stock, and one for the trigger 12 in. from the opposite end, which should be slanting a little as shown by the dotted lines. A spring, Fig. 2, is made from a good piece of oak and fastened to the stock with two screws. The trigger, Fig. 3, which is $\frac{1}{4}$ in. thick, is inserted in the mortise in the position when pulled back, and adjusted so as to raise the spring to the proper height, and then a pin is put through both stock and trigger, having the latter swing quite freely. When the trigger is pulled, it lifts the spring up, which in turn lifts the cord off the tin notch.

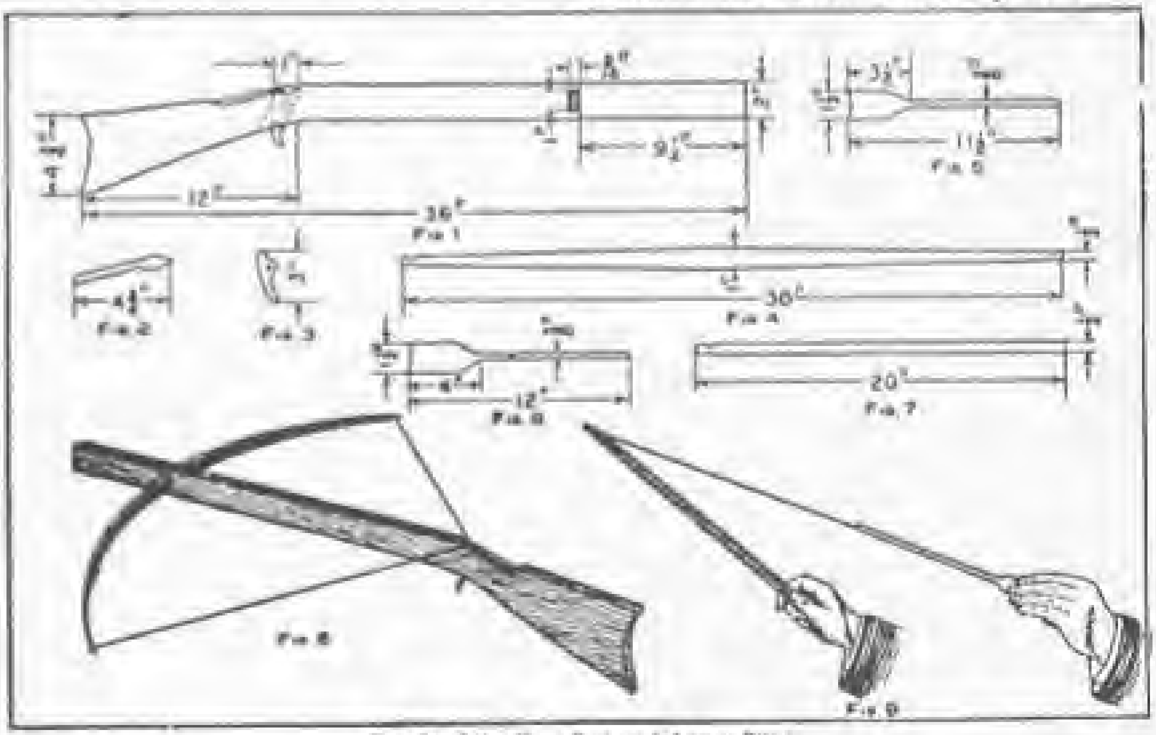
The stick for the bow, Fig. 4, is dressed down from a point $\frac{3}{4}$ in. on each side of the center line to $\frac{1}{2}$ in. wide at each end. Notches are cut in the ends for the cord. The bow is not fastened in the stock, it is wrapped with a piece of canvas $1\frac{1}{2}$ in. wide on the center line to make a tight fit in the mortise. A stout cord is now tied in the notches cut in the ends of the bow making the cord taut when the wood is straight.

The design of the arrows is shown in Fig. 5 and they are made with the blades much thinner than the round part.

To shoot the crossbow, pull the cord back and down in the notch as shown in Fig. 6, place the arrow in the groove, sight and pull the trigger as in shooting an ordinary gun.

The arrow sling is made from a branch of ash about $\frac{1}{2}$ in. in diameter, the bark removed and a notch cut in one end, as shown in Fig. 7. A stout cord about $2\frac{1}{2}$ ft. long is tied in the notch and a large knot made in the other or loose end. The arrows are practically the same as those used on the crossbow, with the exception of a small notch which is cut in them as shown in Fig. 8.

To throw the arrow, insert the cord near the knot in the notch of the arrow, then grasping the stick with the right hand and holding the wing of the arrow with the left, as shown in Fig. 9, throw the arrow with a quick slinging motion. The arrow may be thrown several hundred feet after a little practice.—

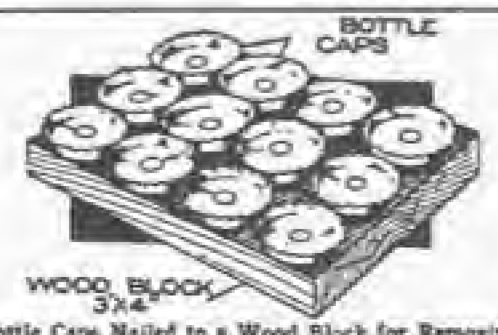


Details of the Bow-Gun and Arrow Sling

A Fish Scaler

Popular Mechanics 1919

All kinds of devices, both simple and complex, have been made and patented for use in scaling fish, but for a novelty I found the following, which necessity compelled me to improvise on an outing trip, to be as efficient as any of them. As usual, the commissary, in making up the outfit, neglected to take the curry comb to clean the fish, and at the same time remembered to take a plentiful supply of bottled goods. Long before it became necessary to scale any fish enough bottles had been opened to provide the basis of a tool for the purpose, which I constructed by using the small tin bottle caps, a few being nailed on a block of wood, about 3 in. wide by 4 in. long, making a splendid fish scaler, as good and efficient at home as in the camp, and both inexpensive and easily made. The sketch shows the general appearance.



Bottle Caps Nailed to a Wood Block for Removing Scales from a Fish

BUILD AN ELECTRIC BUG ZAPPER

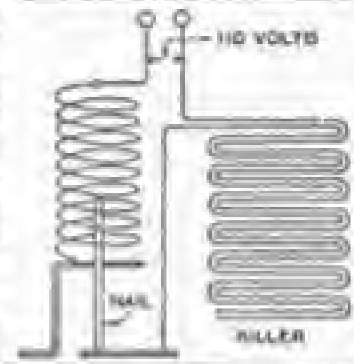
Popular Mechanics 1925

ALTHOUGH the 110-volt house-lighting current is ordinarily not fatal to the human body, it is very effective for electrocuting small animals and insects, because the resistance of these bodies is much less than that of the human body. This explains the effectiveness with which the electric insect killer, shown in the illustration, disposes of roaches, flies, spiders, and other insects. Once the apparatus is set up, it requires little or no attention, as it is automatic in its action, and there is no danger in having it connected continually.

The killer consists of a 10 by 12-in. slab of slate or marble with copper wire wound on it. The edges are nicked with a file to hold the wire in place securely. Care must be taken to get the nicks about ⅛ in. apart so that the wires will run close to each other but will not actually touch. The wire used for this purpose is preferably No. 18, and it must, of course, be bare. Two separate lengths are wound side by side so that the alternate wires will be of opposite polarity when connected to the circuit. The ends of the wires are securely fastened to a pair of ⅛-in. brass screws at opposite corners of the slab to prevent the wires from unwinding. The heads of these screws project far enough below the slab to prevent the wires from touching the surface of the table upon which it is laid, and single screws are provided on the other two corners so that the slab will rest solidly.

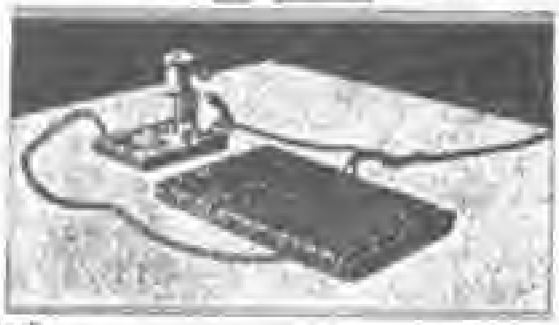
As soon as an insect crawls or alights on the wired surface of this slab, on which sugar or other attractive bait is spread as a lure, it touches two wires of opposite polarity, and this allows a sufficient amount of current to flow through its body to kill it instantly.

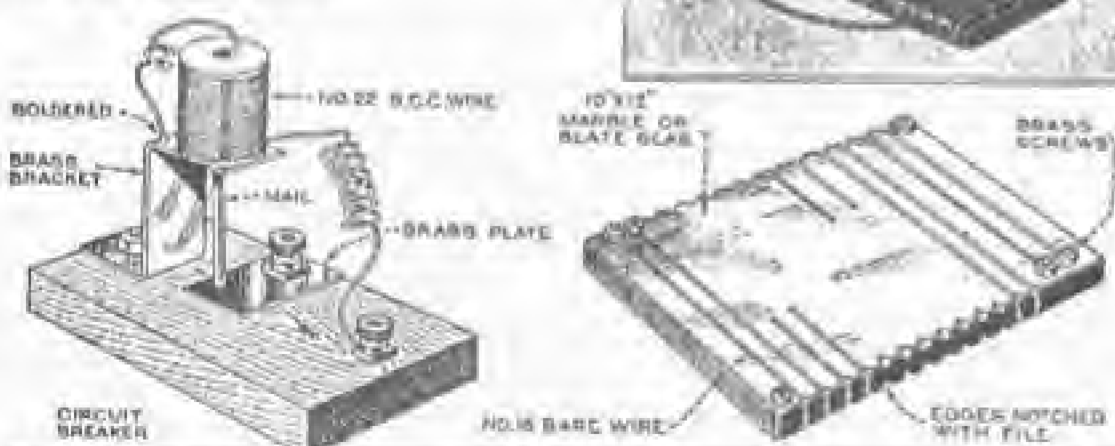
It is not advisable to connect the wires of the slab directly to the lighting circuit as a small piece of metal, accidentally dropped on the wires, will blow a fuse. A small circuit breaker should be provided to prevent this. The construction of a simple one is shown in the lower left-hand detail. It consists of a solenoid made by winding an ordinary thread spool full of No. 22 single cotton-covered copper wire, and using a small wire nail, with the head clipped off, as a plunger. The solenoid is mounted on a brass bracket, which is bent to the shape shown, and screwed to a wooden base. Through this bracket, directly under the hole in the spool, a hole is drilled for the plunger. The spool is held on the bracket securely by small wood screws driven in from underneath. The height of the bracket should be a little less than the length of the plunger. A small brass plate is fastened to the base so that the plunger rests on it when in its normal position, and a thumbnut is provided on the screw that holds this plate in place. A second screw and thumbnut are provided as a separate terminal on the base, and to this terminal one end of the solenoid coil is connected, while the other end is soldered to the brass bracket. Connections are then made to the lighting circuit and to the killer, as shown in the diagram in the upper right-hand corner.



The action of the solenoid is as follows: Current passes through the solenoid and over the bare wires of the killer whenever any two wires of opposite polarity are brought into electrical contact with each other, either through the body of the insect or a piece of metal, shorting them. As soon as the current becomes excessive as it would naturally be in the latter case, the plunger is pulled up into the solenoid, and this breaks the circuit. Of course, the moment that the current is broken the solenoid is demagnetized and the plunger drops again to its normal position, but if the same current still flows the process is repeated continually, causing the plunger to vibrate rapidly. In operation the killer should, therefore, be set up on a slant so that every time an insect is killed it promptly falls off, preventing any long-continued operation of the circuit breaker.

It is surprising how many insects will be killed by this death trap if it is located in the proper place and baited with some sweet-smelling substance. The device can be left connected without any danger to the house wiring. If desired, a ½-amp. fuse can be inserted in the circuit so that in case the plunger sticks, the small fuse will be blown before the one in the lighting circuit.





An Electric Insect Killer, Which Uses House-Lighting Current, and Has Been Found Very Effective: A Small Circuit Breaker Protects the Fuses in Case Too Much Current Flows

How to Make a Flint Arrowhead

Popular Mechanics 1913

If you live where flints abound, possess the requisite patience and the knack of making things, you can, with the crudest of tools and a little practice, chip out as good arrowheads as any painted savage that ever drew a bow.

Select a piece of straight-grained flint as near the desired shape as possible. It may be both longer and wider than the finished arrow but it should not be any thicker. The side, edge and end views of a suitable fragment are shown in Fig. 1. Hold the piece with one edge or end resting on a block of wood and strike the upper edge lightly with a hammer, a small boulder or anything that comes handy until the piece assumes the shape shown in Fig. 2.

Fig. 1

Fig. 2 Fig. 3

The Stone Chipped into Shape

The characteristic notches shown in the completed arrow, Fig. 3, are chipped out by striking the piece lightly at the required points with the edge of an old hatchet or a heavy flint held at right angles to the edge of the arrow. These heads can be made so that they cannot be distinguished from the real Indian arrowheads.

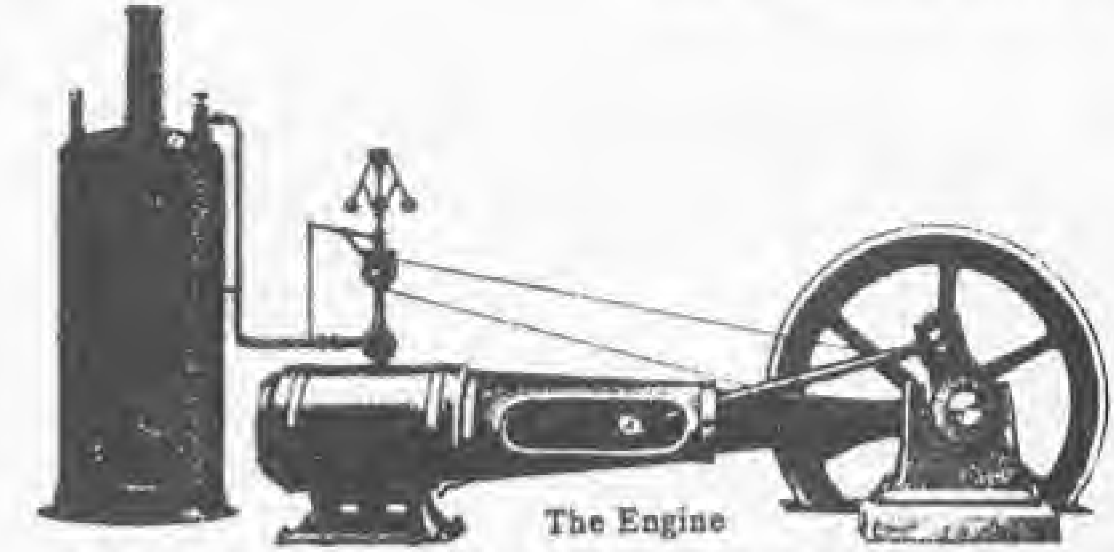
YOUR BASIC STEAM ENGINE

THE STEAM BOILER

What makes a steam engine go? Where does the power come from? It is all done by the expansive force of the gas given off by boiling water. That gas is steam or water vapor. We have all watched the boiling of water in a pan over the fire and seen how, as the water gets hotter and hotter, little bubbles begin to appear over the bottom and sides of the pan, and how presently these bubbles rise and escape into the air. These little bubbles are also water, but water turned into a gas called steam or water vapor. We know that in a few minutes the water will all escape in the form of these bubbles—"boil away" is the way it is commonly described. The bubbles are as clear and colorless as air, and perhaps you have known people who have thought they were bubbles of air. When these bubbles of clear and colorless gas escape into the air, you often see a white cloud appear a little way above the water, particularly if the surrounding air is cold; this white cloud is often called "steam." The white cloud is really a multitude of minute water globules, for the clear invisible steam condenses back into little particles of water when it comes into contact with the cold air. It is such white masses of floating water particles, condensed from water vapor, that we see in the sky as the beautiful clouds of a summer day. When light is reflected from the fine particles of water, they appear white.

Now how can we get power from this gas? As it escapes from the pan into the air, the steam has no more force than the air. But suppose we put a tight cover on the pan, and watch what happens; presently the cover is lifted by the force of the confined steam. If the cover is fitted too tight, there might be an explosion. That is, when steam is confined, it exerts force in trying to expand. The steam tends to occupy 1,600 times the volume of the liquid water, and that is why it exerts force when it is confined. It is this expansive force or pressure of confined steam that is used to run the steam engine. The water is boiled in a strong steel tank or boiler. The confined steam passes through stout pipes to the steam chest of the engine, where as described farther along, the expansive force or pressure is used to drive the piston back and forth.

There is an opening in the top of the boiler, kept closed by a metal plug held



The Engine

THE COMING AGE OF STEAM

By Kurt Saxon

The industrial revolution was powered by steam. Steam mechanics led to most of modern industrial technology. Its power, cheapness and simplicity would have given our modern world a firmer economy and much less pollution.

Underdeveloped nations would have been developed by now. There would have been no oil crisis, no likelihood of a third world war over the Middle East. Petroleum could be better used for the manufacture of fertilizers and other petro-chemicals than for motor fuel.

The turn from steam engines (external combustion), powered by coal, kerosene and other low octane fuels, to the Internal Combustion Engine was the most promising, yet the most socially destructive technological choice in history. That unhappy choice came about with the discovery of petroleum's application as motor fuel and its cheapness and easy availability.

A hundred years ago, coal was the major pollutant. Its released sulfuric acid actually ate the buildings away. No telling what it did to health. Below is an article on coal pollution from Harper's New Monthly Magazine, 1870.

DECAY OF STONE BUILDINGS IN CITIES.

It has frequently been observed that the surfaces of various kinds of stones, especially the limestones, when used for building purposes in cities, in a short time become dimmed and discolored, and at no distant period show unmistakable signs of decay. This is more especially the case where coal is used in the largest quantity; and a careful examination has shown that it is due mainly to the quantity of sulphuric acid liberated by the combustion of this substance, amounting to seventy pounds or more for each ton of even the purest quality. This acid forms sulphates, and it is on magnesian limestones, or dolomites, that the effects are most marked, the resulting sulphate of magnesia being very evident in the scrapings of the surface. The carved portions of the stone, and those which arrest the dirt and dust, suffer most, from holding longer in contact with the stone the acidulated moisture of the air. The resulting disintegration of the stone is also facilitated by the crystallization of the sulphates within its pores.

A careful consideration of the chemical processes involved has led to the use of certain substances for the purpose of preventing the combination mentioned, and, as it would seem, with much success. An aqueous solution of superphosphate of lime was applied to the surface of the cleaned stone, either by brushing or immersion, and produced an insoluble exterior. The cost of the material is but trifling, a gallon of the solution furnishing two coats to about three hundred square feet of Caen or Portland stone. It should not contain any appreciable quantity of sulphuric acid. For treatment of dolomites or magnesian limestones baryta is added to the hardening salt, for the purpose of destroying any sulphate of magnesia already formed, giving rise to the very insoluble sulphate of baryta. When the superphosphate of lime is applied to the fresh surface of limestone, it has been found to add nearly fifty per cent. to the strength; at least, this was the case with the cubes of stone on which the experiment was conducted.

At that time, steam engines were bulky and inefficient. That didn't matter. Just build them bigger, pour in more coal and get the job done.

The coal companies had no interest in research to make steam more efficient. The more coal the steam engines wasted, the richer the coal men got.

If the developers of the Internal Combustion Engine (I.C.) had had to depend on the coal men to back their research, the I.C. would never have gotten anywhere. While the I.C. was in its infancy and no threat to coal, the railroads actually lobbied against and held up the development of steam engines for down by a spring or a weight. If the steam pressure gets too high for the strength of the boiler, the plug or valve opens to let the steam escape. Sometimes this "safety valve" is neglected; then there is likely to be an explosion, and the boiler bursts with great force and destructive effect.

But why does water in the vapor or gas state, that is steam, exert this great force? Heating water means giving its molecules greater motion, and at 212° F. the motion of the molecules is so great that they no longer hold together, but fly apart. It is the blows of these flying molecules against the walls and the piston that produce the steam pressure. These flying steam molecules pass along the pipe from the boiler into the cylinder, as we see in the next picture.

THE ENGINE

In this picture the piston is hidden, but we shall see it in a moment. Here we see the piston-rod, with the rod that connects it to the fly-wheel, and we see, working from this wheel, the cylinder cord controlling the governor—the two beautifully balanced balls immediately above the cylinder. Simple as this engine is—the simplest form of engine we can have—it is wonderful in the smoothness of its working and the rhythmic balance of its parts.

THE STEAM-CHEST

From the boiler the gas rushes through the pipe into the steam-chest of the engine. It flies to the cylinder till it touches the piston, and here these flying molecules bombard the steel disk so hard that the disk flies back to the other end of the cylinder. Then the engine does a very clever thing. As the piston-rod flies back, another rod flies forward. The cylinder doors are fixed to this other rod; and as the piston goes back the slide valve goes forward, so that the door by which the steam came in is shut. No more steam can come that way. But as this door shuts another opens, and through this open door the steam pours in to drive the piston on again. Let us call these doors the front door and the back. They shut and open hundreds of times a minute. The front door opens, the steam rushes through and drives the piston on; then the front door shuts and the back door opens, and the steam through the back door drives the piston back.

No wizard's chest was ever more wonderful than this steam-chest of an engine. Inside it is the secret of the engine that works by steam-power. The ingenuity of its mechanism is well worth studying closely, and these pictures and the picture following make it all quite

non-rail vehicles.

So back then, the I.C. was a genuine promise, a real benefit. The oil companies, making slow progress competing with coal, saw the I.C. as the key to their survival in the energy field. They weren't interested in the steam engine, however. The unsophisticated steamer could still use their competitor's coal. Developed, it would never need their more expensive gasoline but would do very well on cheap kerosene, as it still does today.

Thus, the I.C. was developed and promoted and the steamer was effectively abandoned.

A few dreamers hung in there, however, developing and improving the steam auto. At no stage of its development would its backing have been an advantage to coal men, since such backing would have infuriated rail magnates and the steamer's use of coal would have been eliminated by its next improvement.

In our time, oil is the major pollutant. Our economy is based on it and the Internal Combustion Engine. It is built into our system just the same as was coal a hundred years ago.

Now it's the Internal Combustion Engine which is bulky, inefficient and a major polluter. Now Detroit adopts the same attitude against the auto steam engine as did the old railroad lobbiests.

They use the people's ignorance of steam engines to scare off investments in steam and the purchase of modern steam autos. They create an image of the basic steam engine, described in this issue, and would have you imagine this monster under your hood.

Actually, unless you are a mechanic, you probably wouldn't recognize a modern auto steam engine if you saw one. Most are the same size as I.C.'s but weigh less. They average 30 MPG on cheap kerosene or Diesel fuel. Methane could be used to great advantage in steamers, and with no modification of most engines.

Steam engines are four times quieter than I.C.'s. They are more powerful. Forty per cent of the I.C.'s fuel is wasted whereas only 10% of the steamer's energy is diverted from its actual running.

Freezing is no longer a problem since anti-freeze products protect the steam engine in the same way they protect the I.C.'s radiator. And as to the frequency of filling the engine with water, the modern steamer takes less refilling than does the modern I.C.'s radiator.

A steam auto takes up to 40 seconds to start when cold. After being parked while you are at work or shopping it will take about ten seconds to move. Of course, when in operation, stopping and starting in traffic is the same as with the I.C.

The Internal Combustion Engine starts from cold in five seconds. But with all the steamer's advantages, I can't see anyone but a nitwit rejecting it because he has to wait 40 seconds to start up in the morning.

The worst bugaboo about steamers is the likelihood of their boilers exploding. Such an occurrence is no longer dangerous. The water is in tubes instead of a pot-like boiler. A broken tube would mean a lot of steam and a stopped car, just the same as when an I.C.'s radiator blows up.

Steam backers could more alarmingly point to the thousands of people per year burned to a crisp when high octane gas tanks explode in accidents. Fire danger from low octane fueled steamers in accidents would be minimal.

Concerning pollution, a major factor is that the steamer gives off less than a tenth of that released by the I.C. Exhaust from the steamer's engine is only water vapor. The fuel burns as completely as in a stove and the pollutants it releases are not only less in volume but less toxic in their chemical makeup and so less harmful to the environment.

That the steamer never became popular was largely the fault of its developers. In the beginning it was a combination of rotten timing and bad business practices. By the time the Internal Combustion Engine took hold, steam had lost. The competition from I.C.'s was just too strong.

There was also a lot of naivety in the ranks of the steam developers. Most plain. Not only do the doors shut and open with lightning rapidity and with marvelous precision, but as the piston flies to and fro it clears the cylinder of the used-up gases, driving them into the exhaust-box through the little black hole just under the slide valve.

THE SLIDE-VALVE MECHANISM

Here, looking down on the steam engine, we see how the marvelous exactness of its movements is obtained. We see the steam rushing in and driving the piston through the cylinder. The piston-rod is joined to the connecting-rod, which joins the crank of the main shaft so that, as the piston-rod flies to and fro, the shaft goes round and round. In the middle of the shaft is what is called an eccentric wheel—called eccentric because the center of the wheel is not the center of the shaft. The result of this is that the wheel does not run true but has a kind of wobbling motion. The wobble affects the moving of the eccentric rod, which is joined by another rod to the slide valve.

As the piston flies forward the eccentric wheel drives the slide valve backward, shutting the door and cutting off the steam. As the piston comes one way the eccentric wheel drives the slide valve the other way—that is to say, it admits the steam just when it is wanted and where it is wanted.

THE ECCENTRIC WHEEL

Here we see the eccentric wheel which wobbles out of its center and we see also a top view of the slide valve, or the sliding doors, as we have called them. These two pictures below show how, with the eccentric wheel in one position, the left-hand door is open and the right-hand closed, while with the wheel reversed the right-hand door is open and the left hand closed. The steam drives the piston, the piston works the shaft, the shaft works the eccentric wheel, and the eccentric wheel works the sliding doors, which control the steam that drives the piston. That is the "round and round" of a steam engine, going on faster than we can count, each part fitting into the other, and each doing its share of the work with untiring accuracy.

THE GOVERNOR

These two pictures show one of the most wonderful pieces of mechanism on any engine. It is the little instrument with the hanging balls, and is called the governor. It is connected with the main shaft and is made to revolve by two cog-wheels just below the balls. The faster the main shaft goes around, the faster these cog-wheels and the spinning balls revolve. The governor is like the "sense"

actually believed (and some still do) that Detroit would eventually adopt the steam engine.

An Internal Combustion Engine starts going to hell after about a year. Due to its simpler construction and the lack of internal battering, a steamer would outlast at least five I.C.'s. Detroit would far rather sell five engines than one. Wouldn't you? If this were the only reason, it would be enough for the permanent rejection of steam engines by Detroit.

The basic reason given for Detroit's rejection is retooling. This would be even more complex than during WW II when Detroit dropped civilian and commercial vehicles and converted entirely to tanks, jeeps, etc. At least, the engines were basically the same, even with all their modifications in size.

War-time conversion is by government decree and the public accepts it. But in peace-time the oil people wouldn't allow the government to order conversion. Unions would be as violently anti-steam as the oil people. The Internal Combustion Engine creates more work to employ more people than anything else in our system. From manufacturing oft-replaced engines, to servicing them, to selling gas, the Internal Combustion Engine is the mainstay of our economy. Conversion to steam would eliminate at least two-thirds of road vehicle related jobs. The auto people no more want to be retrained than do the loggers or you.

So there will be no conversion to steam by government decree. Detroit won't convert voluntarily. While there is seemingly plenty of oil, people will continue to drive big cars. Smaller cars will be the rule only when oil really starts running out. By that time, there won't be enough energy to use in the conversion from I.C.'s to steamers.

There will be no conservation of energy in anticipation of real shortages. Energy people will continue to sell as much as they can today and to hell with tomorrow. It's their nature.

In Issue 38, page 18 of The Mother Earth News, we are told that the Massachusetts Institute of Technology was conducting experiments recently on 200 autos, substituting wood alcohol for gas. The experiments stopped shortly after EXXON gave MIT $500,000. MIT officials admitted that EXXON had opposed the study but said there was no connection between the gift of the half million and the stopping of the project.

A reader in New Hampshire sent me the article below, which speaks for itself.

Gas Pressure

The natural gas industry has quietly blocked use of a simple device that would save $200 million in heating bills during each winter month, according to confidential Senate memos.

The mechanism, costing only a few dollars, would decrease use of natural gas in furnances by up to 30 per cent and save the equivalent of half million barrels of oil a day.

The device has been used in Germany for 43 years. In hearings next week by the Senate Anti-Trust subcommittee, the natural gas industry will be asked why it's not being used in the U.S. The fuel-saver is called a "vent damper" and prevents heat from going up the flue. In 1972 we revealed how the industry-run American Gas Association (AGA) had successfully thwarted its widespread use to keep sales of natural gas from dropping.

But Memphis, Tenn., among other cities, tried to give the vent damper a fair trial. The sub-committee has now obtained correspondence which shows that the AGA's industrious president, F.D. Hart, "called (Memphis officials) three or four times and was applying pressure" to prevent the vent damper test.

A subcommittee staff report explains AGA's success: "For approximately ten years, a small company attempted to have the AGA promulgate standards" which are necessary for the device to be widely installed. "The AGA refused. . ."

As a result, only about 5,000 of the vent dampers are in use, although there are 30 million gas fur-

Portsmouth Herald 3-21-76.

of the engine, and its purpose is to regulate the supply of steam to the cylinder.

It is all done by the two balls. We all remember the old-fashioned merry-go-rounds on which we used to ride at country fairs. The faster they went the farther out the horses swung and the higher they were in the air. So it is with a ball on a piece of string. Spin it round and round, and the faster you spin it the higher it will rise. Look at the balls in the left-hand picture—they are still and low down. Now look at the right-hand picture—they are spinning around as fast as they can go. As they spin they rise, and as they rise they pull up with them the rod that connects them with the throttle, so that the throttle works with the balls, shutting off steam when the balls are at their highest, admitting more steam when the balls slow down.

This delicate piece of mechanism was invented by James Watt, the inventor of the modern steam engine, and it is called "Watt's ball governor." In most engines now, this governor of Watt's takes another form, though it is really the same in principle. Inside the big fly-wheel of the engine are two big balls or weights

naces.

The subcommittee has also determined that the devices are safe. Staffer John Ray was sent to West Germany to study the devices first hand. He found that in 43 years, there have been only 14 accidents, all due to improper tampering with the mechanism.

I haven't written a line of this to discourage interest in steam. All my negative arguments have been to show that steam will have to be promoted by Survival types the same as Solar power, methane, wind, etc.

Beginning with the basic steam engine in this issue, I will be doing more articles on steam. This will include not only automotive steam engines but work engines for every job on the farm and in the home.

In time, you mechanics can build your own steam runabouts. When we give steam the promotion others have given to sun power, wind, etc., the steam car manufacturers will start selling enough of their engines to successfully compete with the dying Internal Combustion auto industry.

Whatever headway we make before the collapse, we Survivors will have much more to build with than if we waited to apply steam after the I.C. was gone.

Following is a partial listing of books on steam engines you can get at your library or order through a book store.

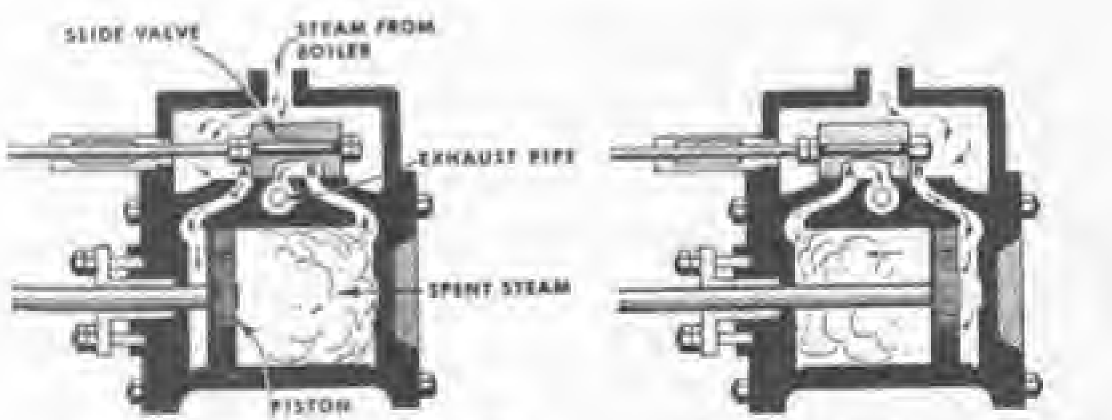
STEAM CARS 1770-1970, Anthony Bird, St. Martin's Press 1971.

SMOGLESS DAYS, Adventures in ten Stanley Steamers, Stanley W. Ellis, Howell-North Books 1971.

THE STEAM-POWERED AUTOMOBILE, Andrew Jamison, Indiana University Press 1970.

A SIMPLE HISTORY OF THE STEAM ENGINE, J.D. Storer, John Baker Publisher London 1969.

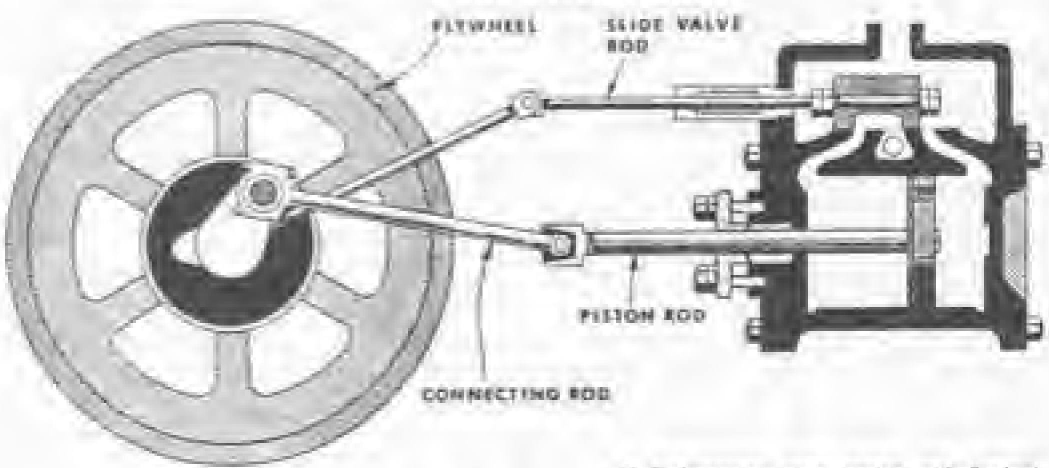
The Steam Boiler



5. Reciprocating engine. Steam enters through A; spent steam passes through B.

6. In this case steam is admitted through B, and the spent steam passes through A.

The Steam-Chest

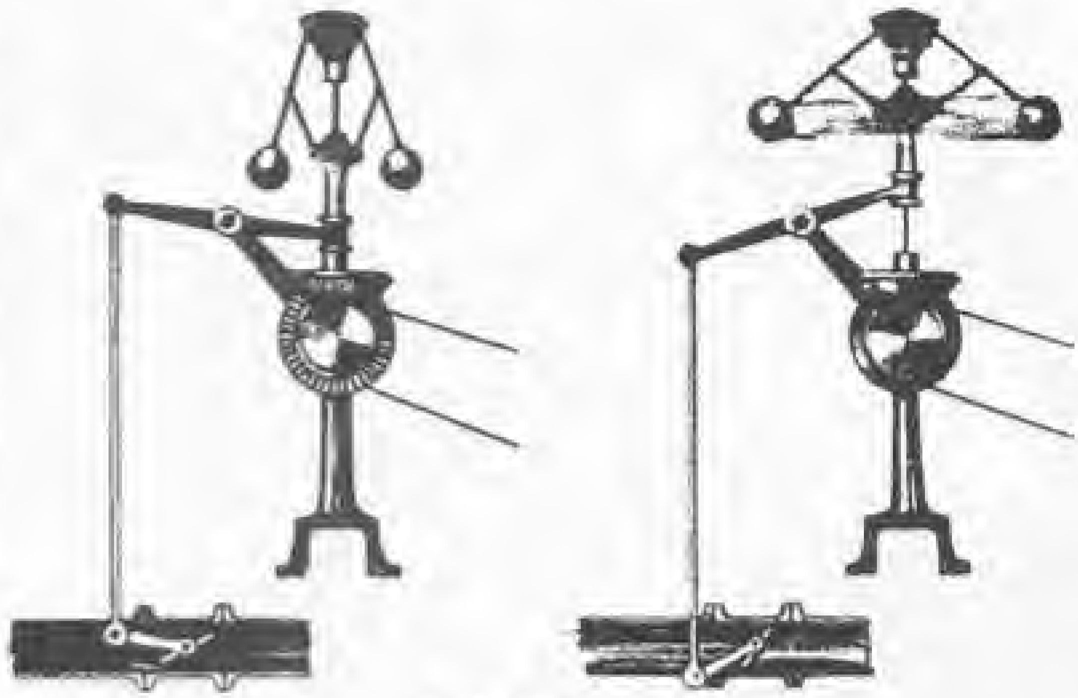


7. Reciprocating steam engine, with flywheel.

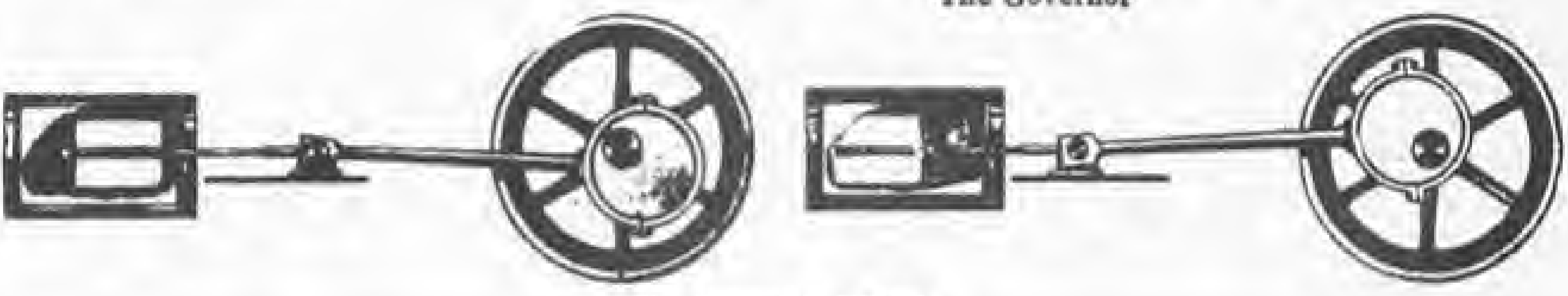
The Slide-Valve Mechanism

fastened on hinged arms. These weights fly out toward the rim of the fly-wheel when the engine is running. Just as in Watt's ball governor there is a rod from the arms of these weights joined to the steam throttle. If the engine runs too fast, the weights fly out so that the rod closes the throttle, shutting off part of the steam, and the engine slows down to the proper speed.

Mercury, which reaches a temperature of 1,000°F. at only 180 pounds pressure, is used instead of water in some turbine engines. After the mercury vapor has operated one turbine, it is still hot enough (about 435°F.) to heat water into steam at 300 pounds pressure, and this water steam in turn operates another turbine. The costly mercury is recovered in a condenser and used over and over.



The Governor



The Eccentric Wheel

ATLAN'S FIRST [and maybe last] MOVIE REVIEW

TAXI DRIVER

In my third issue, James Alan asked for a description of the device the Taxi Driver used to snap the gun out of his sleeve and into his hand. I watched the making of his device, carefully, and am still uncertain of how he did it. Anyway, he had an arrangement built of odds and ends and it had a track going down his arm on which the gun carriage was on rollers. When he snapped his arm to the firing position, the carriage would rattle considerably and the gun would slide into his hand.

It was noisy and it reminded of putting a coin in a Coke machine and waiting for it to finally finish its grumbling and shoot the bottle out. Any police officer I know is faster on the draw and I think such a device would only give the wearer a false sense of security.

Travis, the Taxi Driver, is an ex-Marine and a Viet Nam vet. He can't sleep and whether he is haunted by war memories or intestinal parasites picked up in New York or Viet Nam is not made clear.

Anyway, Travis applies for night taxi duty anywhere in New York City. Here, the degeneracy of New Yorkers is revealed to him and he makes contact with this fantastic, public spirited salesman who carries about twenty pistols in two suitcases. Anti-gun dummies will be offended by the salesman's Messianic zeal in so freely supplying citizens with arms in New York, the showplace of strict gun control.

The Taxi Driver buys four different caliber pistols and carries them all.

Travis develops a protective interest in Iris. A 12½ year old hooker, played by Jodie Foster. She is hardly a turn-on since anyone would identify her with her role as the cute little con-artist playing alongside Christopher Connely in the TV series, "Paper Moon".

While this is going on, the Taxi Driver is on the make for an angelic dimwit campaigning for the presidency of your typical scummy politician. Travis takes her to a skinflick and she walks out, although it showed some footage of microphotography of sperm cells and such along with some footage of an orgy. Iwas surprised at her reaction since the people in the orgy had more redeeming characteristics than did the politician she was campaigning for, and even the Taxi Driver, for that matter.

The upshot of the movie is that Travis raids the house Iris works in and kills everyone but her while stage hands stand off-camera sloshing buckets of orange paint on everyone.

Travis survives and gets his name in the papers as a hero. Iris goes back to school in Pittsburgh. Don't be upset that I've told you the plot. If you've seen the movie you'll thank me for showing you that it had a plot in the first place.

The message I got from Taxi Driver is that most New Yorkers are not fit to survive. Travis shows that casually gunning down New Yorkers is a public service, good target practice, and has its rewards. It's a kind of recruiting film for Vigilantes. But it probably won't inspire much zeal in good folk to go there and help. The Peace Corps fever has largely died out in our land.

Go see it, but leave the old folks at home.

BLACK POWDER
How to Make the Best

The basic formula for black powder is (by weight) 15 parts potassium nitrate, 3 parts powdered charcoal and 2 parts sulfur. One half part powdered dextrine or one part LePages mucilage or Elmer's Glue-All should be added to powder mixed wet. Thus, when it is dry it will remain in the same sized grains you make it.

Say each part is 1/2 ounce. That would give you 8 1/2 ounces of potassium nitrate, 1 1/2 ounces of powdered charcoal, 1 ounce of sulfur and 1/2 ounce of dry dextrine or 1 ounce of wet glue.

Mix the whole mess with enough rubbing alcohol to make a thick mush. (Plain water can be used.)

Next, lay a yard of plastic window screen on a table and rub the mess well into it. Use a spatula to smooth the mush into the screen so you can see, from both sides, all the screen strands. What you want are tiny, uniform squares of black powder.

Hang up the screen and when the powder is dry just bend, tap and generally mess with the screen and you'll have the best black powder possible with the ingredients — if they are fine enough.

The fineness is what stumps most people. The finer it is, the better it is. Also, one ingredient should be as fine as are the other ingredients. Sulfur is seldom a problem as it breaks down easily. Charcoal is pretty easy to pulverize, also. But potassium nitrate is barely soluble in water and is very hard to pulverize, even in a blender.

The best way to pulverize the ingredients is in a lapidary tumbler. This is a can partly filled with carborundum or something else and pretty stones. A motor turns it something like 20 to 60 rpm's hour after hour and after a day or so the dull, rough stones come out shining and smooth all over.

Such tumblers can be bought in nearly every town. Just look in the phone book under "Lapidary Supplies". One handling about a pound of powder at a time costs under $20. It will last for years and uses a negligible amount of energy.

To use, put in about 1/4 the can's volume of ballbearings about the size of marbles. Look under "Bearings" in the phone book.

Second best is one ounce size round lead fishing sinkers bought at any bait and tackle shop.

When you've got your tumbler and balls you need some ingredients to put into it. Potassium nitrate can be bought through most chemical companies. You can even buy it for about $3.85 a pound from any drug store if you're cool. Druggists refuse to sell it if they suspect it is to be used for making any sort of explosive. Just tell the man your brother-in-law gave you some pork from his farm and you want to try to cure some. It's not that important that the guy's going to give you the third degree. If he does, to hell with him. Just go to the next drug store. You can also get pure potassium nitrate from the nursery and garden supply store under the name "Stump Remover", three pounds for $5.

You can also get it from common soil by following the instructions elsewhere in this issue.

At the same nursery store you can get excellent sulfur cheaply in five-pound bags.

For charcoal, go to the nearest grocery store. You can buy a 10 pound bag of charcoal briquettes for about $1.75. Willow charcoal is best for black powder, but briquette makers aren't that selective. If you can't get the best, try briquettes. They may be willow even though the bag doesn't name the tree.

Put a few briquettes in a box and pound them to bits with a hammer. Pour the bits into a blender, if you have one, and blend until the powder all goes through a regular flour sifter. Without a blender it just takes more pounding.

I would advise you to first pulverize a pound of potassium nitrate for 24 hours, then pulverize a half-pound of charcoal, since it is bulkier, for 24 hours.

When the potassium nitrate and charcoal are pulverized, run them seperately through a square foot of 100 mesh brass screen. Such a screen can be bought through any ceramics supply store. This screen is commonly used for sifting glazes.

With your 100 mesh potassium nitrate, charcoal and sulfur (might as well sift it, too) you've got some fine ingredients.

Mix it with the half ounce dry dextrine or one ounce liquid glue and the rubbing alcohol and tumble it for 24 hours. The 24 hour tumbling is arbitrary. It might do just as well in 12 or six. If you want to save three cents on your electric bill cut the time down. Otherwise, give it as much time as you have patience.

When you have a nice pile of flaked black powder you might want to test it. You can ignite it beside a pile of commercial black powder for comparison. If you would rather test it in firecrackers, the technique for making them is in THE POOR MAN'S JAMES BOND. The instructions are general and you can improvise according to your needs and materials. One suggestion is to dip the firecracker in Elmer's Glue-All by the fuse so all the cracker and part of the fuse is covered. Hang the cracker or crackers up by the unglued part of the fuse for maybe three days and you should have an airtight cracker to be proud of.

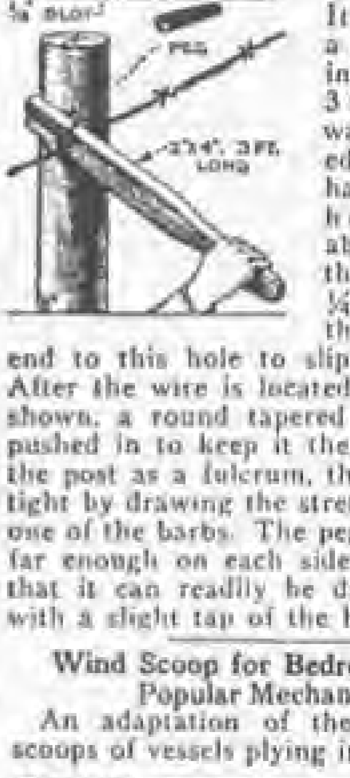
Popular Mechanics 1925
Homemade Barbed-Wire Stretcher

After trying various kinds of barbed-wire stretchers, none of which proved satisfactory, the stretcher shown in the illustration was constructed and gave excellent results.

It was made from a piece of 2 by 4-in. material, about 3 ft. long. One end was slightly rounded to serve as a handle and a 3/4-in. hole was drilled about 4 in. from the other end. A 1/4-in. slot was then cut from the end to this hole to slip over the wire. After the wire is located in the hole, as shown, a round tapered wooden peg is pushed in to keep it there. Then, using the post as a fulcrum, the wire is pulled tight by drawing the stretcher up against one of the barbs. The peg should project far enough on each side of the hole so that it can readily be driven in or out with a slight tap of the hammer.

Wind Scoop for Bedroom Window
Popular Mechanics 1925

An adaptation of the porthole wind scoops of vessels plying in tropical waters makes it possible to deflect the breeze into the bedroom during hot weather.



A wooden frame is covered with stout paper, and fastened to the window frame by wire hooks that fit into the triangular openings between the frame and siding. A wire stay is hinged to the outside corners of the deflector, and it is hooked around the opposite side of the frame, as illustrated in the drawing. It requires only the work of a second to set up or take down the arrangement.

HOW TO WATERPROOF BOOK MATCHES

This is a goody I wrote 16 years ago for a journalism assignment. After all that time I finally found a publication which would print it.

KURT SAXON

"I'm going camping," said my younger brother.

"Hurrah!" I shouted. "I'll show you how to waterproof book matches."

"Don't bother," said he. "I've got a lighter."

He held it up for me to see and I snatched it and ground it under my heel. When I set out to show somebody how to waterproof book matches I let nothing stand in my way.

He told me it was my own lighter which he had stolen not a month ago and my countenance fell; but only for a moment. For the prospect of waterproofing book matches kept all petty hates in momentary check.

I rummaged in the refrigerator and under the couch and finally found the glob of wax my mother got for chewing when the price of tobacco went up. I put it in a sauce pan and lit a fire under it.

As the flames licked hungrily around the pan we watched, fascinated, while the wax melted and burned and smoke rose in a black pall to the ceiling. Then, from the den, we heard a fierce sniffing as if from a snarling hound scenting its prey.

"What are you young'uns doing?" shouted Mother in a tone that showed little delight.

We ignored her as she was invariably a party-pooping conservative. She finally felt her way through the smoke and turned out the fire.

Coughing from the acrid fumes she said to me, "Look at this mess! You know how a woman likes to keep a nice place."

I didn't but I nodded to humor her.

She set about to clean up but, laughing, my brother and I hustled her outside and locked her in the garage.

Then we re-lit the fire and soon the wax was boiling merrily.

While we covered the striking surfaces of the match books with Scotch tape I cautioned my brother to put out the fire crawling up the curtain. He tore the curtain down and threw it out the window.

Finally, I dumped the match books into the boiling wax, watching to see that they weren't in long enough for the hot wax to penetrate the Scotch tape. When they were thoroughly soaked I took them out and shook off the excess wax.

When this was done we opened them and let them dry while we discussed camping. I told him they were handier than stick matches and could even be given away as gifts. He said he would give them away as gifts, since Mother would never let him go camping again.

I would have argued with him but the sirens of the fire engines drowned me out. A fireman poked his head in through the window and said, "Where's all the smoke coming from?"

"We're waterproofing book matches!" I exclaimed.

I showed him a book and ripped off the Scotch tape. Then I struck one of the waxed match heads on the striking surface and beamed triumphantly as it lit.

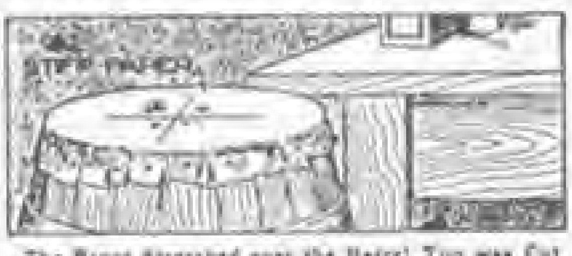
He chuckled and said I belonged in the laughing place. He also said there was no need for the smoke; I just had the fire on too high.

I thanked him for the information and gave him a book of matches. As he walked toward the fire truck he signalled his driver to start the engine by tapping his forehead.

Then my brother let Mother out of the garage and gave her a book of matches. I ran as fast as I could to the bus stop.

Self-Setting Rat Trap

A suburbanite successfully trapped a bunch of rats by stretching a piece of stout elastic paper on the top of an open barrel. Spreading food on this paper he allowed it to remain until the suspicions of the rats were allayed, then he cut two right-angled slashes in the paper with a razor. Next morning



The Paper Stretched over the Barrel Top was Cut after Feeding the Rats on It for Some Time

he found seven of the pests in the barrel.

Simple Method of Making Candles

Very serviceable candles, that produce a flame four or five times as large as that of an ordinary wick candle, can be made in the following manner: About 1 lb. of paraffin—such as is used for canning purposes—is melted in a flat pan. A long sheet of tissue paper, about 6 in. wide, is grasped at each end, and is slowly passed through the melted wax several times, each layer being allowed to cool before the paper is passed through again. When the thickness of the wax is about 1/8 in., the sheet is allowed to cool, and is then cut into pieces from 6 to 12 in. long, depending upon the size of candle desired, and rolled into cylinders.

When dipping, the wax should not be too hot, as it would then melt the layers previously applied, instead of adding a new one. It is best to melt the wax over water, at a temperature of about 212° F. To expose the paper wick for lighting, revolve the end of the candle in a flame until some of the paper lights; it is then ready for use.

A Cheap Charcoal Stove.

I saw the other day at a friend's house one of the simplest and most effective stoves for a small conservatory it is possible to imagine. It was composed of three 12-inch ordinary flower pots. The hole at the bottom of the lowest was covered with a small pot, into the sides of which had been bored a number of holes. The pot was then three parts filled with charcoal, and lighted from the top. This is the furnace. It is covered by pots Nos. 2 and 3, and a light tin funnel and chimney carry off the vapor. The draught is maintained by placing the apparatus on a couple of bricks, and regulated by closing the intervening space with mud, leaving only a sufficient aperture to keep the fire burning. This improvised stove will burn without attention for twenty-four hours, and it is amazing what a great amount of heat is given off from so small a surface.—*S. J., in the Gardener's Chronicle.*

Popular Mechanics 1925

Making Varicolored Flash Papers for Stage Effects

Amateur plays are often produced in small communities where there is no electric-lighting current. If the play calls for fire scenes, lightning, artillery fire, explosions, etc., it is difficult to produce much of an effect without electric lights. For just such occasions, a set of varicolored flash papers will produce the effects desired. These papers can be prepared at home at small cost.

It is well, at this point, to call attention to the danger attending the use of these sheets, as well as of colored fires, etc., in close proximity to scenery, costumes, and other "props" that have not been fireproofed. Sheets of tissue paper, about 12 in. square, are used; these are cut in half for small, weak flashes, while, for longer ones, a whole sheet can be used. The tissue paper is soaked in aqua fortis, which should be bought ready-mixed from the druggist. The paper is thoroughly soaked, but is taken out of the solution as soon as possible, rinsed in running water, and hung up to dry. A wooden clothespin, or something of the sort, should be used to remove the paper from the acid, which should be prevented from contact with the fingers or clothing. When the papers thus treated have dried, they are pinned to a stick, held at arm's length and touched off with a match at one corner. They will burn with a brilliant white flash.

Colored flashes are made as follows: In all cases the paper is first treated as described above, and dried before immersion in the chemical solutions that produce the colors.

For red, dip the treated sheets in a solution of water and nitrate of strontium. Blue is obtained by soaking in copper-nitrate solution. Green can be produced from a solution of copper chloride, while a solution of calcium nitrate will produce another red. A beautiful violet flash is made from a solution of saltpeter and water.

Be sure to pin the paper to the end of a stick, which can be held at arm's length, or else fasten to a tin reflector before lighting.

Popular Mechanics 1918

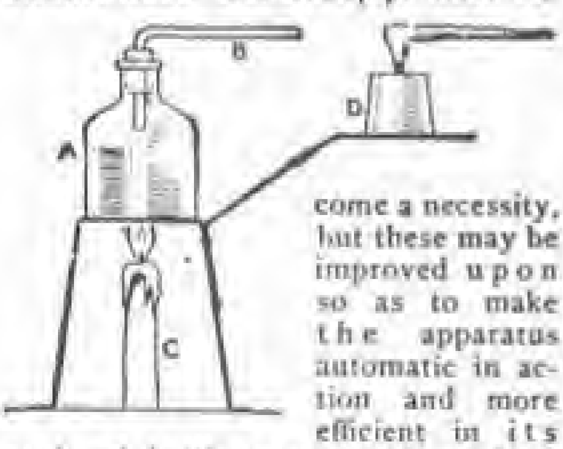
Roses Tinged Blue by Chemicals

Roses may be colored without any detrimental effect by placing their stems in a solution of 100 cubic centimeters of water, 2 grams of saltpeter, and 2 grams of an aniline dye. A centerpiece of roses colored to represent the national colors was made in this way and proved very effective as a table decoration. A convenient way to color the flowers is to place their stems in a test tube containing the mixture.—Contributed by Chester Keene, Hoboken, N. J.

Popular Mechanics 1915

An Automatic Blowpipe

A fine-pointed flame can be used to advantage for certain work, and the alcohol flame and blowpipe have become a necessity, but these may be improved upon so as to make the apparatus automatic in action and more efficient in its work. A bottle or receptacle, A, having a large bottom to provide a sufficient heating surface, is supplied with a cork and a tube, B, bent at right angles. The receptacle, A, is supported on a stand so that it may be heated with a small lamp, C. The light D may be a candle, alcohol lamp, or any flame set at the right distance from the end of the tube B.



The receptacle A is partly filled with alcohol, and the heating lamp lit. The heat will turn the alcohol into gas and cause a pressure, driving it through the tube B, so that it is ignited by the flame from D. The flame will have a fine point with sufficient heat to melt glass.

Smoking One's Own Pork

Even if one does not raise his own pork, he can cure it to his own taste and satisfaction, all that is required being a small container. A dry-goods box, or even a barrel, answers the purpose.

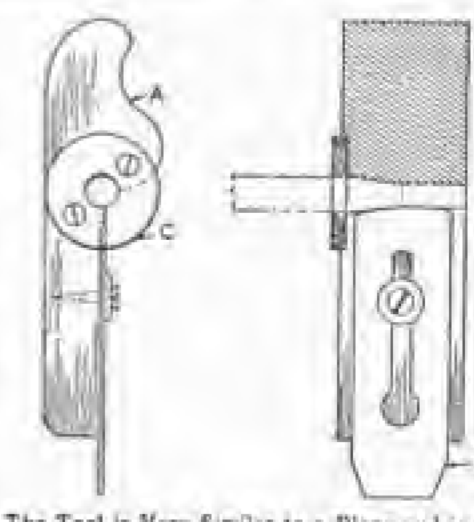
An Improvised Smokehouse for the Curing of Pork can be Built and Operated at Practically No Expense. Hickory Wood or Corncobs are Used for Producing the Smoke

As shown, the container, or smoking chamber, is elevated above the surface of the ground, and the fire, which furnishes the smoke, is built in a tin pail a little to one side. A stovepipe carries the smoke from the pail to the smoking box, where the meat absorbs the characteristic flavor. A piece of scrap tin is used to cover the pail, and either corncobs or hardwood is used for fuel. Hickory is especially desirable, if obtainable, but corncobs will produce excellently flavored meat. Beech, and woods that contain resin, should not be used for smoking meat, as they will impart a bitter taste to the product.

A Dowel-Turning Tool

Popular Mechanics 1918

The owner of a wood or metal lathe can easily construct a tool that will turn dowels of any size quickly. This tool, as described by a correspondent of Work, London, consists of a block of wood, shaped as shown at A, and a plane bit, B, attached with a wood screw. The hole in the collet C must be of such size that it will admit the rough stock freely but also prevent it from wabbling as the stick turns. The stock is chucked in the ordinary manner and the tool is run on the outer end.



The Tool is Very Similar to a Plane and is Used with a Lathe for Turning Dowels

THE JUNK STILL

Many Survivalists who are otherwise courageous and practical, become cowardly and irrational when faced with the task of performing some chemical manipulation. Our specialized culture has built up an image concerning chemistry that humbles most people who are unschooled in that field.

An unwritten law of the Establishment is "Thou shalt not compete with thy superiors, the specialists". Limited permission is granted, however, to the young who might put their knowledge to the service of the Establishment. But once the budding chemist has submitted himself to an education by the Establishment he is often lost to the layman who most needs his knowledge. After a couple of years of high school or college chemistry you can take the boy out of the Establishment laboratory but you can't take the Establishment laboratory out of the boy.

Most chemical manipulations passed down to the layman are from well-meaning chemistry majors who actually reinforce the layman's fear of chemistry. A prime example is Ken Russel's tear gas still I borrowed from the Anarchist Cookbook.

What layman, wanting to make tear gas (acrolein), would dare set up the foolishly elaborate still shown in figure 67. The makers of Mace don't need to fear amateur competition as long as Survivalists depend on chemistry majors to pass down their knowledge to them.

A hundred years ago, people weren't cowed by the challenge to do for themselves. Dick's Encyclopedia of Formulas and Processes is a testimonial to that fact. Copyrighted in 1872, it told the average man of that day how he could duplicate most laboratory processes in his own kitchen or garage. If he could do it so can you.

Of course, most modern formularies are written for Establishment types who are expected to have degrees in chemistry and a lot of elaborate equipment. Also, Dick's is so full of old-fashioned terms the modern layman finds it nearly useless. So I went through Dick's Encyclopedia, line by line, defining about 2500 vague chemical and trade terms and put all the definitions and Dick's kitchen and garage techniques in GRANDDAD'S WONDERFUL BOOK OF CHEMISTRY.

Yet, the layman's sense of helplessness is still there. Any suggestion that he deal with a chemical company or even order

Kurt Saxon's Junk Still

lab equipment through his friendly pharmacist puts him in a panic.

So I will proceed to show you how you can make many wonderful, and some forbidden, products in your own home from junk equipment. It is hoped that this will encourage you to go further afield for better equipment once you have mastered a few simple techniques.

Observe Ken Russel's still. Even I would be scared off by the price of it and its seeming demand for a professional to operate it. In the POOR MAN'S JAMES BOND, I break down Ken's elaborate still to its more basic essentials. But you say you don't have the flask, alcohol lamp and tubing required? You're afraid the pharmacist will read your mind when you request these items? Poor baby!

Then I'll go that extra mile and break it down further. Observe the photo of my junk still.

First is a large coffee can or one formerly holding a gallon of tomatoes or such and thrown away by restaurants. Inside the can is a quart whiskey bottle. Plastic tubing leads from the bottle cap, through a child's plastic sand bucket and down to a jar.

With this simple setup you can distill brandy from wine, almost pure alcohol from rubbing alcohol, make tear gas, extract oils from marijuana and other herbs and make lots of other great stuff.

You can get plastic tubing from any hardware or aquarium supply store or from your local hobby shop. When you get your tubing and all the other items together you should not have spent more than a couple of dollars, if that.

First, punch two holes in opposite sides of the top of the can with a nail. These are for a wire, put through one hole and twisted fast, wrapped once around the

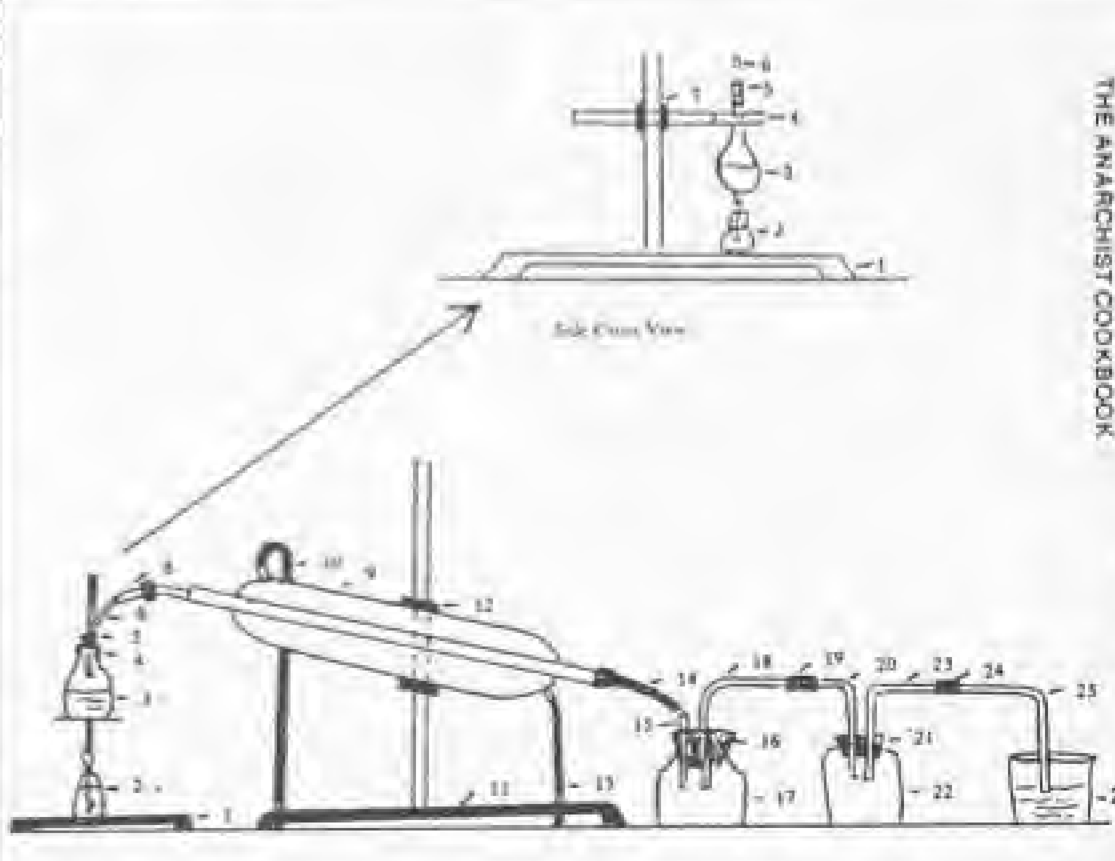


Figure 67. Equipment set up for preparing tear gas.

neck of the bottle, then out the other hole and twisted fast. This holds the bottle in place so it won't fall over.

On the bottom of the can, put some marbles or evenly shaped stones so the bottom of the bottle is surrounded with boiling water rather than sitting directly on the bottom of the can and so getting its heat directly from the fire.

With a small knife, drill a hole in the plastic bottle cap just a bit smaller than the plastic tubing. (Tin caps are started with a nail and forced to size with a ball-point pen.) Force the tubing a half-inch through the hole in the cap and seal around the outside of the cap and tube with epoxy or Silicone adhesive, bought at any hardware store or hobby shop.

When screwing the cap on and off the bottle, don't turn the cap, which might loosen the tube or twist the tubing. Instead, twist the bottle itself.

Next, string a piece of cord or wire over the apparatus so the tubing is held up straight over the bottle, out of the way of any heat.

Three or four twists of tubing is curled around inside of the bucket, with about a foot coming out of its lower side. (Instead of a plastic bucket, you can even use another can.) Just make the exit hole slightly smaller than the tubing and seal the outside with epoxy or Silicone adhesive.

Use some weight, such as a can of food, to hold the tubing down inside the bucket. Just make sure the weight doesn't crush the tubing shut. You can blow through the cap tube when ready to start. If it blows freely, it is not blocked and the setup is completely safe if you follow directions.

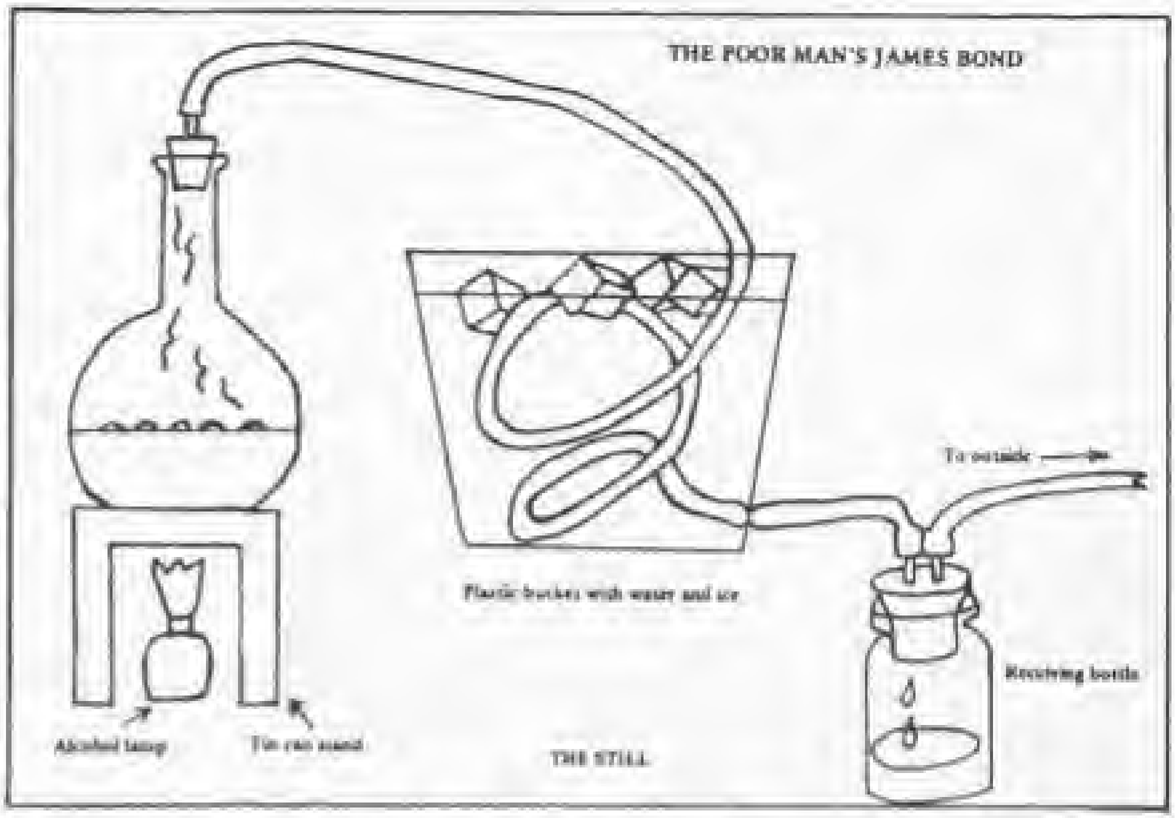
The bucket is filled with water and ice. More ice is added as it melts and the excess is dipped out as necessary.

If you don't have a refrigerator you can buy ice cheaply at most liquor stores. If you have no stove, you can use a hotplate.

Now, say you want to extract the 70% isopropyl or methyl alcohol from the rubbing alcohol bought at any dime or larger grocery store. Extracting oils from herbs demands pure alcohol and this system gets it pure enough for your purposes.

Pour the rubbing alcohol into the bottle and turn the bottle under the cap until it is tight. Then fill the can nearly full with water and turn on the fire so it just covers the bottom of the can.

Put water and ice in the bucket. A few minutes after the water begins to boil,



pure alcohol will fairly flow out of the tube and into the jar. If you have set it up right, when all the alcohol has boiled out, the flow will practically stop. This is because alcohol is a coolant and the water in the bottle can't boil until most of the alcohol is out.

For a sight gauge to tell when the alcohol is almost all out, pour the pint of rubbing alcohol into the jar and make a mark on the jar showing about 70% of the liquid's volume. When the alcohol is about to your mark you can be sure the process is almost finished.

If you are still uncertain, you can stick your finger under the flow and taste it. Isopropyl and methyl alcohols are not fit to drink, but an occasional touch to the tongue is harmless. The taste of the pure alcohol you get at first and the watery leavings at the end is unmistakable. When it stops tasting pure, stop the process.

As the water boils down in the can, replace it with more boiling water, as putting in cold water will temporarily stop the process until the water again reaches the boiling point.

Make or buy plenty of ice beforehand, since the process can take up to two hours. This is done in your spare time, of course, and it's fun.

Your first project might be to get brandy from wine.

Buy a fifth of 20% alcohol by volume wine and screw it up to the cap and tube. You might use another fifth bottle, with the 20% mark on its outside, to catch the brandy in.

Since this is to drink, you stop the process only when you can taste no alcohol. The popskull you get this way will be much stronger than you can buy and will make you a believer in kitchen chemistry.

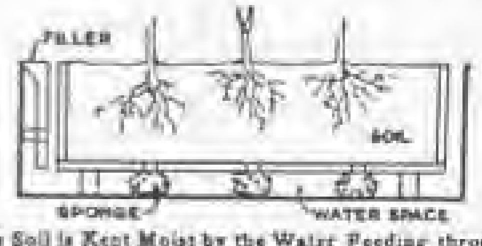
You might also use a bottle of gin or vodka in place of the wine, in order to get nearly pure ethyl alcohol for lab use and ingredients for medicines.

In issue 6 will be the junk process of extracting oils from herbs.

Popular Mechanics 1919

Watering Window-Box Flowers

The window box for flowers can be conveniently watered in the following manner: Construct a metal box to receive the box holding the soil and bore enough holes in its bottom to admit water to the soil. The inside box should be supported about 2 in. above the bottom of the metal box. Sponges are placed in the bottom to coincide with the holes in the soil box. A fill-



The Soil is Kept Moist by the Water Feeding through the Sponges from the Under Side

ing tube is made at the end. The water is poured into the metal box and the sponges admit only enough water for the plants at all times.

A Tool for Transplanting
Popular Mechanics 1925

When transplanting small plants, a simple device made from a tin can and a bit of stiff wire will save considerable work. One of the ends of a can is melted or cut off square, so as to provide a cutting edge; two holes are punched through the opposite end and a U-shaped piece of wire is inserted, after which the wire ring is attached to the ends, as indicated.

In use, the tool is placed over the plant and the can pushed into the ground for a sufficient depth, the plant and a quantity of earth being withdrawn inside the can when it is pulled from the ground. The plants are transplanted into holes, made in the same manner, by holding the roots and earth surrounding them down with the wire loop with one hand and withdrawing the can with the other.

Popular Mechanics 1925

A Double-Action Garden Hoe

By cutting out a portion from the center of the blade of a hoe and pointing the projection on each side, an ordinary hoe is converted into a tool that permits cultivating on

A Fork-Shaped Hoe, Made from the Standard Garden Hoe, Makes It Possible to Save Time by Working on Both Sides of a Row of Seedlings at the Same Time

both sides of a row of seedlings at the same time, thus minimizing the time and effort used.

The blade is cut along the dotted lines, as shown in the drawing, with a cold chisel, and the rough edges are afterward smoothed down by filing or grinding. The implement is used as illustrated, and will be found quite effective for cutting small weeds and loosening up the soil around the roots of the plants.

GUEST EDITORIAL

YELLOW ALERT!

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In the event of national emergencies arising from social, political or economic crises, few will know what to do, or are prepared to face up to the realities of the times. An example of what can happen goes something like this: Our government alerts the bureaucracy that the USSR is dispersing its citizens out of urban and industrial areas as a result of breakdown in SALT talks.

Recalling the Kennedy crisis with Castro in Cuba, the Washington Hierarchy gets set to move out to Maryland's hills where special shelters below and above ground have been prepared for their reception and protection. This is known as 'Crisis Relocation Planning' [CRP], stage one—on which our Nation's capitol has priority.

Then the news sharpies get wind of all the commotion, and instead of waiting for official releases from Dept. of Defense, the Village Voice and other vociferous news rags on both coasts put out bold headlines that the Russian bear is about to attack. Hell breaks loose as people buy up all the food and fuel they can manage, load up their vehicles, and start fleeting helter-skelter out of town.

Stage two—the jig is up, and CRP units makes its formal entry with some boldness and tries to work out problems by the numbers. In the northeast corridor, where more than 60-million would live in such cities as New York, Boston, Philadelphia and Baltimore, the task becomes almost impossible. And on the west coast where another 50-million urbanites reside, the scene becomes chaotic, to say the least.

But all these millions of refugees don't know where to go! Some lucky few who manage to find accommodations in motor inns and private country resorts, soon run out of money to pay for expensive food and lodgings. And when all the others on the road run out of food and fuel, they are left stranded on the highways and byways of America. By the time CRP troops and the national guard gets organized, chaos has already set in—a million times worse than the exodus from Egypt.

Those who remain in urban centers can't buy food, fuel or other essentials. Public utilities [gas, water and electricity] are shut off; police, fire, sanitation and transportation is crippled . . . you can't even make a phone call for help. You're on your own.

City centers may function for a while, provided the forces of martial law are organized and people huddled into areas where they can be controlled and fed in bread lines. For certain, banks, insurance companies, supermarkets and stores are all closed up, if not looted and destroyed. Spending money will be scarce. Checking accounts and credit cards. . . forget it. Infact, all paper money, stocks and bonds will be useless. Only gold and jewelry and silver coins will be honored in bartering for anything; or you can exchange your labor or other tangible goods for luxuries and essentials. Welfare checks you can forget. Even a gold certificate from AT&T or GM will be worthless. Toilet paper will have more immediate value pending the outcome of the social situation.

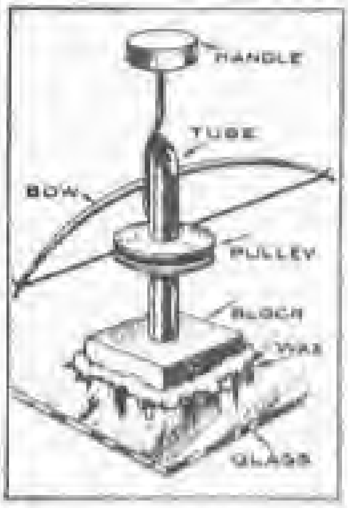
Those who make the trek on the open road had better have a destination—a place where food, shelter and other living essentials are on reserve, with armed friends prepared to defend the position. Only well organized groups will be able to survive. The loner or loose families who think they can hole up in their country homes and estates are the first victims of roving outlaws. Even farmers and ranchers wouldn't stand much of a chance against scavenging mobs of crazed refugees who lack even the minimum knowledge of living off the land, or the intelligence of knowing an edible root from poison ivy.

The power to survive depends on knowledge people should be reading and studying

Popular Mechanics 1925

Drilling Large Holes in Glass

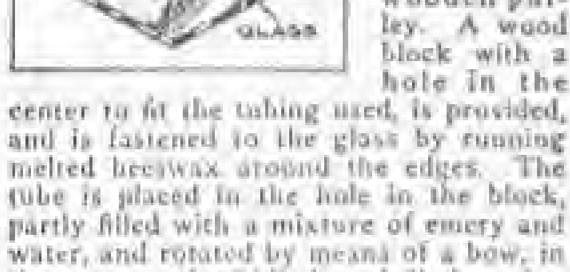
To drill comparatively large holes in glass, without the danger of breaking it, the arrangement illustrated may be used, and will produce a clean, smooth hole. A piece of thin brass or copper tubing, the outside diameter of which is the same as that of the hole to be drilled, is fitted with a wire handle and a small wooden pulley. A wood block with a hole in the center to fit the tubing used, is provided, and is fastened to the glass by running melted beeswax around the edges. The tube is placed in the hole in the block, partly filled with a mixture of emery and water, and rotated by means of a bow, in the manner of a fiddle-bow drill, the string passing around the pulley. This method is particularly suitable for drilling holes in curved glass, as the underside of the block can be shaped to the curvature of the surface, so that the drill will not slip.



Popular Mechanics 1915

A Paper Drinking Cup

The cup is readily made of a piece of paper 8 in. square. Lay the paper on a flat surface, turn the point A over



Several Cups can be Nested Together and Carried in the Pocket or Hand Bag

to meet the point B and crease on the dotted line CD, Fig. 1, then turn the corner D up to meet the line BC, Fig. 2, making sure that the new edge DE is parallel with the lower edge and crease. Turn the corner C in the same manner, that is, fold it over to the point E and crease. Fold the two corners at B outward and down, and crease, and the cup is complete as shown in Fig. 3.

now. But instead, they are wasting their time and money reading 'The Last Days of Nixon', or the life of Jacqueline, or other nonsense which neither reveals nor adds to one's knowledge about survival. Wise people will subscribe to such journals as Mother Earth News, the Plain Truth, Common Sense, and other pertinent periodicals.

There is much activity going on in preparation for troubled times ahead which many economists and political analysts describe as inevitable. Sure. . .there is much optimism in the daily press and highly respected publications, but all of it is based on the Bicentennial of America and the old rhubarb from the national political elections. Like the old song, 'After the Ball was over,' we'll get the impact of all the social/economic/political problems which have been building up over the past decade of uninhibited spending, licentious living, and international difficulties. These problems have not been resolved, and are very much with us, and building up more each day.

Foremost along lines of preparedness are the Crisis Relocation Planners and several corporate groups who are planning private retreats. In Hutchinson, Kansas, they are well along in developing a subterranean habitat encompassing a huge cavern of 250 acres, 650 feet below the prairie. These spacious compartments are used to safeguard industrial/business valuables, such as bank and insurance company records in microfilm; Hollywoods movie classics; Detroit's automobile technology; California's wines and brandy, agricultural seeds, dehydrated and freeze-dried foods, clothing, medicines, arms and ammunition. There is room down there for a surviving colony of 10,000 people or more, and you can be sure they will be mostly scientists, technicians, the wealthy families, disciplined militiamen, and a key group of officers and personnel necessary to establish and train a new social order of civilization with excellent chances of survival.

Other survival groups are developing with outdoor resorts and recreational parks throughout the country. The Mutual Association for Security & Survival [MASS], originators of the idea of utilizing campgrounds as relocation destinations in the event of national emergencies, are busily organizing charter groups. As regional chapters are formed, they are attached to cooperating owners of farms, ranches and campgrounds located far out of urban areas. The MASS now has designs on coordinating survival establishments with campgrounds from Florida to New England, running along the famed Appalachia Trail. A prototype retreat is being made ready in rural area of New Jersey to be called 'Survival Town,' U.S.A.

Along the Main Street of America [on the old Route U.S. 66 which ran from Chicago to L.A.], are developing retreat locations going southwest through St. Louis, Joplin, Mo., the O.K. country through to Albuquerque, N.M., Flagstaff, Az., and into San Bernardino. Legendary places like the ancient caverns of Meramec, Grand Canyon and Onandaga Cave, are now off the beaten path of old '66, with rerouting of the National Highway System. Most of the Rt. 66 motels, service stations and roadside diners have been closed or abandoned, and make ideal locations for survival encampments.

On the Pacific coast, beginning at North Cascade National Park in Washington, and meandering along the Rockies down to Yuma, Arizona, is more than 1200 miles of near desolate countryside with nearly 1000 established campgrounds and outdoor resorts where retreats may be developed, and some actually planned, as one at Millard Canyon near Palm Springs. In future issues of this column, we will report how communes or experimental communities of alternative lifestyles are becoming de-facto retreats by accidental design. There are well over 2000 such encampments scattered in 40 states, the British Honduras and Central America.

It is our purpose to examine and report on all these potential survival groups [such as the United Survival Clubs of L.A.], and relate all there is to know about them. We will survey those most likely to meet the requirements of people who may be looking for a convenient place of refuge in the event of social chaos. Although we recognize this is a subject most people would rather not think about—it is far better to be informed and ready. A danger foreseen is half avoided.

When we have all the facts from resonsible survival groups and addresses where one may write to for specific information, we will publish a special directory of refuge networks and developments. It may well be the first of its kind in the USA, and suggest you reserve your copy and be sure you get that special edition from Atlan.

Popular Mechanics 1913

Foundry Work at Home

I. The Equipment

Many amateur mechanics who require small metal castings in their work would like to make their own castings. This can easily be done at home without going to any great expense, and the variety and usefulness of the articles produced will make the equipment a good investment.

With the easily made devices about to be described, the young mechanic can make his own telegraph keys and sounders, battery zincs, binding posts, engines, cannons, bearings, small machinery parts, models and miniature objects, ornaments of various kinds, and duplicates of all these, and many other interesting and useful articles.

The first thing to make is a molding-bench, as shown in Fig. 1. It is possible to make molds without a bench, but it is a mistake to try to do this, as the sand is sure to get on the floor, whence it is soon tracked into the house. The bench will also make the operation of molding much easier and will prove to be a great convenience.

The bench should be made of lumber about 1 in. thick and should be constructed in the form of a trough, as shown. Two cleats, A A, should be nailed to the front and back to support the cross-boards, BB, which in turn support the mold while it is being made. The object of using the cleats and removable cross-boards instead of a stationary shelf is to give access to the sand, C, when it is being prepared.

About one or two cubic feet of fine molding-sand will be required, which may be purchased at the nearest foundry for a small sum. Yellow sand will be found a little better for the amateur's work than the black sand generally used in most foundries, but if no yellow sand can be obtained the black kind will do. If there is no foundry near at hand, try using sand from other sources, giving preference to the finest sand and that which clings together in a cake when compressed between the hands. Common lake or river sand is not suitable for the purpose, as it is too coarse and will not make a good mold.

For mixing and preparing the sand a small shovel, D, and a sieve, E, will be required. If desired the sieve may be homemade. Ordinary wire netting such as is used in screen doors, is about the right mesh, and this, nailed to replace the bottom of a box, makes a very good sieve.

Fig. 1—Convenient Arrangement of Bench and Tools

The rammer, F, is made of wood, and is wedge-shaped at one end and flat at the other, as shown. In foundries each molder generally uses two rammers, but for the small work which will be described one will be sufficient. An old teaspoon, G, will be found useful in the molding operations and may be hung on the wall or other convenient place when not in use.

The cloth bag, H, which can be made of a knitted stocking, is filled with coal-dust, which is used for a parting medium in making the molds. Take a small lump of soft coal and reduce to powder by pounding. Screen out all the coarse pieces and put the remainder in the bag. A slight shake of the bag over the mold will then cause a cloud of coal-dust to fall on it, thus preventing the two layers of sand from sticking, but this operation will be described more fully later on.

The flask, J, Fig. 1, is shown more clearly in Fig. 2. It is made of wood and is in two halves, the "cope," or upper half, and the "drag," or lower part. A good way to make the flask is to take a box, say 12 in. by 8 in. by 6 in. high, and saw it in half longitudinally, as shown. If the box is not very strong, the corners should be braced with triangular wooden strips, A A, which should be nailed in, previous to sawing. The wooden strips B B are used to hold the sand, which would otherwise slide out of the flask when the two halves of the mold are separated.

The dowels, CC, are a very important part of the flask as upon them depends the matching of the two halves of the mold. A wedge-shaped piece, CC, is nailed to each end of the cope, and the lower pieces, DD, are then nailed on the drag so that they just touch C when the flask is closed. The two halves of the flask will then occupy

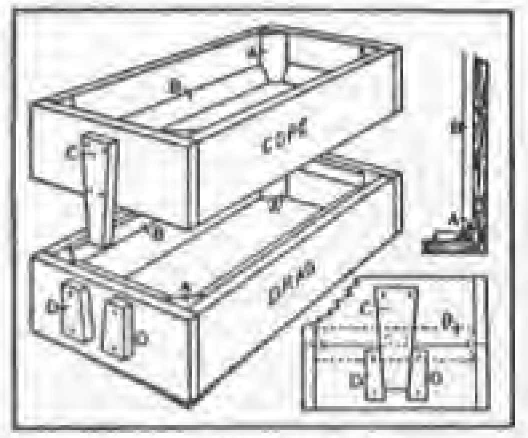


Fig. 2—Homemade Flask

exactly the same relative position whenever they are put together.

After the flask is done make two boards as shown at K, Fig. 1, a little larger than the outside of the flask. A couple of cleats nailed to each board will make it easier to pick up the mold when it is on the floor.

A cast-iron glue-pot makes a very good crucible for melting the metal, which can be either aluminum, white metal, zinc or any other metal having a low melting-point. This completes the equipment with the exception of one or two simple devices which will now be described.

II—How to Make a Mold

Having finished making the flask and other equipment, as described, everything will be ready for the operation of molding. It would be well for those who have never had any experience in this line to visit a small brass foundry, where they can watch the molders at work, as it is much easier to learn by observation; but they must not expect to make a good mold at the first trial. The first attempt usually results in the sand dropping out of the cope when it is being lifted from the drag, either because of insufficient ramming around the edges or because the sand is too dry.

A good way to tell when the sand is moist enough is to squeeze it in the hand. If it forms into a cake and shows all the finger-marks, it has a sufficient amount of moisture, but if it crumbles or fails to cake it is too dry. An ordinary watering-pot will be found useful in moistening the sand, but care should be taken not to get it too wet, or the hot metal coming in contact with it when the mold is poured will cause such rapid evaporation that the mold will "boil" and make a poor casting. A little practice in this operation will soon enable the molder to determine the correct amount of moisture.

When molding with sand for the first time it will be necessary to screen it all before using it, in order to remove the lumps, and if water is added, the sand should be thoroughly shoveled until the moisture is evenly distributed. The sand is then ready for molding.

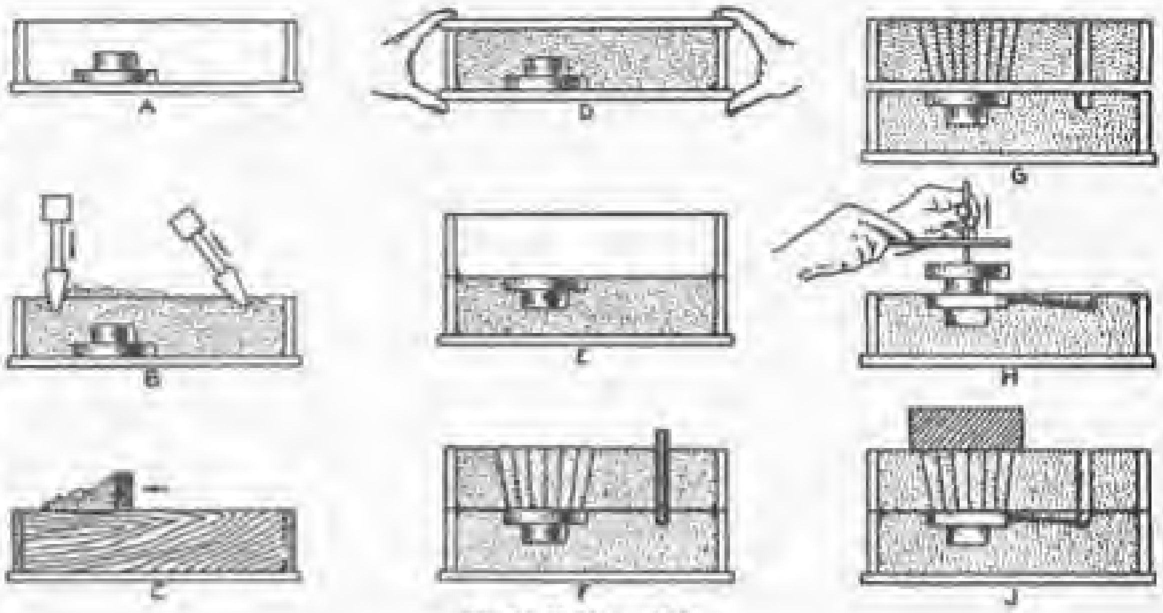


Fig. 3—Making a Mold

The operation of making a mold is as follows: The lower half of the flask, or "drag," and the pattern to be molded are both placed on the cover board as shown at A. A quantity of sand sufficient to completely cover the pattern is then sifted into the drag, which is then filled level with the top with unscreened sand. This is rammed down slightly with the rammer, and then more sand is added until it becomes heaped up as shown at B. It is then rammed again as before.

It is impossible to describe just how hard a mold should be rammed, but by observing the results the beginner can tell when a mold is too hard or too soft, and thus judge for himself. If the sand falls out of the flask when lifting the cope, or if it opens up or spreads after it is poured, it shows that the mold has been rammed too little, and if the surface of the sand next to the pattern is cracked it shows that the mold has been rammed too hard. It will be found that the edges of the mold can stand a little more ramming than the middle. In finishing the ramming, pound evenly all over the surface with the blunt end of the rammer.

After ramming, scrape off the surplus sand with a straight-edged stick, as shown at C, and scatter about 1/8 in. of loose sand over the surface for a good bearing. Place another cover board on top, as shown at D, and by grasping with both hands, as shown, turn the drag other side up. Remove the upper cover board and place the upper half of the flask, or "cope," in position, as shown at E.

In order to prevent the two layers of sand sticking together, the surface of the sand at E should be covered with coal-dust. This is done by shaking the coal-dust bag over the flask, after which the dust on the pattern may be removed by blowing. The cope is then filled with sand and rammed in exactly the same manner as in the case of the drag.

After the ramming is done a number of vent holes are made, as shown at F, from the surface of the mold to the pattern, in order to allow the escape of air and steam when the mold is being poured. These vent holes may be made by pushing a wire about the size of a knitting-needle down through the sand until it touches the pattern. The "sprue," or pouring-hole, is next cut, by means of the sprue-cutter shown at the right, which consists of a piece of thin brass or steel tubing about 3/4 in. in diameter.

Now comes the critical part of the molding operation—that of lifting the cope from the drag. It is here that the amateur often becomes discouraged, as the sand is liable to fall out of the cope and spoil the mold; but with a little practice and patience the molder can lift the cope every time without breaking it, as shown at G.

The next operation is that of cutting the gate, which carries the molten metal from the sprue to the opening left by the pattern. This is done with a spoon, a channel being cut about 3/4 in. wide and about 1/4 in. deep. The pattern is then drawn from the mold, as shown at H, by driving a sharp-pointed steel rod into the pattern and lifting it from the sand. When a metal pattern is used a thread rod is used, which is screwed into a tapped hole in the pattern. Before drawing it is well to tap the drawing-rod lightly with another and larger rod, striking it in all directions and thus loosening the sand slightly from the pattern. Some molders tap the pattern gently when withdrawing, as shown at H, in order to loosen any sand which has a tendency to stick.

After drawing the pattern, place the cope back on the drag, as shown at J. Place a brick or other flat, heavy object on top of the mold above the pattern, to prevent the pressure of the melted metal separating the two halves of the mold, and then pour.

III—Molding and Pouring

Having prepared one or more molds, the next operation is that of melting and pouring. An ordinary cast-iron glue-pot makes a good crucible and can be easily handled by a pair of tongs, made out of steel rod, as shown in the sketch. In order to hold the tongs together a small link can be slipped on over the handle, thus holding the crucible securely.

A second piece of steel rod bent in the form of a hook at the end is very useful for supporting the weight of the crucible and prevents spilling the molten metal should the tongs slip off the crucible. The hook is also useful for removing the crucible from the fire, which should be done soon after the metal is entirely melted, in order to prevent overheating. The metal should be poured into the mold in a small stream, to give the air a chance to es-

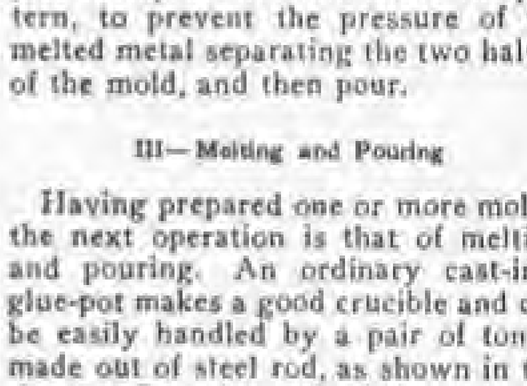


Fig. 4—Pouring the Metal

cape, and should not be poured directly into the center of the opening, as the metal will then strike the bottom hard enough to loosen the sand, thus making a dirty casting.

If, after being poured, the mold sputters and emits large volumes of steam, it shows that the sand is too wet, and the castings in such cases will probably be imperfect and full of holes.

A mold made in the manner previously described may be poured with any desired metal, but a metal which is easily melted will give the least trouble. One of the easiest metals to melt and one which makes very attractive castings is pure tin. Tin melts at a temperature slightly above the melting point of solder, and, although somewhat expensive, the permanent brightness and silverlike appearance of the castings is very desirable. A good "white metal" may be made by mixing 75% tin, 15% lead, 5% zinc and 5% antimony. The object of adding antimony to an alloy is to prevent shrinkage when cooling.

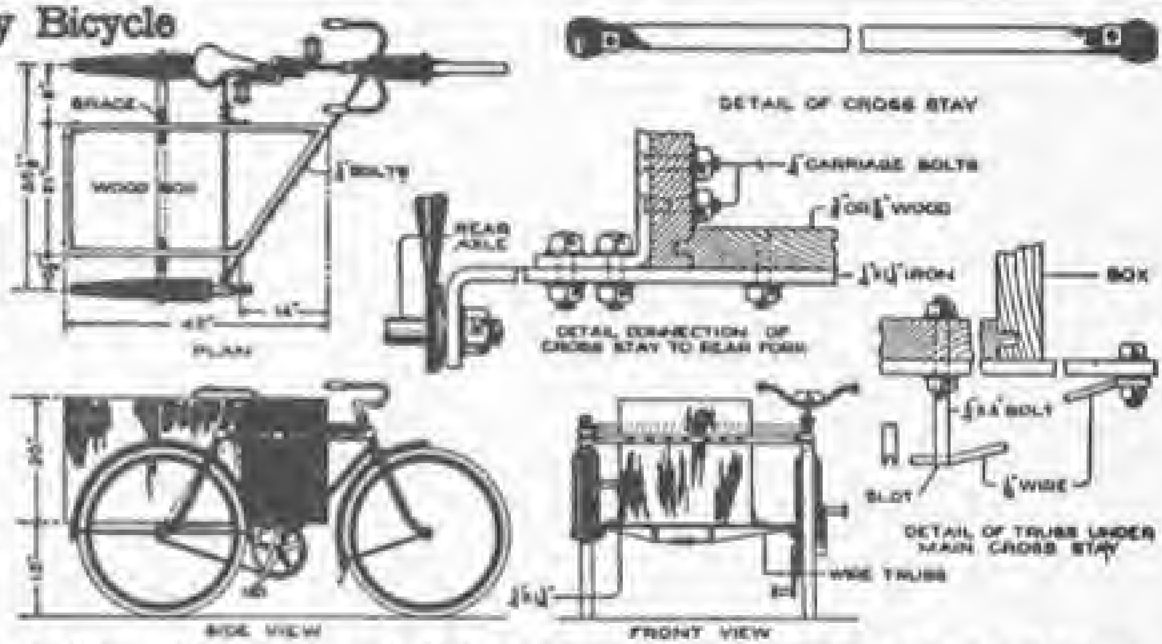
A very economical alloy is made by melting up all the old type-metal, babbitt, battery zincs, white metal and other scrap available, and adding a little antimony if the metal shrinks too much in cooling. If a good furnace is available, aluminum can be melted without any difficulty, although this metal melts at a higher temperature than any of the metals previously mentioned.

In casting zincs for batteries a separate crucible, used only for zinc, is very desirable, as the presence of a very small amount of lead or other impurity will cause the batteries to polarize. A very good way to make the binding posts is to remove the binding posts from worn-out dry batteries and place them in the molds in such a way that the melted zinc will flow around them.

The time required for a casting to solidify varies with the size and shape of the casting, but unless the pattern is a very large one about five minutes will be ample time for it to set. The casting is then dumped out of the mold and the sand brushed off. The gate can be removed with either a cold chisel or a hacksaw, and the casting is then ready for finishing.

Sidecar for a Parcel-Delivery Bicycle

Popular Mechanics 1919



An Ordinary Strong Bicycle can be Made into a Substantial Delivery Car by the Addition of a Body and a Third Wheel

QUICK delivery of small packages within a two-mile radius can be accomplished with a bicycle by a sturdy boy. An ordinary bicycle is used, preferably one with coaster brake and mudguards. Iron braces, 1/4 by 1 1/4 in., are shaped to make the framework, and the ends are looped to fasten around the frame of the bicycle and the supporting fork of the third wheel. This wheel is a bicycle front wheel with a fork. A mudguard on the third wheel is desirable. Make the iron parts as detailed, and fasten them into place. The body is made of 7/8-in. wood, preferably oak. The upper portion of the body is cut to receive the top brace, which is not in the way in loading or unloading the packages. Fasten the box with 1/4-in. carriage bolts, using a spring washer under the nut wherever a joint is made between wood and iron. A canvas cover can be cut to fit the top and secured at one end only, with three catch knobs on the sides and corresponding eyelets in the canvas, keeping the dust and rain from the interior of the body.

It is a good plan to stiffen the body with corner braces, using 1/8 by 3/4-in. should be strongly fastened, tongue-and-groove boards being used, and the side corners should be fitted with iron band iron. The floor of the body braces at the bottom. The body may be extended farther over the rear, if more loading space is required.

One coat of priming and one of paint finishes the box, and with the name of the merchant on the front and rear, the whole makes a neat advertising feature. Regarding the selection of a bicycle, since great speed is not essential, the lower the gearing is, the easier it will be to propel the load, and for ordinary work, where only small grades are covered, a gear of about 65 will be found efficient.

A Window Greenhouse

The drawing shows a simple window greenhouse that can be easily erected from ordinary window sash, assembled, and fastened to the sill, top, and sides of the window casing. The roof is also a sash, but is hinged at the back, next to the house, so that it can be raised in fine weather. A cord attached to an angular bar, which is pivoted to the side, as indicated, is used for raising or lowering the top.

A window greenhouse should preferably be placed on the south side of the house, so as to get the full benefit of the sunlight. Shelves and brackets can be fitted inside for the accommodation of plants that have trailing or drooping habits. Sufficient heat will be furnished from the room to make the growing of hardy plants an easy matter. Among these are violets, pansies, English daisies, lettuce, parsley, radishes, and, in fact, any flower or small vegetable that can be grown in the early spring and late fall in cold frames.

If desired, the greenhouse may be made so that it can be taken apart and the various parts stored away during the summer.

Making Miter Joints

A MITER joint is one having the joining ends, or edges, of the boards beveled at an angle. Probably the best example of the use of these joints is in the construction of picture frames. They are widely used in many kinds of frame and box construction and in the fitting of moldings. One of the principal advantages of miter joints is that the grain of the wood is matched at the corners, giving a more pleasing and finished appearance than is possible with other types of joints (Fig. 1).

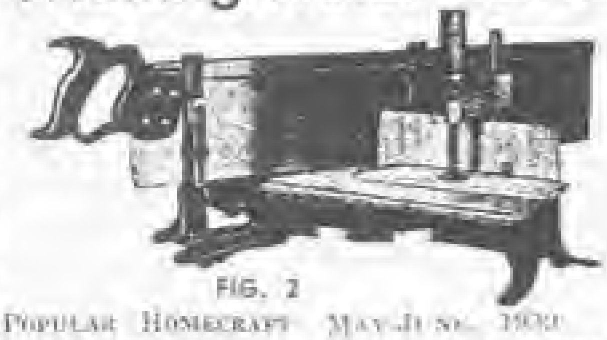


FIG. 2

POPULAR HOMECRAFT MAY-JUNE 1930

To Determine the Miter Angle

Usually frames are made square or rectangular. The sides of such frames meet at right angles, and the angle of their miter cuts is 45 degrees. It should be remembered, however, that frames of three, five, six or any number of sides may be joined together with miter joints. The angle for cutting any miter can be determined by dividing 180 degrees by the number of sides of the frame. Thus, for a triangular frame the cutting angle will be $\frac{180}{3}$, or 60 degrees. For a hexagonal frame, the angle will be $\frac{180}{6}$ or 30 degrees. For an octagonal frame, the angle will be $\frac{180}{8}$, or 22½ degrees.

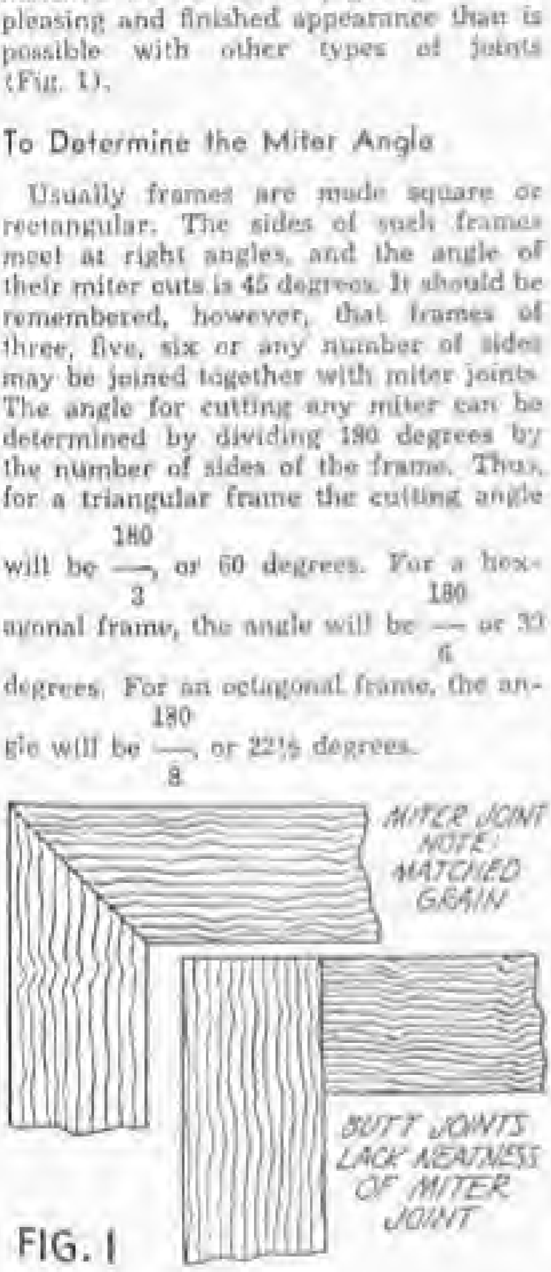


FIG. I

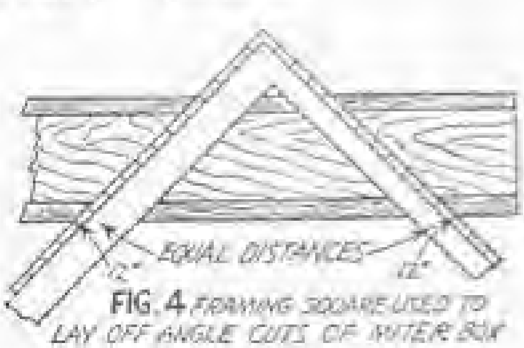


FIG. 4 FRAMING SQUARE USED TO LAY OFF ANGLE CUTS OF MITER BOX

Miter Boxes

The cutting of miters can be made comparatively easy by the use of a miter box. Among the accessories of a well equipped shop will be found a metal miter box, such as shown in Fig. 2. The swivel arm of such boxes has a tapered index pin which engages in holes on the underside of the quadrant. Thus the saw can be set and rigidly held at angles which will give three, four, five, six, eight, twelve and twenty-four sided figures. The quadrant is also graduated in degrees so that any angle, from 30 degrees to 90 degrees may be cut.

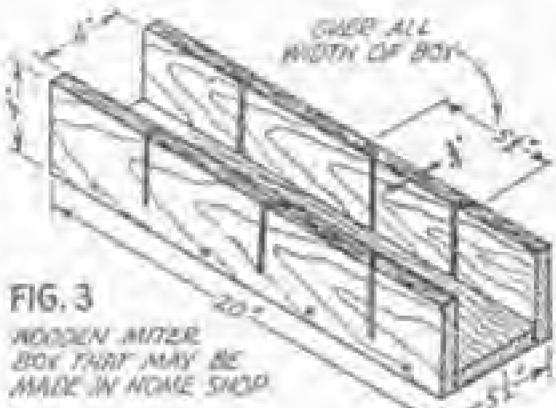


FIG. 3 WOODEN MITER BOX THAT MAY BE MADE IN HOME SHOP

These metal miter boxes are equipped with a fine tooth back saw which may be had in seven lengths, ranging from 20" to 30". The saws have blades of four, five or six inch widths. Adjustable stops are provided for duplicating parts of equal lengths.

Fig. 3 shows a miter box made of hard wood—one that can be made in the home workshop. While not so adaptable to the variety of angles and cuts, it makes a good substitute for the metal box. Usually, the home made miter box is made for only the 45 degree and 90 degree cuts, altho it is possible to construct it for other angles. The usefulness of the box will depend wholly on good construction and absolute accuracy in marking and sawing the angle cuts. One check for a 45 degree cut is to see that the distance it runs along the length of the box is exactly equal to the overall width of the box (Fig. 3). A steel framing square may be used to mark off 45 degree angles, as shown in Fig. 4. Here the square is placed flat down on the top edges of the box. Holding equal distances on both the blade and tongue, either side of the square will form 45 degree angles with the sides of the box. The saw cuts must also be made perfectly square to the bottom board.

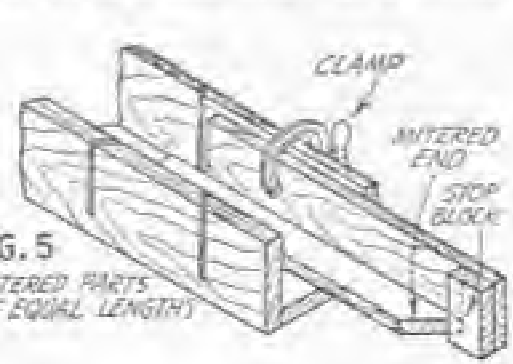


FIG. 5 MITERED PARTS OF EQUAL LENGTHS

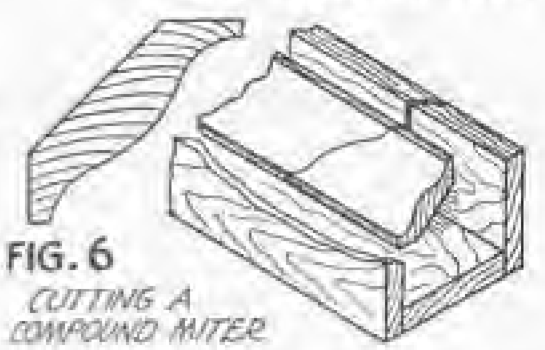


FIG. 6 CUTTING A COMPOUND MITER

The box shown in Fig. 3 also has a right angle cut for sawing square ends on boards.

Even when good miter boxes are used, poor joints may sometimes be cut, due to a poorly conditioned saw. If the saw has more set on one side than the other, or if the teeth on one side are longer than on the other, there is a tendency for the saw to "run" off to one side. The result will be joints that are open either at the top or the bottom.

Mitering to Equal Lengths

When mitering the joints of any framework, the opposite sides of the frame should be of equal lengths. If these pairs of sides are not exactly equal, at least one of the joints will not draw tight together, even though the joints themselves may be perfectly made. Simply to measure and mark the pairs equal and then attempt to saw exactly to the lines is not accurate enough to insure tight fits at all corners. A more positive method of sawing to equal lengths is shown in Fig. 5. Here a stop block is fastened to an auxiliary board. Then after one end of each side is mitered, the auxiliary board is clamped, as shown, to one side of the box. The mitered end of the side is then held against the stop block while the other end is being sawed. In this manner, any number of parts may be cut to exact lengths, it being necessary to mark only the first piece to obtain the proper place to clamp the stop piece.

The metal box has stop rods which may be set for various lengths within their limits. If they are too short, the stops, as shown in Fig. 4 may be clamped to the frame of the metal box.

A miter cut on a board which lies flat or stands vertical on its edge is called a "simple miter." One that is cut on a board that has one edge raised or which does not stand vertical is called a "compound miter." Compound miters are much less used than are simple miters.

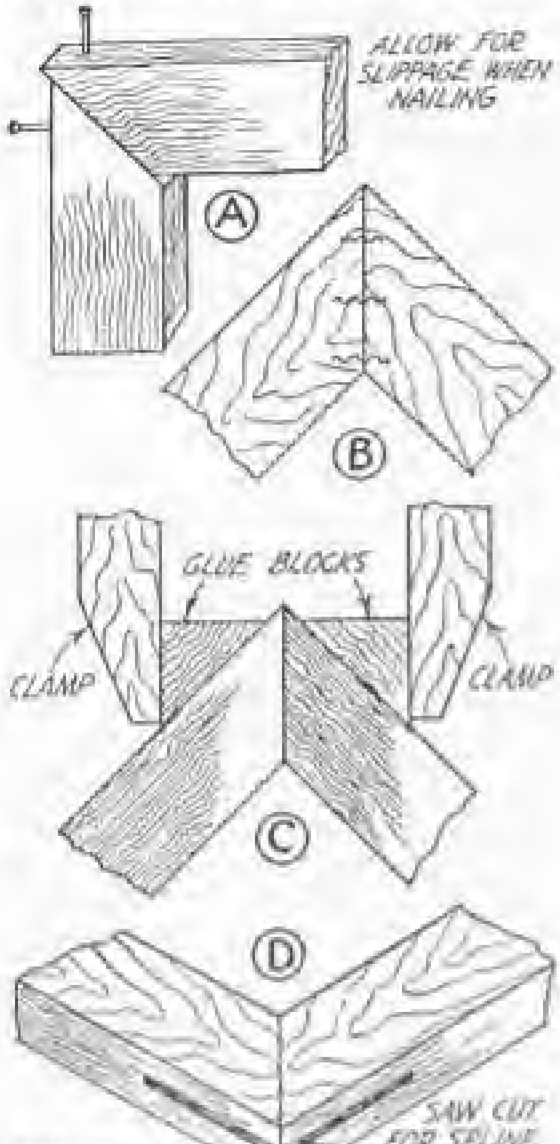


FIG. 7

They appear to be complicated, and it is probable that most craftmen would find them very difficult without the aid of a miter box. If the board is held in the

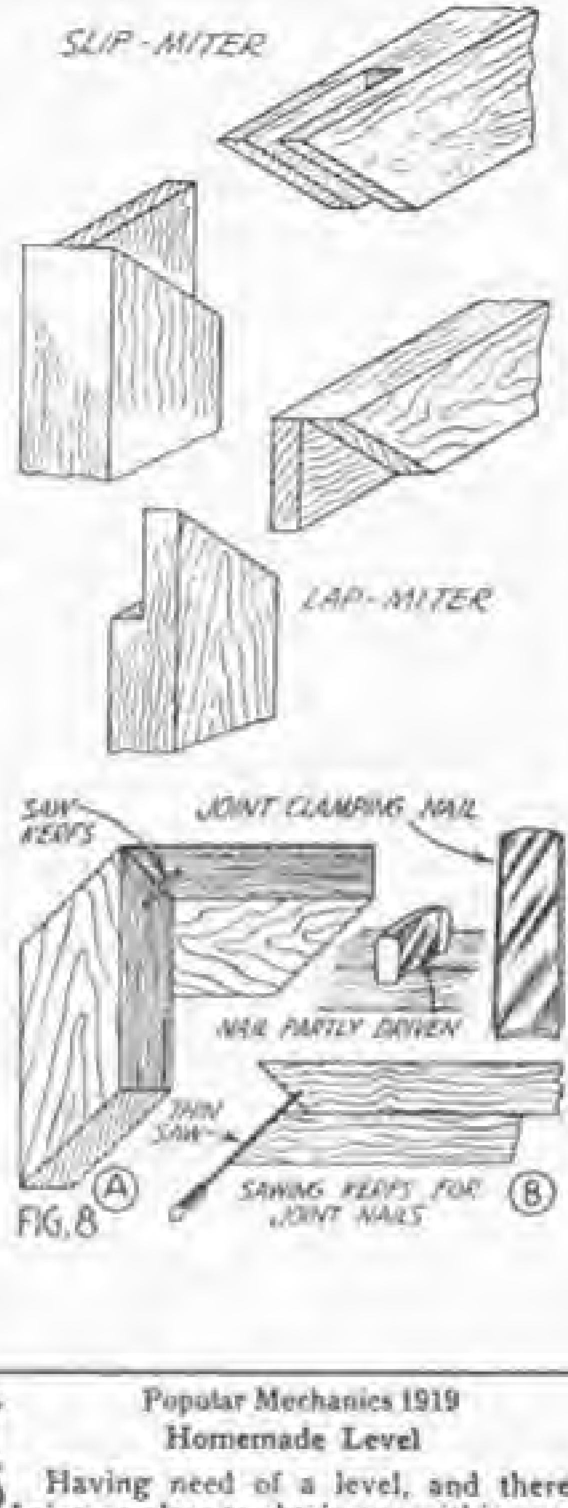


FIG. 8

miter box at the same angle that is to be used on a frame or structure, the sawing of a compound cut becomes as simple as the cutting of any miter joint. See Fig. 6.

Fastening Miter Joints

Light frames are often just nailed together—sometimes glued and nailed. When nailing, allowance must be made for slippage. Fig. 7-A. If the two sides can be clamped firmly while nailing, the allowance for slippage will, of course, not be necessary. The joint should be nailed from both sides, the nails to be placed so that they will miss each other.

Corrugated fasteners may be used on joints where their appearance will not spoil the work (Fig. 7-B).

Fig. 7-C shows how triangular blocks may be glued to the edges of the sides. When glue has set, the clamps may be applied, as shown, while gluing joint.

By clamping the parts together and making a saw cut as shown in Fig. 7-D, a thin piece of wood may be glued in the saw cut, making a fairly strong joint.

Fig. 8 shows the use of joint or clamp nails. They make a very tight and strong joint when correctly used. A thin saw cut must be made in each side of the joint. These saw cuts must match up and must be at right angles to the face of the miter cut. Fig. 8-B shows how one side of the joint may be clamped to the other to use as a guide for the saw, while the cut is being made. These nails are wider at the bottom end, and care must be taken that these wider ends be started into the wood instead of the narrow end.

The joints described here are the most commonly used miter joints, although there are others which are not frequently used and have not been described.

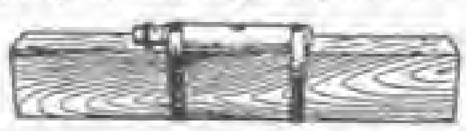
✦

WATER SOFTENING TABLETS

Convenient squares of water softener that save much washing soap are made by melting together trisodium phosphate, sal soda and paraffin in equal parts and pouring ½" deep in a pan. With a knife, mark off 1" squares for use as needed

Popular Mechanics 1919
Homemade Level

Having need of a level, and there being no place to obtain one within several miles, I constructed one as follows: A long medicine bottle was filled with water and tied to a straight piece of wood, 2 ft. long. After setting it properly by turning the piece end for end several times, I found that it could be used with accuracy.



A Bottle Filled with Water and Tied to a Straigh Piece of Wood for a Level

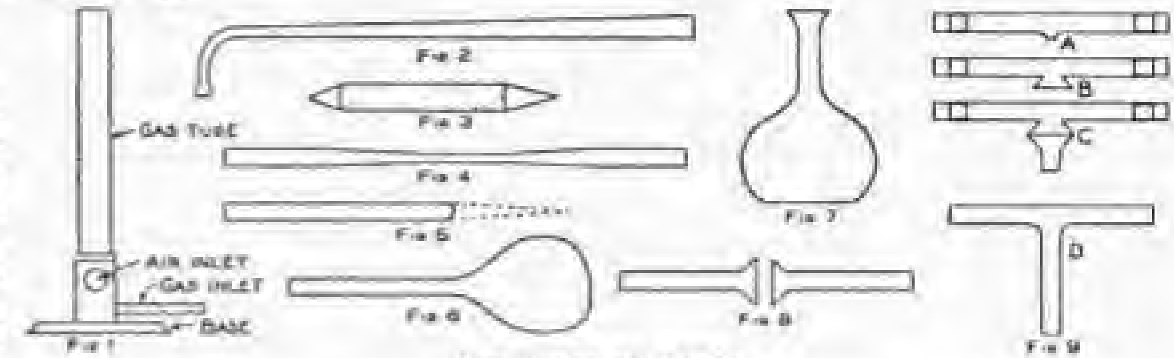
Popular Mechanics 1915
Frosting Glass

Procure a piece of flat iron similar to an iron hoop, bend it, as shown in the sketch, to make a piece 3 in. long and 1¼ in. wide and file one edge smooth. Sprinkle some fine lake sand over the glass, dampen the sand and rub the smooth edge of the iron band over the glass. It requires only a short time of rubbing to produce a beautiful frosted surface on the glass.

The Filed Edge on the Coiled Metal Retains the Sand Particles as It Is Rubbed over the Glass Surface

Glass Blowing and Forming

Popular Mechanics 1913



Glass Blowing and Forming

Fortunate indeed is the boy who receives a stock of glass tubing, a Bunsen burner, a blowpipe, and some charcoal for a gift, for he has a great deal of fun in store for himself. Glass blowing is a useful art to understand, if the study of either chemistry or physics is to be taken up, because much apparatus can be made at home. And for itself alone, the forming of glass into various shapes has not only a good deal of pleasure in it, but it trains the hands and the eye.

Glass, ordinarily brittle and hard, becomes soft and pliable under heat. When subjected to the action of a flame until dull red, it bends as if made of putty; heated to a bright yellow, it is so soft that it may be blown, pulled, pushed or worked into any shape desired. Hence the necessity for a Bunsen burner, a device preferred to all others for this work, because it gives the hottest flame without soot or dirt. The Bunsen burner, as shown in Fig. 1, is attached to any gas bracket with a rubber tube, but the flame is blue, instead of yellow, as the burner introduces air at its base, which mixes with the gas and so produces an almost perfect combustion, instead of the partial combustion which results in the ordinary yellow flame. All gas stoves have Bunsen burners, and many oil stoves.

If gas is not available, an alcohol lamp with a large wick will do almost as well. The blowpipe, shown in Fig. 2, is merely a tube of brass with the smaller end at right angles to the pipe, and a fine tip to reduce the size of the blast, which is used to direct a small flame. Besides these tools, the glass worker will need some round sticks of charcoal, sharpened like a pencil, as shown in Fig. 3, a file, and several lengths of German glass tubing.

To bend a length of the tubing, let it be assumed for the purpose of making a syphon, it is only necessary to cork one end of the tube and heat it near the top of the Bunsen flame, turning the tubing constantly to make it heat evenly on all sides, until it is a dull red in color. It will then bend of its own weight if held in one hand, but to allow it to do so is to make a flat place in the bend. The heating should be continued until the red color is quite bright, when the open end of the tube is put in the mouth and a little pressure of air made in the tube by blowing. At the same time, the tube is bent, steadily but gently. The compressed air in the tube prevents it from collapsing during the process.

To make a bulb on the end of a tube, one end must be closed. This is easily done by heating as before, and then pulling the tube apart as shown in Fig. 4. The hot glass will draw, just like a piece of taffy, each end tapering to a point. This point on one length is successively heated and pressed toward and into the tube, by means of a piece of charcoal, until the end is not only closed, but as thick as the rest of the tube, as in Fig. 5. An inch or more is now heated white hot, the tube being turned continually to assure even heating and to prevent the hot end from bending down by its own weight. When very hot, a sudden puff into the open end of the tube will expand the hot glass into a bulb, as in Fig. 6. These can be made of considerable size, and, if not too thin, make very good flasks (Fig. 7) for physical experiments. The base of the bulb should be flattened by setting it, still hot, on a flat piece of charcoal, so that it will stand alone.

To weld two lengths of glass tubing together, heat the end of a tube and insert the point of a piece of charcoal in the opening, and twirl it about until the end of the tube has a considerable flare. Do the same to the end of the other tube, which is to be joined to the first, and then, heating both to a dull red, let them touch and press lightly together as in Fig. 8. As soon as they are well in contact, heat the two joined flares together, very hot, and, pulling slightly, the flares will flatten out and the tube be perfectly joined. Tubes joined without previous flaring have a constricted diameter at the joint.

To make a T-joint in two pieces of tubing, it is necessary to make a hole in the side of one piece, as shown at A in Fig. 9. This is accomplished by the aid of the principle of physics that gases expand when heated. Both ends of the tube, which should be cold, are corked tightly. The whole is then gradually warmed by being held near the flame. When warm, a small flame is directed by the blowpipe from the Bunsen flame to a spot on one side of by first forming a bulb, then puncturing the bulb at the top, when hot, with a piece of charcoal, and smoothing down or flaring the edges. Very small and fine glass tubes, such as are used in experiments to demonstrate capillary attraction, water or other liquid rising in them when they are plunged into it, are made by heating as long a section of tubing as can be handled in the flame—2 in. will be found enough—and, when very hot, giving the ends a sudden vigorous pull apart. The tube pulls out and gets smaller and smaller as it does so, until at last it breaks. But the fine thread of glass so made is really a tube, and not a rod, as might be supposed. This can be demonstrated by blowing through it at a gas flame, or by immersing it in the closed tube. As it heats, the air within the tube expands and becomes compressed, and as soon as the hot spot on the side of the tube is soft enough, the confined air blows out, pushing the hot glass aside as it does so, leaving a small puncture. This is to be enlarged with pointed charcoal until it also flares as shown at B. This flare is then connected to the flared end of a straight tube, C, and the T-joint, D, is complete.

Using the blowpipe is not difficult. The lips and cheeks should be puffed out with a mouthful of air, which is ample to blow a flame while the lungs are being refilled. In this way, it is possible to use the blowpipe steadily, and not intermittently, as is necessary if the lungs alone are the "bellows."

Small glass funnels, such as are used in many chemical operations, are made colored liquid. The solution will be seen to rise some distance within the tube, the amount depending on the diameter of the tube.

The file is for cutting the glass tubing into lengths convenient to handle. It should be a three-cornered file, of medium fineness, and is used simply to nick the glass at the place it is desired to cut it. The two thumbs are then placed beneath the tube, one on each side of the nick, and the tube bent, as if it were plastic, at the same time pulling the hands apart. The tube will break off squarely at the nick, without difficulty.

The entire outfit may be purchased from any dealer in chemical or physical apparatus, or any druggist will order it. Enough tubing to last many days, the Bunsen burner, blowpipe, file and charcoal should not exceed $2 in cost.

Extracting Oil From Herbs With Junk

In the last issue I showed how to make a still from junk. This was mainly to get relatively pure alcohol from isopropyl or methyl alcohols bought from any dime store or pharmacy as rubbing alcohol.

Of course, if you make wine or hard liquor in your home, the junk still will extract the alcohol from that. This is doubly wonderful because after you've used it to extract herbal oils you can still party with it.

The herb I used to test this method was Japanese red peppers, bought at the better supermarkets or through your local natural food store. I put a half ounce of these peppers, whole, in my blender and had it on until all the seeds were broken. You want it as pulverized as you can get it as this exposes the oil cells to the action of the alcohol. Without a blender you must chop it up, bang it with a hammer, or possibly put it through a fine meat grinder.

Whatever herb you use, it should be as dry as you can get it without heating it. A high heat will only drive the oils into the atmosphere. (I'm going to try distilling dry herbs in a flask over a direct fire and see if my still will handle that. It'll probably be a mess.)

When the herb is as pulverized as you can get it, put it in a jar and put three or four times its volume of distilled alcohol over it. Then let it set for at least a week. Two, three weeks or even a month is even better. (If you are really into this you'll have jars and jars working away so you won't be all that impatient and anxious over the wait.) The alcohol soaks into the herb and dissolves the oils which diffuse, spreading throughout the alcohol. This is

MINIMAL BRAIN DAMAGE: The Greatest Threat of Our Age

By Kurt Saxon

Whether you realize it or not, you know several people with Minimal Brain Damage. This isn't a birth defect. Such a one isn't retarded and may seem normal in most respects. He may have attitudes which work against his interests. But mainly, he just can't get his act together.

The most common sign that a person has Minimal Brain Damage is that he can't read well enough to finish a book, or that its subject bores him to distraction before he's half way through.

His lack of sustained interest keeps him from holding a job unless he's in such a strong union he can't be fired. The same situation holds true in most Civil Service jobs. You've met the Civil Servant with his "couldn't care less" attitude. Those with Minimal Brain Damage who find their way into Union Shops and Civil Service mark their presence by low production in the shop and maddeningly slow and bungling service in the office.

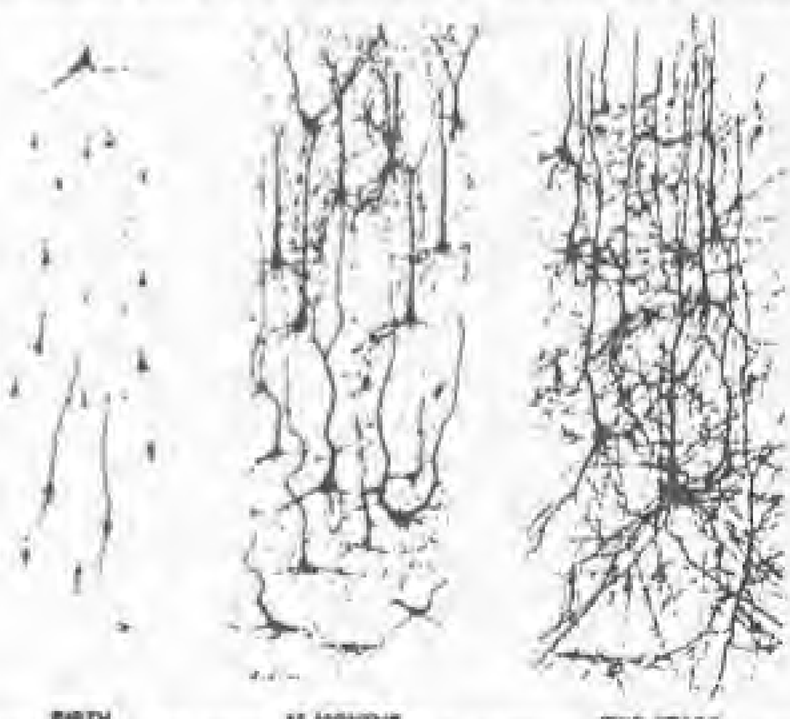
These are the leaners of the world. The rest of society has to prop them up. Aside from those whose habit patterns permit them to at least sign up for work, the majority are on welfare or in prisons. Most of those with jobs would do their fellows a favor by going on welfare and getting out of the way.

Newsweek, November 10, 1975, reported "More than 23 million American adults, one out of every five, cannot read, write or compute well enough to function effectively in today's world. Forty million more posess just the minimal skills necessary for survival. These stark statistics were released by the U.S. Office of Education after a four year study of 'Adult Functional Competency' ".

Further along the article stated, "The College Entrance Examination Board announced the formation of a special panel that will try to find out why scores on the Scholastic Aptitude Tests have been falling for the past twelve years".

Another breakdown showed that only 46% of American adults read adequately or well. This leaves us with 54%, over half of our adult population, incompetent in communication skills one must have to function in a complex society such as ours.

NORMAL NEURONS. In the normal cerebral cortex, the end of each nerve fiber (axon) branches into thousands of tiny fingers that contact neighboring neurons. Creation of this inter-neural network is one of the brain's major construction projects in the first two years of life.



The above diagram shows how the nerve fibers in the infant brain reach across and connect to elements in the brain which determine the mental machinery the infant will have to work with as an adult. These linkages don't happen after three or four years of age. So it's now or never in every infant's life. After three or four years of nutritional and/or sensory neglect the loving foster parent, the better environment, better diet, will at best produce a housebroken, socially acceptable dingbat.

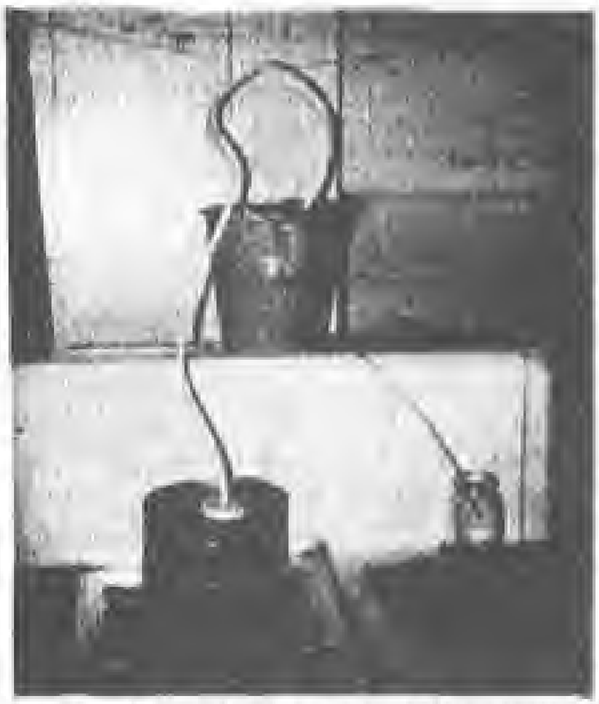
called maceration; the steeping at room temperature of a herb you wish to extract stuff from.

(If what you want from the herbs are the alkaloids or salts, you use water instead of alcohol. Then you use the same method to distill the water off the salts.)

I macerated the pepper in a small mustard jar, starting it last month when I got the alcohol through my first junk still setup. I put the pepper in the jar, filled with alcohol and let it set, shaking it every day to make sure each particle was equally saturated. In a few hours the alcohol became red with pepper oil. After a week, I'm sure there was hardly any oil left in the pepper but I left it alone until I was ready for the next process.

Books call for all kinds of elaborate filters and funnels and such to separate the alcohol and oils from the pulverized goody. What I did was cut the bottom corner out of a gallon, plastic milk carton someone threw away. It could just as well have been a gallon plastic bleach bottle.

I next marked the lowest point in the plastic with a half-dollar sized circle. Then with a "Snarl" button with a pin protruding from its edge, I punched several dozen small holes through the plastic.



Then I put the improvised funnel-sieve on another jar and poured off the alcohol-pepper oil into it. When it had gone through I shook out the pulverized pepper into the thing and pressed with my thumb and got some more liquid and no pepper went through.

(Here, I want to tell you about plastic. There are ever so many fun things you can make from it. You can collect oodles of various sized plastic bottles from the throwaway bins in laundromats.

This irreversible decline in adult competency is not confined to the U.S. Psychology Today, September 1975, stressed the problem as being world-wide. Roger Lewin's article titled, "STARVED BRAINS; New Research On Hunger's Damage", promises "A generation of Clumsy, Feeble Minded Millions".

"An infant deprived of nutrition or stimulation will never develop to full mental capacity. There's no second chance. Today, 70 percent of the world's population seriously risks permanent damage."

The article describes what actually happens to the infant brain when deprived of proper nutrition or stimulation by the environment.

The only book I know of devoted entirely to Minimal Brain Damage is, "SOCIETY PAYS; The High Costs of Minimal Brain Damage In America", by Camilla Anderson, M.D. Dr. Anderson, a psychiatrist with forty years of experience in guidance clinics, schools, prisons and welfare agencies, maintains that the answer is Minimal Brain Damage (MBD), a neurological deficit that she thinks has been seriously underrated, if not neglected, by the Mental Health establishment."

Although her excellent book has been circulating for the past four years, Mental Health workers have largely rejected her findings. Psychiatrists naturally prefer to quiz the MBD on what happened to him during his first six years of life rather than on what didn't happen to his brain during his first two years of life. One might just as well quiz a Thalidomide basket case on his early attitudes which kept him from making the football team. Of course, fixing the blame on irreversible brain damage in infancy would deprive these Freudian hacks of lots of $50 an hour fees. MBD, a deprivation caused calamity, can no more be treated by recalling past experiences than can stunted limbs be restored by even total recall.

Mental Health workers practicing Megavitamin and various drug therapies can reach and strengthen the undamaged portions of the MBD's brain. Their genuine concern and intensive treatment of MBD's can bring about noticeable improvements. Even so, their average efforts contribute more to socially acceptable behavior than to the development of competitive skills.

Moreover, most of their patients are referred to them as real social problems, being dangerous to themselves or others. So the MBDs receiving treatment are a tiny minority out of the teeming millions of hopeless, tragic boobs shambling around in our rapidly collapsing society.

Minimal Brain Damage is not always marked by the inability to read well. In a permanent state of arrested development, the MBD is prone to the infantile demand for instant gratification. This sets patterns of obsessive behavior where instant gratification is sought by the MBD with no thought of the consequences to the MBD or those he uses.

The person with a mature brain can, with imagination and foresight, create mutually satisfying relationships with those around him. The infantile brain of the MBD lacks the thought machinery to practice the self-discipline needed to set up long term, mutually advantageous relationships with individuals and society.

In the sexually oriented MBD we find the Don Juan, nymphomaniac, rapist, child molester, male and female homosexual, sadist and most other one-sided, unproductive and often destructive sexual relationships.

In some MBDs the reading level and I.Q. may be quite high. Yet, arrested development has affected other critical parts of the brain's machinery. Thus, the otherwise intelligent MBD will work as a barely passable fry-cook rather than as the brain surgeon of his fantasies. His infantile demand for instant success, coupled with his lack of self-discipline, prevents him from applying himself to the years of preparation for any far-off goal.

So although he is very bright, he can't seem to finish anything. It's either instant success or mediocre drudgery. In short, he's a functional moron. Here we find the fanatic, the paranoid, the terrorist and the professional (as opposed to the petty) criminal.

With such examples of MBD all around them, the movers and shakers in our

Plastic is also a fantastic fuel for wood stoves. It is made from oil and has more energy than any other fuel you can gather. Ecologists bitch about how it litters the highways and is not bio-degradable. Fine. Collect it and use it for fuel.

It is best used for kindling but can also be used for heat as a supplement for wood or coal. It burns fiercely and extremely hot and I believe it would actually melt parts of a wood stove if you filled the stove with it.

But if you collected it to use for kindling or as a supplement for wood you would be saving on fuel and also helping the environment.

To test the potency of the alcohol-pepper solution I put a drop on my tongue. It was hotter than any other pepper substance I had ever tasted and it took several gallons of water to remove the sting.

(If you used drinkable alcohol to macerate flavoring herbs you might consider using drops of the alcohol-herb oil for flavoring, rather than going further with the process.)

When I was ready, the next step was to prepare the mustard jar lid for the distillery. I punched a nail hole in its center and at the same time, pushed out the waxed cardboard disk from inside the lid. I enlarged the nail hole with a ballpoint pen, just slightly smaller than the plastic tubing going into the ice bucket.

I did the same thing with the waxed cardboard disk and pushed it firmly back into the lid. This was tight enough to recover most of the alcohol. A lid with a rubber seal around the inside would have been more convenient, but in kitchen chemistry one learns to make do.

Then I pushed the plastic tube a half inch through the lid and the waxed cardboard disk. Next, I put Silicon Adhesive around the plastic tubing on the outside of the lid to further seal it. Then I poured the alcohol-pepper oil into the mustard jar and screwed the jar up tightly into the lid.

society, often MBDs themselves, blame everything but the source problem. They blame the educational system, as if dropping College Entrance Exam scores and rising juvenile crime rates (one third of Chicago's murders are committed by youths under 18) are the teachers' fault.

As I was writing this, ABC, on May 27 at 10:00 p.m., put on a special called "American Schools: Flunking the Test". An incredibly stupid and distorted report. Its focus was against the teachers, the unions, the school system, budget cuts, etc. But in the whole hour there was no suggestion of inability due to a lack of intelligence.

All the students interviewed were dull-faced with speech patterns and vocabularies that freely displayed their dullness and stupidity. My impression was that they all had MBD. Had they been interviewed apart from that program, a viewer would swear that they were all students at a school for mental defectives.

The program's prime example, and representative of the one out of five illiterate high school students, was a wretch they called "Peter Doe". "Of average intelligence (?), Peter is a product of the San Francisco Public Schools. He attended class regularly, attracted little attention, and in 1972 graduated from high school.

"**But when Peter** Doe tried to get a job it was quickly apparent he was a functional illiterate. Despite that high school diploma his reading ability was barely at a fourth or fifth grade level. Stunned, Peter and his parents went to a lawyer and sued for 'Educational Malpractice'.

"**He comes from** a basically middle-class white family. Throughout his schooling his report cards said he was doing all right.

"**Only now,** after two years of tutoring at great expense to his parents, is Peter able to read and attend junior college."

Only a very stupid youth could fail to realize such incompetence. Only indifferent, neglectful and unobserving parents could fail to recognize such stupidity in their own child.

Any competent teacher will tell you, and can show proof, that any normal child with a normal interest in his surroundings will learn to read adequately in his first eight years of schooling. Any high school student who can't read and/or apply himself to a disciplined pursuit of adult skills has MBD. Peter Doe couldn't rise above the fourth or fifth grade reading level even after twelve years of steady schooling! Moreover, it took him two more years, with tutoring, just to qualify for Junior College.

The blame for such turkeys was placed squarely on the teachers because they pass them on to grade levels they can't handle. But what is the teacher to do? Our educational sewer lines must be kept open. The social refuse must move on to make room for more. The teacher is simply unable to reach the clod and has no room for him and his fellows in her next semester's class.

If the MBD is not a disciplinary problem she can only write polite comments on his report cards which the parents see as meaning he is doing all right. What the teacher means, however, is that he can read well enough to find the right john, lest he foul himself thereby, and that he can count to eleven without removing both shoes.

Again, Peter Doe wasn't exceptional. The program stated that one out of five high school students are functional illiterates. The national average for adult functional illiterates is also one out of five. The alarming thing this report shows is that the figures of one out of five only apply to students actually attending high school. When you consider the millions and millions of high school dropouts, just as incompetent, it is quite likely that our upcoming generation will prove to have one out of four functional illiterates; far worse than our present adult generation.

In their turn, many teachers blamed TV. Any harmful effects of TV are because the young victim of MBD doesn't have the normal brain circuitry which would depersonalize the boob tube. In cases where the ignorant parent has plopped

The next step was to make the distilling can short enough for the process. The taller can wouldn't work well with the little mustard jar so I simply took my tin snips and cut off about four inches. (You would be wise to just make up a set of various sized distilling cans to start with.)

I again made two nail holes in opposite sides of the can. (I should have made four holes, since the squat mustard jar, as it emptied, tended to rise on its side since the one wire wound around it met at one side. Four holes with wire would have held it in place. As it was, I had to lay a bar of metal over the setup and across the lid of the jar to keep it down.)

When the shorter can was ready I put a layer of marble sized stones on its bottom to keep the jar off the bottom of the can, lest it get too much direct heat, which would cause it to break.

Finally, I put a wire through one hole, wrapped it around the jar under the lid and twisted the wire around both nail holes.

This is to prevent the jar from floating up on its side when it no longer holds enough alcohol to weight it down. As I wrote above, you need four holes.

When all was ready I filled the distilling can with water up to just below the lid of the jar. I put cool water in the ice bucket and when the water in the can began to boil I put in the ice. As the ice melted I dipped out some water and replaced it with more ice.

In minutes, the alcohol began to flow out of the tube leading from the ice bucket to the receiving jar. It was crystal clear with neither the taste nor color of the alcohol-pepper oil in the distilling jar.

As the water boiled down an inch or so in the distilling can I replaced it with more boiling water. The replacement water must be boiling because otherwise the distilling process will stop until the water begins to boil again. Also, pouring cold water in with a hot mustard jar is bound to break it.

By looking down through the outside of the jar I could see that there was only about an ounce of the fluid left. I then stopped the process by turning out the fire. Had I waited, only the oil would have been left and it would have had to be daubed off the bottom of the jar. With a little alcohol left, I could just pour it out into a saucer and let the small amount of alcohol evaporate.

Actually, this method is not the most efficient. It's fine for personal use since it's both cheap and simple and will produce the same result as more technical methods. As you learn the principles you will want better equipment, especially if you mean to make stuff in quantity to sell. But at least you know now that the blessings of kitchen chemistry is available to all regardless of means.

For a larger operation you could use a gallon wine bottle in a bucket instead of the quart whiskey bottle in the large tomato can I used in last issue's article on "The Junk Still". (Continued on Next Page)

the undeveloped infant down in front of the TV as baby sitter and caretaker, TV can be a part of the problem.

To the infant, the TV is simply movement, sound and often color. But it has no reality except that which his infantile fancy gives it. It is up to both parents to constantly stimulate the infant with loving cuddling, play, talking, all of which demand positive responses from the infant and which causes the brain to reach out and thus develop normally.

Parents who both work and leave their child's upbringing to an impersonal TV or an indifferent babysitter or nursery school custodian have no one to blame but themselves when their lad becomes a cloddish degenerate later on. A monster or a permanent dependent is too high a price to pay for "the finer things in life". The mother who stays home giving her infants loving attention and making do on her husband's salary will have a far more liberated life than will the mothers of the Peter Does.

In poverty areas where most parents have MBD the problems are more obvious. The infant is usually denied both proper nutrition (mainly through ignorance) which the developing brain must have, and sensory stimulation, which is just as important as nutrition.

It's widely believed that poor people, with their generally low I.Q.s, pass on their stupidity through heredity. This is academic. MBD is not a birth defect.

Even if a potential genius is born to ignorant parents, the poor diet, the neglect, the life pattern alternating between chaos and boring drabness will produce a defective nearly every time.

An infant needs a pleasant routine he can anticipate. He needs his mother's milk at first, later supplemented by a well balanced diet of natural foods, free from chemical additives. He needs hours of peekaboo, patty cake and cuddling every day, preferably from both parents. After six months he needs bright toys to knock around, blocks to stack, crayons to make pretty marks on walls and an appreciative audience to applaud his antics and reward his progress. Scoldings and even an occasional spanking for excesses is still positive attention to his development. A lot of attention does not mean spoiling.

One thing the infant doesn't need is wall to wall brothers and sisters. Little children do not challenge one another to develop. Childish prattle from others is not communicative and serves only to remind the infant that he has a lot of unfair competition.

Recent studies have shown that one or two children are the most a couple can have and still give them the individual stimulation each needs for brain development. More than two children guarantees neglect and shortchanging of the whole brood. Another way to look at it is that if you have four or more children, the one most aggressive for attention might be smarter, but he may also be neurotic and anxious. Those less aggressive for attention will usually become mentally stunted and generally withdrawn and slow.

Having fewer children is a good idea in these times of uncertainty. It is also the best guarantee that the one or two you stop with will be brighter and better human beings.

If you are a parent-to-be or have an infant, Dr. Camilla Anderson's book, "Society Pays", published by Walker and Company, New York, 1972, is a must read. It will tell you what you must do to insure that your child does not suffer brain damage due to either nutritional or sensory deprivation. Get it from your library or order it through a book store.

Your library can also probably dig out a copy of "Psychology Today" for September 1975. Reprints of its feature article on "Starved Brains" are available at 50c each. Minimum order is six reprints. Order from: Psychology Today, Consumer Service Division, 595 Broadway, New York, N.Y. 10012.

The two articles were suggested by a question from a friend who wanted to know how to extract the oil from marijuana. In trying to satisfy the request I went to every pothead in Eureka, looking for grass. They both said the heat was on and they couldn't get any. (Maybe it was because I had on a clean shirt that day and they thought I was a Nark.) Anyway, the system would work as well on marijuana although I've been told that the amount of oil from a half ounce would be very small. My informant suggested using at least an ounce or, better still, a pound.

A booklet I have says that when one has the marijuana oil it should be mixed with an equal amount of butter or margarine. The fat causes it to be more easily absorbed by the stomach and intestinal linings. The booklet doesn't say how many drops of the marijuana oil makes a dose. It does say that twice its volume of flour, parsley or some other inert ingredient should be mixed in and the doses put in gelatin capsules bought at your friendly natural food store.

(In the last issue I mistakenly implied that my junk still would make acrolein-tear gas. The only lack in the junk still would be a pyrex glass still instead of the whiskey bottle. Since the ingredients for acrolein and many other products need greater heat than in distilling water and alcohol the still must be able to withstand direct heat from the fire.

Also, on page 55, the receiving bottle doesn't really need a stopper with a tube leading outside. At least, not for acrolein.

For a direct heat still you could use the bottom part of a pyrex coffee percolator. Just cut the proper sized circle out of an old tire for a stopper and drill a hole in it for the tube.

If you are into kitchen chemistry at all, you are going to get a real flask from your pharmacy. My methods are examples of simple principles you are expected to enlarge on and modify to fit your own circumstances.

From Popular Mechanics 1915

Varnished Candles Burn Longer

The heated tallow or wax of a candle runs down the sides and this results in a considerable waste. This waste can be stopped by coating the new candles with white varnish and laying them aside for a few days to harden. The varnish will keep the melted tallow or wax from running away and it is used in the wick.

GUEST EDITORIAL

THE EDGE OF SURVIVAL

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Chris Elms, writing in 'Communities', in the first issue of Dec./72, makes the observation that suburban America began after WW2, as people; "hassled by all the blacks, crime and decay in the city, took flight to the suburbs." But now the people are taking re-flights from the suburbs to the country. This is happening since the Supreme Court ruled that slum-prone projects can be built in suburban areas.

Beginning in the early 1970's, affluent people (both black & white), began the exodus out of city/suburban centers, and for good reasons. But survival was not one of them. They simply sought peace and contentment, and forgot about less fortunate people trapped in the ghettos, with all the crime, pollution, and obnoxious behavior of city dwellers.

We overlook the real reasons causing fragmentation of society in the melting pot. Decent people are not only escaping crime and decay, but all the disorders and unsocial habits of minorities seeking equality with the established society. Millions of people who reside in quiet, orderly communities are naturally disturbed by the loud, and raucous conduct of African and Puerto Rican people. It's fine for them, but don't force it upon others. Typical are their ways of entertainments with booze and bongo drums. In an apartment house, the noise reverberates throughout the building, and when carried on through the wee hours of the morning, it's enough to cause even the deaf to flee.

Then too, since the Civil Rights Act of 1964, minorities have taken undue liberties to frustrate and intimidate the kind and gentle people whom they blame for their short-comings. Spreading hate and contempt for the establishment, they resort to insults, assaults, threats, and actually encourage their criminal elements to rob, rape and kill the whites. Those they couldn't frighten off (the tough ones), were the cause of racial strife throughout the land. Society has come to the edge of survival where only the fit and wise can overcome the chaos.

But perhaps the exercise of crime and violence will seperate the sheep from the goats among the people who are to survive. Those who are living on the edges of society in urban America are better able to survive social disaster. Having an edge on something, the chances of success are good; a fighter with an extra inch of height or pound of weight has an advantage over opponents; a hungry person will always find ways and means of scrounging for food, and won't be selective in what they eat. Everyone knows about the 'house-edge' in gambling casinos, and also understands the balance of power between nations.

In these times of worldwide famines, resource shortages, inflation, wars and rumors of nuclear wars, it is logical to say we're in for some trouble. Wise are those who realize this, and are taking measures to protect their right to live in the struggles ahead for society. One such method is to "Be Prepared". This old scout motto is practiced by the U.S.S.R. and other communist nations who are on a war footing, and by smart people who are learning the arts and science of survival.

But for many people, this is a touchy subject they would rather not think about. When men like Kurt Saxon write that "Our future lies in the past", and other men in academia, among scientists and social-economic analysts...warn of impending doom—one would think it sensible to be prepared, or at least learn something about survival. Well, here's news:

The Department of Defense recently allocated $100 million, and reserving one billion dollars (out of the $100 billion defense budget) to set up the 'Crisis Relocation Plan' by Defense/Civil Preparedness Agency. Their reasoning is simple...the Russians are doing it. What's more, some wise leaders in Congress and the Administration are beginning to believe that all is not well in and out of this world. Whether we talk of energy shortages (gas and oil), agricultural drought, international conflicts, or of UFO's (unidentified flying objects)—the future is filled with a promise of great excitement and worsening of existing problems.

Now problems are really challenges which society must face. They are definitely related to the past, and we had better learn about them if we are to survive the future. One of these ways is to know all about the essential needs for survival—things like getting back to the land (alternative lifestyles), improvised weaponry, kitchen chemistry, and cottage industries (making your own houseboat, shelter, food, fiber, guns and ammunition, steam engine and one horsepower windmill). All these things are being fully explained in this publication, but if people would rather read about Dick Tracy or Little Orphan Annie...that's their business. But let them not complain when the chips are down.

In these columns, each month, we will examine and explain all about the new survivalists who are making preparations for survival. Among the best organized groups are communes of hippy and happy adventurers in new life styles—living off the land. There are some 200 such organizations living in 40 states, including Canada, Mexico, British Honduras, Virgin Islands and Central America. They bear such names as The Adventure Trails Survival Schools, Brotherhood of the Spirit, Christian Homesteading Movement, Drop City, Earth People, Fellowship of Friends, Galaxy K Commune, Healthy, Happy, Holy Organization (3 H's) Institute of Human Abilities, Jesus Name Lighthouse, KIRK, Love, Magic Land, New Earth, Order of Aaron, People's Temple, Questers, Reba Place Fellowship, Sky View Acres, The Training Collective & Twin Oaks (Walden 11 concepts), United Cooperative Industries, Vocations for Social Change, Wonderland Civic Association, Yellowhouse Commune, and Zen Mountain Center. There you have it from A to Z.

A Homemade Hydrometer

Popular Mechanics 1915

The hydrometer is an instrument used in determining the specific gravity of a liquid, such as acids, etc. The specific gravity of any material is the ratio of the weights of equal volumes of the material and water. Thus if a pint of acid weighs 1.2 times a pint of water, its specific gravity is said to be 1.2.

A very simple and inexpensive hydrometer, similar to the one shown in the sketch, may be easily constructed, and will give quite satisfactory results, if the scale on the instrument is carefully marked when it is calibrated.

Purchase from the local druggist or doctor two test tubes, one large enough to contain the other, as shown. The smaller tube is to form the hydrometer proper, while the larger one is to serve as a containing vessel in which the liquid to be tested is placed. The large tube should be mounted in a vertical position, by placing it in a hole bored in a small block of wood, or a suitable metal or wooden frame may be made that will accommodate one or more tubes.

The small tube is loaded at the lower end with a quantity of shot, or other heavy metal, in such a way that it will stand in a vertical position when it is placed in a vessel of water. The amount of the loading will depend upon whether the hydrometer is to be used in determining the specific gravity of liquids heavier or lighter than water. If the liquids are heavier than water, the loading should be such that the tube is almost entirely immersed when placed in water; if lighter, only sufficient loading should be used to make the tube stand upright in water. After the amount of loading has been determined it should be fastened in place by means of a small quantity of calcined plaster. A small cork should now be placed in the open end of the tube, and the tube sealed by coating the end with shellac, or melting a small quantity of resin or sealing wax over the top of the cork with a hot soldering iron.

Now place in the large tube a quantity of as pure water as can be obtained—fresh rain water will answer very well and distilled water still better. Immerse the small tube in the water in the large tube and allow it to come to rest. Make a small mark on the small tube with a file, level with the surface of the water in the large tube. If the hydrometer is placed in a liquid lighter than water and allowed to float, the mark made on the tube will always be below the surface of the liquid in which the instrument is placed, and the mark will be above the surface of the liquid when the liquid is heavier than water.

The hydrometer may be calibrated by making use of a hydrometer borrowed from the druggist or doctor. The two hydrometers should be immersed in the same liquid and the tube of the newly made instrument marked to correspond with the markings on the borrowed instrument. If the liquid is heavier than water to start with, its specific gravity can be reduced by adding water, and as the water is added the hydrometers will both rise.

A WARNING

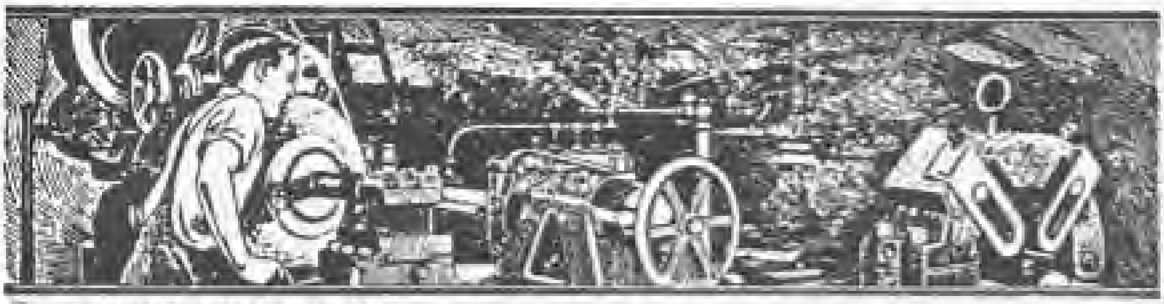
The American dream is fading fast
And soon will be hidden from view,
So you'd better see things differently
If you want to start anew.

For you'll have to rely upon yourself
And learn new skills and ways
If you want to survive and even thrive
In the bleak oncoming days.

Be it famine or war in days to come,
Or what if the government fell.
Could you grow your food & handle a gun
To save yourself from a hell
Of society knocked down to its knees
And driven mad with fear.
Or do you sit there smug and say
"That couldn't happen here."

Well it could and it might so be aware
On how to stay alive,
Because self-reliance is what it takes
If you expect to survive.

DON LAMPSON – 76



From Popular Mechanics 1915

Drill Press on an Ordinary Brace

As the greater part of the energy required for drilling metal by hand is used for feeding the drill, I made what I term a drill box in which the brace is held perfectly true and pressure is applied by a weight. The feed can be changed for the different metals and sizes of drills, also for drilling the hard outside of castings and relieving the drill for the softer body. The constant feed will cause the drill to turn out a long chip, and a number of holes may be drilled to a uniform depth by using the same feed and counting the turns of the brace handle.

To build the box, first find the dimensions of the brace, as shown in Fig. 1: the diameter of the head A, the clearance B from the top of the head to ¼ in. above the top of the handle C, and the over-all length D when the longest drill is in the brace. Make a box having an inside length equal to the dimension D, plus whatever additional height may be necessary for the work. Make the inside width twice the distance C, plus 6 in. for clearance; and the inside depth the length C, plus one-half of the dimension A, plus 3 in. Use material ⅞ in. thick and nail the parts together to form a rectangular frame. Cut a piece of broomstick as long as the dimension B, and two pieces of wood as long as the inside width of the box and as wide as the dimension B. Cut two pieces $\frac{1}{16}$ in. longer than the dimension A and as wide as the length B. Nail these latter pieces together as shown in Fig. 2, leaving a square space in the center. This frame is to be nailed inside of the top of the box flush with the front, but before doing so lay it on top of the box to determine where the center of the square space will come, and bore a hole, large enough for the round stick cut from the broom handle to slip through easily, then nail the frame on the under side of the top piece.

Procure a tough piece of wood, 1½ in. square and long enough to project 2 in. over the right and 10 in. over the left side of the box top, and when in this position, locate the hole bored for the round stick and bore a hole in the square stick, ⅛ in. deep, to coincide with it. Place the head of the brace in the guide and push it up until it touches the top of the box and block it up in this position, then drop the

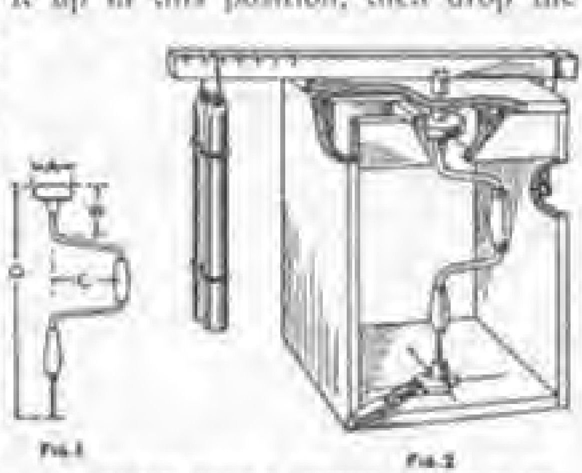


Fig. 1 Fig. 2

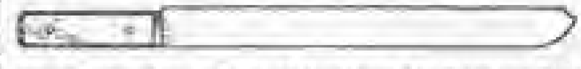
The Weights Apply a Constant Pressure to the Drill, Which can be Easily Turned

round stick through the hole and rest it on the head of the brace. Place the socket in the lever over the top of the round stick. Make a loop, 8 in. long, of heavy wire and hang it over the right end of the lever and mark the box at the lower end of the loop. Turn in a large screw ½ in. below this mark allowing it to project enough to hook the loop under it. Remove the round stick and put a screw at the point the bottom of the loop reaches when the lever is flat on the top of the box. Another screw turned in between these two will be sufficient to hold the lever in position. Different-sized weights, of from 5 to 10 lb., are used on the lever, but for small drills the weight of the brace alone is sufficient.

From Popular Mechanics 1915

Combination Meat Saw and Knife

A very handy combination knife and meat saw can be made of an old discarded saw blade. The blade is cut on a line parallel with the toothed edge, allowing enough material to make a good-sized blade, then the straight part is ground to a knife edge and a wood handle attached at one end. The handle is made in halves, placed one on each side of the blade, and riv-



The Blade of the Knife is Cut from the Toothed Side of a Discarded Saw Blade

eted together, then the projecting metal is ground off to the shape of the handle.

From Popular Mechanics 1915

A Cleaning Bath for Silverware

A good way to clean silverware of all coloring by eggs or other substances is to place the silver articles in a kettle of boiling water containing a few pieces of zinc. An electrolytic action is produced by the zinc, water and silver which decomposes the sulphides on the silver and leaves it well cleaned. No silver is taken away by this method.

WEIGHT OF GRAIN AND PRODUCE PER BUSHEL

ARTICLE	WEIGHT
Alfalfa	60 lbs.
Apples, Green	48 lbs.
Apples, Dried	25 lbs.
Barley	48 lbs.
Bermuda Grass	35 lbs.
Blue Grass Seed	14 lbs.
Bran	20 lbs.
Buckwheat	50 lbs.
Cane Seed	50 lbs.
Carrots	50 lbs.
Castor Beans	46 lbs.
Clover Seed	60 lbs.
Corn, Shelled	56 lbs.
Corn on Ear	70 lbs.
Corn Meal	50 lbs.
Cotton Seed	33 lbs.
Flax Seed	56 lbs.
Hemp Seed	44 lbs.
Hungarian Seed	48 lbs.
Kaffir Corn	56 lbs.
Malt Rye	35 lbs.
Millet Seed	50 lbs.
Navy Beans	60 lbs.
Oats	32 lbs.
Onions	57 lbs.
Onion Top Sets	30 lbs.
Onion Bottom Sets	32 lbs.
Orchard Grass Seed	14 lbs.
Osage Orange	36 lbs.
Peaches, Dried	33 lbs.
Peaches, Green	48 lbs.
Peas, Stock and Green	60 lbs.
Potatoes, Irish	60 lbs.
Potatoes, Sweet	50 lbs.
Rape Seed	50 lbs.
Red Top Seed	14 lbs.
Rice, Rough	45 lbs.
Rutabagas	50 lbs.
Rye	56 lbs.
Salt, Fine	50 lbs.
Sorghum or Cane Seed	50 lbs.
Soy Beans	60 lbs.
Sunflower	22 lbs.
Sweet Clover	60 lbs.
Timothy Seed	45 lbs.
Tomatoes	60 lbs.
Turnips	55 lbs.
Wheat	60 lbs.

From Popular Mechanics 1925

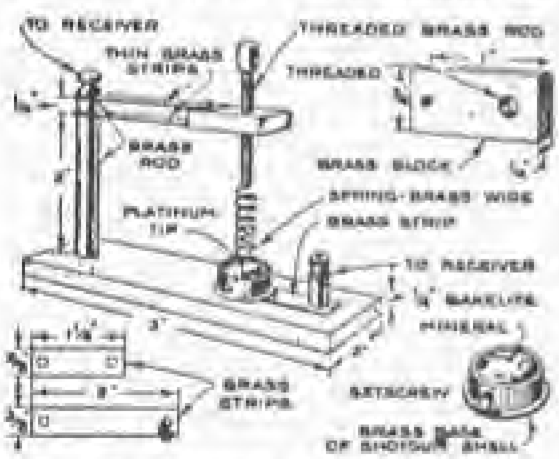
How to Make a Good Mineral Detector

By F. L. BRITTIN

A MINERAL detector should be a part of every radio amateur's equipment, as one never knows when the audion tube may burn out, and this sometimes happens right in the middle of an important message; it is then very handy to be able to switch the mineral detector into the circuit and continue receiving. A good mineral detector is a part of almost all commercial sets, where traffic must go on regardless of accidents. The detector described here is simple to build, and can be constructed from odds and ends about the station.

The base is of bakelite, or may be of any insulating material, 1/4 by 2 by 5 in.; the upright post is of 3/8-in. brass rod, the lower part, 2 in. long, drilled and threaded at each end to take a 1/8-in. brass machine screw, the upper part being 1/4 in. long, drilled through to clear the upper binding screw. This screw is 1 1/2 in. long and serves to hold the two brass strips in place in addition to acting as a binding post, as shown in the drawing.

The small brass block is drilled to take a small bolt, which clamps the brass strips loosely, allowing a side swing to the block. The block is also drilled and threaded to take the knurled-head screw to which the spring wire is soldered; the



A Simple but Substantial "Cat Whisker" Detector: This should Be a Part of Every Radio Outfit, No Matter How Well Equipped

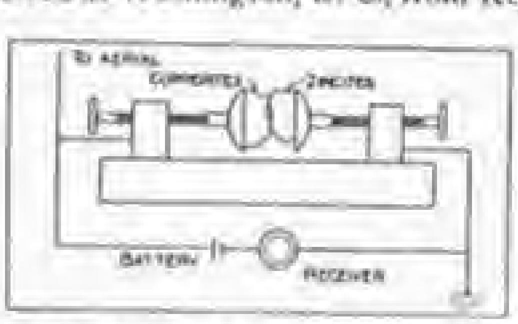
contact point on this spring should be tipped with platinum, which may be done by a jeweler if the necessary facilities are not at hand. The mineral is contained in a little brass cup, made from the base of an empty shotgun shell. A small hole is drilled through the side of the base and threaded to take a small setscrew, which holds the mineral rigid. The percussion cap is removed from the end of the shell cap, and a short flat-head machine screw holds the cup in place on the base. This screw also holds the short brass strip leading to the other binding post.

The detector is neat and effective, and may be mounted on the receiving panel.

From Popular Mechanics 1913

Quartz Electrodes Used in Receiving Wireless Messages

Wireless messages have been received at Washington, D. C., from Key



Details of the Receiving Instrument

West, Florida, a distance of 900 miles, through a receiving instrument in which two pieces of quartz of different composition were used on the electrodes. In making an instrument of this kind the quartz can be purchased from a dealer in minerals. One piece must contain copper pyrites and the other zincites. The electrodes are made cupping to hold the minerals and each should have a screw adjustment to press the pieces of quartz in contact with each other. Connect as shown in the illustration, using a high resistance receiver.

From Popular Mechanics 1925

Fusible Alloys for Setting Crystals

Radio-sensitive crystals, such as galena, silicon, and the like, should be imbedded in metal to obtain the best results, and this is done by using an alloy that melts at a point considerably below the boiling temperature of water. Heat destroys the sensitiveness of the best crystals, and for that reason lead cannot be used.

An alloy which melts at 197° F. is composed of lead, 3 parts; tin, 2 parts, and bismuth, 5 parts. The melting point of the metal can be still further reduced by adding 1 part of warm mercury to the molten alloy when it is removed from the fire. The addition of mercury will cause the alloy to remain liquid at 170° and become a firm solid only at 140°. The boiling point of water is generally taken as 212° F., although the higher the elevation above sea level the lower this temperature will be.

From Popular Mechanics 1925

Renewing a Radio Crystal

When the galena crystal of a small radio set has become dull and dirty, so that it is almost impossible to find a sensitive spot, a simple but very effective method can be used to renew it.

The mounted crystal should be held over a flame, in an old spoon, until the metal begins to run. The crystal can then be turned over with a piece of wire, thus exposing an entirely new sensitive area. A mold can be used to keep the melted metal in the original shape and size, so that it will fit in the detector cup. Care should be taken not to heat the metal too much beyond the melting point, as this will impair the sensitiveness of the crystal.

From Popular Mechanics 1915

A Small Torch

A small torch, that will give a very fine and hot smokeless flame, can be made from a piece of glass tube, about 4 in. long, and 4 ft. of rubber tubing. The glass tube is heated in the center

A Torch Made of Glass and Rubber Tubing, to be Used on an Ordinary Gas Jet

until it is red, then the ends drawn apart so that the tube will have a small diameter. After the glass has cooled, make a small scratch with a file on the thin part and break it. One of the pointed ends is connected to a straight piece of glass tube with a short piece of the rubber tube, as shown in the sketch. A small hole is cut in the side of the piece of rubber to admit air to the gas. The torch is connected to an ordinary gas jet.

A Homemade Exerciser

From Popular Mechanics 1915

A weight machine for exercising the muscles of the arms is easily constructed by using two screw hooks, 5 in. long, and two small pulleys, 2 1/2 in. in diameter. An awning pulley can be used for this purpose. The hole at the top of the hanger will allow the pulley to freely turn at almost any angle. A paving brick or a piece of metal can be used as a weight for each rope.

The Yoke of the Pulley is so Arranged as to Make It Move in All Positions on the Hook

PRIMITIVE RADIO

There are two types of crystals which are used in communications work, the rectifying and the piezo-electric. Among the first may be mentioned galena, germanium, silicon and silicon carbide. All have the property of passing current in one direction and not in the other, or in some cases unequally in the two directions. Since demodulation or detection is fundamentally a process of rectification these crystals may be used as detectors of modulated radio signals.

The piezo-electric crystal has the peculiar property of giving a voltage across certain faces when a mechanical pressure is applied to other faces. Among crystals exhibiting this effect are Rochelle salt and quartz, the first being by far the most active but the second being much stronger mechanically. These crystals are used in numerous ways in communications circuits. Rochelle salt is used for **microphones** where the sound waves striking the crystal produce corresponding voltages which are amplified for use, for phonograph pickups where the pressure is produced by the needle linkage (see **Crystal Pickup**), for loud-**speakers** and headphones where use is made of the reversibility of the process, i.e., the voltage is applied and it causes the other faces physically to move. Quartz is widely used for frequency control of radio transmitters (see **Oscillator**), for **filters** in telephone **carrier** circuits and for very sharp tuning in **receivers**.

CRYSTAL PICKUP. Since piezo-electric **crystals** produce electrical voltages when subjected to mechanical stresses they offer possibilities for various electromechanical processes. One of these is the phonograph pickup, where the phonograph needle operating in the groove of the record must transmit mechanical motion to something which will convert it into electrical effects so vacuum-tube **amplifiers** may be used. The crystal is one of the most sensitive and at the same time one of the highest fidelity devices for doing this. While many crystals exhibit the piezo-electric effect, Rochelle salt is the most sensitive and is used for pickups, microphones, etc. Through a mechanical linkage the motion of the needle is transmitted into mechanical stresses on the crystal and hence produces electrical effects which may be amplified and then converted to sound by the loud-**speaker**.

PIEZO-ELECTRIC EFFECT. The interaction of mechanical or electrical stress-strain variables in a medium. Thus, compression of a crystal of quartz or Rochelle salt generates an electrostatic voltage across it, and conversely, application of an electric field may cause the crystal to expand or contract in certain directions. Piezo-electricity is only possible in crystal classes which do not possess a **center of symmetry**. Unlike **electrostriction**, the effect is linear in the field strength.

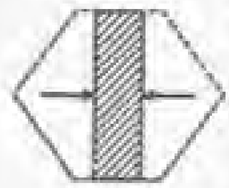


Fig. 1.

The directions in which tension or compression develop polarization parallel to the strain are called the piezo-electric axes of the crystal. Thus the axis of a hexagonal quartz crystal indicated by the arrows in Fig. 1 is known as an "X-axis," and a plate cut, as shown, with its faces perpendicular to this direction is an "X-cut"; while one cut with its faces parallel to the lateral faces of the crystal is a "Y-cut."

The magnitude of the piezo-electric polarization is proportional to the strain and to the corresponding stress, and its direction is reversed when the strain changes from compression to tension. The principal piezo-electric constants of a crystal are the polarizations per unit stress along the piezo-electric axes. While these constants are much greater for Rochelle salt than for quartz, the latter is better adapted to some purposes because of its greater mechanical strength. It is also stable at temperatures over 100° C.

Fig. 2.

If a quartz plate is subjected to a rapidly alternating electric field, the inverse piezo-electric property causes it to expand and contract alternately. As an elastic body, the plate has a certain natural frequency of expansion and contraction in the direction of the field, and if the field is made to alternate with the same frequency, the plate responds with a vigorous resonant vibration. This reacts, through the direct piezo-electric property, to augment the electric oscillations. A circuit arranged for this purpose, as in **Fig. 2**, is known as a piezo-electric or crystal oscillator, the crystal itself, *P*, being the piezo-electric resonator; *T* is the oscillation transformer, and *C* a variable condenser. This device has been much used as a **frequency** control in radio transmitters. Both X-cut and Y-cut quartz plates are subject to changes of frequency with temperature, due to change of elastic modulus; but certain planes in the crystal have been found, oblique to both X and Y, such that plates cut parallel to them are nearly free from the temperature effect.

PIEZOID. A finished piezo-electric crystal product after the completion of all processes; this may include electrodes adherent to the crystal.

From Popular Mechanics 1919

A Small Variable Condenser

The condenser shown in the diagram combines the large capacity of a fixed condenser with the gradual capacity variation of a variable one. It is suitable for a wireless receiving circuit, or to shunt around the vibrator of an induction coil, by making the units considerably larger. It is made up of several fixed condensers, connected in parallel, a lever being the means whereby the capacity is varied. Five or more units may be used, each being a small condenser, built up of 10 sheets of waxed paper and nine sheets of tin foil. A convenient size for the tin foil is 6 by 4 in., and for the paper, 5½ by 4½ in. The latter should be a good grade of very thin linen paper and should be carefully prepared by dipping it in hot paraffin. The sheets of tin foil and paper in each unit are piled up alternately, allowing about ½ in. on each tin-foil strip to project beyond the paper for making connections. The pile is covered with heavy paper, and a heated flatiron is passed on the top of each unit until the paraffin begins to melt. Upon cooling, the units are compact.

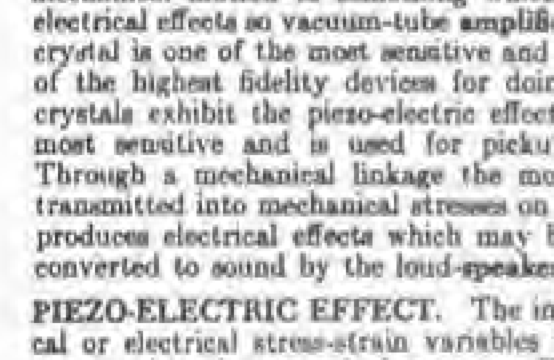


Diagram for a Small Variable Condenser

The connections necessary are shown in the diagram. The condenser units C, D, E, F, G, each have one side connected to a common terminal A. The other sides of the condensers are connected to the copper strips H, J, K, L, M. They are ½ in. wide and $\frac{1}{16}$ in. thick. A copper lever, ⅛ by ½ by 8 in., is pivoted on one end so that it will connect two or more of the condensers in parallel. The pivoted end is connected to the terminal B. The dotted line shows different positions of the lever. The apparatus is mounted in a wooden box.

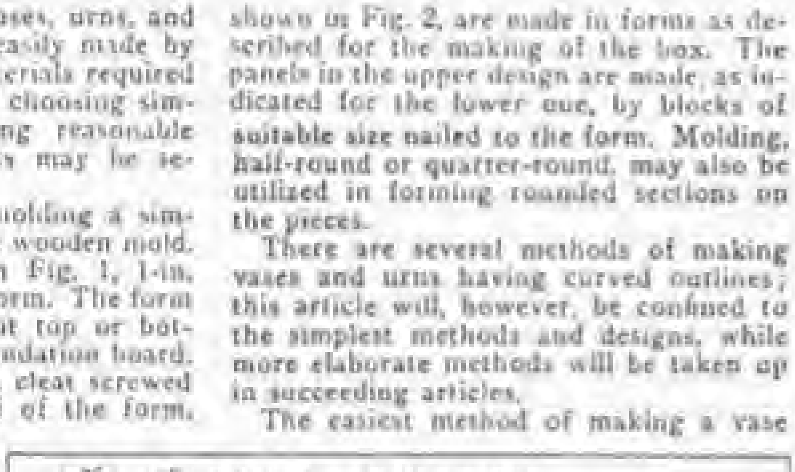
By James Tate

Part I—Flower Boxes and Vases

PERMANENT flower vases, urns, and boxes of concrete are easily made by the home worker. The materials required are not expensive, and, by choosing simple designs, and exercising reasonable care, many pleasing effects may be secured.

The easiest method of molding a simple flower box is by using a wooden mold. This is built as shown in Fig. 1, 1-in. boards being used for the form. The form is made like a box without top or bottom, and is placed on a foundation board, being held in position by a cleat screwed to the board, at each end of the form. The interior of the form should be oiled or greased, or at least well wetted, before any concrete is placed in it.

When filling the box form, first place a 1½-in. layer of concrete in the bottom, then put in the reinforcing; this is ½-in. mesh, No. 20 galvanized-wire lath, and is procurable at most hardware stores. It is bent up on the sides and ends as indicated. Next fill in more concrete so that the bottom is about 3 in. thick. The inside form is then placed in position, centered, and filled with sand, to prevent its collapsing under the pressure, and the remainder of the concrete poured. The concrete used throughout this job should be a mixture of one part cement to two parts sand. The pouring of the cement in the stand form is performed in a similar manner, except that the reinforcing may be omitted, if desired.



Simple Boxes or Vases of Rectangular Section Are the Easiest Forms for the Beginner. They are Cast in Wooden Molds, Which may be Used Repeatedly. Figure 2 Shows How Panels are Made by Blocks Nailed to the Form

Remove the forms in about 24 hours and paint the pieces all over with a cement and water mixture. To erect, place the stands in position at the proper distance apart, and set the box on them, using a mortar of cement to bond the stands to the box bottom.

Simple vases, square or rectangular, without stands, of designs similar to those shown in Fig. 2, are made in forms as described for the making of the box. The panels in the upper design are made, as indicated for the lower one, by blocks of suitable size nailed to the form. Molding, half-round or quarter-round, may also be utilized in forming rounded sections on the pieces.

There are several methods of making vases and urns having curved outlines; this article will, however, be confined to the simplest methods and designs, while more elaborate methods will be taken up in succeeding articles.

The easiest method of making a vase such as shown in Fig. 3, is by means of a template, or "sweep," and the first step consists in making the core that forms the inside of the vase. The vase itself is shown half in section and half in elevation in the upper left-hand corner.

First make the foundation board. This should be of 1-in. lumber, well ·aced, and about 2 ft. 6 in. square. An old door will answer, if the surface is perfectly flat and the joints tight. In the center of the board, screw a ½-in. floor flange, and into the flange a length of ½-in. pipe, cut to the same length as the intended depth of the core. The top end of the pipe is fitted with a hardwood bushing, drilled to receive a pin on the template. The template is made of ¾-in. boards, as shown, cut to the required taper of the core, and faced with a piece of galvanized iron, projecting ⅛ in. from the edge of the template. This forms a cutting edge, and the template is beveled back of it, as shown in the section A-B. Exactly at half the core diameter, as measured from the edge of the galvanized iron, either drill a hole in the edge of the template and drive in a pin to fit the hole in the pipe bushing, or fasten the pin by means of a strap and by bending the galvanized iron over it, so that the center of the pin is exactly on the edge of the template. The latter is the better method, and is the one shown in the drawing. In order to economize cement, build up around the pipe, which is first coated with oil or grease, with broken rock, bricks, or any similar material, bonding them with a little cement, if necessary. This should form the bulk of the core. Then mix one part cement with two parts sand as before, drop the template into place, give it a turn to see that none of the rough core strikes it anywhere, and proceed to lay on the cement.

This should be liquid enough to percolate through the stone mass, but not thin enough to run all over the board. Plaster it well over the sides, building from the bottom upward, and as it comes near the required diameter, commence turning the template around; this will form the surface. The template must be pressed to the foundation board, which should be kept clean. During the last stages, thin the concrete a little, and pour it over the core from the top, always keeping the template on the move, and keeping the edges of the latter free from hardening cement. The finished core should be left on the board until thoroughly dry, and then be given two or three coats of shellac.

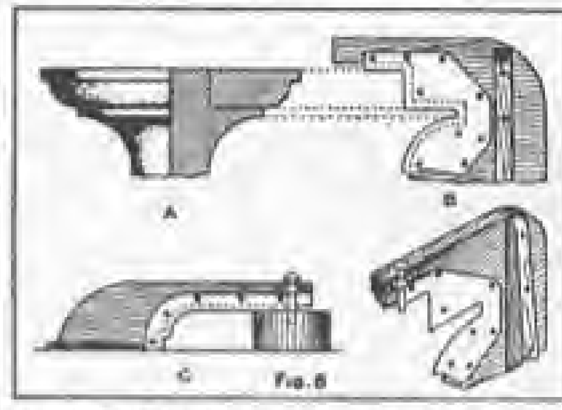
While it is drying, proceed to make the template for the outside of the vase. This is made in a similar manner to the one for the core, half the pattern of the outside being used, and, as the galvanized iron forms the true template, too much care need not be taken in cutting out the wooden frame.

Unscrew the pipe from the core and screw a longer one into place, the exact length of the vase, lifting off the core, if necessary, before unscrewing the pipe. When the shellac has hardened on the core, give it a coat of paraffin, or heavy oil. Plaster on concrete until it is as heavy as half the desired thickness of the wall, then place the previously prepared reinforcing on the concrete. This reinforcing should be placed so as to support th overhanging portions of the vase, such as the base, and may be prepared in either of the two ways shown in the drawing. One side of the reinforcing shown is made of twisted galvanized wire, the other is made of wire lath, such as used for the flower box in Fig. 1. The drawing is made as shown merely to illustrate the two methods of reinforcing, and must not be followed literally. If wire mesh is used, make the entire reinforcing of mesh, bracing it with hoops made of wire, and similarly with the twisted-wire reinforcing, which may be held to the hoops as illustrated in the enlarged detail.

Spread the concrete over the reinforcing and proceed to build upward, dropping the template into place as the diameter approaches the desired size, and keep on building and turning the template as described for the core. When nearly completed, thin down the concrete with water until it is more pasty than before; this will smooth up better and make a somewhat finer surface.

Instead of the pipe as a center support, a piece of 1-in. square hardwood, tenoned into the base, may be used. This is shown in the lower right-hand corner of Fig. 3. The pipe is a little more substantial; the results obtained by using either support will, however, be the same.

If any difficulty is met with in making the base, that is, if trouble is encountered in holding the concrete up while forming, it may be made separately, as shown in Fig. 6. The main former or template will then be as at B, the base template as at C,



One Method of Forming the Base, Where Difficulty is Encountered in Making the Vase in One Piece

the hole in the base being formed by a circular block of wood, in the center of which the pin turns. The base and vase can afterward be joined as shown at A by a good cement mortar.

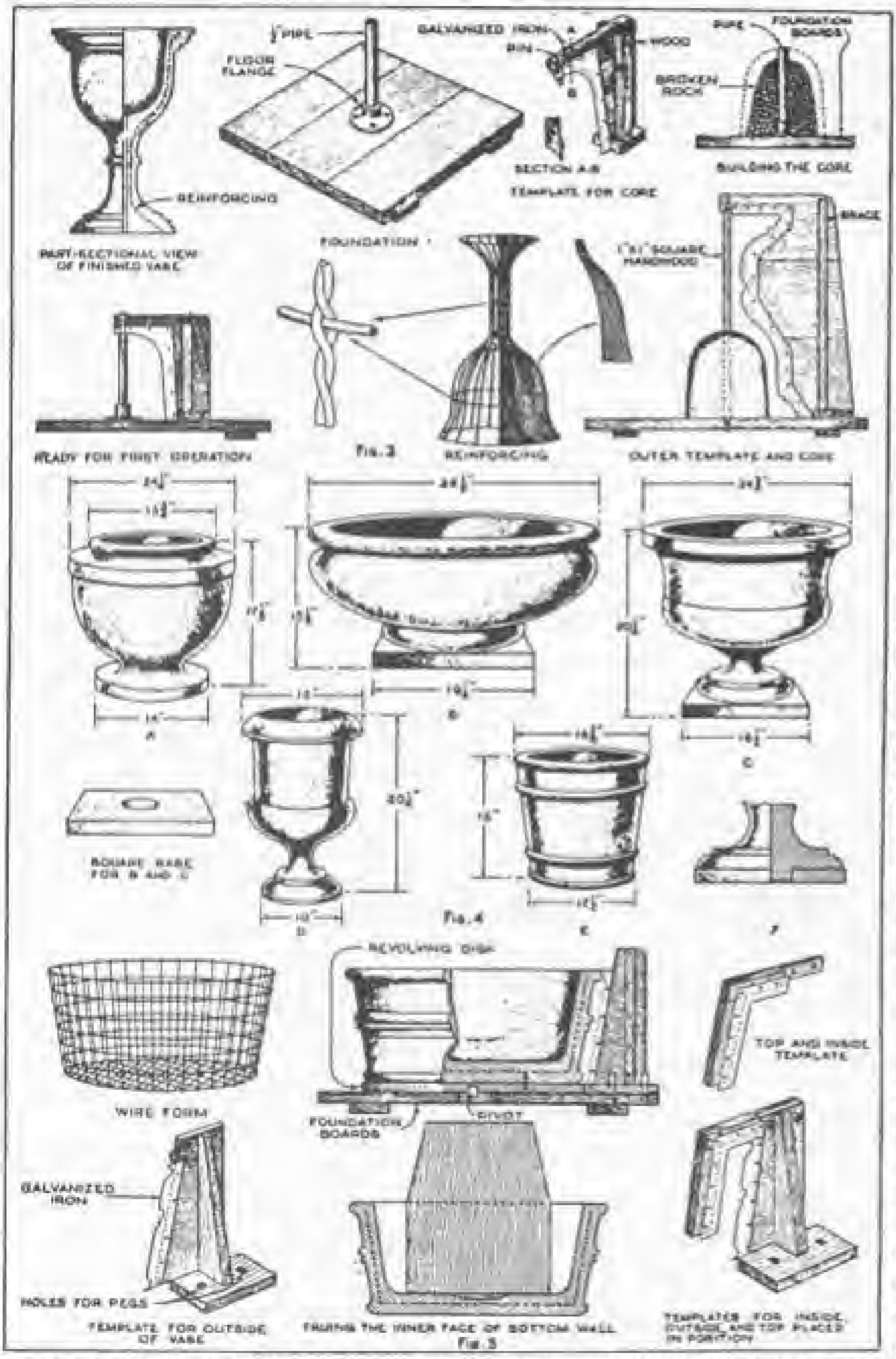
Figure 4 shows a number of pleasing, yet simple, designs. The square bases of B and C may be cast in a wooden box mold, being assembled as shown at F.

Another method, especially applicable to designs such as shown at E, Fig. 4, consists in rotating the work against a stationary template. A wire-mesh frame is made, upon which is plastered a roughing coat of one part cement to two parts sand, together with some plasterers' hair. The last can be purchased at any plasterers' supply house. Do not get the mixture too wet, just wet enough to squeeze through the holes in the wire mesh. Cover both sides and bottom of the frame, leaving the surface rough; then let the cement set.

A good mixture for the finishing coat consists of one part cement to two parts marble dust, mixed to a heavy paste.

The cement-covered form or frame is placed upon the center of the turntable, as in Fig. 5, and a nail is driven through the work and into the table; next, the template is moved up into contact with the turntable and fastened by means of pegs, then the finishing coat is plastered on, all the while rotating the table, and with it the work. Before putting on this coat, rough up the first coat with a sharp-pointed tool, and wet thoroughly.

When the outer surface has been formed, a horizontal piece of wood, edged with galvanized iron, is bolted or screwed to the template at the proper height, and the top edge of the vase trued, then another piece, to form the inside of the vase, is attached to the horizontal strip, as



The Various Tools, Forms, and Methods Used in Making Circular Urns and Vases by the Template Process are Shown in Detail in This Illustration. The Designs Chosen are Well Adapted to This Process, the Square Bases Shown in Designs B and C, Figure 4, being Cast Separately in Simple Wooden Molds. Figures 3 and 5 Show Alternative Methods of Using the Templates, the Only Difference Being in the Method of Application shown in the drawing.

The bottom may be trued by holding a piece of wood as shown, and revolving the work.

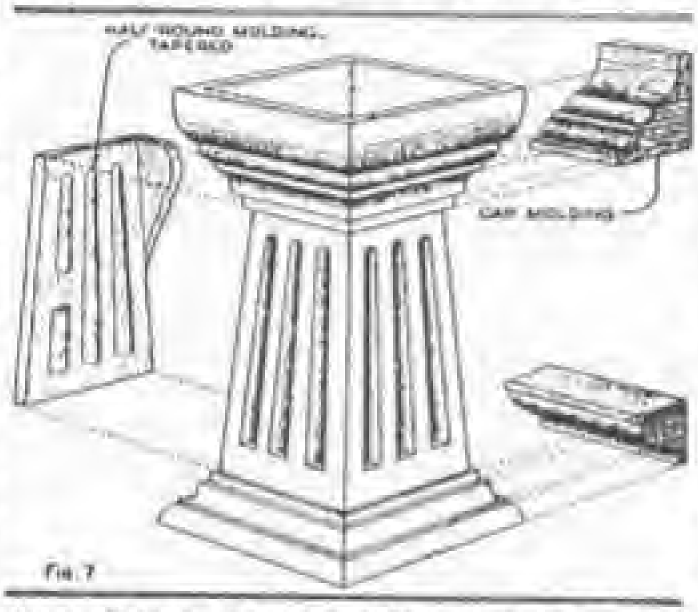
The finishing coat, of cement and marble dust, spoken of in connection with the last example, may be used with any of the pieces made by the template method. This forms a surface that is light, and full of sparkle when dry, presenting a very pleasing appearance.

Part II — Pedestals and Bird Baths

THE methods of making wooden forms described in Part 1, and illustrated in Figs. 1 and 2, may also be used in making the vase and pedestal shown in Fig. 7.

The forms for the top of the pedestal, or capital, and for the base, may be built up of molding sections, as shown; these moldings can be procured from any dealer in millwork; some forms of cap molding or plate-rail molding come in the shapes illustrated; if these are not easily obtainable, the form may be built up of simple sections; half-round molding, tapered and nailed to the sides of the pedestal-body form, will form the grooves.

The pedestal, base, and vase are preferably reinforced with wire mesh, and the pedestal may, by using a tapered wooden core, be cast hollow, thus saving material.



Wooden Molds for Pedestals and Vases may be Built Up by Using Cap Molding or Simple Moldings, as Shown in This Illustration

The whole piece may be cast as a unit, if desired, but if the cap, base, and pedestal are cast separately, they should be formed as shown in Fig. 6; this makes the unit much more solid than if the ends were merely left flat.

A number of designs for sundial pedestals and bird fountains are shown in Figs. 8 and 10. The bases and square capitals are cast in wooden molds, or made as shown in Fig. 11, by means of a template working on the edge of a box.

A square bottomless box, of the desired size, is placed upon the foundation board; a template is cut from galvanized sheet iron, to the proper shape, and fastened to a wooden guide, as indicated. After the cement has been placed in the box, the template is moved along each side in turn, the material scraped off being carefully removed. This method may, of course, be applied also to the making of the caps and base in Fig. 7.

A simple method of placing the pedestals on the lawn is indicated at B, Fig. 8. A hole is cored in the base of the pedestal; when it is set in position, a post, driven into the ground and a neat fit in the pedestal hole, will hold the unit firmly in place.

The sundials used with the pedestals illustrated are not usually fastened in place, their weight being sufficient to hold them in position, but for light dials, or where a permanent fastening is desired, four small holes may be made in the cap by inserting shellacked and oiled plugs into the soft concrete. The dial is then mounted as suggested in Fig. 9, the holes being filled with neat cement.

Little need be said about the bird bath and fountains shown in Figs. 10 and 12, except that the fountain in Fig. 10 and the pedestals of Fig. 12 should be made by the method shown in Fig. 3, Part I, while the small bird bath, the top of the table, and basin of the fountain in Fig. 12, can best be made by the fixed-template method illustrated in Fig. 5, Part I.

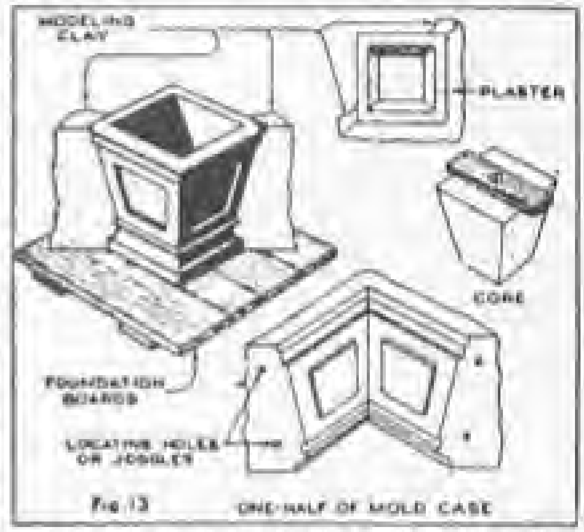
Where a vase, pedestal, bird bath, or any similar article is already at hand, and it is desired to duplicate it, the best method, if the design is not too elaborate and has no undercut portions, is to make a plaster mold.

The making of plaster molds for elaborate pieces demands a great deal of experience. We will, therefore, choose only such designs as can easily be made by the amateur, commencing with a simple rectangular vase.

The vase shown in Fig. 13 can be made in a wooden mold; in fact, it would be advisable to make it this way, but it is convenient for illustration, and as a simple exercise for the beginner.

The materials needed are: fine casting plaster, moist modeling clay, stearin, a good heavy-bodied oil, such as lard oil, some loosely woven burlap, and orange-shellac varnish.

Shellac the vase, inside and out, two or three coats, permitting each coat to harden before applying the next, then set the vase on the foundation board. Build up, on diagonally opposite corners, with the modeling clay, as shown, making one face of each wall straight. Dissolve some stearin in kerosene, and apply a thin coat to the vase faces; coat the clay walls and foundation boards with the oil, then mix up the plaster. This should be mixed by first filling a wide basin with water, then taking up the plaster in double handfuls and sifting between the fingers into the water. Some judgment as to the amount mixed and the proper consistency is necessary; 11 cups of plaster to 7 cups of water is about the right proportion. Build the plaster onto the vase, as shown in the plan, and allow it to harden. When it has hardened, remove the clay and scrape two holes, about ½ in. deep and ½ in. in diameter, on each end face of the half mold. These are known as "joggles," or "joggle holes," and when the other half



The Making of a Simple Plaster Mold for a Rectangular Vase: This Is a Good Exercise for the Amateur Concrete Worker

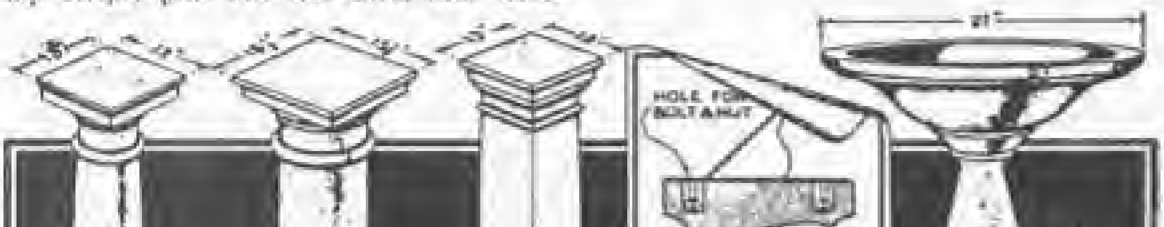
of the mold is cast, small projections fit into the holes, thus locating the halves accurately.

Shellac and oil the exposed edges of the half case, and then plaster on over the remaining sides of the vase, to form the other half of the mold. Coat the inside of the vase with stearin and fill with plaster, then lay a strip of wood, with a woodscrew in the center, across the center of the vase, sinking the screw down into the soft plaster. This will form the core of the mold. The core may, if desired, be made of wood, well shellacked. When choosing designs to copy, it is well to pick one having the interior well tapered, so that the core may be made in one piece. If the plaster mold is to be used for many pieces, it should be reinforced with burlap. This is cut into two lengths, each a little shorter than the length of two sides of the vase, and somewhat narrower than its height.

When the plaster is applied to the vase, to about half the thickness of the case, one of the lengths of burlap is dipped into the plaster and applied to the case; the remaining portion of the plaster is then applied over the burlap to the proper thickness. This strengthens the case considerably.

When the core and casing have hardened, give them two coats of shellac, then a light coat of stearin, and assemble them on the foundation board. The two halves of the mold may be held by dipping strips of burlap in a thin plaster mixture and pasting them over the corners of the case. These, when hard, will hold the case firmly. Suspend the core in the center of the case, by means of the wood strip, and pour in the concrete. When this has hardened, remove the burlap strips, pull out the core, and withdraw the case carefully. Cover the vase with wet cloths for two days, then place it in a tub, and keep it covered with water for several days.

Further instructions in making plaster molds will be given in the next installment.



Various Designs for Sundial Pedestals, Bird Baths, and Fountains are Shown in Figures 8, 10, and 12. Figure 9 Illustrates a Method of Fastening Sundials to Pedestals; Figure 11, Molding Bases by the Template Method

Part III—Plaster Molds

THE method of making models in plaster, of pedestals, balusters, and other objects of circular cross section, and of making a mold from the model, is very similar to the process of making plaster lamp bases, described on page 631 of the April, 1921, issue of Popular Mechanics.

It is better for the amateur, especially if he is doubtful of his ability to produce a neat and harmonious design, to procure a wooden baluster or column, shellac it well, and use it as a model on which to build his mold. Balusters or columns may be purchased, at a very small cost, from any dealer in millwork, and will save much work and time. Those who wish to work out their own designs, however, will be able to do so by following the instructions given in this article.

The first thing to do is, of course, to select the design. This should be as simple as possible, with no undercut portions that would cause trouble in withdrawing the model from either the template or the mold.

Obtain a piece of galvanized sheet iron, about 6 in. wider than the largest radius of the design, and about 3 in. longer than its height. True up one edge, and, using this edge as a center line, lay out one-half of the design upon the sheet. With cold chisel and snips, cut out to the approximate shape of the design, finishing with fine half-round files.

This sheet-iron template is then mounted on a backing of 1-in. lumber, as shown in Fig. 14, in such a manner that the edge of the sheet iron will project from ⅛ to ¼ in. from the wood, which should follow the outline of the design closely. This backs up the template. The latter, with its wooden backing, is then nailed to a stout box, as shown in the upper right-hand corner of Fig. 14, the box being of sufficient depth to clear the largest portion of the design. A spindle, which may be either of light iron rod or pipe, is then made as shown and provided with collars, which bear against the spindle supports, or bearings, and prevent end motion.

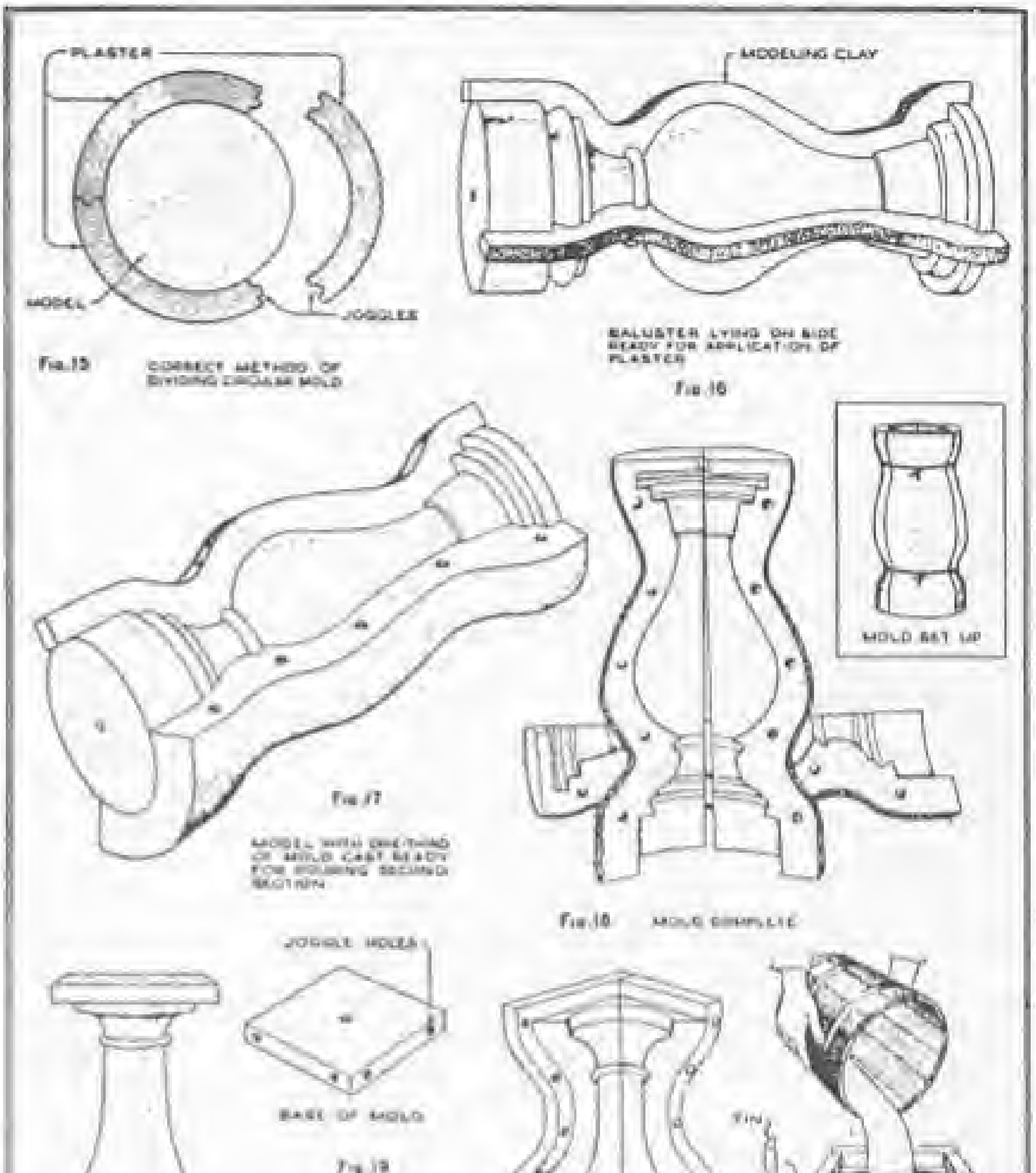
The spindle supports are screwed in position, and holes to fit the spindle bored in them; the centers of these holes must be exactly in line with the edge of the sheet-iron template, and the spindle, when inserted, should bear against the template. When laying out the template, provision should be made for the diameter of the spindle; that is, as the center of the spindle will be the center of the finished model, the edges marked A on the template must be cut back for a distance equal to half the diameter of the spindle.

Set the spindle in place, adjusting the collars, so that, while allowing it to turn freely, there is no end motion; cut a piece of burlap, a couple of inches shorter than the design and about a foot in width, dip this in a thin plaster mixture, and wrap around the spindle, tying it with pieces of cord if necessary. This affords a good foundation for the plaster, and also reinforces it.

Mix fine casting plaster in water to a thick creamy consistency, and commence pouring over the burlap-wrapped spindle, at the same time turning the latter by means of the crank. As the plaster builds up, it will be shaved off by the template. When the model approaches completion, thin the plaster just a little.

When the model is completed, remove it by unscrewing the spindle supports,

While It Is Easy to Obtain Wooden Balusters and Columns from Which Molds may be Made, This Illustration Shows the Method of Originating Models in Plaster by Means of a Template



The Various Steps in Making Molds from Models of Circular Section are Shown in this Illustration. Figs. 15 to 18 Show the Construction of a Mold for Pieces Having a Circular Section Throughout; Figs. 19 to 21, Making a Mold for Pieces Having Square Sections Incorporated in the Design, As, in This Instance, the Cap and Base. A Method of Fastening the Molds When Filling with Concrete is Also Shown

and set it aside to harden for about 24 hours.

At the end of this period, saw the spindle off close to the ends of the model, shellac the latter, two or three coats, allowing each coat to dry before applying the next, and it is ready to be used in making the mold.

The proper method of dividing a circular mold is shown in Fig. 15. If the mold is made in two pieces, one piece is quite likely to be a little larger than the other; that is, the division would not be exactly on the center line of the mold, so that one piece would embrace somewhat more than a half circle, making it impossible to withdraw the model without breaking the edges of the mold. By making the mold in three parts, the risk of such damage is eliminated.

Lay the model, or the wooden baluster, if this is employed, on its side. Build up, as shown in Fig. 16, two walls, or dams, of modeling clay, about 2 in. square and about 120° apart. When these have set a little, coat both dams and the surface of the model between them with lard oil, then fill in between the dams with plaster to the same height as the clay, smoothing it off roughly on the outside. If desired, when the plaster has been poured on to about half the desired thickness, pieces of burlap may be used to reinforce it, as described for the making of the square-vase mold in the June installment.

Allow the plaster to harden thoroughly, then strip off the clay, build up another clay dam, 120° farther around, scrape out the "joggles," and shellac the exposed edge of the part of the case already cast. When dry, oil the dam, model, and edge of the first section, and pour on plaster to make the second section. When this, in its turn, has hardened, strip off the clay, cut the joggles, shellac and oil the exposed edges, and pour the third section. The plaster of each section may be carried over the end of the model if desired, as shown in Fig. 18, to form a bottom for the mold, although, if the mold is to be used on a good level foundation board, this is not absolutely necessary. When thoroughly hard, the mold is well shellacked on all surfaces, and is then ready to be assembled and filled with the mixture of one part cement, two parts sand, and three parts clean broken stone or gravel, which must not be larger than will pass through a 1/4-in. screen.

Another method of making molds, particularly applicable to designs with square caps or bases, or both, is shown in Figs. 19 to 22. A square base, of the same size as the bottom of the model, is first made, as shown in Fig. 19. Joggle holes, and a hole in the center for an iron reinforcing rod, are cut in this; when hard, it is then set up against the bottom of the model, which is laid on its side, and clay dams are built along the length of the model and base, the dams being shaped and placed as shown in Fig. 20. When the plaster for the first section has been poured and has hardened, the model is turned over, and the opposite side is treated in the same manner. Joggle holes are cut in the four exposed edges of the mold sections, the edges are shellacked and oiled, and the remaining sides poured. The form of two of the completed mold sections, the base, and reinforcing rod, are shown in Fig. 21, and the mold set up and in course of being filled in Fig. 22. When fastening the mold sections with wire, use L-shaped pieces of tin at the corners, to prevent the wire from cutting the mold.

Part IV—Glue Molds

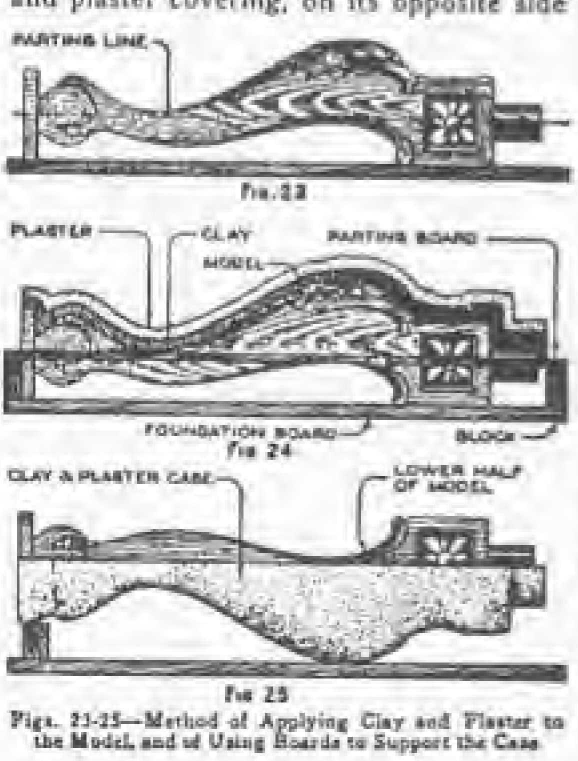
WHEN pieces of elaborate design, containing portions more or less undercut, are to be cast in concrete, glue molds are employed.

To the worker who has followed this series thus far, the making of glue molds will present little difficulty. In this, as in the casting of balusters and pedestals, it is necessary that the worker procure a wooden model of the design to be reproduced, unless he has sufficient ability as a modeler to make his own designs in clay. For one who has not, there is a wealth of material available in old carved furniture, or in plaster ornaments, parts of which may be pressed into service; for example, the writer has often used old carved legs of tables as models for the legs of garden tables; pieces of plaster-ceiling ornament as decorations for panels on sundial and other pedestals, and ornamental plaster molding as models for molding to be used in connection with similar garden pieces; many other carved-furniture parts and ornaments may be used with equal facility. The last illustration in this installment shows a garden table made by using models of this character, and the making of the legs is illustrated in the other drawings.

The first step is to shellac and oil the model. Lay it down on the working board, as shown in Fig. 23, and draw a line along each side, in the most convenient position for parting.

Obtain two pieces of thin board, about 6 in. wide, and cut one edge of each piece to fit the model as closely as possible, at the parting line. Nail blocks on these boards, as in Fig. 24, to support them so that their upper face will be exactly at the parting line.

Take a sheet of old newspaper, wet it, and spread it over the upper half of the model, pressing it down into close contact. Then take some modeling clay, flatten it out into a sheet, about ½ in. thick, and apply it over the newspaper, pressing the clay down into every detail on the model surface, and carrying it down until it rests upon the boards at each side of the model. Oil the surface of the clay, then build up upon it a plaster case about 1 in. thick. Fig. 24 shows the clay and plaster coating, in section, upon the model. When the case has hardened, turn the model, with its clay and plaster covering, on its opposite side



Figs. 23-25—Method of Applying Clay and Plaster to the Model, and of Using Boards to Support the Case

and remove the boards. This leaves one half of the model exposed, as in Fig. 25, with a straight, clean surface of clay and plaster at the parting line. Spread wet newspaper over the exposed half, apply the clay coat, oil, cut joggles in the edge of the plaster case, oil this edge, and pour the remainder of the case. Allow the whole assembly to harden thoroughly, then cast a plaster base on the case, as shown in Fig. 26, tapering the bottom edges of the case before pouring the base. When hard, remove the base, separate the halves of the case, and carefully clean away the clay and the newspaper, both from the model and the case, shellac and oil all surfaces of the plaster case and base, oil the model, and reassemble. We have now the model inside the plaster case, with a space between, as may be seen by reference to Fig. 26, of the same thickness as the clay had been. This space is to be filled with glue.

The glue used for molds is a good grade of white glue, obtainable at any dealer in painters' or plasterers' supplies. It must be melted in a regular gluepot, if the

Mold in Position, Ready for Filling with Glue; Figure 27 Shows How the Glue should be Melted for Large Pieces

piece is small, or, if much glue is required, use two pails, one inside the other, as shown in Fig. 27. Support the inner one upon a block, a few inches high, fill the outer one about one-third full of water, put the glue, which has previously been soaked in water for about 15 minutes, into the inner one, with about a quart of water, then heat gently. When the glue is of the proper consistency, pour it into the space between case and model. The glue will require about 24 hours to harden. When hard, remove the plaster case, and cut the glue carefully along the slight ridge that marks the parting line of the case. This makes a glue mold in two parts. Paint the inside of the glue mold with the very best grade of clear varnish, three or four coats.

When ready to make a cast, place each section of the glue mold back into its own half of the case; this is necessary because the glue is so flexible that it will not support either its own weight or the weight of the concrete. Oil the interior, assemble the case and base, strap the case firmly, and the mold is ready for filling with the mixture of 1 part Portland cement to 2 or 3 parts sand. Do not hesitate, when stripping the glue from either model or finished piece, to pull firmly, though carefully, on the glue mold over undercut portions; it will come away easily if proper care is taken, and will snap back into place when released. Glue molds cannot be used for more than four or five casts, but as the old mold, cut up into small pieces and allowed to dry, may be used again, there is little or no waste. The writer has seen molds made of glue that had been used for several hundred casts, and that, when used with a proportion of new glue, retained all its first flexibility, reproducing the most delicate designs with great fidelity.

The making and using of glue molds is a very interesting process, and is one that will repay the effort spent upon it. The worker should keep his eyes "peeled" for suitable subjects and models; many models may be picked up during the dismantling of old buildings; the passing of the saloon especially has made available many pieces of woodwork eminently suitable for this purpose. When reasonable care is used, pieces that will be a delight to the eye may be made from glue molds, and if simple designs are used, they will harmonize with almost any surroundings. Simple designs should, in any case, be chosen by the beginner, as, with elaborate

Table Cast in Concrete: The Legs were Cast in a Glue Mold Made by Using a Carved Table Leg as a Model

ones, the first results are apt to be somewhat disappointing.

Part V — Ornamental Pools

THE appearance of even the simplest garden may be considerably enhanced by the addition of an ornamental pool, of a size suitable to the surroundings. The construction of the garden pool is simple, and, with or without the presence of aquatic plants, a note of dignity and attractiveness is added to the garden by the cool, quiet water.

The selection of the site, while governed, of course, by the space available, and by consideration of the other details of the garden, is important, and should be given careful thought. The ground must be firm and well drained, to afford a good foundation for the walls and floor. The weight of the water and concrete in a pool of fair size is considerable, and if the ground does not afford a solid support, there is some danger of settlement, with resulting cracking of the concrete. The quality and method of placing the concrete, the reinforcing, the forms used, and the method of surface finish are all important considerations, if the resulting walls are to be smooth, dense, and water-tight.

The foundations, as shown in the detailed illustration, should be carried down below the frost line, the drain pipe being led out underneath the footing. The forms should be made, for the rectangular pool, of 1-in. lumber, and, to insure a smooth, dense face on the wall, should be planed on both edges and face, carefully matched, and water-tight, as a small leak in the surface of the forms will allow the cement to run through, thus leaving an air pocket in the surface of the wall.

Particular attention should be paid to the bracing of the forms; the best method is shown in the illustration. In addition to woven-wire reinforcing, shown by the dotted line in the cross-sectional view, ⅜-in. rods are used in the side walls; three on each side and end will be enough, spaced about 6 in. apart.

The concrete used is what is known as a 1:2:4 mix, that is, a mixture of 1 part Portland cement, 2 parts clean sharp sand, and 4 parts of clean broken stone. An estimate of the amount of material needed for a rectangular pool of the dimensions shown is: cement, 9⅓ bbl.; sand, 2.8 cu. yd.; broken stone, 5.61 cu. yd.; woven wire, 65 sq. yd., and ⅜-in. rod, 140 ft. When the outside forms are in place and the foundation laid, adjust the woven-wire reinforcing as shown by the dotted line, place the inside forms in position, then fill in the concrete, which must be of a "mushy" consistency, spading it well next to the forms, and laying in the ⅜-in. rods in the proper positions. By spading is meant the thrusting of a thin paddle between the newly placed concrete and the form, to obtain a wall surface free from pits and voids. A hoe, straightened out in line with the handle, makes a good tool for this purpose, or a thin wooden paddle may be used. The inner forms may be removed in about 24 hours, and the face of the walls painted with a cement and water mixture, to make the surface more dense.

It should be noted that the inner form must be set to slope, as shown. This is necessary because, when winter sets in, and ice forms in the pool, the ice will slip up the sides, instead of exerting its thrust straight against the face of the walls, as it would if the faces were vertical.

The following materials will be necessary for the construction of a circular pool of the dimensions given: cement, 9½ bbl.; sand, 3 cu. yd.; broken stone, 5.62 cu. yd.; woven wire, 75 sq. yd., and ⅜-in. rod, 110 ft. This pool may be constructed by using silo forms, if these

A Pleasing Concrete Lily Pool of Suitable Size for the Small Garden

are available; if they are not, sheet-metal forms will be found just as good. The method of reinforcing, placing the concrete, etc., is similar to that used in making the rectangular pool, but the inner face, to save trouble in making the form, should be left vertical, removing the inner form as soon as possible and forming the interior slope with cement.

The walls and bottoms of the pools should be wetted at least twice a day for about two weeks, to assist in curing the concrete, and the pools should not be put into service until the end of this period.

The best method of keeping the concrete wet is to cover all the exposed surfaces with canvas, wetted frequently. Another method of preventing the floor from drying too rapidly is to cover it with a layer of earth, 2 in. deep, sprinkling this thoroughly, together with the walls, several times a day.

At the end of the curing period, the floor should be covered with about 1 in. of water, this depth being gradually increased, until, at the end of about 20 days, the pool is filled with water.

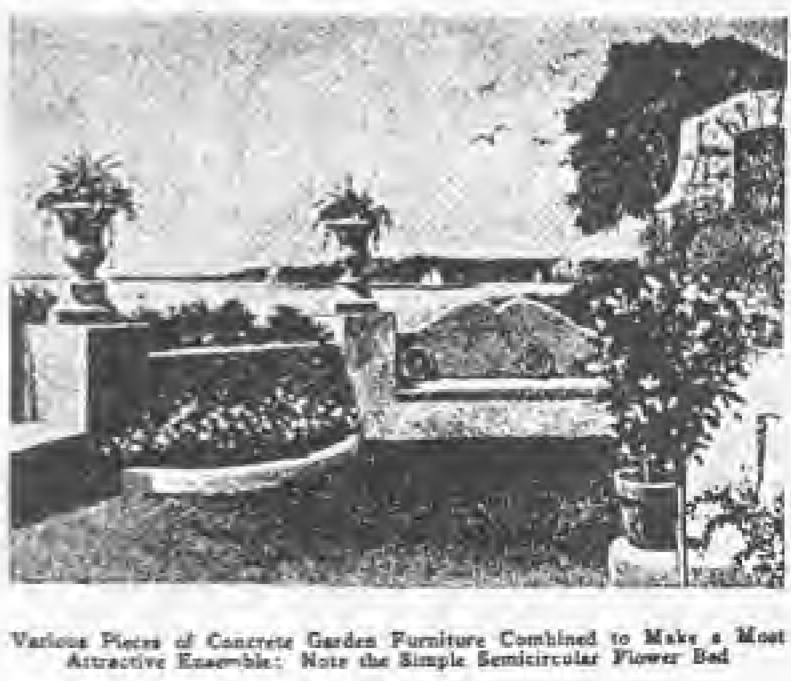
It may not be amiss to give here a list of aquatic plants best suited for small pools. Among the *nymphæas*, or water lilies, the following varieties give best results: *N. Graziella*, *N. Aurora*, *N. fulva*, *N. pygmæa*, *N. pygmæa*, var. *helvola*. Parrot's feather, water snowflake, water poppy, and pickerel weed are also suitable, while papyrus forms a very attractive centerpiece around which to group smaller plants.

Many of the foregoing instructions apply with equal force to the construction of swimming pools, although somewhat greater care must be used in the selection of a suitable site, and in the reinforcing of the walls and floor.

As it is not possible to lay the floor of a large pool in a single day, joints must be provided at the end of a day's work. A

Simple Pedestals, Benches, and Flower Boxes Add Considerably to the Appearance of the Formal Garden

½-in. strip of wood, afterward removed, will form this joint. The open joint is afterward filled with a bituminous sealing compound. A similar joint must be pro-



Various Pieces of Concrete Garden Furniture Combined to Make a Most Attractive Ensemble: Note the Simple Semicircular Flower Bed vided at the junction of wall and floor, and V-joints to provide a proper bond between previously laid material and the new concrete must be left in the walls.

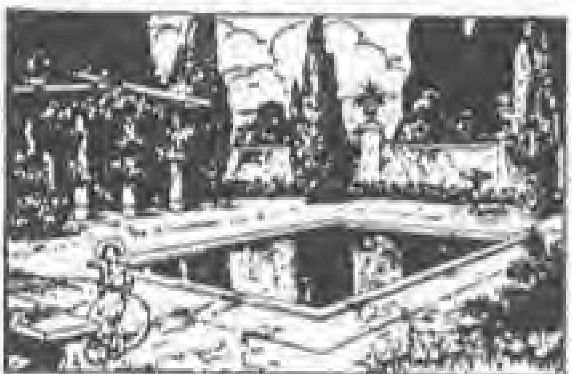
The fittings for a swimming pool will, of course, depend upon personal preference. A springboard is almost a necessity, and steps or climb-out ladders, the latter preferably of U-shaped iron rods, with the ends imbedded in the walls, should be provided for convenience of the bathers.

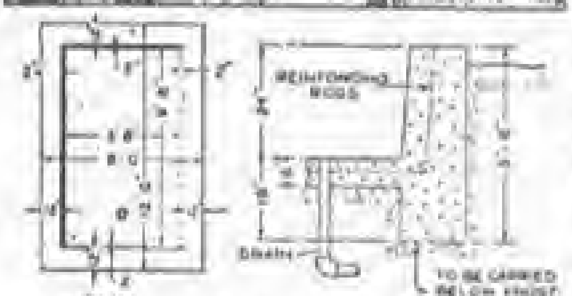
A concrete walk, rough-finished to prevent slipping, should run around the pool; this should not be laid until the backfill around the walls has settled for a period of several months; this will prevent the concrete walk from cracking.

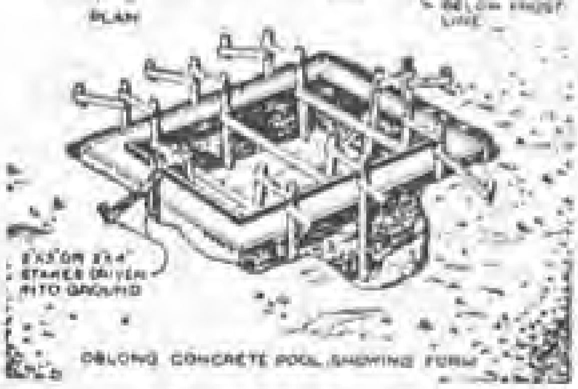
Wading pools are a godsend to the youngsters in hot weather, and will more than repay the effort of construction. They may be built with gradually sloping sides, dispensing with the wall and footing, and rough-finished with a wood float, to eliminate the danger of slipping. In these, as in all other pools, the underlying earth must be compact and firm, to support the concrete and prevent cracking.

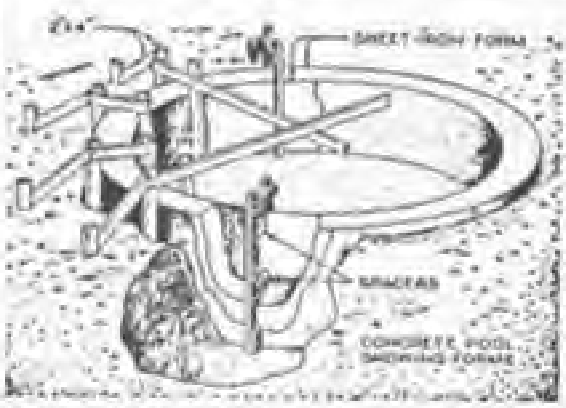
The various types of garden furniture described in this series by no means exhaust the subject. The illustrations show what may be accomplished by grouping several pieces such as vases, pedestals, benches, etc. Small semicircular flower beds, set against, or made a part of, the wall, relieve the monotony of a long wall, and are very easily made; to the ingenious reader, many other combinations will suggest themselves.

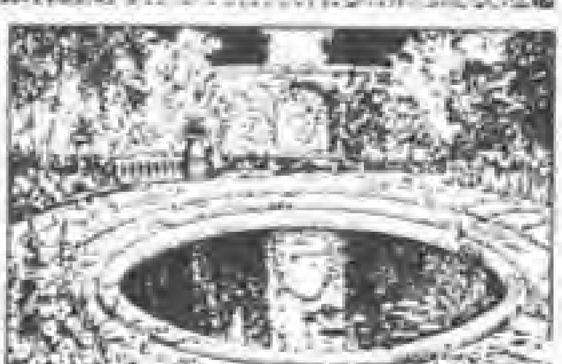
In conclusion, I may say that the worker will find the making of garden furniture in concrete a very interesting pursuit, and the articles produced are a permanent addition to the attractiveness of the home site.











Dimensions and Full Details of Two Easily Made Garden Pools: This Work Is of the Simplest Nature, and the Results will Be Very Pleasing If Proper Care is Used in the Selection of a Site. Aquatic Plants, Such as Water Lilies, Parrot's Feather, etc., may be Used in the Pools if Desired

STAKE YOUR CLAIM

BY KURT SAXON

Since little land, if any, is available for homesteading, a 20 acre mining claim may still give you that refuge hideaway. You can even stake your claim in one of our National Forests. Then, when it all hits the fan, you will have a secure haven in which to weather the coming storm.

I believe that such claims in our National Forests will benefit both Survivalist and forest. One family living on 20 acres constitutes a built-in forest ranger, ecologist, firefighter and wildlife protector, all free to the State. Such an arrangement is also a guarantee that the best of us will still be around when it's all over for the worst of us.

There is no need to restrict yourself to gold or silver when considering a claim. Any mineral for which there is a market is fair game. So when you find the site you like, first see what minerals are around and go by that.

First, locate the Geological Survey office in your area, usually in the Courthouse, and ask them to show you what minerals have been found. Then go with a pick and shovel and several friends carrying beer and start digging for pay dirt.

If you find something worth mining, your claim is secure and hassle-free. If there are only traces, you may tough it out for a couple of years if you're cool, but the Forest Service will do their best to get you out of there.

If they don't think your claim is worth your time, that is, if you can't earn a living on it, and then some, they get nasty. They will charge that you are only a squatter. Then they will spring the "Prudent Man" goody on you. Roughly, this is a clause which says that a serious miner or "Prudent Man" would not work a claim on which he wasn't making a profit.

They mean a money profit, of course. Esthetic considerations such as natural beauty, tranquility and just plain happiness cuts no ice with a Civil Servant. In their opinion, if you can't afford a lot of junk you don't even want, you're a squatter.

I think that if a mineral is there and you can get enough of it out to support yourself in your little paradise, that should be any "Prudent Man's" idea of profit.

The "Prudent Man" clause is so vague that the Forest Service and the miners will probably go around and around for a couple of years. So a person with a really good claim has no problem. But if he really can't show much reward for his labors, he may have to move.

The inability of the Forest Service to take quick action against a Survivalist miner is in your favor. You have to work your claim long enough to see if it is worth working. Thus, you at least have time enough to get established and to learn the art.

In that time, if you are a prudent man, you can cast about for a better claim. If lucky, you can find a fresh claim more promising than the first. Or you can buy a claim from another miner.

When you've staked your claim it's up to you to live there on it or to commute back and forth. Living on your claim means you'll need some sort of shelter which can be taken down when and if you give up your claim. The idea is to leave the claim and the land as natural as you found it.

Commuting to a claim seems simple. You just go out there on weekends, dig a little and you are a miner. This would be fine if your claim was on a major highway. But easy to reach claims have already been taken, worked out and returned to the State long ago. You may have to backpack ten or more miles, carrying everything you will need.

If you want a claim but wouldn't consider living on it now, your best bet is to buy an established claim. Many such claims, all over the Southwest, are advertised in the California Mining Journal, P.O. Drawer 628, Santa Cruz, Calif. 95061. The Journal also provides sources from which to buy the books and equipment you will need. $5.00 will bring you a year's subscription and all the expertise you will need at the beginning.

In the meantime, you can organize your resources and get ready to move if your claim gives you the sense of security you're looking for. Then, if you decide to take the plunge, moving onto your claim will be as easy as the terrain allows.

Right now, there is considerable harassment by the Forest Service wanting to dispossess people they judge to be squatters, rather than prudent miners. Even with such harrassment, many such miners and their families are enjoying a wilderness life.

If the system crashes while they are still there, they will be better able to survive than any group I know of. They are hardy, intelligent and love the land. They grow their own food, create their own energy, and even with minimal returns, are thriving. No environmentalist could find fault with any miner I know. Their being on the land secures it for posterity: theirs and yours.

FILING YOUR MINING CLAIM

by Ivan Hess

Any American citizen can stake a 20 acre mining claim on the 450 million acres of public land presently under the control of the Bureau of Land Management. 187 million of these acres are classified National Forest and control has been delegated to the National Forest Service. Staking a mining claim is extremely simple; holding onto it under the pressures of the Federal Government is another thing. The basic right to establish and work a mining claim is established by the 1872 Mining Laws found in the United States Code, Title 30, Sections 21-54.

To establish a mining claim, the

Notice of Location - Placer Claim

To All Whom It May Concern:

1. *The Name of the claim is* ______________________________, *a placer mining claim.*
2. *This claim is situated in Section* ______________ *(if known or surveyed), Township* __________, *Range* __________, __________ *Meridian, in the* __________ *Mining District (if known), County of* __________, *State of California.*
   The acreage claimed is __________ *acres.*
3. *The date of this location is the* __________ *day of* __________, *19* ______, *on which date the notice of location was posted on the claim.*
4. *The locator or locators of this claim are: (current residence or mailing address)*

Name ______________ *Street* ______________
City ______________ *State* ______________ *Zip* __________
Name ______________ *Street* ______________
City ______________ *State* ______________ *Zip* __________
Name ______________ *Street* ______________
City ______________ *State* ______________ *Zip* __________
Name ______________ *Street* ______________
City ______________ *State* ______________ *Zip* __________

5. *Each locator is a citizen of the United States, or has declared intention to become such.*
6. *The locator(s) do(es) hereby locate and claim, on land embraced in the United States Public Land Surveys, the land and deposit described as the* ______________________________ *of the above section.*
   If not described or taken by legal subdivision description, or if on unsurveyed land, the boundaries of the claim and the land taken are described as follows:
   Commencing at the discovery monument where this notice is posted, thence __________ *(Direction)* __________ *to the* __________ *corner which is the point of beginning to describe the boundaries,*
   thence __________ *feet to the* __________ *corner*
   thence __________ *feet to the* __________ *corner*
   thence __________ *feet to the* __________ *corner*
   thence __________ *feet to the* __________ *corner*
   thence __________ *feet to the point of beginning.*
7. *The discovery monument is situated at the point of discovery about* ______________________________

(distance from natural object or permanent monument and give direction as accurately as possible, to identify the claim located)

LOCATORS

______________ ______________

______________ ______________

Proof of Labor Upon Mining Claim

*I the undersigned state: That between 12 o'clock noon of the first day of September, 19*____, *and 12 o'clock noon of the first day of September, 19*____ *the following described work and labor were performed and made upon, or for the benefit of these certain contiguous Mining Claims, situated in the* __________ *Mining District, County of* __________ *State of California, named and recorded as to original location, and as to the amended location, if any, as follows:*

Name of Claim ______________, *Section* __________,
Township __________, *Range* __________, __________ *Meridian MDBM.*
Original Location: Vol ______, *Page* ______, *Bk. Name* __________
Amended Location (if any): Vol ______, *Page* ______, *Bk. Name* __________

Name of Claim ______________, *Section* __________, procedures are relatively simple:

1) Locate a valuable mineral on previously unclaimed land and mark the discovery point.
2) Establish the boundaries to your twenty acres around the point of discovery and mark the corners.
3) File a Notice of Location-Placer Claim form with the County Recorder's Office.
4) Invest a minimum of $100 worth of labor or materials per year in your claim and file your annual Proof of Labor form.

You can also purchase an existing claim, in which case you must file the Quit Claim Deed (your title to the mineral rights) and pursue the annual assessment work.

LOCATION: I can't teach you how to prospect, but you need to find the mineral before anything else. Panning, sluice work or dredging are relatively inexpensive and there are many people out in the woods and on the streams who will be more than happy to help you learn. Once you locate your deposit, place a post close to the point (a piece of 4 x 4, four feet tall) and affix a small jar by the lid with a sign indicating the name of the claim and identifying this as the Point of Discovery. Place a piece of paper in the jar with the name of the claim, location of the claim in terms of section, township, range and meridian (this is easily established on a Geological Survey Map), your name and address, date, and if possible, a description of the distances to each corner. Eventually, you might simply wish to place a Xerox copy of your notice of location in the jar which has all this information.

Next, pace off your boundaries to locate your corner posts. You want to try and establish 20 acres, which in rough country can be a bit difficult. Most common dimensions which work out well are 660 ft. x 1320 ft. Place another 4 x 4 post with jar at each of these corners with the same information as the Point of Discovery in addition to indicating which corner it represents (NE, NW, SE, SW). Incidentally, when you start working out your boundaries, don't forget to consider you'll want water and possibly a building site. Try and lay out your corner posts to include such geological assets.

FILING: Obtain a Notice of Location form from your local County Recorder's Office for approximately $.15 and fill it out. Make as many copies as you need for the corner posts and send it in to be recorded. There is a minimal fee of about $3.00. If you are buying an existing claim, you'll need a Quit Claim Deed and it must

Township ______ *Range* ______ , ______ *Meridian MDBM.*
Original Location: Vol ____ *Page* ____ *, Bk Name* ______
Amended Location (if any): Vol ____ *, Page* ____ *, Bk. Name* ______

Name of Claim ______ *, Section* ______ ,
Township ______ *, Range* ______ , ______ *Meridian MDBM.*
Original Location: Vol ____ *, Page* ____ *, Bk. Name* ______
Amended Location (if any): Vol ____ *, Page* ____ *, Bk Name* ______

LABOR AND IMPROVEMENTS: Specify (for example, state depth of shaft sunk; feet of tunnel, drift, adit or crosscut driven; size of exploration cut of trench; or refer to separate document, filed as required by PL 876, describing geological, geochemical or geophysical survey). Give value for each item and dates on which, or periods of time within which the same was performed or made, and total value.

WORK OR LABOR DONE	*DATE*	*VALUE*
		$
		$
		$
		$
		$

Name of Affiant or Declarant ______
Current Mailing Address ______ *City* ______ *State* ____ *Zip* ____
Current Residence Address ______ *City* ______ *State* ____ *Zip* ____
Name of Owner ______
Current Mailing Address ______ *City* ______ *State* ____ *Zip* ____
Current Residence Address ______ *City* ______ *State* ____ *Zip* ____
Name of person(s) who performed the improvements ______

Current Address ______ *City* ______ *State* ____ *Zip* ____

All monuments required by law to have been erected, and all notices required by law have been posted, on each claim(s) or copies of such notices were in place on the claim(s) on ______ *, 19* ____ *, and on that date each corner monument bore or contained marking sufficient to designate the corner of the mining claim(s) to which it pertained and the name of the claim(s).*

The above listed claim(s) is/are held and claimed by the owner of the undersigned (if he is entitled to possession thereof) for the valuable mineral contained therein.

I hereby certify under penalty of perjury that the foregoing is true and correct.

Executed at ______ *, California this* ______ *day of* ______ *, 19* ____

______
Signature

Quitclaim Deed

This Indenture *made the* .... *day of* .... *one thousand nine hundred and* ....

Between

the part...... of the first part,

and

the part...... of the second part,

Witnesseth: *That the said part...... of the first part, in consideration of the sum of* .... *dollars, lawful money of the United States of America, to* .... *in hand paid by the part...... of the second part, the receipt whereof is hereby acknowledged, do .... hereby release and forever QUITCLAIM unto the part...... of the second part, and to .... heirs and assigns, all th...... certain lot...., piece......, or parcel..... of land situate in the* .... *County of* ....

State of ...., and bounded and described as follows, to-wit:

Together *with the tenements, hereditaments, and appurtenances thereunto belonging or appertaining, and the reversion and reversions, remainder and remainders, rents, issues, and profits thereof.*

To Have and to Hold *the said premises, together with the appurtenances, unto the part..... of the second part, and to .... heirs and assigns forever.*

In Witness Whereof *the part..... of the first part ha...... executed this conveyance the day and year first above written.*

Signed and Delivered in the Presence of

.... } ....

.... } ....

be notarized when the title is signed over. Finally you are required to file an annual Proof of Labor form indicating the amount and type of work you do each year. Again, the forms are available at the Recorder's Office and are filed there. Work in California must be filed by September 1st each year. Basically, this is all that is necessary to get you started in the mining business, but if you intend to do any more than a bit of simple panning or start thinking about a cabin, you are confronted with new problems and requirements, especially if you're on National Forest Land.

MINING OPERATIONS: There is generally a permit of some kind required for any sizable mining operation. If you keep a low profile, you'll probably be alright, but if you're thinking in big terms, you may be looking at Environmental Impact Reports, filing of Mining Operation Plans, extra fees and numerous agencies looking over your shoulder. The best policy seems to be not to open Pandora's box. If you're the conscientious type, contact your local District Ranger's Office, The Department of Fish and Game or Bureau of Land Management.

Dredging is usually the more successful means of placer mining these days and it is rather hard to camouflage with all the noise they make. Luckily, it isn't too difficult to get set up legally to use one under 12" diameter. There are specific seasons for dredging, depending upon what area you're in. Write your local Fish and Game Department and they'll send you a form and regulations. Again, there's another filing fee, usually around $5.00.

BUILDING: If You have plans on building a cabin on your claim, you may be in for problems, especially if you're on National Forest Land. As soon as you start any construction, you'll probably be hassled. Portable homes such as old buses or trailers are usually allowed, although they look terrible sitting in the woods. Whatever you build must be temporary; no permanent foundations or utility hook-ups. If you want to tackle the hassles, it's a good idea to contact your local building department and acquire a Temporary Housing Permit which will also require a percolation test and assorted plans being filed again with the county.

The information above should be sufficient to get you started. There are many fine points to learn and a lot depends upon where you specifically intend to set up your operation. Sources for more information are appended and the following list of incidentals might be worth pointing out:

1) Be conscientious about your assessment work; don't try and just home stead, you'll be leaving yourself wide open.

2) If you're looking into an area for mining, talk to the locals. Most miners will bend over backwards to help you get started and will know what works in a given area.

3) Don't even think about getting into mining unless you're serious and industrious. It's no easy life and requires lots of hard work, determination and ingenuity.

4) Keep track of your productivity and labors. You may eventually be confronted with a validity check on your claim and be required to prove your serious intent and efforts. Take pictures of your operations, keep receipts of all gold sales and generally cover your back.

For further information on mining claims, the following State and Federal offices have pamphlets available:

Bureau of Land Management:

Questions & Answers About the 1872 Act Use Regulations Affecting Prospecting and Mining in National Forests

What You Should Know About Multiple Use Classification of Public Lands in California

Regulations Pertaining to Mining Claims Under the General Mining Laws of 1872

U.S. Forest Service

Staking a Mining Claim on Federal Lands

Patenting a Mining Claim on Federal Lands

California Division of Mines and Geology

Basic Placer Mining: Special Publication 41

Legal Guide for California Prospectors Miners (a must before you really get into it)

The Versatile Querl

"Querl" is the German name for a kitchen utensil which may be used as an egg-beater, potato-masher or a lemon-squeezer. For beating up an egg in a glass, mixing flour and water, or stirring cocoa or chocolate, it is better than anything on the market.

Fig. 1

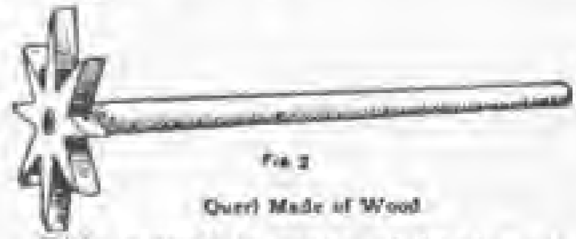


Fig. 2

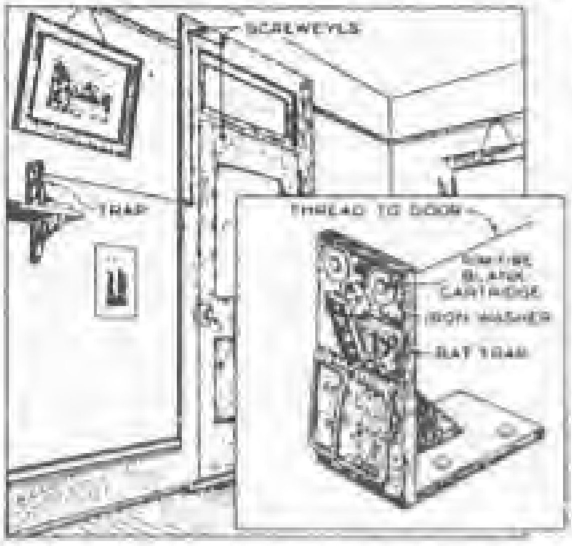
Querl Made of Wood

This utensil is made of hardwood, preferably maple or ash. A circular piece about 2 in. in diameter is cut from ½-in. stock and shaped like a star as shown in Fig. 1, and a ⅜-in. hole bored in the center for a handle. The handle should be at least 12 in. in length and fastened in the star as shown in Fig. 2.

In use, the star is placed in the dish containing the material to be beaten or mixed and the handle is rapidly rolled between the palms of the hands.

A Burglar Alarm That Shoots

A burglar alarm that will fire blank cartridges, when operated by the entrance of an intruder, can easily be made at a



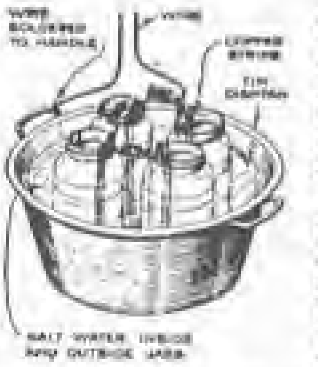
An Ordinary Spring Rat Trap, Converted into a Burglar Alarm, Shoots Blank Cartridges When the Door or Window to Which It is Connected is Opened

cost of but a few cents, from an ordinary spring rat trap. To convert the trap into a burglar alarm, it is only necessary to drill one or two holes in the base, into which 22-caliber blank cartridges are inserted, in such a manner that the spring of the trap will strike the rim of the cartridges and fire them. A hole is drilled underneath the trigger arm, and a thread or wire attached to the arm for releasing the trap. The burglar alarm is mounted on a base in the manner shown, the base being screwed down to the floor or shelf. The alarm is connected to the door or window by means of a stout thread or string, so that the door or window cannot be opened without giving an alarm.—

Emergency Wireless Condenser

From Popular Mechanics 1925

While operating a high-frequency set, an amateur wireless operator had the misfortune to burn out his condenser. Desiring to resume operation as soon as possible, he assembled the emergency condenser shown in the drawing. An old tin dishpan was obtained, and four ordinary fruit jars were set in the pan, which was filled to within about 2 in. of the top with strong salt water. Each jar was also filled with salt water to the same level. Then a copper strip was placed in each jar and a connection made to each strip, the other wire being connected to the tin pan. This makeshift condenser was found very efficient and was used for several months. As the water evaporated, a fresh supply was added from time to time.



BRAIN DAMAGE BEFORE BIRTH

By KURT SAXON

In my last issue I believed I had covered Minimal Brain Damage due to malnutrition. Also, I believed that Minimal Brain Damage was not a birth defect. I meant hereditary brain damage. That is, such MBD was not passed on by the grandparents to the child. I was right about the hereditary part concerning MBD but wrong about it happening only as a result of malnutrition after birth.

Since then, I've found that deprivation-caused MBD can happen as early as six months or more before birth.

On Saturday, June 12, 7:30 p.m., ABC presented an hour-long report on "The Unfinished Child".

This program was largely narrated by Patricia Neal, who did such a fantastic job alongside Gary Cooper in "The Fountainhead".

The Unfinished Child dealt mainly with poverty groups, losers in our society, whose children are so state-linked that their surviving the fall of the State is almost impossible, regardless of how well-fed they are. No matter. The point is well made. Before birth, nutrition is just as important as nutrition after birth and sensory stimulation.

The report made only vague references to the child's need for responsible parents, fewer siblings and a wholesome environment. It was not stressed that a potential genius born to and raised by clods would probably only be a more clever clod, wiser in the ways of clods in getting "his rights".

It was a good report, nonetheless and if you missed it you ought to write to ABC TV, 1330 Avenue of the Americas, New York, N.Y. 10019, and ask for a reshowing.

Concerning a poverty preggy who showed up early at a clinic, Miss Neal said, "...because, during the last six months of pregnancy and the first two years of a child's life, the brain does most of its growing. Did you know that by the time Penny's baby is one day old, its brain will have grown 60% of all the cells it will ever have? If Penny wasn't eating enough (during pregnancy) and didn't feed her baby properly during those (first) two years, the baby's brain growth could be stunted and might never recover."

She went on with genuine concern for those not reached by Federal and State funded pre and post-natal nutritional guidance programs. "But there are thousands out there who can't get into this kind of clinic. There just isn't enough money. Thousands and thousands of children are born every year in America suffering from malnutrition. They are all part of what the sociologists call 'The Poverty Cycle'. Now, what that means is, if your folks were poor, you're going to be poor. And your baby's going to be poor. It's a lousy inheritance. And part of that inheritance includes not getting enough to eat."

The report properly points out that family planning has gotten the lion's share of public funding. Prevention is better than cure but unless enforced sterilization of public dependents is made law, the taxpayer must shell out more money now or prepare to slaughter more rampaging morons later. The following figures should convince you that our society will simply not be able to afford an increasing load of public dependents.

"What you find is that all the new money that's been provided for women, in spite of the fact that it's known that there are nearly a million women a year who need help of some kind, that all the new money in the field is for family planning. So we are much more interested in stopping pregnancies than in helping the people who do have pregnancies have a healthy one.

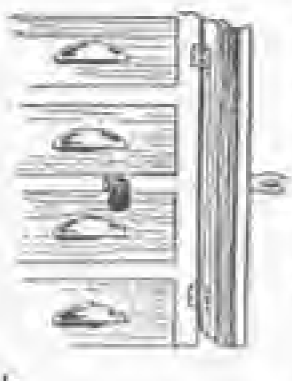
"Even though we are not terribly concerned about the economics of an individual baby in our intensive care nursery, the cost of intensive care for those babies works out to approximately $5000 a pound to get those babies from a birth weight of two pounds up to a weight of four and a half or five pounds when they're ready to go home."

Clinically administered programs to prevent pre-natal damage are relatively

From Popular Mechanics 1915

Locking Several Drawers with One Lock

A lock for a number of drawers in a bench or cabinet may be applied with a strip of wood hinged to the cabinet edge so that it will overlap the drawer fronts, as shown. A hasp and staple complete the arrangement for use with a padlock.



From Popular Mechanics 1915

A Furniture Polish

A good pastelike furniture polish, which is very cheap and keeps indefinitely, can be made as follows: Mix 3 oz. of white wax, 2 oz. of pearlash, commonly known as potassium carbonate, and 6 oz. of water. Heat the mixture until it becomes dissolved, then add 4 oz. of boiled linseed oil and 5 oz. of turpentine. Stir well and pour into cans to cool. Apply with a cloth and rub to a polish. The paste is nonpoisonous.

JAVELLE WATER

Javelle water, a solution of sodium hypochlorite in water, is a bleaching agent, cleanser, and disinfectant. It is easily made as follows:

Add soft water slowly to ¾ lb. chloride of lime in an enameled pan, crushing the lumps to make a smooth paste. Put 3 lb. washing soda in a 2-gal. stoneware crock and add 1 gal. warm water. When the soda is dissolved, add the lime paste and enough water to fill the crock. Leave covered for several hours, until the lime settles; then dip or syphon off the clear liquid. This is a concentrated solution and should be diluted with four times its volume of water before use. The above quantities therefore make nearly 10 gal. of solution.

Only soft water should be used in the above formula. Do not allow Javelle water to drip on clothes or other fabrics. Metal fixtures with which it has come in contact should be washed immediately with clear water and dried.

cheap per individual case.

"**I estimate** that it costs $150 per case. That's $150 including the food. And this is a very low cost when comparing the latest estimates we have on what it would save the nation if we could prevent one case of mental retardation. That cost is $900,000!

"**Agnes Higgins** (a Canadian nutritionist) figures that if a mentally retarded child can be kept out of an institution by proper feeding during (its mother's) pregnancy, the investment of $1.00 could save $6000 or more. Now here's another statistic. There are 13 times as many mentally retarded children in the poverty group as in any other group."

A big danger of pre-natal malnutrition is premature birth. Not only is such an infant stunted overall, but, as reported above, it costs up to $5000 per pound for a hospital to bring it up to a normal birth-weight. This can put most working families on welfare.

A doctor interviewed said, "When you find a child who ought to do well in school but doesn't, are there any things in that child's background that would suggest that problem is a carry-over? And again, you go back and you find out that there is a higher than expected incidence of small babies who later have troubles under the heading of learning disabilities."

"**There can** be direct relationships between low birth weight and the diet of a pregnant woman."

One pathetic drudge who had dropped eleven young said, "On the first date I had never had no special interests and I just ate what I had to. Then after I went to a diet dispensary and I got the last three, I had a special diet. They were big babies. The rest were all small. There were a lot of handicaps. Brain damage in one, three of 'em had epilepsy. They didn't mix well with other people. They were very, very slow at home and they were much, much harder to take care of than the normal baby. Then the last three, well, they grew up normal, mixed very, very well, no problems in school."

Her standards of doing well in school are probably lower than mine but her point is well taken.

Another excellent point stressed in this report was breast feeding. "At a clinic in Brooklyn, Paula Fishman talks about feeding the newborn. And she believes Nature provides the perfect formula.

'**The reason** that I think it's good, as a nutritionist, is because we know now, it is the best milk for your baby. One of the reasons is that when you breast-feed your baby, you pass from your body to the baby, some resistance to infections and diseases. That you can't do with a formula. Formula is an acceptable substitute but the breast milk has something extra!

"**Paula's convincing** arguments don't work. It's not that simple. Most women caught in the Poverty Cycle reject breast feeding for a majority of reasons. Feeding the baby, whether breast or bottle is an important and happy time. It should be the beginning of a real relationship between mother and child.

"**Mother** and the baby need to get involved with each other and that begins to happen physically as the mother holds the baby during the feeding. The baby responds to the mother, the mother responds to the baby, and that's the start of communications.

"**The baby** who is not getting enough to eat may not have the energy or vitality to be interesting to the mother and if the mother is not getting enough to eat she may not have the energy to spend on her baby to stimulate him into play. When that happens, often the baby ends up flat on his back with the bottle, unattended. He gets no attention because he's uninteresting and undemanding. He is uninteresting and undemanding because he gets no attention.

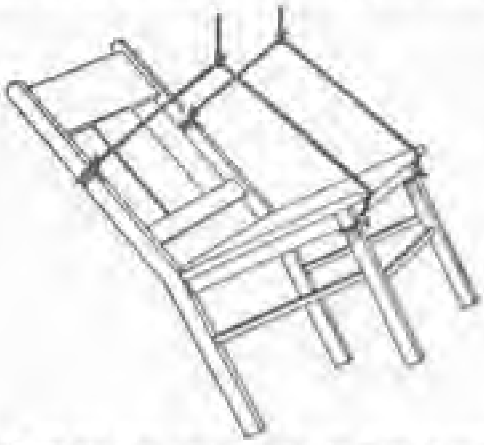
"**Another** of those vicious circles. Vicious because the physical contact and nutrition are important in getting the baby not only to survive, but to thrive."

Not only can breast-feeding be critical to the child's future chances, but

From Popular Mechanics 1915

A Chair Swing

A comfortable porch or lawn swing can be easily and quickly made with a chair as a seat, as follows. Procure some rope of sufficient strength to bear



The Ropes are Tied to the Chair so That It will be Held in a Reclining Position

the weight of the person, and fasten one end securely to one of the front legs of the chair and the other end to the same side of the back as shown in the illustration, allowing enough slack to form a right angle. Another piece of rope, of the same length, is then attached to the other side of the chair. The supporting ropes are tied to these ropes and to the joist or holding piece overhead.

From Popular Mechanics 1915

Attractor for Game Fish

A piece of light wood, shaped as shown and with four small screweyes attached, makes a practical attractor **for game fish,** such as bass, etc., by its **action when drawn through** the water or carried by the flow of a stream. Hooks are attached to three of the screweyes and the fourth one, on the sloping surface, is used for the line.

A Device for Attracting Game Fish Which is Used in Place of Bait

the closeness between the mother and her child in its first three days can be extremely important. "Awake", a Jehovah's Witness bi-weekly publication, in its July 8, 1976 issue, carried a short piece entitled, "Brainy Babies". It stressed the importance of closeness between mother and child from the very beginning.

"Prolonged maternal contact with babies during the first three days after birth improves their speech and brain power, according to a study conducted from Case-Western Reserve School of Medicine. Mothers who received the usual limited hospital contact with their babies were found to have less interest in and affection for their infants than those who had more contact. The 'intimate' mothers went on to spend more time talking to their babies as they grew up. By age five, their babies 'had a richer vocabulary, better comprehension, and could understand more complex and mature language', noted Dr. Normel Ringler. 'And they registered higher scores on the IQ tests."

In most hospitals you will see a roomfull of piteously squalling newborn babies behind glass. I suppose this is so their fathers and relatives can see them. But is this observation by their adult relatives more important than the initial intimacy between them and their mothers? Mothers should insist, before going into a hospital, that their babies be with them every possible minute.

Mongoloids and spastics are images most people have of brain damage. But these are only the obvious signs of certain types of damage. Brain damage may not be so easily noticed, the report continued:

"These two children probably, at first glance, appear very normal to you. However, if you take a closer look, they are behind in height, weight and development.

"This is probably a result of very poor pre-natal and post-natal feeding, in addition to a lot of emotional circumstances on the part of the mother and her whole social history of deprivation.

"The history of malnutrition does not occur. It is an end-of-the-line thing. What you do find is a lot of frail children, small children, an excessive amount of children, with small head sizes. It's like an iceberg. You see only 10% of it. But there is 90% of it that you cannot see.

"A body less than it could have been. A mind less than it could have been. Behind as a baby, behind in school, behind in life. That's the kind of sentence that may be handed down by malnutrition."

Reasons for stunted bodies and brains can be quite specific. A major, and tragically unnecessary cause of damaging malnutrition can be simple iron deficiency.

"It's very hard to prevent iron deficiency in young infants when they're growing very fast. Especially in the first year of life when they triple birth weight. One good way is to encourage breast-feeding. Breast milk has very little iron, but that iron is well absorbed. However in our society it's very hard to maintain breast-feeding for more than two months or so. The only proven way of preventing iron deficiency in the first year of life in a high risk population is by fortifying the infant formula.

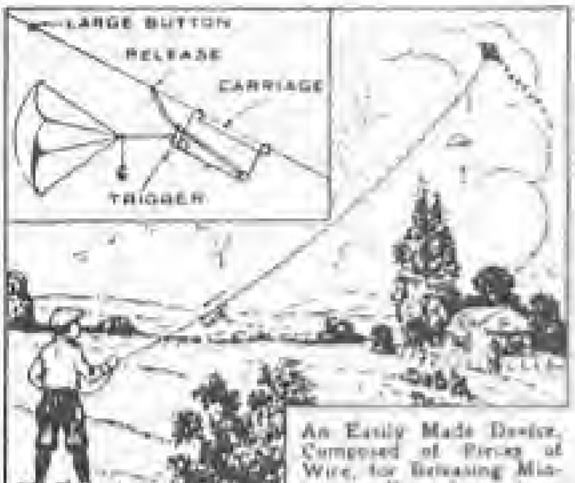
"St. Jude's Hospital is constantly on the lookout, testing for iron deficiency anemia, one of the most widespread forms of malnutrition.

"There are some indications that iron deficient children have poor attention spans and perhaps learn less well. There are some animal studies to indicate that iron deficiency early in the growth of the animal can lead to long-standing changes in the brain.

"The important thing to realize, of course, is that iron deficiency, like any nutritional deficiency, is completely preventable. That, although it has been seen in 25% of the children, at the time the study was begun, this incidence has been reduced to less than 5% by providing food from the beginning of the child's life, containing iron, initially iron containing formulas, and then later on, other iron containing foods. So this is an important cause of

Parachute Drop for a Kite

Every boy likes to drop a parachute from his kite when it is high in the air, but nearly always he has trouble getting



An Easily Made Device, Composed of Pieces of Wire, for Releasing Miniature Parachutes from a Kite String

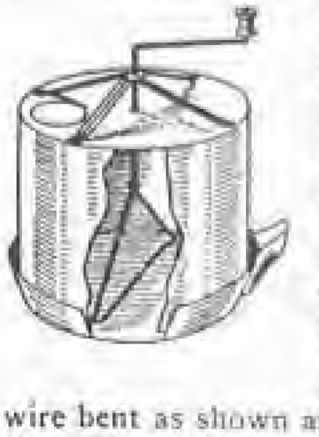
it to drop when he wants it to, or else gets things hopelessly tangled and spoils the fun.

The little device shown in the drawing can be placed on the kite string without breaking the cord. Wire is used for making all the parts, and the completed article should not be more than about 5 in. long. The carriage is first formed, then another small piece for the trigger, and a third for the release.

When formed as shown, the "drop" can be hooked over the string. Tie a short piece of string to the parachute just above the weight, make a loop in the end to slip over the trigger, and drop the release over the trigger, as well. The wind will catch the parachute and pull it toward the kite, right up the string. Then, the minute the release strikes the large button that has already been tied to the kite string, the former will be raised, releasing the trigger and liberating the parachute, while the drop comes sliding down the string ready for another trip.—

A Pop-Corn Popper

The accompanying sketch shows the construction of a pop-corn popper for thoroughly flavoring the corn with the hot butter or lard, and at the same time mixing it with the necessary amount of salt. Procure a metal bucket that just fits the bottom of the frying pan. The stirring device is made of heavy wire bent as shown and provided with an empty spool for a handle. A brace is made of tin bent in the shape shown and riveted to the bottom of the bucket.



nutritional deficiency in America today. It's also a cause which is completely preventable."

Then of course, there is protein. A nutritionist on the program said: "I try to get every woman to have a quart of milk and two eggs every day. Forty grams of the highest quality protein. And we go over the whole concept of how protein protects the mother's liver, prevents her from having toxemia abruption as well as protecting the baby's brain. And when we focus attention on whole grains, green leafy vegetables, yellow and orange vegetables and fruits, what nutritionists call the basic four, and when the doctor does it, it is so effective."

The nutritionist went on about drugs: "The other thing I wanted to bring up was the drugs. When I teach women to eat I say don't take any drug unless you absolutely need it. And the two drugs that worry me the most are amphetimines (and diuretics). You wouldn't believe that in the late '40s the drug industry began to promote amphetimines to hold weight down. And they put it right into obstetrics so that women got amphetimines, and still get them in many areas, to keep their weight down.

"The other thing is diuretic pills, and as I mentioned before, up to two million women a year in this country, out of four million, (preggies, I'm sure he meant) were given water pills."

Ideally, those finding themselves pregnant should temporarily swear off coffee, tea, alcohol, tobacco, marijuana, etc. Not even aspirin or any other non-prescription medication. A woman with diabetes or any other physical or mental disability requiring long-term medication will be in bad shape when the crash comes. Regardless of the potential effects of her medications on her unborn child, she should leave child-bearing to others.

To sum it all up, becoming a diet-nut and avoiding all non-food stimulants and medications may seem a months' long drag. Take your mind off it with some hobby.

The little pleasures a preggy gives up for a few months will seem as nothing if the product is a healthy, joyous, lifelong friend. But if, through stupidity and a lack of self-discipline, she damages the baby while she's still carrying it, she may later wish the expensive monster, and even she, had never been born.

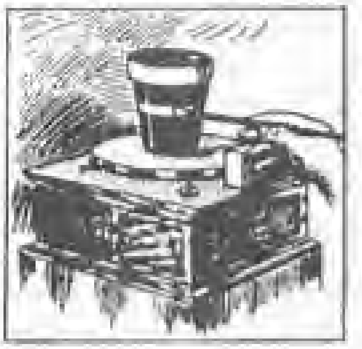
Edging Flower Beds — From Popular Mechanics 1915

To improve the appearance of a flower bed, it must be edged evenly and quite often. As this became a tiresome task, I constructed an edger, as shown in the sketch. It consists of a wheel on a 4-ft. length of material, 2 by 4 in. in size, made tapering and having a cross handle, 18 in. long, attached to its end. The wheel is 8 in. in diameter, and the cutter is attached, as shown, across the center of the wheel axle, to make the edger turn easily on curves and corners. The cutter is 12 in. long and turned under 1½ in. It is pushed along in the same manner as a garden cultivator.

An Edger, Similar to a Garden Plow, for Quickly Trimming the Sod around a Flower Bed

Phonograph as a Banding Wheel

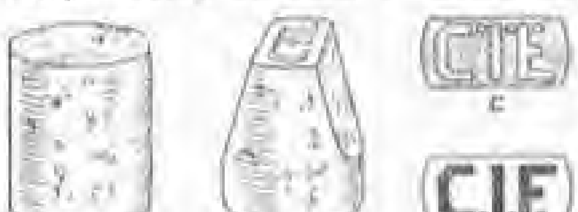
One of the most difficult pieces of work the decorator of pottery or china has to do is to make a continuous band of color around an article so that it will not deviate from the horizontal but will meet perfectly at the ends. The drawing shows how a phonograph can be used as a banding wheel. The brush is held firmly at the proper height and brought in contact with the work as the latter rotates.



From Popular Mechanics 1915

Substitute for a Rubber Stamp

A large number of coupons had to be marked, and having no suitable rubber stamp at hand, I selected a cork with a smooth end and cut the initials in it. I found that it worked as well, not to say better, than a rubber stamp. An ordinary rubber-stamp pad was used for inking. Angular letters will cut better than curved ones, as the cork quickly dulls the edge of any cutting tool.



Initials Cut in a Cork Served the Purpose in the Absence of a Rubber Stamp

A Home-Made Hand Vise

A very useful little hand vise can easily be made from a hinge and a bolt carrying a wing nut. Get a fast joint hinge about 2 in. or more long and a bolt about ½ in. long that will fit the holes in the hinge. Put the bolt through the middle hole of the hinge and replace the nut as shown in the drawing. With this device any small object may be firmly held by simply placing it between the sides of the hinge and tightening the nut.

Hand Vise Made from a Hinge

GUEST EDITORIAL

SURVIVAL SCHOOLS

T.A. DeMattis, Editor
The Ultimate Society
P.O. Box 6
Lakehurst, NJ 08733

Choosing a survival destination is not something to do casually. A bad location or poorly organized compound can expose inhabitants to unnecessary risks of privation, attack by hostile adventurers, or even to fatal accidents with loss of life and fortune.

Recent surveys by survival experts alerts people to the problems. Of several installations studied, they lacked sufficient storage of food and other vital necessities. Some didn't even have medical aide, and their water supply was limited to a small hand-pump barely able to deliver 2 or 3 gallons of water per minute. In one location, the encampment was close to a highly traveled road, only 25 miles from a major city. This would be a prime target for roving bands of hungry refugees, and in another, they didn't even have a shotgun to defend themselves. Few in all the places visited could be considered self-sufficient and safe for any extended stay in the event of trouble.

A well developed retreat must, first of all, be far out of reach of marauders, preferably 60 to 100 miles away from urban centers. It must be out of sight from any interstate highway or main road, and in a defensible position, well hidden in the contour of surrounding landscape. Its store of supplies should include dehydrated and freeze-dried foods having a shelf-life of ten years or more, as well as food supplements as vitamins and minerals. Canned foods are prone to spoil after a few years of storage, and may even be dangerous to consume. There must be adequate water [stored or available], and provisions for sanitary facilities.

In addition to essential supplies, a good retreat will have been well organized with a complement of trained men and women able to take care of sickness and accidents; guard the outpost; prepare rationed portions of meals, and grow or hunt for food if necessary. This means having farmers, craftsmen, soldiers, doctors, engineers and technicians who are versed in the technological arts and crafts. Any group of people without proper leadership, arms and equipment, cannot long survive in any circumstance.

There are growing numbers of survival schools now teaching basic ways one can live "off the land" in a wilderness environment. Some give complete courses in extensive survival training by groups who band together because of common interests, such as social, fraternal, religious, sports, and newly organized 'survival clubs'. One of the best schools is the PIONEER SURVIVAL ACADEMY, P.O. Box 547, Hamilton, MT 59840, and the Carla Emery School in Hendricks, Idaho — an alternative farmstead that also teaches how to raise food.

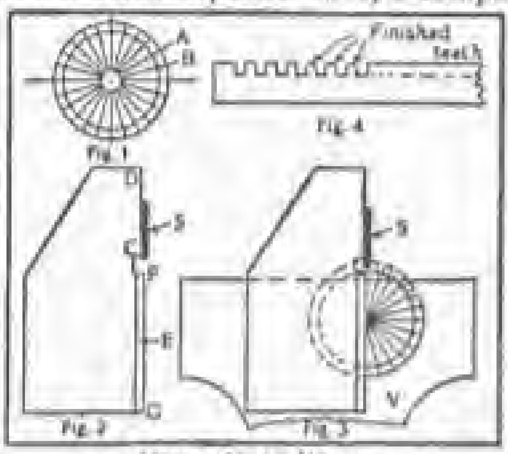
Among many interesting subjects taught by PSA is basic automobile survival, down to earth self defense techniques and weaponry skills, what to do when lost in the wilderness, guarding against extreme heat and cold, backwoods medicine and proper first aid "pioneer style", how to locate and purify water, primitive fire making and cookery, tracking and trapping of animals, fish and fowl, finding edible roots, avoiding poisonous plants, insect bites, dangerous predators, etc. They also wise you up to the proper role of government, true American history, the origin and purpose of the Bill of Rights for all independent people under the U.S. Constitution.

Another good source of guidelines in what to do in the event of trouble is provided by the JOURNAL OF CIVIL DEFENSE, P.O. Box 910, Starke, Fl. 32091. This bi-monthly magazine, formerly called "Survive" gives you official facts about civilian defense, and what one must do when social order breaks down. It reveals what really makes Soviet Civil Defense tick: what guarantees the USSR over 94% survival in a

How to Make SMALL GEARWHEELS
Without a Lathe

Popular Mechanics 1913

To make small models sundry small gears and racks are required, either cut for the place or by using the parts from an old clock. With no other tools than a hacksaw, some files, a compass,



Making Model Wheels

and with the exercise of a little patience and moderate skill, very good teeth may be cut on blank wheels.

First take the case of a small gearwheel, say 1 in. outside diameter and $\frac{1}{16}$ in. thick, with twenty-four teeth. Draw a circle on paper, the same diameter as the wheel. Divide the circumference into the number of parts desired, by drawing diameters, Fig. 1. The distance AB will be approximately the pitch. Now describe a smaller circle for the base of the teeth and halfway between these circles may be taken as the pitch circle.

Now describe a circle the same size as the largest circle on a piece of $\frac{1}{16}$-in. sheet metal, and having cut it out and filed it up to this circle, fasten the marked-out paper circle accurately over it with glue. Saw-cuts can now be made down the diameters to the smaller circle with the aid of a saw guide, Fig. 2, made from $\frac{1}{16}$-in. mild steel or iron. This guide should have a beveled edge, E, from F to G, to lay along the line on which the saw-cut is to be made. The straight-edge, CD, should be set back one-half the thickness of the saw-blades, so that the center of the blade, when flat against it, will be over the line FG. A small clearance space, FC, must be made to allow the teeth of the saw to pass.

The guide should then be placed along one of the diameters and held in position until gripped in the vise, Fig. 3. The first tooth may now be cut, care being taken to keep the blade of the saw flat up to the guiding edge. The Model Engineer, London, says if this is done and the saw-guide well made, the cut will be central on the line, and if the marking-out is correct the teeth will be quite uniform all the way round. A small ward file will be needed to finish off the teeth to their proper shape and thickness.

In making a worm wheel the cuts must be taken in a sloping direction, the slope and pitch depending on the slope and pitch of the worm thread, which, though more difficult, may also be cut with a hacksaw and file.

A bevel wheel should be cut in the same manner as the spur wheel, but the cut should be deeper on the side which has the larger diameter. To cut a rack the pitch should be marked along the side, and the guide and saw used as before (Fig. 4).

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nuclear attack, and exposes the ingredients for Soviet success in "people protection."

There are too many false assumptions about what to do and what is going on around the world. People are going their merry ways of spending and consuming vital substances, oblivious of social/economic trouble which lies in the wake of international problems, and troubles right here at home. One of the most important of these is economics, or what makes our monetary system work. Right now, paper dollars can still buy goods, but it has a purchasing power of only 27¢ on the dollar. At the present rate of devaluation, and barring another round of double-digit inflation, it will be worth less than a nickle by 1985. People are foolishly saving their dollars in banks, stock, bonds and other paper equities——which wouldn't be worth the printing in the event general bankruptcies now threatened in some of our major cities.

Wise people are not only conserving on expenditures, but converting their dollars into gold and silver coins and other tangible assets which can be exchanged for goods and services. A trustworthy source of buying precious coins is CENTRE COIN CO. P.O. Box 1, Sherman Oaks, CA 91413. Several others are being checked out and will be reported in future issues of this column. Wise people are not only hedging their bets with money leverage, but investing in good properties suitable for group survival——a place where they may safely store essential food and other goods, and be reasonably assured that, comes trouble, they have their own place of retreat along with others of like mind and sense. In such unity, there is strength.

SURVIVAL TOWN, USA is but one of these prepared establishments located on the eastcoast. Julius Rose who ramrods the outfit, can be contacted at Box 188, Richland, NJ 08350. His project may be primitive and premature, but is starting to gather adherents to his concept of 'survival', and who knows but that metropolitanites from N.Y. & Phila. may need such a place after the fiasco of the 1976 national elections/conventions and partying.

The Emergency Broadcast System [EBS] is little noted or taken seriously by radio listeners whenever a test is done by major networks on order of the FCC. When that signal becomes real [one day soon], millions of our people will be caught with their pants down——you can be sure. Chaos is sure to take place, and wise are those who prepare and plan in advance. Like insurance, we hope we'll never need it, but oh, how good it is to have it when calamity strikes. T.A. DeMattis

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Homemade Vaporizer

A simple vaporizer which can be used by designers to project their colors in a fluid spray, or by housekeepers to disinfect or perfume their apartments, can be made in the following manner: Two goose quills are forced through holes in a cork at right angles to each other, as shown. Place the vertical quill in a bottle containing the fluid to be sprayed and by blowing through the horizontal quill a very effective spray will be produced.

THE HOME SMELTER

The material for smelting was taken from Knight's American Mechanical Dictionary, 1874. I had hoped to come upon many ingenious methods on how the homefolk of that day smelted their own metals. I was disappointed to learn that people in 1874 left smelting to the smelting companies. At that time they weren't threatened by the breakdown of those companies and so weren't interested in doing such basic metallurgy at home. Grandad wasn't a survivalist. He was an industrial progressive. As fast as big industry took over a home industry, home industry was abandoned. If the home industrialist couldn't clean up his act and compete with the big boys, his neighbors took their trade elsewhere.

Even so, Grandad had simpler methods, more applicable to individual enterprise than are commonly known today. The basic principals were better understood and improvisation saved many a project that would have been abandoned in our time.

In the case of smelting and other industrial processes, 1874 methods are still beyond the resources of individual survivalists. But Knight's does give the historical methods and principles, seldom bothered with in technical manuals written today.

Therefore, once the 1874 methods are understood, even though they are inapplicable, the individual can still apply some of the their improvements to Knight's descriptions of historical methods. This will give you the basic methods of history, the 19th century, and combined with today's blacksmithing practices, you should be able to improvise a system to suit your own needs.

Smelt'ing-fur'nace. A furnace for disengaging the metal from its gangue or the non-metalliferous portions of the ore. The furnaces differ much for treating different metals.

The smelting-furnace for iron is in the form of a truncated quadrilateral pyramid about 50 or 55 feet high. The outer part is of brick or squared stone, with contrivances to obviate the danger of its cracking by the expansion that takes place when it is heated, and it is lined with two courses of fire-bricks having a layer of pounded coke between them to prevent the escape of the heat. The interior or cavity may be divided into the following parts from below upward. First, the hearth, about two feet high; its base and sides are formed of massive blocks of coarse, pebbly gritstone, as being the most infusible of all common building-stones. Upon this is erected the crucible, a four-sided cavity between 6 and 7 feet high, slightly enlarging upward, so as to be at top about 2½ feet wide. The part above, called the *boshes*, is in the shape of a funnel or inverted cone, about 8 feet high and 12 feet wide at top. On this is placed the great cavity of the furnace, of an irregular conical form, about 30 feet high, and gradually narrowing so as to be only about 3 feet in diameter at the top. From this part it enlarges into a funnel-shaped chimney, about 8 feet high, in which is cut a large square aperture, through which the charge is thrown from time to time into the furnace. About two feet above the hearth is an aperture through which the blast-pipe or tuyere is introduced. Sometimes there are two opposite tuyeres, and occasionally even three.

The character of the iron is affected by the nature of the fuel, and, by the choice of the latter, metal may be rendered more suitable for the purpose for which it is intended.

The effect in the smelting-furnace is due to the high temperature, and this is produced by the action of the oxygen of the atmosphere, which enters at the tuyere-hole, excites intense heat by combination with the carbonaceous particles of the fuel, the other constituents of the air passing out, in company with certain gases evolved, at the top of the furnace.

The air may be hot or cold, but is driven by a machine of some description. Varieties of the original forms of blowers may be found under *bellows*, but the larger kinds of blast apparatus are associated under the caption BLOWERS (which *see*). In a furnace working under high pressure and delivering 6,292 cubic feet per minute (estimated at atmospheric pressure), the weight of the air thrown in is calculated at 693,604 pounds, while the charge of coke, ore, and limestone in the same time amounts to 74,648 pounds.

The heat is developed, as has been said, by the combination of the oxygen of the air with the carbon of the fuel; but part of the carbon is required to reduce the magnetic oxide to the metallic state, and some carbon is also required to unite with the iron to form cast-iron, which is a compound of iron and carbon. The amount of air required will therefore be the quantity necessary to combine with the remainder of the carbon of the fuel, after deducting the amount of carbon required to reduce the oxide, and to unite with the metal.

The charge, placed on top of the furnace, descends gradually, the iron becoming gradually carbonized. As the carbon penetrates the fragments of ore, the limestone parts with its carbonic acid, which passes off. The fuel loses some of its combustible ingredients. As the charge comes under the direct action of the blast, the reactions are more energetic, the fuel burns rapidly, its carbon uniting with the oxygen and with the metal, which becomes melted, while the lime unites with the earthy particles to form a fusible slag; the fused matters descend from the boshes into the crucible, the metal, by its superior gravity, taking the lower position on the hearth, from whence it is drawn off from time to time, either into ladles to form castings, or into furrows made in sand, where it is run into pigs.

The vitreous scoriæ or *slag* floats on the iron and overflows at an aperture.

The appearance of the slag indicates the cooking condition of the furnace. Here the skill of the smelter will watch the healthy working of his furnace, detect the signs of disorder, and determine upon the appropriate remedies.

An authority gives the following indications: If the color of the slag be pale yellow, the sign is favorable. Green color indicates oxide of iron and a deficiency of lime. Streaks of blue indicate protoxide of iron, and show a deficiency of fuel or excess of blast.

Dark-colored, heavy slag shows that iron is going to waste, and suggests that the iron produced will be deficient in carbon. It indicates either a deficiency of fuel or a too rapid working of the furnace, so that the iron was imperfectly carbonized on arriving within the action of the blast.

Great economy of fuel, with a generally admitted deterioration of quality of the metal, is effected by using a blast, heated artificially. The heat attained varies from 200° to 600° Fah. This was invented by Neilson.

The primitive smelting-furnace by which the "iron is taken out of the earth" (Job xviii, 2), and which the Hebrews learned to use while in Egypt, was probably like the ancient Indian furnace yet used in Asia, and thus described by Dr. Ure: —

"The furnace or *bloomary* in which the ore is smelted is from 4 to 5 feet high; it is somewhat pear-shaped, being about 5 feet wide at bottom and 1 at top. It is built entirely of clay. There is an opening in front about a foot or more in hight, which is filled with clay at the commencement, and broken down at the end of each smelting operation. The bellows are usually made of goat's skin, and the nozzles are inserted into tubes of clay which pass into the furnace.

"The furnace is filled with charcoal, and a lighted coal being introduced before the nozzles, the mass in the interior is soon kindled. As soon as this is accomplished, a small portion of the ore, previously moistened with water to prevent it from running through the charcoal, but without any flux whatever, is laid on top of the coals, and covered with charcoal to fill up the furnace. In this manner ore and fuel are supplied, and the bellows urged for three or four hours. When the process is stopped, and the temporary wall in front broken down, the bloom is removed with a pair of tongs from the bottom of the furnace."

It was said of the land of Canaan (Deuteronomy viii. 9), "a land whose stones are iron, and out of whose hills thou mayest dig brass" (copper). The hills of Palestine furnished the ore in the time of the Judges, and do to this day. It was used for making the bedstead of Og, king of Bashan (see BEDSTEAD), for the axes and sickles of the Egyptians from time immemorial, and for axes in Palestine in the times of Samson and Elisha; for chains in the time of Jeremiah; harrows in the time of Samuel and David; for mattocks, files, goads, swords, spears, shares, colters, forks, etc., previous to the time of Saul, say about 1100 B. C., and no doubt long before.

The Israelites worked in the iron-furnaces of Egypt during their captivity. The rigidity and strength of iron afford a basis for several metaphors in that most ancient and wonderful poem, the Book of Job.

The iron-smelting furnaces of Africa are thus described by Dr. Livingston: —

"At every third or fourth village (in the regions near Lake Nyssa) we saw a kiln-looking structure, about 6 feet high and 2½ feet in diameter. It is a clay, fire-hardened furnace for smelting iron. No flux is used, whether the specular iron, the yellow hematite, or magnetic iron ore be used, and yet capital metal is produced. Native manufactured iron is so good that the natives declare English iron 'rotten' in comparison, and specimens of African hoes were pronounced at Birmingham nearly equal to the best Swedish iron."

Dr. Barth makes a similar statement.

The articles produced by these peoples are hammers, tongs, hoes, adzes, fish-hooks, needles, and spear-heads. The *assagais* of the Caffres are made of iron similarly procured, and of excellent quality. The *wootz* of India is still produced in the manner partially described by Aristotle when speaking of India, and by Diodorus Siculus, referring to the iron ores of the island of Ethalia.

The Hottentots, though so far below the average of what may be classed as savages, have pottery, iron manufactures, sheep, and oxen.

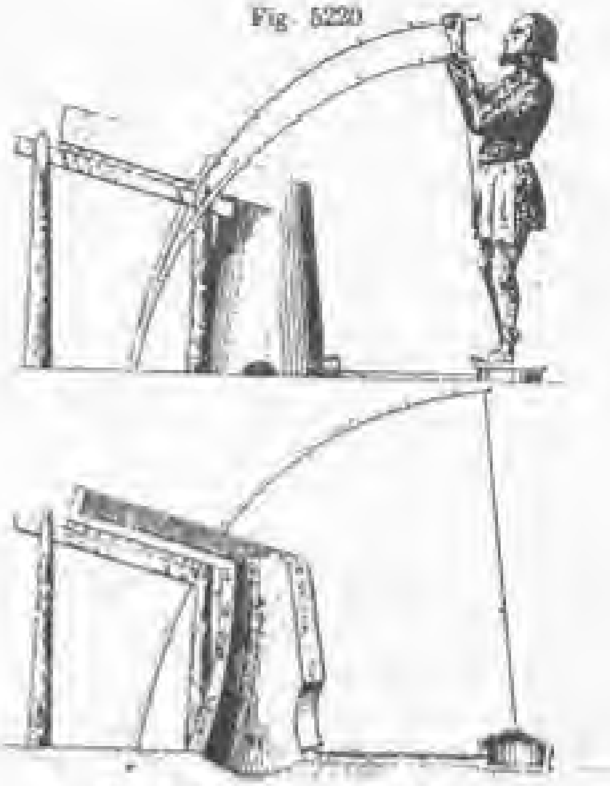
Their iron-furnace is a hole in a raised ground, large enough to contain a good quantity of iron stones, which are plentiful on the surface in some parts of their country. About 18 inches from the upper hole they make a smaller one, connecting with the former by a narrow channel. A hot fire is made in the upper hole, sufficiently long to heat the earth thoroughly, and it is then charged with fuel and iron. Fuel is added, and the fire urged until the metal runs into the receiver. When it is cool it is broken into pieces, heated, and hammered out with stones. It is almost exclusively used for making weapons.

Fig. 5220 represents a blast-furnace of the Kols, a tribe of iron-smelters in Lower Bengal and Orissa. The men are nomads, going from place to place, as the abundance of ore and wood may prompt them. The charcoal in the furnace being well ignited, ore is fed in alternately with charcoal, the fuel resting on the inclined tray, so as to be readily raked in. As the metal sinks to the bottom, slag runs off at an aperture above the basin, which is occupied by a viscid mass of iron. The blowers are two boxes with skin covers, which are alternately depressed by the feet and raised by the spring-poles. Each skin cover has a hole in the middle, which is stopped by the heel as the weight of the person is thrown upon it, and is left open by withdrawal of the foot as the cover is raised.

Variously modified in detail and increased in size, these simple furnaces are to be found in several parts of Europe, the Catalan and Swedish furnaces resembling in all probability those of the Chalybes, so famous in the time of Marathon (490 B. C.), and those of the *fabrica* or military forge established in England by Hadrian (A. D. 120) at Bath, in the vicinity of iron ore and wood. The brave islanders met their Roman invaders with scythes, swords, and spears of iron, and the export of that metal from thence shortly afterward is mentioned by Strabo.

During the Roman occupation of England some of the richest beds of iron ore were worked, and the *débris* and cinders yet

Fig. 5220



Kol Smelting-Furnace, Hindostan.

exist to testify to two facts, — one, that the amount of material treated was immense; the other, that the plans adopted were wasteful, as it has since been found profitable to work the cinders over again.

During the Saxon occupation the furnaces were still in blast, especially in Gloucestershire.

The direct method of obtaining wrought-iron from the ore prevailed until the commencement of the fifteenth century, and then gradually gave way to a less direct process, but one more convenient in the handling of large quantities. Furnaces, operating by the aid of a strong blast, to *melt* the iron and obtain *cast-iron*, which is carbureted in the process, were in use in the neighborhood of the Rhine about 1500. A second process in a *forge* hearth was used to eliminate the carbon and other impurities, and the result was *wrought-iron*.

It took several centuries to accomplish this with wood, and several other centuries to devise means for substituting pit-coal for charcoal.

In the reign of Elizabeth blast-furnaces were of sufficient size to produce from two to three tons of pig-iron per day by the use of charcoal. In the small works the iron was made malleable before being withdrawn from the blast-furnace, and in larger works was treated by the refinery furnace.

Wood becoming scarce, and a number of furnaces having gone out of blast, in 1612 Simon Sturtevant was granted a patent in England for 31 years for the use of pit-coal in smelting iron. Failing in his proposed plans, he rendered up his patent in the following year. Successive persons applied for a patent for the same, the government continuing desirous of encouraging the development of home resources. Dudley, in 1619, succeeded in producing three tons of iron per week in a small blast-furnace by the use of coke from pit-coal. The parties who yet possessed plenty of wood, and with whom the production of iron was fast becoming a monopoly, urged the charcoal-burners to destroy the works of Dudley, which was done. Dudley's patent was granted for 31 years, which would bring it to 1650, the time of the Protectorate, when England had a ruler fit to succeed Queen Bess. The celebrated statute of King James, limiting the duration of patents to 14 years, was passed in 1624. Dudley's petition for an extension was refused.

Iron of poor quality continued to be made in districts where wood was scarce, and of good quality from charcoal in places where forests yet remained. The demand for iron continuing to grow, — a natural effect of advancing civilization, — iron was imported from Sweden and Russia in large quantities and of excellent quality. The forests of these countries gave them a natural advantage over England, whose forests had by this time become thinned out, so that the use of wood for iron smelting had been forbidden by act of Parliament in 1581 within 22 miles of the metropolis, or 14 miles of the Thames, and eventually was prohibited altogether.

The art of making iron with pit-coal and of casting articles of iron was revived by Abraham Darby, of Colebrookdale, about 1713, and was perseveringly followed, although it was but little noised abroad. In the "Philosophical Transactions" for 1747 it is referred to as a curiosity.

The extension of the iron manufacture dates from the introduction of the steam-engine, which increased the power of the blast; and the blowing engines, driven by manual, horse, or ox power, were henceforth operated by steam-engines. The dimension of the blast apparatus was increased from time to time, and about 1760 coke was commonly used in smelting. In 1760 Smeaton erected at the Carron Works the first large blowing cylinders, and shortly afterward Boulton and Watt supplied the steam-engines by which the blowers were driven. Neilson, of Glasgow, introduced the hot blast in 1828. Aubulos, in France, in 1811, and Budd, in England, in 1845, heated the blast by the escaping hot gases of the blast-furnace. In the smelting of iron four tons weight of gaseous products are thrown off into the air for each ton of iron produced.

As a means of estimating by comparison the value of the hot blast, some facts may be mentioned. Mushet states that at the Clyde Iron Works, before the introduction of the hot blast, the quantity of materials necessary for the production of one ton of pig-iron was, —

Calcined ore .... 1¾ tons
Coke .... 3 tons
Limestone .... ½ ton.

In 1831, when the system was coming into use, the blast being *warm*, —

Calcined ore .... 2 tons
Coke .... 2 tons
Limestone .... ½ ton.

In 1839, with a hot blast, —

Calcined ore .... 1¾ tons
Coke .... 1¾ tons
Limestone .... ½ ton

the saving in fuel being nearly one half.

In addition may be mentioned the fact that anthracite coal and black band ore are intractable under the cold blast, but the former yields an intense heat, and the latter a rich percentage of good iron with the hot blast.

The Calder Works, in 1831, demonstrated the needlessness of coking when the hot blast is employed.

Experiments in smelting with anthracite coal were tried at Mauch Chunk in 1820, in France in 1827, and in Wales successfully by the aid of Neilson's hot-blast ovens in 1837. The experiment at Mauch Chunk was repeated, with the addition of the hot blast, in 1838–39, and succeeded in producing about two tons per day. The Pioneer furnace at Pottsville was blown in July, 1839.

The first iron-works in America were established near Jamestown, Virginia, in 1619. In 1622, however, the works were destroyed, and the workmen, with their families, massacred by the Indians. The next attempt was at Lynn, Massachusetts, on the banks of the Saugus, in 1648. The ore used was the bog ore, still plentiful in that locality. At these works Joseph Jenks, a native of Hammersmith, England, in 1652, by order of the Province of Massachusetts Bay, coined silver shillings, sixpences, and threepences, known as the *pine-tree coinage*, from the device of a pine-tree on one side.

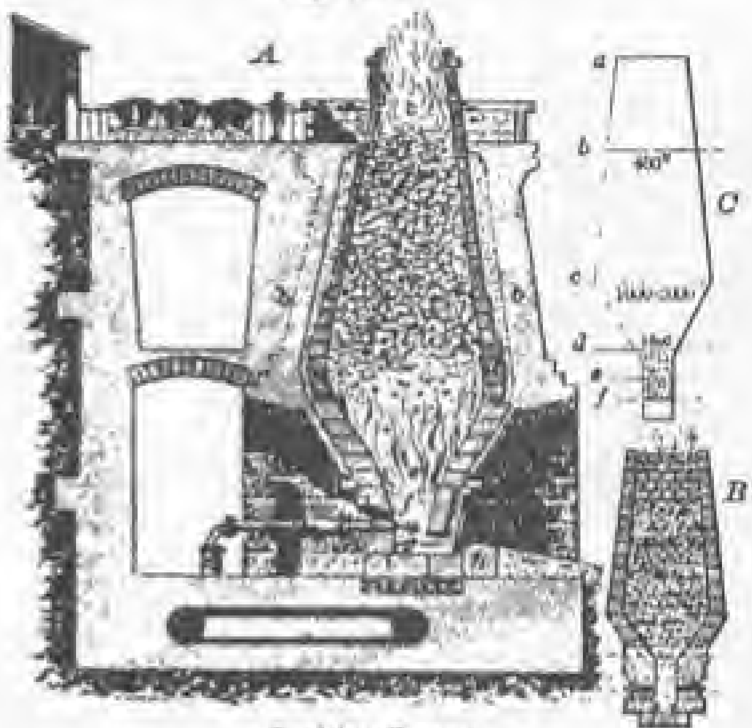
Early in the eighteenth century, a smelting-furnace was erected in Virginia by Sir Alexander Spottswood, governor of Virginia, who lived at the Temple Farm, near Yorktown, Va. He had been wounded at Blenheim, where he served with Marlborough. He was the first to cross the Blue Ridge and see the Shenandoah Valley. He was appointed commander of the expedition to Carthagena, but died at Annapolis, Md., June, 1740, as the troops were about to embark. He was buried in the mausoleum from which the Temple Farm derived its name. In this expedition the elder brother of George Washington served, and on his return named his estate on the Potomac "Mount Vernon," after the English admiral.

The blast-furnace for reducing iron from its ores is shown at Fig. 5221, *A*.

It consists of an interior lining of fire-bricks *a a*, forming a doubly conical chamber, surrounded by a packing of broken scoriæ or refractory sand, and incased within a construction of masonry *b b*, from the upper part of which the charge of fuel and ore is delivered through a suitable opening into the furnace.

The portion from *c* to *d* is termed the *shaft*; *d* to *e*, the *boshes*; the widest part being the *belly* or upper part of the boshes;

Fig. 5221.



Smelting-Furnace.

the narrow part *f* the throat, below which is the crucible or hearth *g*, which receives the molten metal; the lower part of this is prolonged toward the front, forming the breast-pan, which is closed by the dam-stone *h*, between which and the side of the furnace wall is a slit, called the tap-hole, closed by fire-clay, which is removed to withdraw the molten metal. The dam-stone is protected by an iron plate. The top of the open side of the hearth is formed by a large slab of stone, termed the *tymp*, supported by a massive piece of iron, termed the *tymp-iron*. *i* is one of the tuyeres, usually two in number, through which compressed air is forced, to assist combustion and promote fusion of the metal.

The furnace is charged first with fuel, and as this burns down alternate layers of fuel and of mixed ore and limestone or other flux, according to the nature of the ore employed, are added (*B*).

The iron collects on the hearth, while the slag produced by the combination of the flux with the foreign matters in the ore floats on top and is drawn off over the dam-stone. As the hearth becomes filled with metal, usually about twice in 24 hours, the tap-hole is opened and the metal allowed to flow.

The interior of the furnace may be divided into five zones: the first heating zone *a b* (Fig. 5221, *C*); the reduction zone *b c*; the carburation zone *c d*; the melting zone *d e*; the combustion zone *e f*. In the first, the materials become thoroughly dried and are brought to a low red heat; in the second, the ore is reduced to a protoxide, and finally to metallic iron, by the various gases, carbonic oxide, carbureted hydrogen, and hydrocyanic-acid gas or vapors of cyanide of potassium; in a certain part of this zone the iron is present in a malleable state. In the carburation zone the metal becomes combined with carbon, producing a steely and caky iron, which, ou falling into the lower or melting zone *d e*, becomes fully charged with carbon, by which it is brought into the condition of pig-iron.

The figures indicate the temperatures at the respective parts of the furnace.

Buttgenbach's blast-furnace is so arranged that the base is independent of the stack, which is a mere shell of fire-bricks, about equal in thickness to the lining of the ordinary blast-furnace.

The base is formed either of brickwork with open arches (*A*) or of cast-iron standards (*B*). In the first case the shaft rests on a crown-ring above the tops of the arches, and in the latter upon a cast-iron ring-plate supported by the standards. The boshes join the stack just above the base-ring, and both are hooped at intervals; they and the tuyeres are protected by water-boxes. The gases are led off by a central tube, and through lateral openings, which communicate with the hollow columns, which serve as down-takes, and also support the gallery.

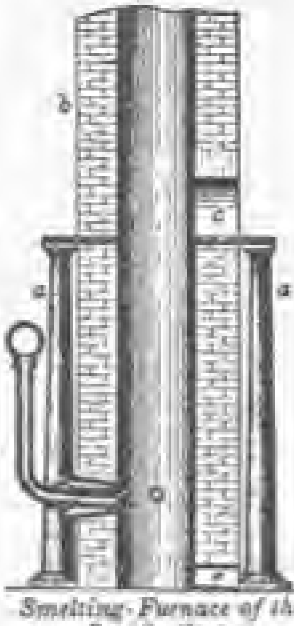
Fig. 5222.

Smelting-Furnace.

Fig. 5223 is a vertical section of the smelting-furnace commonly used in the Pacific States.

Four cast-iron columns, from 8 to 11 feet high, support a square cast-iron plate *a* with a circular hole about 4 feet in diameter. On this plate is built the stack *b* of the furnace, with an opening *c* through which the furnace is charged. Under the plate and inside the columns is built the cylindrical shaft of the furnace, filling the space from the plate to the ground. *d* is a tuyere, and *e* the stirring and discharging hole.

Fig. 5223.



Smelting-Furnace of the Pacific States.

The smelting-furnace of Shropshire, England, is a stone and brick structure of a truncated conical form, 56 feet high, and 38 wide at bottom. Its cost, there, is about £1,500; and it requires in its construction 160,000 bricks, 3,000 fire-bricks, and 825 bosh-bricks. Its production is about 60 tons of iron per week. The furnaces are built larger and smaller than the size mentioned. Including the coal of calcination, it is estimated that 3½ tons of coal are required to obtain a ton of cast-iron. The proportions of the materials dumped into the furnace are 14½ tons of coke, 16 of roasted ore, 6¾ tons of limestone, every 24 hours, producing 7 tons of pig-iron every 12 hours. Advantage is taken of a side-hill to make a convenient access for charging and delivering.

In the illustration, *a* represents the regulating-cylinder, 8 feet in diameter and hight; *b*, the floating piston, loaded with weights, proportionate to the power of the machine; *c*, a valve 26 inches long, 11 inches wide, by which the air is passed from the pumping-cylinder into the regulator; *d*, the aperture at which the blast is forced into the pipe leading to the tuyere. The pipe is 16 inches in diameter; the wider this can be made, the less is the friction and the more powerful the blast; *e* is the blowing or pumping cylinder, 9 feet high, and 6 feet in diameter, the piston within it having a stroke of from 5 to 7 feet; *f*, the blowing piston, with its valve or valves, of which there are sometimes several distributed over the surface of the piston, the area of each being proportioned to the number; *g* is a pier of stone or masonry supporting the regulating-cylinder, to which is attached the flange and blowing-cylinder; *h* is the safety-valve or cock, by the simple turning of which the blast may be admitted to or shut off from the furnace, passing to a collateral tube on the opposite side; *i*, the tuyere, by which the blast enters the furnace; the end of the taper pipe which approaches the tuyere receives small pipes of various diameters, from 2 to 3 inches, called nose-pipes; these are applied at pleasure, as the strength and velocity of the blast

Fig. 5224.

Shropshire Smelting-Furnace.

may require. *k*, the bottom of the hearth, 2 feet square; *l*, the top of the hearth, 2 feet 6 inches square; *k l*, the hight of the hearth, 6 feet 6 inches; *l* is also at the bottom of the boshes, and where they terminate is of the same size as the top of the hearth, only the former is round and the latter square. *m*, the top of the boshes, 12 feet diameter and 8 feet perpendicular hight. *n*, the top of the furnace, at which the materials are charged, commonly 3 feet diameter; *m n*, the internal cavity of the furnace from the top of the boshes upward, 30 feet high; *n k*, total hight of the internal parts of the furnace, 44½ feet. *o o*, the lining; this is done in the nicest manner, with fire-bricks made on purpose, 13 inches long and 3 inches thick. *p p*, a vacancy round the outside of the first lining, 3 inches broad, and filled with coal-dust; this space is allowed for the expansion which might take place in consequence of the swelling of the materials by heat when descending to the bottom of the furnace. *q q*, the second lining, similar to the first. *r*, cast-iron lintel on which the bottom of the arch is supported. *r s*, the rise of the arch; the arch on the outside is 14 feet high and 18 feet wide. *v v* are the extremes of the hearth, 10 feet square; this and the bosh-stones are always made from a coarse gritted freestone, whose fracture presents large rounded grains of quartz, connected by a cement less pure.

The description by an iron-master, as given by J. R. Chapin, gives a sensible idea of the process: —

"You must know that there are about 140 tons of material in the furnace, in the proportion of 60 to 75 tons of ore, 60 tons of coal, and 15 to 20 tons of limestone, fed into the furnace at the opening above. The furnace is 40 feet square at bottom, and 40 feet high, with a hollow space or "flask" in the center, lined with fire-brick, and about 14 feet in diameter. The material dumped into the furnace becomes melted, and the iron, being the heaviest, sinks to the bottom, while the flux, like oil upon water, floats upon the surface, and, having an affinity for the dross of the coal and iron, it grasps and holds it separately from the metal, until it is drawn off in what is called *slag*. This is done once every hour. The gases evolved pass out at the chimney. The trouble is, the iron also has an affinity for the dross, and does, and will, retain some of it, notwithstanding all we can do.

"The floor of the building is of fine sand, divided into two parts by a track, on either side of which gutters, or *runners*, are formed leading from the mouth of the furnace. At equal distances are 8 branch gutters, or *sows*, as they are technically called, which conduct the molten ore to feed the *pigs* in the *bed*. All these are nicely formed by each set of hands after the previous cast has been cooled and removed."

"You see, there are 26 *pigs* in a *bed*, and 4 *pigs* in the *sow*; that is, they break the *sow* into 4 pieces, each the size of a *pig*. There are 16 beds, and consequently there are 480 *pigs*, or about 11 tons in each cast. At each of the branch gutters, or *sows*, a man is stationed with a spade, with which he prevents the metal flowing into his bed until the bed below him is filled, when he suddenly transplaces it, and, cutting off the flow downward, turns it into his own bed. The next man does the same in succession, and when all the beds on one side of the track are filled, the flow is turned in the same manner into the other *runner*, and the process is repeated until all are filled, when the opening in the flask is closed by clay prepared for that purpose. New supplies of coal, ore, and limestone are dumped in above, and the operation of smelting goes on for the next 12 hours."

The pig-iron is used either for casting, or for conversion into wrought-iron by puddling, etc.

Howell's furnace for making malleable iron direct from the ore with stone coal, patented in the United States about 1831, was thus described by the inventor: "This furnace combines within itself the advantages of a close furnace and an open fire. In the upper or close portion, being all that above the hearth, with anthracite coal, excited by a proper blast, a degree of heat is generated much greater than can possibly be obtained in the ordinary fire with charcoal; while the lower portion, opening into the hearth and permitting the free action of the blast upon the burthen, performs all the offices of the open or forge fire. The ore, descending to the region of the tuyeres, becomes perfectly fused, and, passing below the influence of the blast, a part is driven out at the open front. The burthen in the furnace being temporarily supported by bars, the masses are gathered into a *loup*, which is removed by tongs and taken to the forge-hammer."

Bel'lows. (*Pneumatics.*) A device for forcing a stream of air, usually as a means of urging a fire.

Bellows were used in Egypt in the time of Thothmes III., 1490 B. C., and are represented on a tomb bearing the name of that Pharaoh.

A pair of leathern bags or cylinders, attached to disks, were alternately inflated and compressed, during the latter action driving air by a pipe to the fire. The cut is from the tomb referred to, and the men are shown working the bellows with the feet and hands, throwing the weight on the bags alternately, and lifting with a cord the one which is just exhausted; the other man is holding the rod of metal in the fire. The oldest form of wind-bag was probably the skin of an animal sewed up, or else a wooden reed with a piston like that of a popgun, until tubes were bored out of wood or made of a ring of bark taken from a tree. Our common bellows, consisting of two

Fig. 940.

Egyptian Bellows (Thebes).

boards joined by a piece of leather, was early known to the Greeks and Romans. See Fig. 145.

In the *Spiritalia* of Hero, 150 B. C., is described a steam-boiler from which a hot-air blast, or hot air mixed with steam, is blown into the fire, and from which hot water flows, or cold is introduced.

Double foot-bellows, and duplicate pipes to the iron furnace, with four tuyeres, are shown in the paintings of Kourna, Thebes. The blow-pipe and tongs in connection with a smelting-furnace in the same place.

The mention of the burning of the bellows in Jeremiah vi. 29, seems to have been in connection with lead and silver smelting and refining. This is a common combination of metals in ores.

Strabo ascribes the invention of the bellows to Anacharsis the Scythian, who was coeval with Solon. The anchor and the potter's wheel are also ascribed to this man by Pliny, Seneca, and other Romans; the declaration, however, is quite inadmissible as to the potter's wheel, and equally untrue as to both the bellows and the anchor. Homer mentions the potter's wheel, and it was used in Egypt one thousand years before Homer. On the walls of the tombs of ancient Egypt are painted, Ptah, the Creator, and Neph, the Divine Spirit, sitting at the potter's wheel turning clay to form men.

Among the ancient forms of bellows may be cited: —

Skins of animals sewed up to form bags, and used in a manner analogous to the bellows of the bagpipe.

Fig. 841.

Japanese Blacksmith's Bellows.

Two such skins used alternately would give a continuous blast: such was the ancient Roman forge-bellows.

A pair of hollow cylinders, made of bamboo or hollow logs, and having pistons actuated by manual power.

A pair of large calabashes connected by two reeds, and having large openings at the top, covered by tubes of soft goatskin, which are closed down alternately.

A cylindrical bag of soft skin closed at the ends by two wooden disks, by which it was opened and closed like a Chinese lantern. This device in its duplicated form, to render the blast continuous, is still used in Europe and South America.

The Japanese bellows consists of a box *a*, with a reciprocating piston *b*, and two eduction-tubes *c c*, leading from the respective ends of the box to the fire. Our illustration does not indicate the valves in the tubes to prevent reflux of air, nor the air-induction openings. The artist leaves them to be supposed, which is not difficult to do.

The smelting of the ferruginous sand of the Nunkreem Valley, on the confines of English India, is very rudely carried on in charcoal fires blown by

Fig. 842.

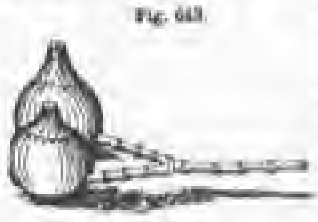
Nunkreem Bellows.

double-action bellows, worked by two persons, who stand on the machine, raising the flaps with their hands and expanding them with their feet, as shown in the cut. There is neither furnace nor flux used in the reduction. The fire is kindled on one side of an upright stone (like the head-stone of a grave), with a small arched hole close to the ground; near this hole the bellows are suspended; bamboo tubes from each of its compartments meet in a larger one, by which the draft is directed under the hole in the stone to the fire.

The ore is run into lumps as large as two fists, with a rugged surface; these lumps are afterward cleft nearly in two to show their purity.

Fig. 643 shows a bellows employed by the Foulah blacksmiths on the west coast of Africa. It consists of two calabashes connected together by two hollow bamboos or reeds inserted into their sides and united at an angle to another which leads to the fire. A large opening is made in the top of each calabash, and a cylindrical bag of soft goatskin stitched or otherwise secured around the edges. The workman seats himself on the ground, and, placing the machine between his legs, grasps the ends of the bags, and by alternately raising each with the mouth open and pushing it into the calabash when closed, the contained air is forced into the tubes and a continuous blast maintained.

Fig. 643.



Foulah Bellows.

Wooden bellows were known in Germany in the middle of the sixteenth century, but it is not certain by whom they were invented. Lohsinger of Nuremberg (1550), and Schelhorn of Schmalkalden, in Coburg (1620), are cited as having introduced them.

They are described in a work by Reyner, professor at Kiel, 1669, as being "pneumatic chests," and as consisting essentially of a lid moving in a closely fitting box. In another form we find that two boxes were used, one fitting closely within the other, and the two, being perhaps quadrantal segments of cylinders, were hinged together so that the movable one vibrated on the common axis.

The ordinary bellows in its simplest form consists of two flat boards, usually of triangular shape, each having a projecting handle; and between the boards are two or more hoops bent to the figure of the bellows. A piece of leather is nailed to the edges of the boards, partially infolding the hoops, and forming an inclosed chamber, which is enlarged or contracted by raising the upper board while the lower one remains stationary. The lower board has a metallic pipe attached and a valve in its center, opening upward, which rises when the upper board is raised, admitting air into the chamber, which is expelled through the pipe by depressing the upper board; this arrangement does not afford a continuous blast, the air issuing in puffs, and accordingly the smith's bellows is furnished with a third board, of the same shape as the other two, connected to the lower board by a piece of leather, and dividing the bellows into two similar chambers connected by a valve opening upward; the blast-pipe is connected to the middle board, issuing from the upper chamber. The lower board is held down by a weight, and a weight is also attached to the upper board. In working the bellows the middle board is raised, drawing the air through the valve into the lower cavity, and the descent of the board forces it into the upper cavity, the valves preventing its return, and the weight, depressing the upper board, forces the air out through the pipe in a continuous blast; the ascent of the middle board fills the lower cavity, while its descent fills the upper cavity, the irregular puffing action being confined to the lower cavity of the bellows; the blast is however, though continuous, not quite regular, as, when the air is forced into the upper cavity, there is an excess of pressure over the pressure during the descending motion of the lower board.

Fig. 644.

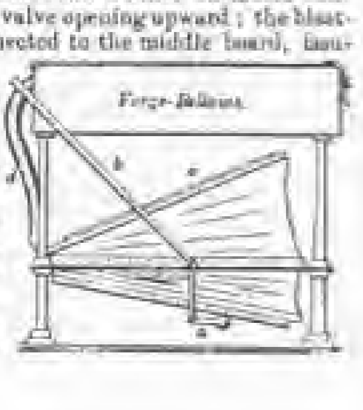


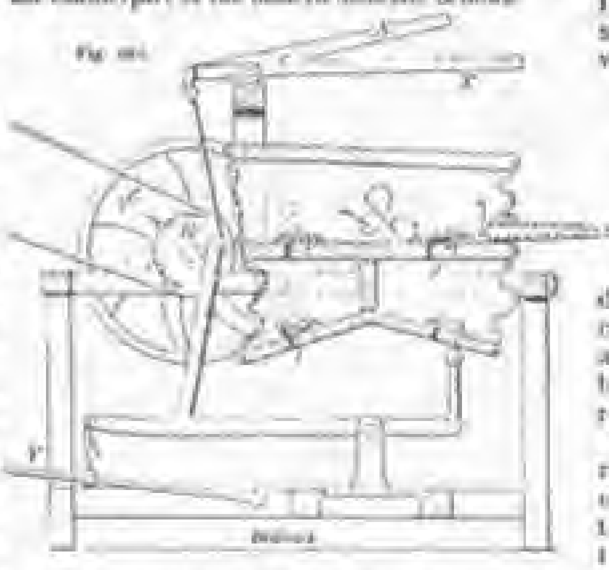
Fig. 645.

Old Roman Lamp.

The smith's bellows is worked by means of a rocker with a cord, chain, or rod attached. By drawing down the handle *b* of the rocker the movable board rises, forcing the air through the valve into the upper chamber; the weight on the board *c* forces the air out through the pipe *d* to the fire on the forge-hearth.

Fig. 645, from an ancient Roman lamp, is an exact counterpart of the modern domestic bellows.

Fig. 646.



Bellows.

Various machine-worked bellows have been invented, but generally those which rise to the dignity of machines lose the pulsative character and have come to be called blowers.

In Fig. 646 the V-shaped bottom is pivoted in the middle, and has a rocking motion imparted by lever *X*, treadle *Y*, or pulley with fly-wheel *E Z*, either affording a continuous blast.

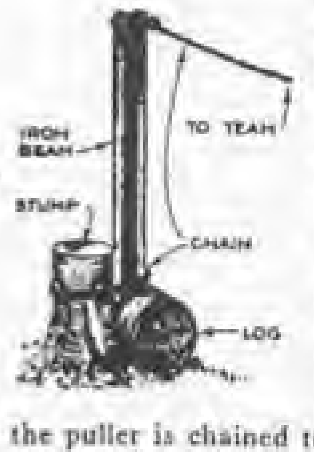
Fig. 647.

Bellows-Pump.

From Popular Mechanics 1925

A Simple Stump Puller

In upper Wisconsin, where thousands of acres of cut-over timberland are being cleared for agricultural purposes, an easily constructed but powerful stump puller is being largely used with good effect.



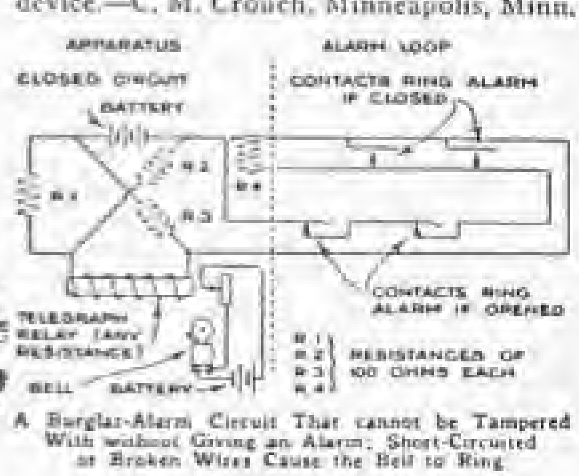
The device resembles a huge mallet, with a log for a head and an iron beam, or piece of steel rail, for the handle, the purpose being to obtain increased leverage in pulling the stump. In use, the puller is chained to the stump in the manner shown in the drawing, and a team of horses is hitched to a chain attached to the extremity of the handle. The pull gives a rolling movement to the head that has a tendency to lift the stump, while the power of the team, applied to the handle as a lever, is greatly increased. A stump puller of this type is a very effective substitute for the horsepower capstan-type puller, excepting in the case of very large stumps.—

From Popular Mechanics 1915

Burglar-Alarm Circuit

The burglar-alarm circuit shown in the drawing cannot be put out of order without giving an alarm. The only special apparatus required are a relay, which may be of most any type, four coils of equal resistance, and the closed-circuit battery.

With the alarm circuit completely connected as shown, the relay will remain inoperative because both sides of the battery, positive and negative, are connected to each end of the relay winding through equal amounts of resistance. The relay is in a neutral position with respect to the battery and receives no current. Now, should the side of the bridge forming the alarm loop become unbalanced, short-circuited, or broken, the current would flow through the relay winding, causing it to operate and ring the bell, or other alarm device.—C. M. Crouch, Minneapolis, Minn.



A Burglar-Alarm Circuit That cannot be Tampered With without Giving an Alarm; Short-Circuited or Broken Wires Cause the Bell to Ring

The Super Still

With the natural pollution of rural groundwater from sewage, insecticides, herbicides, inorganic minerals and salts from the earth itself, even back-to-the-landers need a still. The city dweller, however, is actually in danger without it.

Most city water is fluoridated. Sodium fluoride is put into everyone's drinking water to protect the teeth of children after they've lost their baby teeth and until their permanent teeth are developed. Thus, it is useful to children only from about the ages of from five to seven.

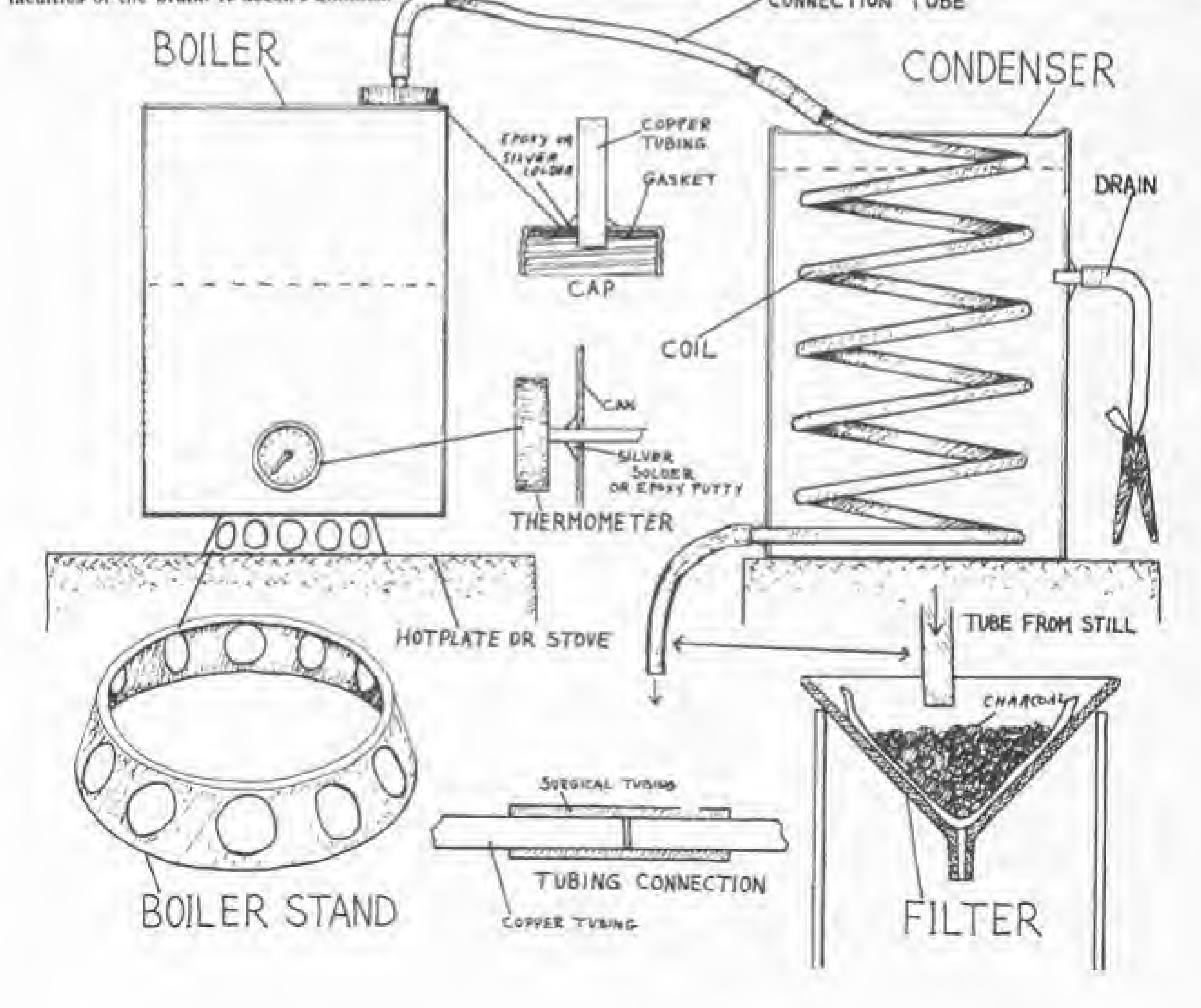
It may be harmful to children's brains and it is certainly of no value to adults. I have had experience with fluoride which proves to me that it dulls the creative faculties of the brain. It doesn't diminish intelligence but it does block out creativity so a person on a new project can feel rather stupid, helpless and frustrated when trying to get his act together.

A still was tested by the Food, Chemical and Research Laboratories, Inc., in Seattle, Washington. The test was made on tap water containing 0.92 parts per million of sodium fluoride. After distillation, the fluoride was less than 0.05 ppm. A second laboratory distilled water with 9.0 ppm fluoride. After distillation no trace of fluoride was detected, again less than 0.05 ppm.

It also leaves behind chemicals and salts commonly found in city water such as chlorine, mercury, sulphates of carbonates, arsenic, sodium, potassium, phosphorus, silicon, calcium, magnesium, chlorides, cyanide, chromium, lead, silver, cadmium, sulphur, nitrates, zinc, iron, copper, phenols, pesticides and herbicides.

These inorganic minerals are not needed by the body. As a general rule, inorganic minerals can't be utilized by the body until they have been processed by vegetation.

Whether such chemicals, unprocessed by vegetation, come from springs, streams, wells, or the city faucet, they are only excess baggage at best, and harmful at worst. They must be flushed out of the system lest they cause general debility or even such things as birth defects, mental disorders, heart trouble, cancer, etc. Also, the already overloaded system cannot be properly flushed out with more polluted water.



Aside from health considerations, there is always the danger of a water cutoff. In such an event you could get water from various places but it wouldn't be fit to drink. Boiling it, treating it with clorox or halazone tablets would spare you only from living organisms.

A city's water supply comes from their best source. It has less pollution in it than any water you might find outside the water system in that immediate area. So although you might kill the micro-organisms in standing water, it might be filled with lethal doses of pesticides, herbicides, or industrial chemical wastes no one considered removing since that water was never meant for human use, anyway. That's why a still could save your life.

In storing water, it is best to store distilled water. First, there are no living organisms in it. If some get in after distilling, there is so little mineral content to feed on that they could not thrive.

Ladies will appreciate this still for the completely soft water it produces. It is perfect for washing the hair and for doing fine washables which break down so quickly when washed with common tap water. Soft water is also best for washing the face, especially before putting on makeup.

Although the still operates over any heat source, even a camp fire, it does give off some heat of its own. This is cozy and an energy saver in winter. But in summer you might want to put it in a back room.

Distilled water is sold in stores for from 40c to $1.50 per gallon for irons, car batteries, photo developing, drinking, etc. My still makes it for from three to five cents per gallon. If you do it on a wood stove it's free.

Coffee, tea, alcoholic drinks and food taste better when prepared with distilled water. Also, chemists, and even alchemists, will appreciate the ability to distill the same water several, or even hundreds of times for goodies requiring multi-distilled water.

In using this still, too much heat will cause the liquid to boil beyond the coil's capacity to distill it. This will cause vapor to come out the tube. You must turn it down then because this means the liquid is escaping and you will not only waste liquid but get less out of the still, since the vapor is going elsewhere.

Cheap wine, and of course, any homemade wine or whisky, will have fusel oils which taste bitter. It can even be harmful in large quantities. Dick's 1872 process for removing fusel oil from alcohol, No. 1445, follows: "To Free Alcohol from Fusel Oil. This may be effected by digesting the alcohol with charcoal. The alcohol is filtered through alternate layers of sand, wood-charcoal, boiled wheat and broken oyster shells; this removes all other impurities as well. The fusel oil can be extracted from small quantities of alcohol, by adding a few drops of olive oil to the spirit, agitating thoroughly in a bottle, and after settling, decanting. The olive oil dissolves and retains the fusel oil."

For the real poop on alcohol for its own sake, get GRANDDAD'S WONDERFUL BOOK OF CHEMISTRY. Alcoholmetry starts on page 129 and anything else you want to know about it starts on page 134.

From my bottle of Red Mountain Burgundy, I got almost a quart of about 100 proof alcohol for $2.99 plus tax. A fifth of 100 proof Vodka costs $6.10 plus tax. This cheap wine has 12% pure alcohol. That means it has 24%, or almost a quart, of 100 proof alcolol after distillation.

If you cut the 100 proof goody with orange juice or something, you can get just as merry on half or less, since stronger stuff does it better than wine. This, in itself, would cut your liquor bill by half or more.

(I wouldn't worry about fusel oil in commercial wines or even in the home-made stuff. But if you are into making your own whiskey from mash, you ought to consider filtering it.)

If you want the alcohol for chemistry or making extracts, hash oil, flavors, etc., you can re-distill the alcohol until you've got the purest stuff going.

The still would work just as well with whiskey mash. You could fit the still to a cooker of unlimited size and get at least eight gallons of alcohol in 24 hours since alcohol distills faster than water.

There are several manufactured stills on the market, usually sold through health food stores. These are quite expensive so I wanted one anyone could make cheaply.

I designed a heavy-duty still and had Clyde Barrow build it. It didn't work well so he redesigned it and now has an improvised still which works as well as any commercial still on the market.

The Saxon-Barrow, or Barrow-Saxon, design is high-yield production still. It processes at least a quart of water per hour and even more alcohol in the same time. The entire unit can be made for about $25.00 and assembled with simple hand tools. The unit is easily disassembled for storage.

The still has three basic parts. The part that goes on the fire is the boiler. We used a five-gallon, square can with a screw-top. These cans can be bought empty and unused for about $3.00 at paint stores and elsewhere. You can also buy a two-gallon, unused gas can from any auto supply store.

Either size is cheap enough new that you should avoid trying to use a can which had paint, paint thinner, gas, etc. in it before. A used can may not be dangerous, but what it had in it could give off volatile residues which will cause a taste in the water or booze for the life of the can.

Begin by drilling, or punching, a hole in the screw-top lid large enough to insert a two inch long copper tube with an outside diameter of 3/8ths of an inch. Such copper tubing can be bought from most hardware stores for about 59 cents per foot.

Remove the lid's gasket and epoxy or silver-solder the tube in place. (See drawing) When the tubing is firmly set, replace the gasket. (If you use solder, make sure it's silver solder. Lead solder will break down and poison the distillate. That's why people go blind after drinking booze made from stills soldered with lead).

If you are using a gas or electric stove, you ought to buy a candy thermometer with a six inch metal tube. I got mine at a restaraunt supply store for $4.00. Most hardware stores carry them.

Alcohol boils at 173 degrees F. Water boils at 212 degrees F. If you're distilling alcohol and want pure stuff, the less water coming over, the purer the alcohol. So you want the temperature just above 173 but considerably below 212.

If you install the thermometer, when alcohol and water starts coming over you can lower the temperature. When the temperature floats at about 180 degrees you can make a mark near your burner knob. Next time you use the still you only have to set the knob at the mark and leave it alone. It will not rise above the temperature you have it set for. (If all you want to distill is water, or if you just want to drink the alcohol, or don't mind redistilling, you don't really need the thermometer).

To install the thermometer, punch or drill a hole about three inches from the bottom of the can. Stick the tube as far in as you can and still have room enough to silver-solder or epoxy the thermometer in place. If silver-solder is used, the thermometer's dial should be wrapped in a damp rag to prevent damage from the soldering iron's heat.

If you're using a gas stove, the boiler must be a couple of inches above the burner. Otherwise the fire will go out. For a stand which would keep the boiler elevated over the flame, Clyde used a steel cake pan about eight inches in diameter. I'd want one considerably wider but that size suits Clyde. Use tin snips to remove the bottom of the pan and to cut large, circular holes around the pan. Holes large enough to start the tin snips can be made with a drill or a hammer and nail. The holes in the side of the stand must be large enough to allow plenty of air to get to the gas burner.

To test the stand's air intake, place it on the stove and light the burner. Put the boiler on the stand and watch the flame. If it begins to flicker or pop, the vents must be enlarged to increase the air supply.

Now we come to the condenser, which is a round, five gallon paint can, bought used from any paint contractor for a dollar. This holds the coil and the cooling water. It doesn't need to be new or even clean, since its contents do not come in contact with whatever is being distilled.

Two holes must be drilled in the condenser can. The first, abut six inches from the top, is the drain. It is fitted with a two inch copper tube, soldered or epoxied in place. Attach one end of a two foot length of surgical tubing to this copper tube. Such tubing, 5/16 of an inch, inside diameter, can be bought from most pharmacies for about 48 cents per foot.

The lower end of this drain tube is held shut with a clothes pin or any convenient clamp. As the still operates, the water in the condenser will heat up, with the hotter water rising to the top. The surface water can be almost scalding to the touch, while that a few inches below will be comparitively cool. Periodically, about a gallon of this hot surface water is drained and replaced with cold water, poured in after the draining.

The second hole is drilled near the bottom of the can at the point where the coil rests on the bottom. This is the exit hole for the bottom end of the coil. The coil is made by wrapping ten feet of copper tubing around a can with a smaller diameter than that of the condenser. Care should be taken in bending the copper tubing lest it collapse. A good way to prevent this is to plug one end, fill the tubing with fine sand, plug the other end and then bend it to the shape you want. When the coil is bent, remove the sand. (Part of the reason I get so depressed and crazy in this work is that some of my readers would leave the sand in and then write and tell me the still worked poorly).

The coil should have a definite downward spiral for maximum efficiency. Any uphill areas in the coil will trap water. This will cause the still to spit and sputter as it builds up the necessary pressure to push the trapped water up and over these areas.

Next, place the completed coil in the condenser, with the lower end protruding from the hole about an inch. Solder or epoxy the copper tubing in place.

The upper end of the coil is left protruding free from the top of the condenser. This allows it to move as it expands and contracts without the danger of popping the bottom seal and causing a leak.

The boiler and condenser are joined with a removable copper tube about two feet long. Two two-inch long pieces of surgical tubing are used to join the two foot length of copper tubing to the protruding coil and the boiler cap. The lengths of copper tubing joined by the surgical tubing should be as close as possible so there is little or no surgical tubing exposed to the hot water vapor going from the boiler to the condenser. Exposed surgical tubing imparts a rubber taste to the distillate.

The surgical tubing leading from the coil to the collecting vessel will not impart a taste since the liquid running through it is cool.

When the distilling process is over, give the boiler cap a twist just to let the outside air pressure get in and equalize the pressure inside the boiler. If you don't loosen the cap, the greater air pressure outside the boiler will cause it to collapse.

MATERIALS LIST

New five gallon square can with a screw on cap, $2.50; 15 feet of 3/8th inch outside diameter copper tubing, $9.00; candy thermometer with a five or six inch projection, $4.00; 8 inch diameter steel cake pan, $2.00; used five gallon paint can,$1.00; 3 feet of 5/16th inch inside diameter surgical tubing $1.50.

If joints are to be soldered, silver solder, flux and either a soldering iron or torch are needed.

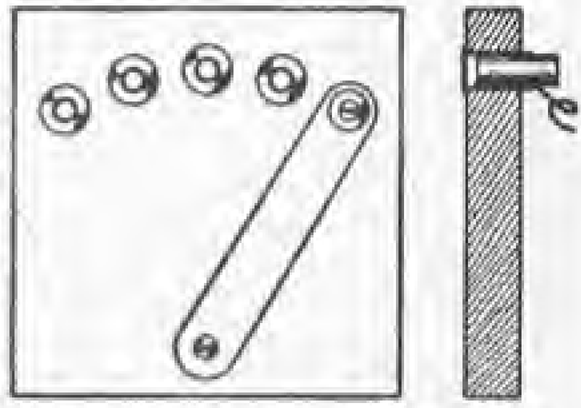
If epoxy is used, Duro E-POX-E Ribbon at $1.89 is best. Bought from most hardware stores. It is molded with the fingers.

Remove all grease and dirt from the areas before using epoxy. Press the epoxy firmly into the open spaces to assure a watertight seal. Epoxy breaks down from heat and is not as permanent as silver solder.

If you were a real fanatic about it and kept this still working throughout a 24 hour period you could make at least 36 quarts of at least 100 proof alcohol. A quart of 100 proof gin or vodka would cost at least $8.00 in the liquor store. If you sold your alcohol for only $5.00 a quart you could take in $180 per day.

Cartridge Shells Used for Electrical Contacts

In making small switchboards, rheostats, and other electrical devices, I found a good use for old center-fire cartridge shells as shown in the sketch. A hole a little smaller than the diameter of the shell is made in the board and the shell is forced in. The proper wires are then soldered to the metal on the inside, or the wire may be placed inside of the shell and held in contact by driving a wood plug in as indicated.



The Heads of the Cartridge Shells Make Good Contacts for a Switch Lever

Homemade Electric Whipper

From Popular Mechanics 1925

A homemade electric whipper, resembling those used on soda fountains, has been found useful as an egg beater, cake-batter mixer, and cream whipper. It consists of a small electric-fan motor, a length of ½-in. nickel-plated pipe, a clamp, and a hardwood base, arranged as shown in the illustration.

The length of pipe, which serves as a standard for holding the motor, is held by a floor flange, screwed to the base. The motor is fastened to the standard by means of a sheet-metal clamp, riveted to the motor, and clamped on the standard with a bolt and wingnut.

A short length of steel rod, of the same diameter as the motor shaft, is threaded on one end, a nut run on, and the end of the rod riveted over, to prevent the nut from unscrewing. The rod is attached to the shaft by means of a brass sleeve, made of tubing and soldered in place.

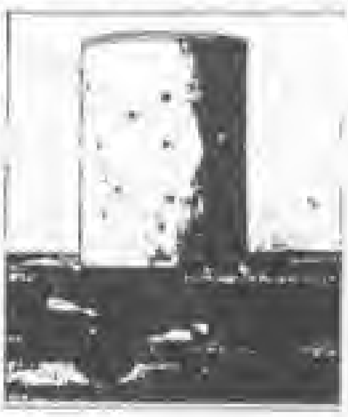
The Hunter's Woman

The hunter's woman, tended the flame
While he went out to hunt the game
Out in an early winter storm
His woman kept the cabin warm
She didn't know how far he'd go
As darkness fell, just like the snow
The fear she felt was for his life
Deep in the heart of the hunter's wife
The cold sind howled, and the snow grew deep
Without her man she could not sleep
Then the night sky cleared, the temperature dropped
As she burned wood the hunter chopped
The fear grew worse, and her tears began
She begged the cold, "Don't Kill my man!"
Then all of a sodden, her man appeared
And on his back, a fresh slain deer
She sighed relief for her man's life
Rejoicement filled the hunter's wife
She knew that he again would roam
But now her man was safe at home

Don Lampson

An Improvised Heater

A very satisfactory heater for taking the early-morning chill from the kitchen can be made from an old can. A medium-sized can is selected, punched with holes, and inverted over one of the burners of the gas stove, or hot plate. A small room can be warmed very quickly by a heater of this sort.—



A Glass Breaker

After cutting glass, and especially where a small strip is to be removed, the part must be broken away in small

The Nut is Set to the Thickness of the Glass and Used to Break Pieces Away

pieces. The accompanying sketch shows a very useful tool for this purpose. The tool is made of a piece of metal having a bolt fastened to it at one end whose nut can be adjusted to the thickness of the glass.

You Can't Change the Channel

By KURT SAXON

A while back I saw a funny and tragic cartoon in a magazine. It showed a car pulled over to the side of the road. A harried and exhausted mother was inside, flanked by some miserable children who plainly didn't like the situation at all. The father was outside, trying to pump up a flat tire.

While hard at work trying to save their vacation, the father was saying, "But kids, this is real. This is life. We can't change the channel".

The cartoon showed the absurdity of the children's confusion between reality and TV. I got a charge out of it because it paralleled the American adult's confusion between real world conditions and pure entertainment.

Now, I don't mean to imply that the American adult is so moronic as to mistake real news footage of the carnage in Beirut with the fictional cops-and-robbers carnage on the next channel. However, watching TV has become the major occupation of the average American, especially city folk. This can't be discounted when considering their inability, or downright refusal, to accept the warnings so apparent to Survivalists.

Before TV, movies were certainly an influence. But you had to leave home to see a movie. You chose what you wanted to see and accepted the fact that you were being entertained. After the delightful fantasy was over, you walked out into the cold night. There were the derelicts, shambling up to the movie leavers to beg for booze money. A couple in an upstairs room screaming obscenities at each other. A firetruck barreling around the corner to save some wretched smoker from an ignited mattress.

All this broke the mood. Unpleasantly, of course, but it at least helped to put things back in their proper perspective.

The viewer of TV can go from Boob-tube to beddy-by without his fantasy mood being broken. In fact, with several channels, he can maintain his fantasies from the time he gets home from his boring job until he goes to sleep.

Over the years, the average American has selected a set of fantasies and maintained them for hours each day. Mood breaking reality is avoided. An excellent example of this is a commercial for CARE. It shows children in Darkest Somewhere or Other, with their pot bellies. Pitiful. A child viewer whines, "Why do we have to watch this?" The father figure then reads from his script that we must help these people. Of course, the poor little tykes in the film had probably died before the footage was shown, but the commercial still points out the reality avoidance of the average viewer.

This was also shown during the coverage of the Democratic Convention. All it really amounted to was the posturing and ranting of a lot of political pigs wanting to get at the public trough. But it did give a pretty thorough rundown of the ills besetting our nation. The networks reported that during this coverage, they lost about two-thirds of their viewers to other channels.

Moneysworth, July 19, reported that even in Russia the TV viewers tune out socially relevant programs in favor of movies, quiz and variety shows.

Most people are bored with their daily routine. They are also anxious about the future. Such a combination of boredom and anxiety creates stresses that only hours of fantasizing can relieve.

Since most of today's problems can't be solved by the individual as long as he stays in his rut, he marks time on his job until he can go home to his own Disneyland. During the day he will talk about sports and other programs he watched on TV. He tries to recreate the dream world he finds most secure.

If you intrude on his daydreaming he is likely to try to change your channel and get you to echo his own fantasies. Failing this, he will become grumpy and tune you out entirely.

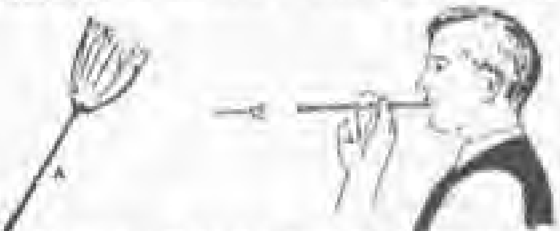
Thus, few Americans communicate today apart from routine specifics or comparisons of whatever highs they experienced last night in front of the tube.

How to Make a Blowgun
From Popular Mechanics 1915

Either a 12-in. length of a small curtain-rod tubing or a straight piece of small bamboo pole, cut off between the joints, can be used for the gun part of this simple device. If bamboo is used, see that it is cleaned out smoothly on the inside.

The dart used in the gun is shown at A in the illustration. It is made by threading the eye of a darning needle full of yarn, clipping all the strands off to a uniform length of about ¾ in., and then picking out the fibers into a brushlike mass above the needle's eye. Another needle or pin can be used for fuzzing the threads. The point to observe is that the brush is of somewhat larger diameter than the bore of the gun, so that when the needle is pushed into the mouth end the brush will be compressed and make an air-tight plug.

After thus inserting the dart, hold it as shown and give a quick, sharp blast of the breath into the gun. The dart will travel with great speed and accuracy for 20 ft. or more, and stick wherever it strikes. The point being

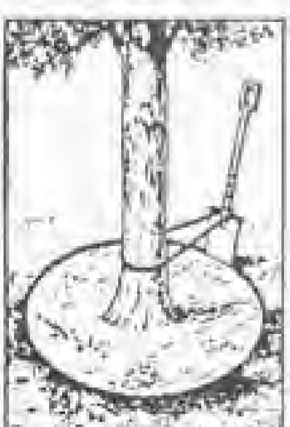


The Blowgun is Made of a Piece of Tubing, and the Dart of a Darning Needle

so small, it can be used in the house for shooting at a paper target pinned to the wall without injury to the plaster or woodwork.

Cutting Sod around Trees
From Popular Mechanics 1925

To cut the sod from around the trunks of trees, and at the same time form a circle, is a little more difficult than is generally realized. However, by the method shown in the drawing it is possible to describe a circle and cut the sod at the same time. A loop of rope is tied around the tree and the spade is inserted into the opposite end. A circle of any desired diameter may be obtained by increasing or diminishing the radius, represented by the length of the loop of rope.—



They are increasingly hard to reach with reality subjects which seem to threaten the continuance of their routine or their fantasy world.

Meanwhile at home, the women lead fantasy lives, identifying with their soap opera queens and their oh, so very sophisticated problems. Women's fantasy involvement with soap operas has been covered quite well without my help. But it is increasingly evident that reality in the home is less important to the female than the fantasy world of her soaps.

A perfect example is Mary Hartman-Mary Hartman. Mary is the Typical Consumer Housewife. She can deal with waxy buildup and other problems solved by TV commercials. Many social problems have their answers in TV characters who have also been there.

But does "As The World Turns" tell what to do when Leroy drowns in a bowl of chickensoup forced on him by Mary? Does "Somerset" tell how to deal with the troubled lad who massacred the five-member Lombardi family, their two goats and eight chickens?

Mae gave Tom VD. He gave it to Mary. Looking for love and appreciation, Mary then made out with Sergeant Foley in his hospital bed while he was resting up from a heart attack. All this would have been duck soup had only "General Hospital" handled it first. But it didn't, so what had poor Mary to go on? She was shattered.

Confused wretch that she is, she's picked as the Typical American Consumer Housewife. Her selection is based on the fact that she is representative of most American housewives. She has no hobbies, interests or ambition. On the night of the award presentation she goes crazy on the David Suskind Show and we leave her in the nuthouse until September. You see, confronted with real-life problems, Mary couldn't change the channel, so she came apart.

Mary Hartman-Mary Hartman is believed to be a takeoff on soap operas. But I see it as a takeoff on the American housewife, so caught up in soap operas, commercials and other mass media that she can't function without their direction.

In a sense, men are worse off than women when it comes to problem solving through TV. Sports are no help. Sports heroes (?) are inspirational only to mentally defective youngsters. When Jack Nicklaus hunkers before First Base, pitches the ball past the forty-yard line and sinks it in the basket, only a no-hoper would take heart. But there are a lot of no-hopers out there, friend. Men so devoid of intellect, so crushed by their own mediocrity, that a gum chewing, flank-scratching cretin symbolizes all that's manly and heroic.

In sports, the only enemy is the opposing player. In Westerns and war movies the enemy is long dead or fictional. Besides, the movie hero always wins. A heady, but harmless drug, when taken sparingly.

Before TV these entertainments were usually strung out over weekends with a Saturday night movie and a Sunday game. The mind could come awake between fantasies wherein the fantasizer is shooting at the Clantons at the OK Corral or playing football with the Giants.

The American male's identification with infantile sports and their players and with movie stars was simply recreation before TV. But with TV, one can immerse himself in fantasies the whole weekend and for hours and hours each evening. And the average man does, because he can't cope with the real world anymore. Instead of trying to cope with today's problems, he has taken to fantasizing every waking, non-working hour.

This barrage of heroic imagery gives a person little time to adjust to his own reality. After an evening of mastering all his fantasy foes the dreamer goes to bed, then wakes up and is brutally thrust into the real world.

Still feeling heroic, he is forced into the wrong lane by some hot-rodding punk. Then his boss snaps at him. Normal setbacks and irritations, easily handled before TV are now too much for him.

Joe Namath or Burt Lancaster could handle such problems. But a man

Popular Mechanics 1915

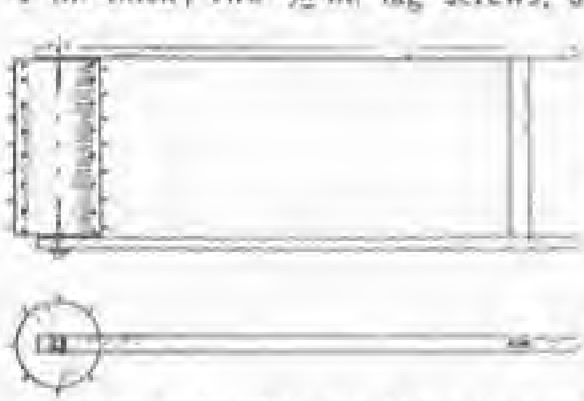
A Hanging Vase

A very neat and attractive hanging corner vase can be made of a colored bottle. The bottom is broken out or cut off as desired and a wire hanger attached as shown. The opening in the neck of the bottle is well corked. Rectangular shaped bottles fitted with hangers can be used on walls.

Popular Mechanics 1915

A Garden Roller

A garden roller for digging the earth and crushing clods is easily made of the following material: One round piece of wood, 10 in. in diameter and 18 in. long; two pieces of wood, each 56 in. long, 2½ in. wide and 1¼ in. thick; one piece, 21 in. long, 2 in. wide and 1 in. thick; two ½-in. lag screws, 8 in. long, and a quantity of 8-penny nails.



A Roller for Crushing Clods and Digging the Earth in Garden Making

The short piece of wood is fitted between the two long pieces with tenon-and-mortise joints to serve as a handle at one end and the roller is fastened between the side pieces at the opposite end to revolve on the lag screws. The nails are driven into the roller so that they project about 1 in.

From Popular Mechanics 1915

Filing Soft Metals

It is well known to mechanics that when lead, tin, soft solder or aluminum are filed, the file is soon filled with the metal and it will not cut. It cannot be cleaned like the wood rasp by dipping it into hot water or pouring boiling water over it, but if the file and the work are kept wet with water, there will be no trouble whatever. Both file and work must be kept thoroughly wet at all times.

fantasizing their roles finds himself more helpless in such situations than he used to be when he handled them alone. Muscles and hot lead win the day on the screen but not on the highway or in the shop or office.

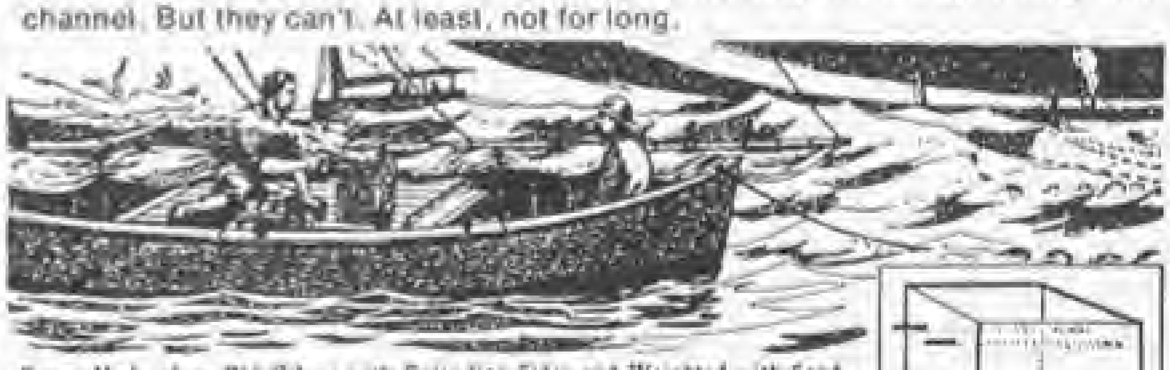
Since our TV addict spends more time in his fantasy world than away from it, he finds himself avoiding unpleasantness, rather than confronting it. Last night he was tuned into a program on famine and saw that he couldn't resolve the problem by clever footwork or a fast draw so he changed the channel.

Today he saw an old lady being mugged by two punks half his size. But he'd left his gun and football shoes at home in the TV so he couldn't get involved. In the case of the old lady he could change the channel simply by walking on. But in his own life situation he can't change the channel except by quitting his job or by slugging someone and getting fired. Barring this, he simply becomes more withdrawn.

His fantasy world is so much better than his real world that he increasingly shuts the real world out. In a limited sense, he can change the channel in this way. In only a few hours he will be back in front of the tube and be rid of this irritation. Thus, he will not become involved. He will accept no more responsibility. He won't stand up to a bullying foreman. After all, in a few hours he will gun the oaf down, along with the Clantons.

The American male has increasingly given up his responsibilities to the police, unions and politicians. He regards these forces as necessary evils and gives his off-TV hours up to their direction. In short, most Americans have turned into gutless, daydreaming sheep.

That's why, when you urge them to act toward their own survival, they give you the brushoff. They won't be awakened. They will leave their protection to overworked, thinly spread cops. Their jobs, which they do so poorly now, are secured by corrupt labor union officials, more interested in pension funds than production. They will gladly leave their political responsibilities up to the most personable political hack on the tube. After all, they seem to think, if conditions get worse under their political hero, they can always change the channel. But they can't. At least, not for long.



Stove Made of an Old Oilcan with Extending Sides and Weighted with Sand for Use on a Fishing Boat Holds the Cooking Vessel Safely in a Sea

A Canoe Stove

From Popular Mechanics 1915

Limited space and the rocking motion of salmon-fishing boats in a heavy sea on the Pacific coast brought about the construction of the canoe stove shown in the illustration. It is made of a discarded kerosene can whose form is square. A draft hole is cut in one side of the can, 4 or 5 in. from the bottom, and a layer of sand placed on the bottom. Two holes are punched through opposite sides, parallel with the draft hole and about 3 in. from the top edge. Rods are run through these holes to provide a support for the cooking utensil. The smoke from the fire passes out at the corners around the vessel.

The main reason for making the stove in this manner is to hold the cooking vessel within the sides extending above the rods. No amount of rocking can cause the vessel to slide from the stove top, and as the stove is weighted with the sand, it cannot be easily moved from the place where it is set in the canoe.

The use of such a stove in a canoe has the advantage that the stove can be cleaned quickly, as the ashes and fire can be dumped into the water and the stove used for a storage box. The whole thing may be tossed overboard and a new one made for another trip.

A Kraut and Root Grinder

From Popular Mechanics 1915

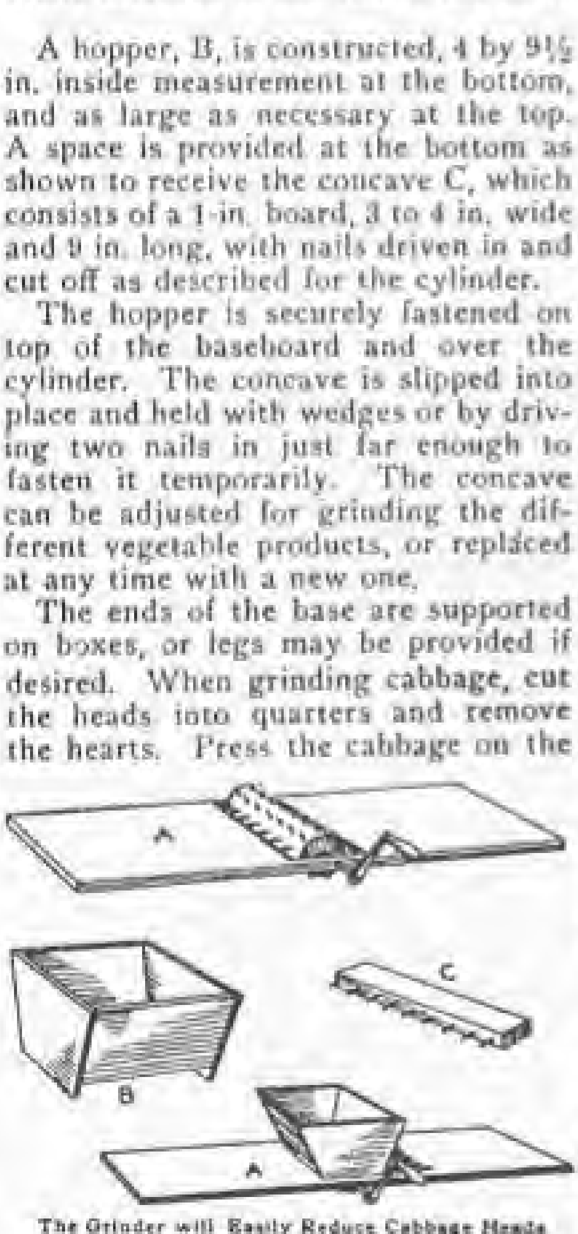
The grinder is intended mainly for chopping cabbage when making sauerkraut, but it is also of much service in grinding vegetables and roots to be cooked for poultry.

The base A is made of a plank, at least 1 ft. wide and 4 ft. long, with a 9¼ by 9½-in. hole cut in the center. The grinding part, or cylinder, is made of wood, 3 in. in diameter and 9 in. long, with 8-penny nails, spaced 3/16 in. apart, driven partly into it and then cut off so as to leave ¼ in. projecting. The cylinder is turned by means of a crank attached to the end of the shaft.

A hopper, B, is constructed, 4 by 9½ in. inside measurement at the bottom, and as large as necessary at the top. A space is provided at the bottom as shown to receive the concave C, which consists of a 1-in. board, 3 to 4 in. wide and 9 in. long, with nails driven in and cut off as described for the cylinder.

The hopper is securely fastened on top of the baseboard and over the cylinder. The concave is slipped into place and held with wedges or by driving two nails in just far enough to fasten it temporarily. The concave can be adjusted for grinding the different vegetable products, or replaced at any time with a new one.

The ends of the base are supported on boxes, or legs may be provided if desired. When grinding cabbage, cut the heads into quarters and remove the hearts. Press the cabbage on the



The Grinder will Easily Reduce Cabbage Heads to Bits Suitable for Sauerkraut

cylinder and turn the crank. Fine bits of cabbage, suitable for sauerkraut, will be the result.

GUEST EDITORIAL

UNITED WE SURVIVE, DIVIDED WE FAIL

T. A. DeMattis, Editor
The Ultimate Society
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Few people in New York City are fully aware of its economic crises, and fewer are prepared for survival with the outbreak of social chaos resulting from bankruptcy. They are going about their daily business oblivious of deteriorating municipal services, such as police and fire protection, sanitation and utilities [gas, electric, water and sewage]. There are other essential services closing down or going to pots—hospitals, asylums, prisons, courts and social agencies. Then there are cultural institutions phasing out—schools, libraries, museums, parks and zoos, music and art centers. Although many are still functioning, but bravely, the signs of bad times are obvious to any intelligent person living-in or visiting New York, or other major cities in the Nation.

Crime and economics are the two principal causes of havoc. Since passage of Liberal civil rights legislation by Congress, people appear to have gone berserk with licentiousness. Rich and poor, black and white, christian or heathen are taking undue advantage of liberties to do as they damn well please. Evidence of this is found in littered parks and streets, subways and public buildings; all the noise and air pollution, wanton graffiti and juvenile delinquency in the extreme, not to mention beastiality and violence among apartment dwellers. Murder, rape and robberies go on with impunity discharged by criminal justice.

Rising crime rates, along with inflationary economics by business, industry and labor, are out of control. Money, the love of which is the root of all evils, is rearing its ugly head among the people. There is so much of it in circulation, it is losing its value each year [and soon each month] until we reach the inevitable point of no return. Consumers may notice that a 3c stamp now costs 13c; gas at 15c a gallon sells for 75c; a 5c can of beans is now 35c, ad infinitum. These inflated prices are on the brink of acceleration according to leading economists, and to find out what it means, just take time off from watching TV nonsense, and read the books and newsletters recommended by this publication.

Of course, there are other extenuating factors besides crime and economics which cause social chaos; the population explosion, diminishing natural resources [coal, oil, forests and croplands], climatic upsets retarding food production, wars and rumors of nuclear holocaust, famines, disease and pestilence. But most people pay no attention. Threats of runaway inflation, population growth, incessant crime and social pressures is very much like the threat of an atomic war. All these threats are not being understood or believed. There is no question in the minds of economists and social analysts that unless these problems are dealt with forthrightly, the American era of happiness and prosperity will come to a close.

But who's the god that will save us? Nothing short of an almighty effort can turn the trick. It becomes the responsibility of each person to do what is right for themselves, and start thinking in terms of survival of the fittest and wisest. Those who think they can escape by stocking their country cottages and vacation homes with life's essentials and live out the holocaust, are sadly mistaken. Survival, like civilization, requires cooperation between people, their cultures and industry. The lone hunter in prehistoric times soon discovered it was better to forage for food with companions. These groups became tribes, and later got together to form states and nations. No one person could possibly do it alone, and yet there are people who think they can survive by themselves.

The necessity to band together is a proven practice by such diverse groups as campers, hunters, motorists, fraternities, sororities, religionists, politicians, criminals

THE BOW DRILL

Bow drills have been used for thousands of years by many cultures. They are simple and capable of extreme accuracy. They will never compete with the power drill for speed. But in craft and metal work they are unexcelled. If you have ever used one of those 4000 rpm hand drills you will remember many a fine piece being ruined because the drill's speed was so much faster than your reflexes in pulling it away before the work was overdone or shattered.

Modern bits are fine for use in the bow drill. Jewelry bits in a bow drill will ensure much better control on fine work and every craftsman should have one.

Bow-drill. A drill operated by means of a bow, the cord of which is given one or more turns around the handle of the drill, and alternate revolution in opposite directions imparted to it by alternately reciprocating the bow backward and forward.

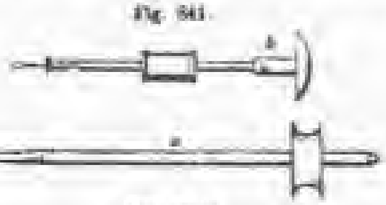
The most ancient drill of which we have any authentic representation is the bow-drill. The annexed cut is from a painting in a tomb at Thebes, where one drill is shown in its detachable socket, and another one disconnected. So much pains did the artist take to make all plain to the comprehension of the spectator of future ages. It was for such they were painted, as the tombs themselves were occupied by the mortal remains which they expected to be again tenanted by the same mind and soul.

Fig. 840.

Bow-Drill.

The various tools employed in chair-making are shown in the hands of the workmen or hanging on the wall. The saw and the adze were the principal shaping-tools. The parts of the chair were secured together by tenon and mortise, fastened by wooden pins. See the chairs in Dr. Abbott's collection, New York Historical Society's Museum. The same collection has drill-bows and cords from Sakkarah and elsewhere.

Fig. 841.



Bow-Drills.

The modern bow-drill is shown in Figs. 841, 842. a in each figure is designed to have a back-centre in one of the holes in the end of the vise-cock, in which case the work is held in the left hand and the bow in the right; or the drill-stock may have a handle b which is grasped in the left hand, pressing the drill upon the work, which is on the bench or in the vise, while the bow is operated by the right hand.

Fig. 842.

Bow-Drills.

FREEMAN'S drill, instead of a bow, has a flat strip of wood with a facing of india-rubber, which has sufficient frictional adhesion to the wooden pulley on the drill-stock to rotate it by pressure, when the flat strip is reciprocated like a violin bow.

Fig. 843 shows a pair of pulleys driven by a catgut band as the bow is reciprocated. The bow-string is wound around one of the pulleys, and the axis of the other is a stock which holds the drill a, and enables it to be presented at right angles to the length of the stock.

Fig. 843.

Bow-Drill.

and anarchists. We've all heard of the Mafia, KKK, AAA, Elks, Moose, Tammany Hall, the Salvation Army and numerous associations. Good or bad, they all had one thing in common—a spirit of fellowship and cooperation. Who's to sit in judgement and call the other wrong?

Until recently, few ever heard of 'Survival Clubs', thinking it was something for boy or girl scouts. The media simply ignores them until they make news, and then it's too late. Once the iron is in the fire, you either cast to mold or go fishing. This is what is called separating the sheep from the goats. Let each one take his choice.

There are growing numbers of survival groups forming quietly around the country. Their purpose is group survival in the face of social chaos. Leading these groups are the federal government with installations in the Maryland hills providing a place of retreat for bureaucrats. The President and his cabinet, Congress and the Supreme Court are non-expendable. Then there are retreats organized by business and industry; one that we know of in the salt mines of Hutchinson, Kansas. The labor-union empire is believed to be planning their own retreats, and corporate interests are in the early stage of preparing for the worse, and hoping for the best.

What about the people? They are mostly believing what they read in the daily press and on radio and TV. All's well that ends well, they say. And this is a fact...if it ends well. But some think differently and are preparing for the worst. Ron Whipple said it best in his masthead: Those who will not read have no advantage over those who cannot read. Ignorance is bliss, and the meek shall inherit the earth. If you believe this, God bless you. Social chaos has befallen other countries in the historical past but it can't happen over here. Civil Rights guarantees that all will be fed, clothed and housed, with equal opportunities to the geese and ganders.

Homemade Hinges for Boxes

A very simple form of hinge can be made as shown in the sketch. It is merely a matter of cutting out two pieces of flat steel, A, punching holes in them for screws or nails, and fastening them to the box corners, one on each side. When the box is open, the lid swings back clear and is out of the way. A hinge of this kind is very strong. For a light box, the parts can be cut from tin.

Hinge Parts Made of Sheet Metal and Their Use on a Box Cover

Removing Old Putty

A very effective way to remove old putty from window panes or other articles is to apply a red-hot iron, as follows: The iron should be made of a broken file or cold chisel and the point heated quite hot. This is run over the surface of the putty, which will crack and fall off. Be careful not to let the hot iron touch the glass, as the heat may cause the latter to break.

DISARMING THE LETTER BOMB

At various times of the year, probably during full moons, letter bombers go into their act. Too cowardly to confront their enemy, even through a rifle scope, they send their pitiful attempts at destruction through the mail.

As there is status among criminals, there is also status among political fanatics and others who use violence to register protest. Among any prison population, the lowest group includes child molesters and all those who use helpless children to work out their pathetic fantasies.

The letter bomber has the same status. You can't get any lower. In fact, I see a similarity. I wouldn't say that all child molesters are letter bombers, but all letter bombers would have the same degree of social inadequacy. So if the cops ran a complete workup on a captured letter bomber I'll bet they could solve every case of child molestation in his neighborhood.

I have two basic objections to letter bombs. The first is that there is such a tiny chance that the addressee will actually open it. This is especially true in the cases of official types, most of whom have secretaries who open the mail and give only the important stuff to the boss. Often, it doesn't even get to the addressee's office. More postal workers get their hands blown off than do secretaries. So the letter bomb is an inefficient way to deliver harm to an enemy.

My second objection is that these bombs usually only maim people. They blow off fingers and hands. They blind. A thus crippled enemy has nothing to do for the rest of his life but work on who sent it. He has the cooperation of all those around him. The case is never closed.

The only fatal letter bomb I know of concerned an Israeli official in New York. His secretary was probably on a coffee break and he opened the mail himself. He was sitting up close to his desk. Holding the bomb just over the edge of that wooden desk, he opened it and it went off.

Although a letter bomb has a blast, or shattering, radius of only a couple inches, it blasted off the edge of the desk, sending fragments into his abdomen.

There are two main aspects to any bomb. The first and most important is the blast radius. This is the area directly around the explosive itself as it disintegrates. This shatters flesh, bends metal and pulverizes paper, etc.

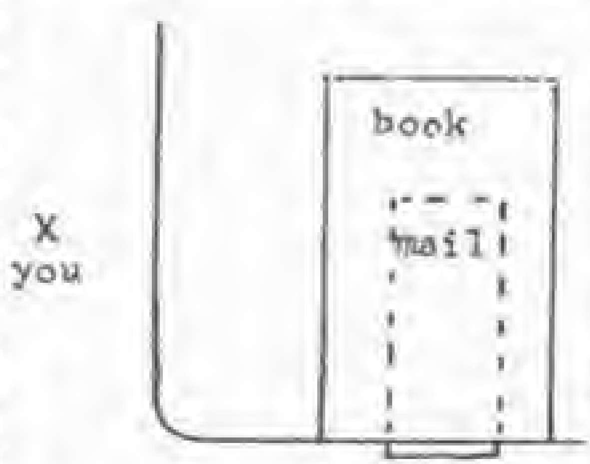
Next is the concussion. This is simply air being pushed out from the blast area. Concussion is slight in the case of letter bombs but can push out bits of matter from the mechanism and its container, which can be blown into the eyes, but is otherwise usually harmless.

A letter bomb is often heavier than other letters and is usually about a quarter inch thick. Only the best made letter bombs last long enough to get to the target's office. If one gets that far it is usually safe to assume that it will not go off unless opened.

A secretary can't afford to get paranoid about this and call the Bomb Squad to open every bulky letter. Most such bulky mail is usually stuffed with pamphlets of one kind or another. But my system is so simple that all mail which might be suspect can be handled in relative safety.

The equipment is simple and cheap. You need a pair of gloves: quilted cloth, leather or canvas. Clear plastic goggles, completely covering the eyes, will keep any fragments of paper or bits of metal out of your eyes. Any auto supply store has them. You'll also want vegetable tongs, with flattened ends, bought at any dime store. Then you'll need scissors and a heavy book, maybe five or more inches thick. Ear plugs are optional.

If a letter bomb gets past the Post Office, it's probably safe to handle unopened. Even so, in any handling of suspect mail you should wear goggles and gloves and carry it with the tongs.



First, copy the return address. It's usually phony but even a phony address is often relevant to investigators, especially with the postmark and city of origin. It is best to Xerox it if you have a copying machine. The address, whether typed or hand written, can provide many clues to experts.

Put the suspect piece of mail at the edge of a heavy table or desk with the end of the envelope protruding slightly over the edge. Put the book over the letter and stand to the side of the desk at point "X".

Next, you must secure the envelope to the table or desk. Otherwise, if the contents of the envelope are stuffed in tightly, pulling on the contents would just pull the envelope and the book off the table.

To secure the envelope just put a few drops of Elmer's Glue-All on the table and lay the envelope on the glue. This glue dries completely in 30 minutes and it sets up and becomes tacky in less than five minutes. So just wait three or four minutes and the envelope will be secure enough to allow the contents to be pulled out.

You can set up several envelopes in a line this way. When finished, the envelopes are pulled off and the glue is wiped away with a damp cloth.

The bomb could go off under the book. The book would absorb the blast and there would be little damage except to it and the desk.

When everything is in place, snip off the end of the envelope. If nothing happens you can sidle around and peek in the end of the envelope. If the contents look metallic or are of thick pasteboard you have cause for alarm. Call the Bomb Squad.

If the contents appear to be only folded paper, they probably are. Even so, reach in with the vegetable tongs and pull them out. An explosion then would cause no damage except for coronaries and such. Since the shattering range is only a couple of inches, the blast would dissipate before it even reached your hand, except for small bits of debris.

Any office subject to crank letters should employ this method. It should also be publicized that any potential target of such bombs never opens the mail. Letter bombers are too far gone to feel remorse over an innocent victim. But as a matter of simple practicality, the bomb would not be sent if it were known that the potential victim never opened his own mail.

I'm not saying my method is perfectly safe. After all, a bomb is a bomb. But if you work for someone who is a potential target, it is only sensible to set up such a system.

Chances are, you'll never open a letter bomb. But if your boss is any kind of prime target and you play your cards right, you might put in for hazard pay and get it.

BY
AL APPELMAN

Exactly one week from yesterday at 9:30 p.m. in Anytown, U.S.A., after the third straight day of miserable, stormy weather, the electric lights went out. The 60 families of Doolittle Terrace were not perturbed by this failure of electricity, it had happened a few times before and never over an hour at a time. The children were put to bed a little earlier than usual and the parents followed suit as the blackout continued. It was rather comfortable and snug lying there in total darkness with the storm whipping up a fury outside.

With grayish morning coming on the people in Doolittle Terrace started stirring. The electricity was still off. The parents reluctantly crawled out of their warm beds, into a cold clammy room. The all electric homes lacked heat. Cooking was impossible, no hot water. Actually there was no water as the cities water supply depended on electric pumps. Without water, the toilets wouldn't function and even with water the sewage plant would require electricity for its operation.

The children were roused and dressed in warm clothing. What for breakfast? Some bread and butter and jam, a bottle of milk, some cold cereal and some water drained from the hot water heater. A tub was placed out in the rain to catch some rain water. Life is starting to be complicated and a little miserable.

Mr. Anyone decided to go to his favorite Super Market and get some candles, some briquettes, and some food. Down to the market to discover that everyone else had the same idea. Everything for light or fire was gone. All the bakery products were gone, no fresh meat or milk. Still some canned goods and vegetables that were starting to wilt. In desperation, he purchased whatever edibles he could haul out and place in his car. He was not permitted back into the long line for more food.

Back home the seriousness of the situation started to register. He was able to dig out the camping stove from the garage. An incomplete but warm meal was whipped together for dinner. The bathroom was starting to smell from the unflushed toilet. The odor was nauseating. Early to bed for warmth and because lack of light. Another gray cold morning, the rooms getting clammier with cold and moisture. No newspaper, no radio, no TV. What caused the power failure? Is it local or area wide? How much longer will it last?????

Not enough gasoline in the car to go to the folks place in the country and no more gas because the pumps are electric operated. No power means no bakery goods, no refrigerated goods, no transportation, no heat, no light, no water. The homes in Doolittle Terrace have changed from havens of security and peace. They have now become abodes of despair. Panic is starting to appear.

It Could Be Better

Across the town 47 families live in Doomore Place. It is not as new and stylish as Doolittle Terrace. It consists of a littler older set of people and a few retired people. When the lights went out the people of Doomore Place also put the children to bed. They lit up a friendly kerosene lamp, which was available, and relaxed. Some of the homes had fireplaces or supplementary wood stoves. These soon became warm with fires built from their supply of wood stored in the garage.

In the morning these people got up and dressed in warm clothes. Those equipped with wood stoves or fireplaces soon had them going merrily and others lit up their gasoline or butane camp stoves. They had all put the use of the toilets off limits and had brought out their portable toilet with plastic bags. As these were filled, a little Clorox or Purex would be added, the neck securely tied and placed into the bathtub for future disposal. Garbage was placed in large plastic bags and treated the same way.

The emergency two week ration and water supply was tapped for a good hot nourishing breakfast. Everything in the refrigerator that might spoil was prepared for consumption. Mr. and Mrs. Everyone and family from Doomore Place were quite content. Hot meals would be available, soft light broke the bleakness of the long night, paper plates and cups eliminated dishwashing. They had sufficient water and some warmth. Their home was their castle. Just like camping out. They closed off all the rooms they didn't need. The front room with its wall to wall rug covering would be quite comfortable. The children in their sleeping bags lying on the rug floor would be comfortable. Who could ask for more? The windows were covered with either blankets or black plastic sheeting. This kept the place warmer and avoided display of the well being of these people.

This day with the Citizen Band operators ferreting out information over the air waves, they became aware that there had been extensive area wide sabotage and that power would be off for possibly 7 to 10 days.

The people of Doomore Place now put into action, plans which had been worked out long before. Families without wood fireplaces or wood stoves moved into pre-assigned homes so equipped. Their supplies of food, water, kerosene, sleeping bags, etc., were moved with them. A 24 hour watch was set up manned by the men, assisted by the teenage youngsters, both boys and girls. The retired captain organized and supervised this operation. All firearms were cleaned and prepared for defensive action in protection of lives and property if necessary. These people were aware that within three days all food would disappear from the markets. That panic might ensue and people, from pure fear and desperation would do anything for food. In numbers there is strength.

The people from Doomore Place were comfortable, their children warm, they would have sufficient drinking water, warm food and enough light to shatter the stygian darkness. Sanitation would present no problem. These people would weather the crisis with hardly a ripple to upset them.

Our modern America is dependent on electricity. With widespread sabotage or an area-wide natural disaster, a crisis can be quickly precipitated. With a little preparation and foresight this crisis could be no worse than a camping trip. Within two weeks the "Wheels can be rolling again" -- supplies will be coming into the region, transportation and distribution can be restored, communications opened up and a fairly normal life can be resumed. However, these two weeks could be the most terrifying of your life. The decision to BE PREPARED or NOT is your responsibility. You must prepare to feed and care for your children yourself.

Prepare

The preparation is rather simple, the cost very little, the feeling of satisfaction in being able to protect yourself and family is very satisfying and rewarding.

Our forefather didn't have super markets handy to supply all their needs. They canned food, dried fruits, salted and smoked meat, raised a garden, a few chickens, a goat or cow, a couple of porkers and a few fish and wild game filled their larder. They had a well or creek water and an outhouse served the other end.

Today - the situation has changed, however, the needs are the same.

Water Water

In evaluating the needs to survive, we must place water as the indispensible object. A 5 GALLON CONTAINER FOR EACH PERSON should be the minimum. This can be stored in glass, suitable plastic containers, etc. Water that is contaminated may be made safe for human consumption by boiling for two minutes or by putting 3 drops of iodine or 4 drops Clorox or Purex per quart of water and shake well. Let stand for 5 minutes. If cloudy or dirty water is used, double the amount.

(For short time survival you do not need one item other than water. Any average person can go 30 days without eating a morsel of food and have no ill effects. If one is aware of this simple bit of knowledge, he should have no need to perish from fear or panic. Your body is well equipped to see you through 30 foodless days).

FOOD

Eating is a habit which we all enjoy and lack of it can be rather tough, especially on the children. Your food supply should be based upon two normal weeks usage. Keep a DETAILED LIST of all food consumed for a TWO WEEK PERIOD. Now study your list carefully. The regular canned foods such as fruits, vegetables, juices, meats, fish, soups, etc. can be listed as is for your survival reserve. Fresh meats, fish and fowl should be replaced with equivalent canned products and or stews, hash, etc. Fresh milk should be replaced with canned or dried milk. Fresh fruit and vegetables and frozen food should be replaced with canned or dehydrated products, butter and oleo with peanut butter and jams. Bakery goods will have to be replaced with Bisquick, pancake mixes, flour etc. These products and dried cereals must be used on a rotation basis. Take these products out of the survival kit as you need them in your regular locker as soon as you have purchased replacements. Now add coffee, cocoa, tea, postum, sugar, salt and pepper, dried milk, baking soda, dry yeast and learn to use them, and matches, and you are in business. The new dehydrated foods take very little space and have excellent keeping qualities. A good idea is to replace your canned goods every year or two. A jar of rock candy will sweeten up the children.

LITE

For light, a few candles and a kerosene lamp and a gallon of kerosene will do the job. Kerosene gives a soft pleasant light, a quart lasts about 40 hours. It is not explosive like gasoline, and it gives off a little heat. A gasoline or propane light is also excellent if you have sufficient fuel for them and they do give off some heat. NOTICE: Always have some ventilation when you use any light that is exposed, as they burn up oxygen and give off some carbonmonoxide. Adjust the flames of gas or butane so that they burn blue. Flashlights are fine but they have a limited life and should be used sparingly. (Save for outdoors).

HEAT COOKING PROTECTION

For heat, warmth, and cooking, a fireplace or wood heater and sufficient fuel for two weeks can hardly be beat. For cooking, a gasoline camp stove, kerosene stove, or butane camp stove is excellent. According to how much use of these stoves and if they will also be used for heating will determine your fuel supply. Probably five gallons of gas, or five gallons of kerosene, and 5 to 10 gallons of butane will do the job. NOTICE: Proper ventilation is absolutely necesary. Crack that window a bit at the top.

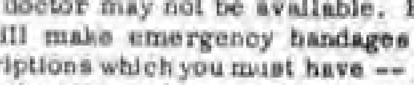
A barbecue or habachi is dangerous if used inside. Better use it outside or open the door of the garage and use them in there.

Have enough clothing to keep comfortably warm. The average family will have no problem here. Sufficient bedding and or sleeping bags for the purpose is necessary.

Keep your normal supply of medicines, with maybe a few extras inasmuch as a doctor may not be available. Bedsheets or pillow cases will make emergency bandages and slings. If you have prescriptions which you must have -- then make it a habit to renew when it reaches a two week supply.

Place blankets or black plastic sheeting over your windows to retain heat which will dissipate from radiation from your windows and also to black-out your place. A place that is lit up is more apt to draw dangerous or desperate people who have not provided for themselves. If you have weapons - be sure they are clean and in good working order and you have a supply of ammunition. Learn proper use of firearms and safetly with same. Keep your home securely locked. Ball bats, knives, pick handles, heavy frying pans, etc. make pretty good defensive weapons. Have them handy.

SANITATION



For your sanitation problems, there must be some method of disposal of body waste. Plastic bags securely tied at the neck is one method. Place a few drops of Clorox or Purex in the bag. (A hole in the back yard in which a shovelful of dirt is thrown will also work). For garbage disposal the large plastic bags will prove suitable.

Now add a gallon of bleach (Clorox, Purex, etc, has many uses for portifying water, sterilizing waste products, etc.).

Paper plates and cups (preferable hot and cold) will simplify a lot of problems.

A box of large kitchen matches. That's about it.

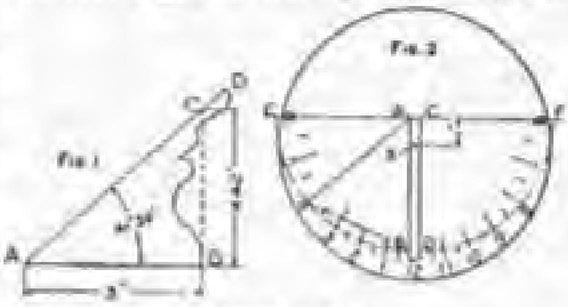
Tomorrow morning start listing your food usage, and immediately start getting your short term survival plan in operation. You cannot start this program after a crisis has hit. If you do get caught with "Your pants down", then use the water from your hot water heater or snow or rain water and please remember that you can go 30 days without a morsel of food. Don't panic, please, because if you try to get some of your neighbor's survival supplies you may get a deadly reception.

How to Lay Out a Sun Dial

(From Popular Mechanics 1913)

The sundial is an instrument for measuring time by using the shadow of the sun. They were quite common in ancient times before clocks and watches were invented. At the present time they are used more as an ornamentation than as a means of measuring time, although they are quite accurate if properly constructed. There are several different designs of sundials, but the most common, and the one we shall describe in this article, is the horizontal dial. It consists of a flat circular table, placed firmly on a solid pedestal and having a triangular plate of metal, Fig. 1, called the gnomon, rising from its center and inclined toward the meridian line of the dial at an angle equal to the latitude of the place where the dial is to be used. The shadow of the edge of the triangular plate moves around the northern part of the dial from morning to afternoon, and thus supplies a rough measurement of the hour of the day.

The style or gnomon, as it always equals the latitude of the place, can be laid out as follows: Draw a line AB, Fig. 1, 5 in. long and at the one end erect a perpendicular BC, the height of which is taken from table No. 1. It may be necessary to interpolate for a given latitude, as for example, lat. 41°-30'. From table No. 1 lat. 42° is 4.5 in. and for lat. 40°, the next smallest, it is 4.2 in. Their difference is .3 in. for 2°, and for 1° it would be .15 in. For 30' it would be ½ of 1° or .075 in. All added to the lesser or 40°, we have 4.2 + .15 + .075 in.= 4.42 in. as the height of the line BC for lat. 41°-30'. If you have a table of natural functions, the height of the line BC, or the style, is the base (5 in. in this case) times the tangent of the degree of latitude. Draw the line AD, and the angle BAD is the correct angle for the style for the given latitude. Its thickness, if of metal, may be conveniently from ⅛ to ¼ in.; or if of stone, an inch or two, or more, according to the size of the dial. Usually for neatness of appearance the back of the style is hollowed as shown. The upper edges which cast the shadows must be sharp and straight, and for this size dial (10 in. in diameter) they should be about 7½ in. long.



Details of Dial

To lay out the hour circle, draw two parallel lines AB and CD, Fig. 2, which will represent the base in length and thickness. Draw two semi-circles, using the points A and C as centers, with a radius of 5 in. The points of intersection with the lines AB and CD will be the 12-o'clock marks. A line EF drawn through the points A and C, and perpendicular to the base or style, and intersecting the semi-circles, gives the 6-o'clock points. The point marked X is to be used as the center of the dial. The intermediate hour and half-hour lines can be plotted by using table No. 2 for given latitudes, placing them to the right or left of the 12-o'clock points. For latitudes not given, interpolate in the same manner as for the height of the style. The ¼-hour and the 5 and 10-minute divisions may be spaced with the eye or they may be computed.

When placing the dial in position, care must be taken to get it perfectly level and have the style at right angles to the dial face, with its sloping side pointing to the North Pole. An ordinary compass, after allowing for the declination, will enable one to set the dial, or it may be set by placing it as near north and south as one may judge and comparing with a watch set at standard time. The dial time and the watch time should agree after the watch has been corrected for the equation of time from table No. 3, and for the difference between standard and local time, changing the position of the dial until an agreement is reached. Sun time and standard time agree only four times a year, April 16, June 15, Sept. 2 and Dec. 25, and on these dates the dial needs no correction. The corrections for the various days of the month can be taken from Table 3. The + means that the clock is faster, and the — means that the dial is faster than the sun. Still another correction must be made which is constant for each given locality. Standard time is the correct time for longitude 75° New York, 90° Chicago, 105° Denver and 120° for San Francisco. Ascertain in degrees of longitude how far your dial is east or west of the nearest standard meridian and divide this by 15, reducing the answer to minutes and seconds, which will be the correction in minutes and seconds of time. If the dial is east of the meridian chosen, then the watch is slower; if west, it will be faster. This correction can be added to the values in table No. 3, making each value slower

TABLE No 1.
Height of stile in inches for a 5 in base for various latitudes

Latitude	Height	Latitude	Height
25°	233	42°	450
26°	244	44°	483
27°	255	46°	518
28°	266	48°	555
30°	289	50°	596
32°	312	52°	640
34°	337	54°	688
36°	363	56°	741
38°	391	58°	800
40°	420	60°	866

TABLE No 2.
Chords in inches for a 10 in circle Sundial

Latitude	HOURS OF DAY										
	12-30	1	1-30	2	2-30	3	3-30	4	4-30	5	5-30
	11-30	11	10-30	10	9-30	9	8-30	8	7-30	7	6-30
25°	.28	.56	.87	1.19	1.57	1.99	2.49	3.11	3.87	4.82	5.93
30°	.33	.66	1.02	1.40	1.82	2.30	2.85	3.49	4.26	5.14	6.10
35°	.38	.76	1.16	1.59	2.06	2.57	3.16	3.81	4.55	5.37	6.23
40°	.42	.85	1.30	1.77	2.27	2.82	3.42	4.07	4.79	5.55	6.32
45°	.46	.94	1.42	1.93	2.46	3.03	3.64	4.29	4.97	5.68	6.39
50°	.50	1.01	1.53	2.06	2.68	3.21	3.82	4.46	5.12	5.79	6.46
55°	.54	1.08	1.63	2.19	2.77	3.37	3.98	4.60	5.24	5.87	6.49
60°	.57	1.14	1.71	2.30	2.89	3.49	4.10	4.72	5.34	5.93	6.52

when it is east of the standard meridian and faster when it is west.

The style or gnomon with its base can be made in cement and set on a cement pedestal which has sufficient base placed in the ground to make it solid.

The design of the sundial is left to the ingenuity of the maker.

TABLE No.3

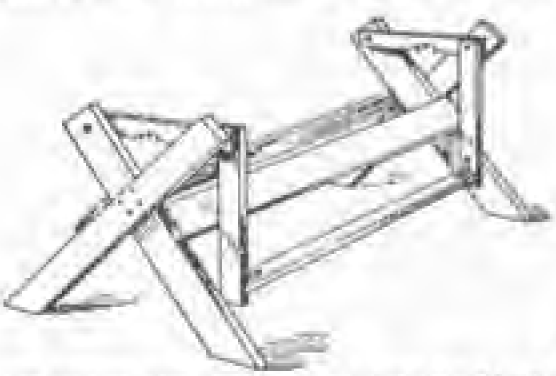
Corrections in minutes to change Sun time to local mean time,- add those marked +, subtract those marked -, from Sundial time.

Day of month	1	10	20	30
January	+3	+7	+11	+13
February	+14	+14	+14	
March	+13	+11	+8	+5
April	+4	+2	-1	-3
May	-3	-4	-4	-3
June	-3	-1	+1	+3
July	+3	+5	+6	+6
August	+6	+5	+3	+1
September	+0	-3	-6	-10
October	-10	-13	-15	-16
November	-16	-16	-14	-11
December	-11	-7	-3	+2

Holding Wood in a Sawbuck

Popular Mechanics 1915

Anyone who has used a sawbuck knows how inconvenient it is to have



The Holding Attachment Easily Adjusts Itself to the Stick of Wood Placed in the Crotch

a stick roll or lift up as the saw blade is pulled back for the next cut. With the supplementary device, shown in the sketch, which can be easily attached to the sawbuck, these troubles will be eliminated. It consists of two crosspieces hinged to the back uprights of the sawbuck and a foot-pressure stirrup fastened to their front ends as shown. Spikes are driven through the crosspieces so that their protruding ends will gouge into the stick of wood being sawed. The stirrup is easily thrown back for laying a piece of wood in the crotch.

Saw Driven by an Automobile

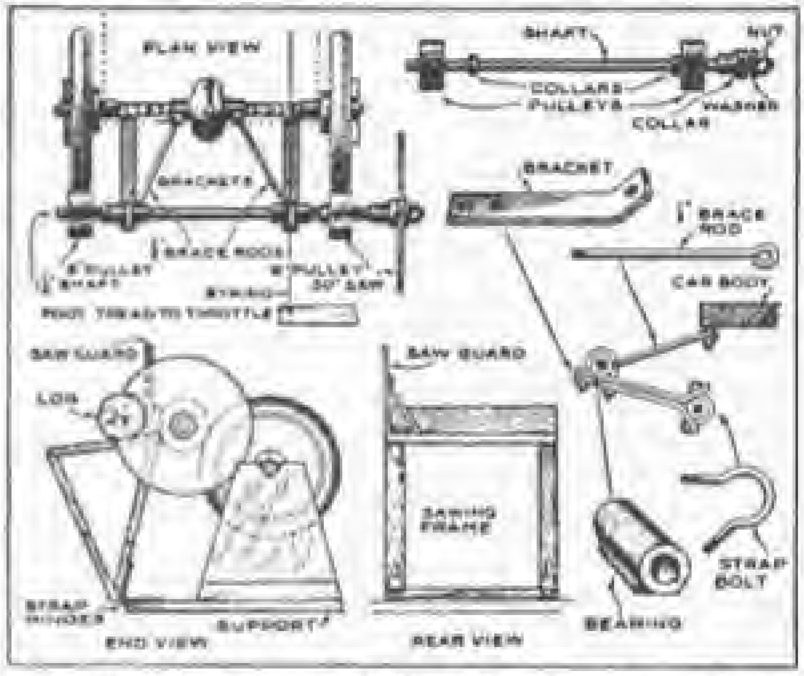
From Popular Mechanics 1925

A comparatively simple arrangement for operating a circular saw, for cutting up cordwood, and for similar purposes, can be operated by any automobile. A 1¼-in. shaft, having two 8-in. pulleys permanently attached and spaced such a distance apart as to line up with the rear wheels of the car, is attached to the rear axle by two wrought-iron brackets provided with bearings.

The shaft bearings are secured with strap or U-bolts, passing through slots so as to permit moving the pulleys back or forth, as may be desired. The right end of the shaft is fitted with a collar and thread for mounting a circular saw of about 24-in. diameter. From each bracket a ½-in. round rod runs to the spring supports of the car to give additional rigidity. The engine is controlled from the rear of the car by a cord attached to the throttle on the carburetor, a spring being attached to the throttle to keep it normally closed, or at normal speed. This is to prevent racing of the motor.

The saw table is of the swinging type, with an extension on which is placed the vertical supports onto which the car is jacked. This arrangement keeps the table steady and in line with the saw. In use, the car is driven to the scene of operations, the rear wheels are jacked up and let down on the supports, the brackets and braces attached, and the bearings adjusted so that the pulleys will be in contact with the tires.

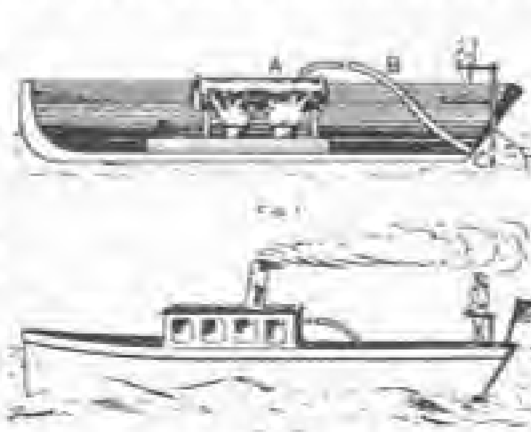
Such an outfit can be made up very simply, as no belt is needed, and the materials required are quite generally obtainable at slight cost.



A Simple Arrangement to Enable the Auto to be Used as a Driving Medium for a Circular Saw: No Alterations are Made to the Car, and the Device may be Attached or Detached in a Very Short Time and No Belt Is Necessary as It Has a Friction Drive

A Simple Steamboat Model (From Popular Mechanics 1913)

The small boat shown in the accompanying sketch may have a length of 12 to 18 in. and is constructed in the following manner: A small steam boiler, A, is supported by two braces over an alcohol lamp in the middle of the boat. A small pipe is fastened to the top of the boiler in such a way that the open end will be opposite the open end of another pipe, B, somewhat larger in size. The pipe B opens into the stern of the boat at C, as shown in Fig. 1. The steam, coming through the small pipe A, is driven forcibly through the larger pipe B, and carries with it a certain amount of air out through the opening C into the water. As the boat is driven forward by this force, the steam arises to the surface in the form of bubbles. The boat soon attains considerable speed, leaving a long wake behind.



Sectional View and Completed Boat

From Popular Mechanics 1925

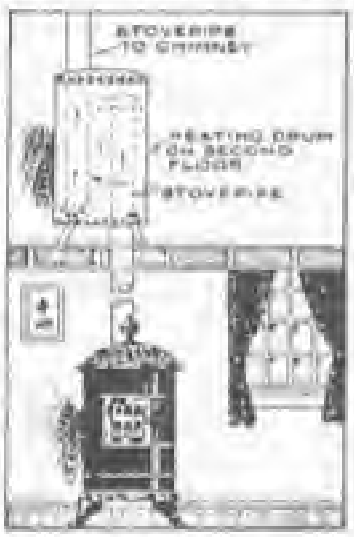
Magnifier for Close Work

Retouchers, artists, and draftsmen who need a magnifier while using a pencil, will avoid the inconvenience of using both hands by making the simple attachment shown in the drawing. Solder a short strip of brass to a pencil holder, or to a metal lead holder. Obtain a small high-power magnifying glass, and attach it to the brass strip by means of a screw, to allow adjustment. The result is a complete tool that can be held in one hand, the magnifier always being in focus for the work.

From Popular Mechanics 1925

Heater Made from Old Tank

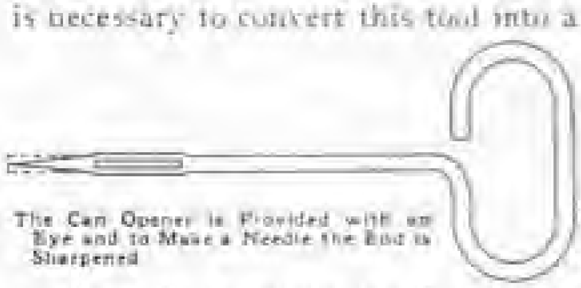
The illustration shows how a discarded steel tank was put into service for heating a room on the second floor of a dwelling. Four legs were riveted to the tank and a hole was cut into each end just large enough to admit a stovepipe. The bottom stovepipe conducted the heat and smoke into the tank from the stove below, the pipe being inserted to within a few inches of the top. The smoke escaped through the second stovepipe which was inserted through the hole in the top of the tank, as indicated.



From Popular Mechanics 1915

Needle for Sewing Burlap

A needle for sewing burlap can be easily made of the ordinary opener that comes with sardine cans. All that is necessary to convert this tool into a needle is to grind the blunt end to a sharp point, as shown in the sketch.



The Can Opener is Provided with an Eye and to Make a Needle the End is Sharpened

POLITICS AND POLITICIANS

By Kurt Saxon

Every four years our Silly Season comes around. It is then that the American public is given the responsibility of either keeping competent politicians in office or sweeping the rascals out in favor of better men.

In a small town, where people know their politicos, the system works fairly well. If a campaign promise is not kept, the one using it to get elected faces impeachment at worst and non-reelection at best. To save his career he must prove an unforeseen obstacle prevented him from acting as he said he would.

In a local issue, his excuse is easily checked. He can't fool enough people to stay in office. Thus, most junior politicos are sincere.

But as his scope widens, he comes up against people who use politicians to further their own interests. The Highway Commissioner promises him the votes of all those who would benefit by the highway system if he enlarges it. These include construction workers, truckers, sellers of road building materials, businesses along the route, etc.

If the new system was really needed the politico has earned his votes to a higher office. Too often, however, it is just a stopgap measure. There is temporary employment, a lot of money is spread around but the result is more arable land covered with concrete, more forests butchered. It is another ecological disaster.

The taxpayers are left holding the bag and property taxes go up again. The construction worker is unemployed again. Businesses along the route fail during a fuel shortage. Little old ladies lose their crackerbox homes because they can't pay the increased taxes.

The politico who backed the program finds it very easy to blame everyone concerned and plead ignorance. Politicians have become so good at pleading ignorance that ignorance has become their hallmark.

The higher up he goes in politics the less control the politician has over the programs he backs. There are so many interested persons telling him things they only hope are true, that he and the voters are easily taken in.

So this sincere politico goes from local issues which he can control to state issues, too complex and with too many vested interests for him to be expected to control. But by the time his promised benefits have failed to materialize, he is on the next rung of the political ladder. His past mistakes are now far behind and his future ones are close ahead. He now vows that with the support of the voters, he and they will never be swindled again.

Had he stayed where he was, he might have learned the pitfalls of that level, and some do. But up he goes and the public is shafted again. Relying on the political amnesia of the public, he now runs as a popular friend of all. He is ignorant but well-meaning. But with your support, everything is possible.

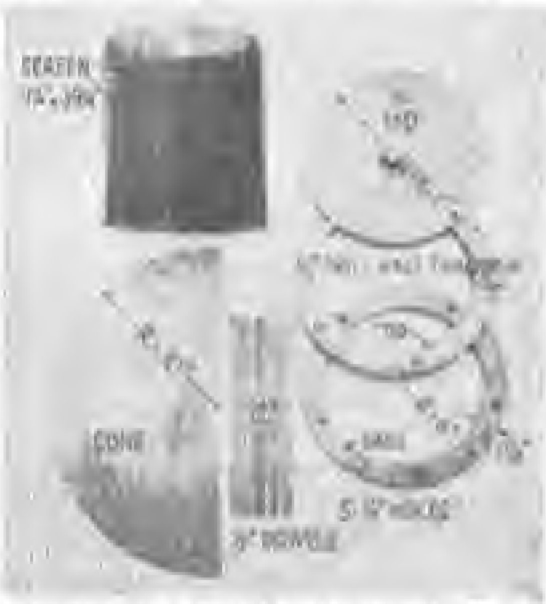
Since this dummy is not able to know everything, he makes ignorance a virtue, often implying that those really qualified are suspect. If they do know what's happening they must be on the inside, with the enemy. So you are actually encouraged to vote against the most able. Any competence is suspect since it smacks of inside knowledge. So the most ignorant, the dreamers, the wishful thinkers, leave the "eggheads" far behind in most political races.

Of course, most of the eggheads are simply a little more intelligent. This doesn't mean they know enough to come in out of the rain. Actually, the intellectual politico is simply the one who can read without moving his lips.

He usually surrounds himself with degree holders whose only abilities lie in sneering down any practical approach to a problem. The degree holders, politicos who court them, and their numerous hangers-on are called "Liberals" and their only concern is with impoverished no-hopers.

The Liberal is so insecure in his real value that he must reduce the value of all so that he looks better by comparison. Hence, the idealistic social

Fly and bee trap. Bait with fish heads or old meat. Attracts insects, keeps them off food. Trapped inside screen, they die.



Fly trap collapses for transport. To assemble, fit dowels in wood rings, tack on screen. Leave ¼-inch hole in top of cone.

A Fruit-Jar Opener

The accompanying sketch shows a handy device for turning up and unscrewing the covers on glass fruit jars. The loop is slipped over the cover and the handle turned in the direction of the arrow. To unscrew the cover, the tool is turned over and the handle turned in the opposite direction.

The loop should be just large enough to slip over the cover easily.

The Loop in the Leather Grips the Cap Tightly When the Handle is Turned as the Arrow Indicates

It is made of leather and fastened to the wood handle with screws.

programs that fail right along with the roads that go nowhere and the dams that break and the publicly subsidized industries which loot the wage-earners.

It doesn't really matter if the dummy is ignorant or actually stupid, whether he calls himself a Liberal, Conservative or a Moderate. They are all political pigs wanting only to get up to the public trough, and stay there.

They all plead ignorance, in one way or another. They need the support of the American people, as if that support will somehow put the stamp of validity on their incompetent efforts toward a better life for all.

That's why they all say, "Even if you don't vote for me, vote." They know your vote is a vote for their own way of life. It insures that if they lose this election, they'll still have a goal to shoot for next time. It's a vote to keep those places at the public trough available for creeps who have nothing to sell but themselves.

And since they have nothing to sell but themselves, the accent is on personality and agreeableness. They parade out their usually pretty wifes and homely children and read speeches written by others. Most such speeches are written by Madison Avenue types whose works sound like commercials written for kiddie shows. "Vote for Captain Monster. More sugar to the spoonful."

The speeches are usually geared to pleasing everybody, no matter what opposite ambitions the voters have. They generally promise a paradise for both the dog and the flea. It's all an illogical, wasteful and often cruel circus.

Our society is collapsing due to over-population, mental cripples, pollution, changing climate and a scarcity of resources. All any politician can do is manipulate scarce resources and divert them to the loudest rabble or the most influential industries and away from the wage-earners.

Nothing these turkeys promise will really change things. A person who believes it will is only delaying urgent action toward his own survival.

This month, the results of a voter rebellion poll came out. It predicts that 70 percent of Americans old enough to vote will not go to the polls this November. That's more than the combined vote totals for Lyndon Johnson and Barry Goldwater in 1964.

In the last two national elections, the survey found, up to 10 million people have dropped out. The possibility exists that come November, for the first time in over 50 years, a majority of eligible voters will not choose who their president is to be.

Most of the dropouts are college educated and reasonably affluent. One well-dressed young protester interviewed as a potential voter said, "Look at the whole thing. We're going to get screwed one way or the other. We're gonna get it. And no one's really looking out for our benefit."

There was still another disturbing statistic (to the pollster). Of the 87 percent of non-voters who said they could be turned back on by a candidate in which they could place their faith, only one percent mentioned the name of President Ford or Jerry Carter. This is no real hope for those wanting a third party such as the American Independent, Libertarian, etc. Also, chances are still no better for the gutter politicians of the radical Right and Left.

The American political system is the instrument of Business and Labor. The Republican politico favors Business and acknowledges Labor. The Democrat favors Labor and acknowledges Business. Business and Labor are completely interdependent and neither could survive if either were favored beyond a certain point, or if another interest were favored to any effectual degree.

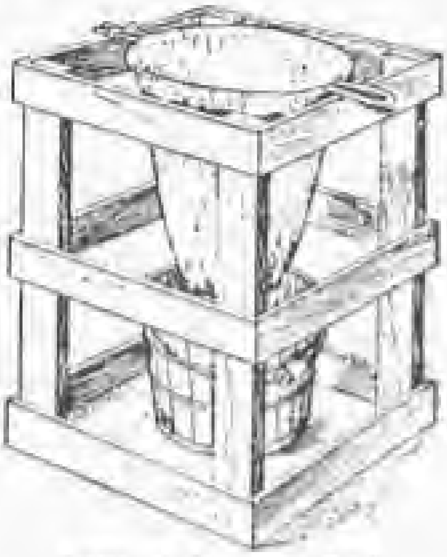
Business and Labor are the two largest power blocks, each having a greater concentration of voters. The self-employed, unemployed, the farmers, students and racial minorities, have no common ground on which to come together in the alliance it would take to gain a majority.

So both parties give lip service to the needs of small business, farmers and minorities. These groups have sincere spokesmen in both parties. But this is

(From Popular Mechanics 1913)

A Jelly-Making Stand

Every housewife who makes jelly is only too well acquainted with the inconvenience and danger of upsets when using the old method of balancing a



Cheesecloth Strainer on Stand

jelly-bag on a couple of chairs stood on the kitchen table, with the additional inconvenience of having a couple of chairs on the kitchen table out of commission for such a length of time.

The accompanying sketch shows how a stand can be made from a few pieces of boards that will help jelly-makers and prevent the old-time dangers and disadvantages. The stand can be stood in the corner of the kitchen, or under the kitchen table where it will be out of danger of being upset.

From Popular Mechanics 1915

Catching Bugs Attracted by Light

Bugs, moths, and insects attracted by lights on summer evenings can be caught by means of sticky fly paper, suspended as shades around the lamps. Cuts in the shade allow the greater portion of the light to pass through and attract the bugs, which will surely be caught as they travel about the light onto the sticky paper. It is advisable to make two shades at the same time from a double sheet of the sticky paper, pasted, as when bought, with the sticky faces together so that the shades may be cut and handled easier.

arranged, don't you see? Fewer people are fooled.

Over half the people have given up on politics and politicians. Over two-thirds agree with the statement that candidates say they will do one thing and then do the opposite. This is true because both Republican and Democrat need the votes of Small Business, Farmers and racial minorities. Even if they are sincere, when they gain office, they find that their party's basic interests must be served even if that means making a liar out of the winner.

As more people catch on to the fraud of voting in national elections, only the simple-minded continue to vote. I was listening to the complaints of a registrar of voters on a TV news show. He was saying that a certain sample ballot was too complex. His point was that the average voter reads at a sixth grade level. Are you surprised? Aren't most political appeals made to morons?

But the fact that the ballots were too complex had nothing to do with intelligence. The issues on sample ballots are usually written in single, long sentences, vague and impossible to understand without prior briefing. If you haven't studied the issues on your own, the ballot will often cause you to vote opposite to your real intentions.

You probably remember issues on which the ballot tells you to vote "yes" if you are against it and "no" if you are for it. This seems to be a snare set up by the overall political machine. If you are among the intelligent minority and know what you're voting for, you will not be deceived. But you will still have wasted your time voting.

A case in point is Proposition 13 in California which called for a study of atomic power with the view to shutting down the power plants. So a yes vote was against atomic power and a no vote was for it. The intelligent voter who was against atomic power voted yes. The less aware voter who was also against atomic power voted no, meaning he didn't want it. Atomic power won with a two-thirds majority.

Survivalists don't involve themselves in national politics at all. They don't want to be dependent on either Big Business or Labor Unions, the Tweedle-Dee and Tweedle-Dum of our political system. They know that, as part of an intelligent minority, their votes will be cancelled, several to one, by the ignorant.

Only a fool, nowadays says, "If you don't vote, you have no right to criticize." Actually, just the reverse is true. If you vote for either Tweedle-Dum or Tweedle-Dee you are endorsing a dual-monopoly. Either side is just one side of the same coin. Every vote for either side is an endorsement for the monster. The non-voter is the only one qualified to criticize that monster.

If a majority refuses to vote in national elections, the dual-monopoly will be shattered. Politics will become regional. Thus, most of the people in an area will be catered to instead of just those affiliated with Big Business and Labor Unions. Smaller parties will have a chance for the first time to address themselves to neglected interests.

Your non-vote in the national election will be a vote for whatever chance this country still has.

Cheap Soap for Mechanics

Scraps of soap are put into a metal container with water and reduced to a paste by boiling. While the mass is in a semiliquid condition, a quantity of fine sawdust, or finely powdered pumice stone, is added and thoroughly mixed. When cool, this soap will be found excellent for removing grease and stains from the hands.

BISCUITS, Hard.—Warm two ounces of butter in as much skimmed milk as will make a pound of flour into a very stiff paste, beat it with a rolling-pin, and work it very smooth. Roll it thin and cut it into round biscuits; prick them full of holes with a fork. About six minutes will bake them.

How to Cane Chairs

(From Popular Mechanics 1913)

There are but few households that do not have at least one or two chairs without a seat or back. The same households may have some one who would enjoy recaning the chairs if he only knew how to do it, and also make considerable pin money by repairing chairs for the neighbors. If the following directions are carried out, new cane seats and backs can easily be put in chairs where they are broken or sagged to an uncomfortable position.

The first thing necessary is to remove the old cane. This can be done by turning the chair upside down and, with the aid of a sharp knife or chisel, cutting the cane between the holes. After this is done the old bottom can be pulled out. If plugs are found in any of the holes, they should be knocked out. If the beginner is in doubt about finding which holes along any curved sides should be used for the cane running nearly parallel to the edge, he may find it to his advantage to mark the holes on the under side of the frame before removing the old cane.

The worker should be provided with a small sample of the old cane. At any first-class hardware store a bundle of similar material may be secured.

The cane usually comes in lengths of about 15 ft. and each bundle contains enough to reseat several chairs. In addition to the cane, the worker should provide himself with a piece of bacon rind, a square pointed wedge, as shown in Fig. 1, and 8 or 10 round wood plugs, which are used for temporarily holding the ends of the cane in the holes.

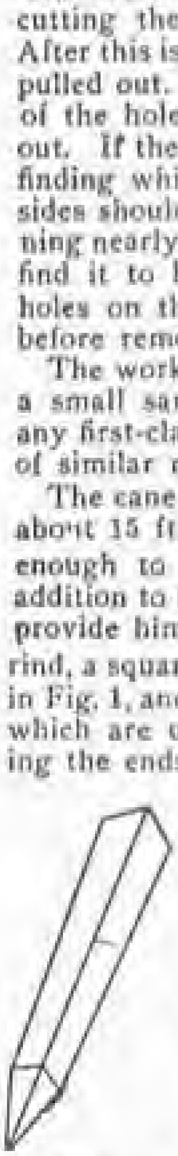


Fig. 1

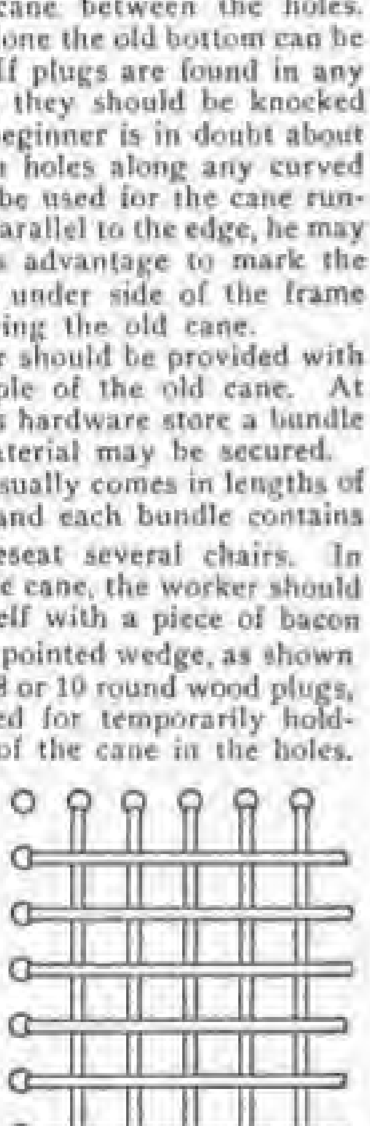
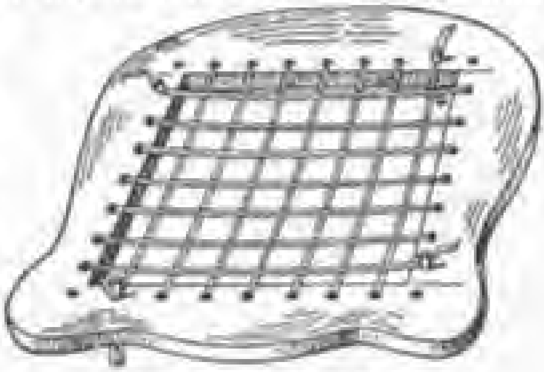


Fig. 2

First Layer of Strands

A bucket of water should be supplied in which to soak the cane just before weaving it. Several minutes before you are ready to begin work, take four or five strands of the cane, and, after having doubled them up singly into convenient lengths and tied each one into a single knot, put them into the water to soak. The cane is much more pliable and is less liable to crack in bending when worked while wet. As fast as the soaked cane is used, more of it should be put into the water.

Untie one of the strands which has been well soaked, put about 3 or 4 in. down through the hole at one end of what is to be the outside strand of one side and secure it in this hole by means of one of the small plugs mentioned. The plug should not be forced in too hard nor cut off, as it must be removed again. The other end of the strand should be made pointed and passed down through the hole at the opposite side, and, after having been pulled tight, held there by inserting another plug. Pass the end up through the next hole, then across and down, and hold while the second plug is moved to the last hole through which



First Two Layers in Place

the cane was drawn. In the same manner proceed across the chair bottom. Whenever the end of one strand is reached, it should be held by a plug, and a new one started in the next hole as in the beginning. No plugs should be permanently removed until another strand of cane is through the same hole to hold the first strand in place. After laying the strands across the seat in one direction, put in another layer at right angles and lying entirely above the first layer. Both of these layers when in place appear as shown in one of the illustrations.

After completing the second layer, stretch the third one, using the same holes as for the first layer. This will make three layers, the first being hidden by the third while the second layer is at right angles to and between the first and third. No weaving has been done up to this time, nothing but stretching and threading the cane through the holes. The cane will have the appearance shown in Fig. 3. The next thing to do is to start the cane across in the same direction as the second layer and begin the weaving. The top or third layer strands should be pushed toward the end from which the weaving starts, so that the strand being woven may be pushed down between the first and third layers and up again between pairs. The two first strands of the fourth layer are shown woven in Fig. 3. During the weaving, the strands should be lubricated with the rind of bacon to make them pass through with ease. Even with this lubrication, one can seldom weave more than half way across the seat with the pointed end before finding it advisable to pull the remainder of the strand through. After finishing this fourth layer of strands, it is quite probable that each strand will be about midway between its two neighbors instead of lying close to its mate as desired, and here is where the square and pointed wedge is used. The wedge is driven down between the proper strands to move them into place.

Start at one corner and weave diagonally, as shown in Fig. 4, making sure that the strand will slip in between the two which form the corner of the square in each case. One more weave across on the diagonal and the seat will be finished except for the binding, as shown in Fig. 5. The binding consists of one strand that covers the row of holes while it is held down with another strand, a loop over the first being made every second or third hole as desired. It will be of great assistance to keep another chair with a cane bottom at hand to examine while recaning the first chair.

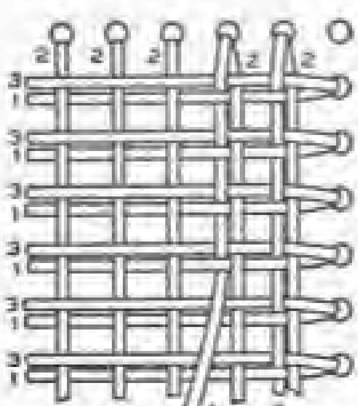


Fig. 3

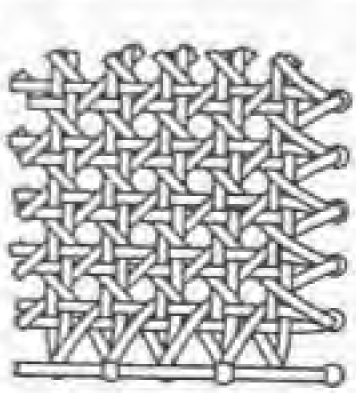


Fig. 5

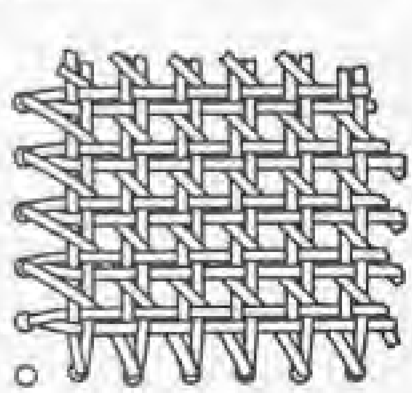


Fig. 4

Three Stages of Weaving

 THE SURVIVOR Vol. 1

SURVIVAL AMMUNITION

by Clyde Barrow

Anyone preparing for survival in these uncertain times should be sure that he will have adequate ammunition for any guns he might own. Ammo prices are already outrageous, 7 to 14 dollars per 50 rd box of pistol ammo and rifle cartridges are often 5 to 8 dollars for 20 rounds. Many gun stores are often out of even the most popular calibers, claiming "ammo is becoming hard to get."

All ammunition will probably disappear from dealers' shelves damn fast when things really start to go to hell.

Even though ammo is currently available, it is so expensive that few gun owners are really proficient with their weapons. Practice makes perfect, but practice costs money.

There are three solutions to the problem:

One—Buy ammo now in case lots, cheap military surplus if possible, but at least try for a discount. One can buy at wholesale prices if he has a Federal Firearm License. Factory ammo is oil and water resistant and will keep for years. It is an excellent investment and will probably become a major medium of exchange.

Two—You can get into reloading on a large scale basis. This can become quite costly, several hundred dollars worth, and is practical only if one intends to do a lot of shooting or wishes to have an underground ammunition factory when the crunch comes.

Three—The practical solution for most gun owners is the compact reloading kit known as the Lee Loader, manufactured by Lee Custom Engineering Inc. Lee produces loaders for all popular calibers of pistols, rifles, and shotguns.

The basic kit costs about 11 dollars, comes with complete instructions and is very easy for anyone to use. The only necessary items not included are a large plastic hammer, about 5 dollars at hardware stores, and some parafin or commercial case lube for resizing. Of course you still need cases, primers, powder and bullets. Primers and powder can be purchased at most gun shops. Bullets can be bought ready-made or can be cast at home in bullet molds available from Lee and similar companies. Cases can be bought new or empties from fired factory ammo can be used. Cases can be reloaded many times if they are handled carefully.

Several inexpensive accessories are also available from Lee and while they are not necessary, they do simplify and speed up the process. The one fault of the Lee Loader is that it is rather slow and tedious work. An item that really helps is the Lee Priming Tool. This handy little devil doubles the production rate and only costs 3 dollars, with individual shell holders for each caliber an additional 2 dollars each.

The Lee Loader system is not only inexpensive, but also very portable, the whole works fits in a shoebox and can be taken anywhere. If you can't find a loader at your local dealer write to the factory for more information.

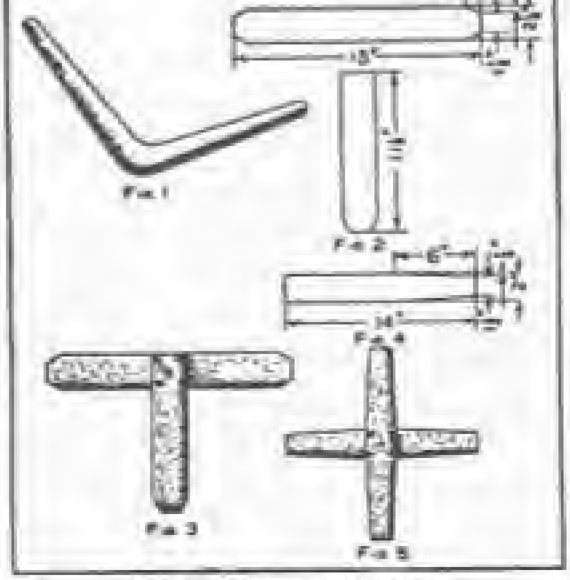
Lee Custom Engineering Inc. Hartford, Wisconsin 53707.

Another item that is hard to find lately is shot for reloading shotgun shells. Shot can be improvised by melting down old bullets or other lead scrap and pouring it through a seive into a bucket of cold water. When the droplets of lead hit the water, they cool and solidify into perfect round balls. The correct size shot for your needs can be obtained by regulating the size of the holes in the sieve. This is a simplification of the commercial process and should work very well. (That's why they call it chilled shot).

Boomerangs and How to Make Them

(From Popular Mechanics 1913)

A boomerang is a weapon invented and used by the native Australians, who seemed to have the least intelligence of any race of mankind. The boomerang is a curved stick of hardwood, Fig. 1, about 5/16 in. thick, 2½ in. wide and 2 ft. long, flat on one side, with the ends and the other side rounding. One end of the stick is grasped in one hand with the convex edge forward and the flat side up and thrown upward. After going some distance and ascending slowly to a great height in the air with a quick rotary motion, it suddenly returns in an elliptical orbit to a spot near the starting point. If thrown down on the ground the boomerang rebounds in a straight line, pursuing a ricochet motion until the object is struck at which it was thrown.



Details of Three Boomerangs

Two other types of boomerangs are illustrated herewith and they can be made as described. The materials necessary for the T-shaped boomerang are: One piece of hard maple 5/16 in. thick, 2½ in. wide, and 3 ft. long; five ½-in. flat-headed screws. Cut the piece of hard maple into two pieces, one 11½ in. and the other 18 in. long. The corners are cut from these pieces as shown in Fig. 2, taking care to cut exactly the same amount from each corner. Bevel both sides of the pieces, making the edges very thin so they will cut the air better. Find the exact center of the long piece and make a line 1¼ in. on each side of the center and fasten the short length between the lines with the screws as shown in Fig. 3. The short piece should be fastened perfectly square and at right angles to the long one.

The materials necessary for the cross-shaped boomerang are one piece hard maple 5/16 in. thick, 2 in. wide and 30 in. long and five ½-in. flat-headed screws. Cut the maple into two 14-in. pieces and plane the edges of these pieces so the ends will be 1½ in. wide, as shown in Fig. 4. Bevel these pieces the same as the ones for the T-shaped boomerang. The two pieces are fastened together as shown in Fig. 5. All of the boomerangs when completed should be given several coats of linseed oil and thoroughly dried. This will keep the wood from absorbing water and becoming heavy. The last two boomerangs are thrown in a similar way to the first one, except that one of the pieces is grasped in the hand and the throw given with a quick underhand motion. A little practice is all that is necessary for one to become skillful in throwing them.

'Now Who's Stupid, Dad?'

By Marc Ridenour

Ever since I'd first brought up the subject of survival, my father had scornfully rejected anything I had to say. He was one of those with the "it can't and won't happen here" attitude. He reminded me of the brass in the U.S. high command prior to Pearl Harbor, December 7, 1941.

That evening, as I sat reading my latest issue of "The Survivor" in my room, my younger brother Jeff, who is a carbon copy of the old man, stuck his head through the door. "Whatcha doin'?" he demanded.

"Get out, Himmler," I barked.

He stuck out his tongue at me. "Don't have to."

Laying aside the paper, I got up and went for him. Turning, he fled for the stairs. Closing the door, I locked it, and then sat back down and resumed reading.

Presently I heard heavy footsteps on the stairs, and my father's voice demanded, "Are you reading that idiotic paper again? Cluttering up your mind with that survival rubbish?"

I didn't reply.

"Answer me!" he demanded.

"Open that door this instant!" came a second demand.

Again I paid no attention.

Muttering about "worthless whelps" and other things, he stomped away, and went back downstairs. He, the runt and my mother would all agree how impudent, disrespectful and no good I was and how I ought to be punished.

But, by maintaining as low a profile as possible, I could get by without too much trouble.

Sighing, I finished reading the copy of "The Survivor" and laid it aside with the others I kept. My parents couldn't invade my room because I kept it locked all the time. Besides "The Survivor" copies my father would love to burn, there were other books and equipment he'd enjoy disposing of.

But unless they wanted to break the door down or send for a locksmith, two expensive propositions, they couldn't get in. And my gear stayed secure.

When I first read "The Survivor" and other like papers and magazines, I was smart enough to realize they were telling the truth—my father's opinions notwithstanding.

So, since it wasn't possible to persuade him or anyone else—Mom or the brat, I decided to concentrate on saving my own hide when and if the Crunch came.

Stowing the latest issue of "The Survivor", I was about to begin reading a sci-fi novel when the lights went out. I swore, then got up and broke out my calcium carbide lamp. This had happened before, my father cutting off power to my room at the breaker box to demonstrate his authority or show off his machismo or something—to strike back at me.

The carbide lamp hissed and burned, casting a soft white light that burned away the darkness and let me read. A knock came at the door, and I called, "Who is it?"

"Can I borrow a flashlight?" asked Jeff.

"Bug the old man to put the circuit breakers back in," I replied. "Then you'll have light a-plenty."

"The power's off all over town—even the streetlights!"

My first impulse was distrust. I trust my father and brother to knife me in the back whenever they can, so I looked out the window, and sure enough, the power was off!

Finding my AM-FM portable radio, I switched it on and listened. The local station was off the air as well! For the first time, unease began to gnaw at me. Digging out my CB walkietalkie, I switched it on and began to call, "This is KLZA 1508 to anyone with their ears on. Come in please. Over."

I was transmitting on Ch. 11, the "monitor" channel, that almost everyone listens to. Within minutes I had a reply.

"KLZA 1508 this is KNH 1234, alias Coconut Pete. I copy you."

"What's the problem? The lights are off everywhere."

"That's a big 10-4, by golly. The radio station's off the air, too. It must be serious."

"10-4," I agreed. "I'm gonna monitor 9 (the distress channel). KLZA 1508 clear and on the side."

Switching to Channel 9, I heard a jumble of transmissions. "This is Unit #8. I've just arrived at the light plant—man, it looks like somebody dropped a bomb—everything's down or really blown up! "Better call out the Emergency Corps and the Sheriff's Posse."

"Any fire?"

"Negatory—there isn't enough left to burn!"

Keying my transmit switch I cut in, "Breaker 9."

"Go breaker."

"This is KLZA 1508. Is that the Southland light plant east of town?"

"10-4. Are you official?"

"Negatory. Is the plant totally destroyed?"

"Looks like it—and clear this channel, motormouth!"

"Ten-four, hotrock," I replied and clicked to channel 11 again. By now the wavelengths were getting crowded. The news the light plant had exploded and was totally destroyed was just starting to get around. Someone was yelling the Russians had bombed us, while someone else with a stronger transmitter was overriding him and claiming one of the huge boilers had blown. Each of those boilers was as big as a small building, and if one of them had blown, it would be as devastating as a bomb.

Besides M'town, the Southland plant supplied other areas with power. With the plant itself gone, it would be days, at least, before we'd have any power, let alone full service. And without electricity, a city is a dead hunk of iron, concrete, asphalt and plastic.

Flicking to channel 22, I began to transmit again. "KLZA 1508 to KRAO 2345. Do you copy?" The reply was almost instantaneous.

"10-4 KLZA 1508. We copy."

"Ol' buddy, the balloon just went up—Southland blew a boiler, and that pretty well leveled the whole joint. I'm beginning my Emergency Contingency Plan, and am activating Stage One. Do you copy?"

"Ten-four. Will meet you at the rendezvous site."

"Roger. KLZA 1508 clear and on the side."

Laying aside my walkietalkie, I dragged out the huge backpack and frame I'd had built for me by a tentmaker and welder. The frame measured 2½ feet wide by 4 feet long. The great pack could take a lot, and it was possible to strap a dufflebag or two, along with a sleeping bag, tarp and groundcloth onto the frame itself. I'd designed it with that in mind. After clearing it from the closet, I began to pack, working as fast as I could, without making any mistakes. By the time I was finished, I had everything I'd need—from basic survival gear to books, magazines and newspapers and tools that would come in handy for long-term survival.

The fully loaded pack weighed almost half as much as I did, but I got it on at last. Then, picking up my shotgun and donning my hardhat with the calcium carbide lamp on it, I walked out my room's door after unlocking it, relocked it behind me, and headed for the stairs.

They had candles lit when I stepped into the living room, and Dad started when he saw me. "What are you doing with all of that stuff?" he demanded.

"Leaving," I told him.

"Where?" he demanded.

"You wouldn't care," I told him.

"Are you going on that survival kick again? Do you think the Crunch, as you call it, has arrived?"

"It'll do until one comes along," I told him.

"You stay right here—this won't last long—they'll have repairs completed by morning."

"No they won't—the whole plant is gone."

"Where'd you hear that? Over that stupid CB radio you play with?" he sneered.

Ignoring him, I turned and opened the front door and walked out. "Why was I given such a stupid son?" was the last thing I heard him say.

Walking down the totally darkened street, my carbide lamp lighting the way, I heard the sound of glass shattering and suddenly running men appeared in my light's beam. "Hey! There's one—get him!"

My shotgun leaped to my shoulder, finger squeezing the trigger. BOOM! the flash and roar were tremendous, and the charging figures vanished as if by magic—except for the one who lay sprawled on the street ten feet from me . . .

Walking hard, I reached the rendezvous point, grateful I'd spent $2 for that MASS info packet, that had put me in touch with an M'town sportsman's club that was also a survivalist association.

Presently, a station wagon towing a trailer came slowly idling up to the spot, and I walked up to it, halting when a flashlight squirted light into my face.

"Hi—ready to go?" asked a cheerful female voice.

"Ready," I murmured, shrugging off my pack and loading it in first, and then climbing into the crowded rear seat, holding my gun carefully.

The station wagon took off, cruising slowly. The woman at the wheel, and her three kids, were quiet and alert, looking around.

"Where's Jack?" I asked.

"He's still at home—securing it."

"Good. My family'll still be there," I grimaced. "My father called me stupid whenever I tried to warn him."

"Your family isn't coming?" she asked, and I nodded.

"The brat, my folks—they wouldn't believe me. 'It can't happen here.' I'm the 'stupid son'."

"Stupid like a fox," she replied crisply.

Grinning, I relaxed. It was curious, but I found myself not caring too much what happened to them. I guess they'd killed any love I'd had for them over the years with their picking, belittling and nagging and bitching.

We left the city limits behind us, and drove down the asphalt. Reaching a gravel turnoff, we pursued that until it came to an intersection. Hanging a left, we drove along that road until we came to a small farmhouse and outbuildings. Several cars were parked there, and lights were on inside.

"Our wind-generator gives us enough power for some light after dark," said Wanda, as she stopped the car. Helping her with their gear, we were soon inside with everything—kids, gear and us. Everyone else who belonged to the survival association was already there, save for Jack, but soon, he too arrived, and then the chairman began to call the roll.

Everyone was present, and after that was taken care of, the chairman asked for a report from each of us. When he got to me, I told of my conversations on and monitoring of, the CB channels, and my encounter with the looter gang.

"The situation seems clear—if grim," the chairman stated boldly. "With power gone, the rest of the public utilities will go too—and in a few days, the city will be a pigpen. From what we know also, law and order are breaking down inside the city—the looter gang that one of us ran into was probably just one of many. So, we had best prepare for a long, long stay—perhaps as long as two months. In view of the fact lawlessness is starting to appear, we shall mount guard in case nightriders come our way. Tomorrow, we'll decide what shall be done in the way of long-term preparations, but for now, we shall mount guard and turn in. I have a duty roster drawn up. As I call out your names, stand up and get ready . . ."

I didn't draw guard duty that night. But the following morning I did wind up on wood-gathering detail. Armed with my machete, folding saw and hatchet, I ventured into the woodlands around the small farmsite, and with three other fellows proceeded to cut and gather up dead wood.

Upon returning with our sizable load, we then split up the bigger pieces, and then kept breaking up the smaller ones until all we had left were sticks about as big and long as corncobs and fingers. Small sticks burn better than big ones.

The Franklin stoves we had wouldn't be necessary yet—except for food preparation. The large garden out back would provide enough food to see us through the winter, if it came to that. All in all, we numbered some forty people—men, women and kids. It was a bit crowded, but we were glad for the company. We had well water, and for sanitation, a crude septic tank affair—that was hooked up to a methane gas generator. The methane gas was in turn piped to either storage tanks, or burned by the small light plant we had set up along with our wind-charger.

A week went by, and we marked our first week with a celebration—we sang songs—played games and had a shooting contest with non-firearm weapons. I did so-so with my slingshot, but one guy with a longbow made everyone look sick—except for another guy with a crossbow, who made the longbowman look sick.

We monitored CB channels and listened to the local radio station, which was back on the air. For the first time we found out what had actually happened. A boiler had exploded at the Southland plant—due to a structural flaw that had passed unnoticed by all until heavy pressure had been built up in it. The plant had indeed been almost gutted by the blast, and the loss of life had been heavy. It was not yet known just when electrical power would be restored—although vital public utilities should be restored in another week or so—scant consolation for the thousands who hadn't prepared at all for the debacle.

And so we stayed out at the retreat, working, playing, taking turns tutoring the kiddies, and all in all, we had a decent time of it.

The second week went, and then the third. By then I was adjusting to the routine, and for the first time in my life, I was a contributing member of a community. I was respected, and people listened to me, and didn't call me a dummy, either.

On the third day of the fourth week we were there, a Tuesday, one of the kids was fooling around with one of the radios, and suddenly the local station, which had been broadcasting a pretty weak signal via standby generators, came through like a 21-gun salute.

I was helping with the washing that day, and I'd struck up a friendly relationship with one of the girls—a pretty dark-haired brown-eyed senorita named Consuelo. We'd just hung up the laundry when Jack came dusting around to tell us the news. Electrical power had been restored. The city had full power again, all public utilities were operating at capacity.

We held a meeting late that afternoon, and the consensus was that with things getting back to normal in the city, we could all head on back tomorrow.

That evening, sitting around the small Franklin stove, Consuelo beside me, everyone else singing, laughing, talking, having a good time, I was sad. Tomorrow I'd have to go back to my family and revert to being "the stupid son." Back to the nagging, bitching, belittling. Out here I'd been somebody with respect. I'd been a good man to handle many chores—cutting wood, washing clothes by hand, hoeing in the garden, doing other chores that need to be done—I'd won myself respect and was esteemed by my fellow survivalists as a man they could trust. But tomorrow—it would end. I'd go home—and catch hell for having ducked out. But after all, they hadn't believed me—just like most people hadn't listened to Noah. Only when it was too late did they try to get aboard the Ark—but by then, God had shut the door. And no-one else could get aboard. It was much the same way with the survival community.

"What's wrong?", asked Consuelo softly.

I told her—all of it. And ended with, "I don't want to go back—but what else is there?"

She smiled. "Maybe they'll change their tune when they see you. "Stand up for yourself."

"I plan to, honey." I told her.

The next morning, Wednesday, we all piled into our vehicles and rode back to town.

Jack and Wanda were kind enough to drop me off at my place—which was outwardly okay. The front door was wide open, and I entered with my gun at ready—and found no-one else at home. Nothing looked disturbed, so I began to explore—and found a note on the kitchen table.

It said, "We have gone south to stay with some friends of your father's. We'll be back after things get back to normal. Love, Mom."

Laying the note down, I turned on the living room light and sat down in my father's recliner chair. Footsteps sounded on the porch, and two Army or National Guard MP's stalked inside, both in fatigue battledress, .45's drawn and ready.

"Hey—what is this?" I demanded, rising.

"Who're you?" snapped the senior MP, a tall, husky man with grim planes on his face.

"I live here. What's the deal?"

"Let's see your ID," demanded the second MP. Carefully, I dug out my wallet and tossed it to him. He caught it, flipped it open and scanned my papers—driver's license, social security card, draft card and gun club membership card and my sportsman's club card.

Tossing it back to me, he lowered his gun. "Sorry—we've had reports looters were still in this area."

"Are they?" I asked, with a start.

"We aren't sure—but they were real bad on the south side of town up until just awhile ago—after power was restored."

"Yeah—the gangs were really having a time of it—ambushing the refugees trying to leave the city by the south roads."

I gulped, "My folks said they were cutting out by the south roads. "This note's dated a week ago."

"Then they're dead—those gangs killed everyone they got their hands on, buddy. What's their names?" asked the MP. I gave them, feeling a funny, empty space appear in my gut all of a sudden.

The MP looked at his partner and nodded. "We'll check it out—the bodies have been mostly identified by now. Some got through, but not many. I hate to be gloomy, but—but it looks like your folks are dead."

They turned and marched out, as I went to the phone. Lifting it, I heard a dial tone. I called City Hall and they referred me to Civil Defense. I called them, and asked if they knew whether my folks were dead or alive.

A CD clerk checked and then got back to me. "Your little brother's at the pediatrics ward at MACH East hospital. I'm sorry, but your parents are dead—killed by looters when they tried to crash a roadblock."

"Thank you," I murmured, and slowly hung up. Gazing at the picture of my parents on the buffet in back of me, I murmured softly, "Dad, you said I was stupid, lazy, ignorant, dumb—ever since I was a kid, you said it. Well, who's the dummy now, Dad? Who's the dummy now?"

From Popular Mechanics 1913

An Emergency Glass Funnel

Secure a glass bottle having a small neck and tie a string saturated in kerosene around the outside at A and B as shown in the sketch. Light the string and allow it to burn until the glass is heated, then plunge the bottle quickly into water. The top or neck will then come off easily. The sharp edges are ground or filed off smooth. This will make a good emergency funnel which serves the purpose well for filling wide necked bottles.—

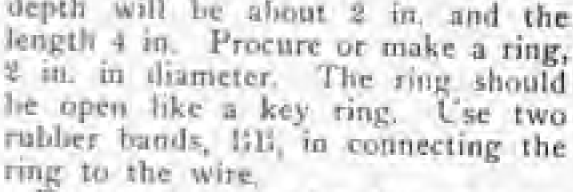
(From Popular Mechanics 1913)

A Quickly Made Lamp

A very simple lamp can be made from materials which are available in practically every household in the following manner: A cheap glass tumbler is partly filled with water and then about ½ in. of safe, light burning oil, placed on the water. Cut a thin strip from an ordinary cork and make a hole in the center to carry a short piece of wick. The wick should be of such a length as to dip into the oil, but not long enough to reach the water. The upper surface of the cork may be protected from the flame with a small piece of tin bent over the edges and a hole punched in the center for the wick. The weight of the tin will force the cork down into the oil. The level of the oil should be such as to make the flame below the top of the tumbler and the light then will not be blown out with draughts. The arrangement is quite safe as, should the glass happen to upset, the water at once extinguishes the flame.-

How to Make a Flutter Ring

The flutter ring is for inclosing in an envelope and to surprise the person opening it by the revolving of the ring. The main part is made of a piece of wire, A, bent so that the depth will be about 2 in. and the length 4 in. Procure or make a ring, 2 in. in diameter. The ring should be open like a key ring. Use two rubber bands, BB, in connecting the ring to the wire.



The Shape of the Wire and Manner of Attaching the Rubber Bands to the Ring

To use it, turn the ring over repeatedly, until the rubber bands are twisted tightly, then lay it flat in a paper folded like a letter. Hand it to someone in this shape or after first putting it into an envelope. When the paper is opened up, the ring will do the rest.

Interpreting Baby Talk

What do an infant's cries mean? Hunger, usually, or discomfort, or fear. But they also reveal a slow process of learning how to communicate. Within a few months the baby's noises already show signs of patterns: a cry followed by a pause to listen for reactions, then another cry.

So reports Jerome Bruner, 60, longtime Harvard psychologist now teaching at Oxford and author of such pioneering works as *A Study of Thinking* (1956) and *The Process of Education* (1960). In a recent address to the 21st International Congress of Psychology in Paris, Bruner challenged the popular view that infants are born egocentric and acquire language merely through some innate skill. "If you look at the child's behavior as he develops procedures of communication," said Bruner, "you cannot help but be struck by the fact that from the start the child is sociocentric. The child communicates not only because it is alive but because it is stressful for the child to be in a noncommunicative situation."

Adult Vicars. Learning to talk is no sudden discovery, according to Bruner. It takes about two years of dogged practice—by the mother as well as the child. (Bruner means not necessarily the child's natural mother, but someone who acts as "vicar" of the adult community.) Every word the vicar uses is a lesson in what sounds and tones work best. By the age of two months, the child can make a cry that demands or one that requests, *i.e.*, one that awaits a response from the mother. "Mother talk," corresponding to "baby talk," tells the child that its request will be met and gives the child signs of the consequences of his requests. Says Bruner: "Linguistic competence is developing before language proper."

In addition to making sounds, mother and child use their eyes as part of the communication process. A mother spends much of her time during the child's first four to nine months, says Bruner, simply trying to discover what the child is looking at. At four months, 20% of babies can be induced to follow their mother's gaze, and by one year, 70% can do the same thing, even if she is looking at an object behind the baby.

She begins pointing out objects and giving them names. From ten months on the child as well begins pointing out objects. Mothers introduce a familiar pattern: 1) pointing to an object; 2) putting the question to the child, "What (or who, or where) is that?"; and 3) labeling the object, person or place ("That's a hat," "That's Grandma," "That's the bedroom").

Without knowing it, the mother has already set in motion the process of fostering the four basic skills that Bruner considers essential for making sentences later on:

- "Well-formedness," when the mother demands a closer approximation to the correct pronunciation of a word with each repetition.
- "Truth functionality," generally begun after the first year, when she corrects a mistake: "That's not a dog, it's a cat."
- "Felicity," which means that the manner of speech must be appropriate to the situation.
- "Verisimilitude," when she allows a child to place a box on his head and pretends it is a hat, but does not encourage him to do the same thing with, say, a ball.

Step by step, in a steady series of accretions of meaning, these lessons lead toward acquiring the gift of speech. Says Bruner: "Man realizes his full heritage when he reaches language. But he is doing things along the way which are also quite remarkable."

The above article from TIME, Aug. 3/76, shows that a baby's cries are often attempts at actual communication. No cry should be ignored. Every cry should be answered, either by a reassuring voice or by picking up and talking to the infant. If the infant is ignored its brain will stop reaching out for communication. It will, in time, learn to lie quietly and think its own thoughts. You may believe you have trained it and kept it from being such a bother. Actually, without a constant exchange of communication between infant and parents, the brain will be stunted in its areas of communication.

Then when the child learns to speak your language you will wonder why he reacts as if you were speaking Chinese. "Why can't we get through to this kid?", you ask your mate.

Well, the kid could never get through to you in babyhood. His physical needs were probably met but when he wanted to communicate you shut him out. Consequently, his brain areas associating his own wants with those of others were not allowed to develop. He lives in his own little world as he did when he was confined to his crib. He may be intelligent. But his intelligence and what he might use it for may never include you.

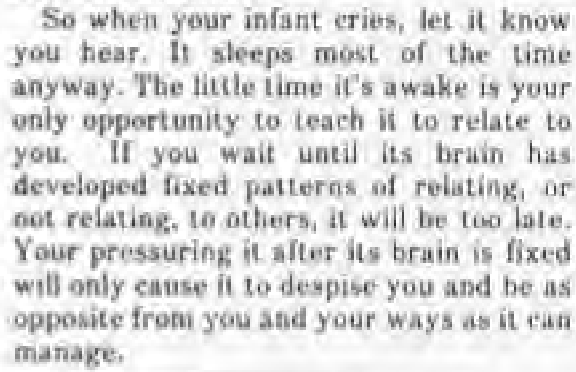
When he fails to relate to you, he's not being stubborn. He just doesn't have the concept of cooperation. He's a mental cripple and may never know it. He shows the same independence, and often stupidity of a cat. A cat simply is not developed to cooperate unless it concerns his immediate wants.

You may wonder why I keep on about the care of children in such a paper as THE SURVIVOR. But a child, living in his own little world, giving so little thought to family needs he might as well be a stranger, will be a fantastic liability in any Survival situation.

So when your infant cries, let it know you hear. It sleeps most of the time anyway. The little time it's awake is your only opportunity to teach it to relate to you. If you wait until its brain has developed fixed patterns of relating, or not relating, to others, it will be too late. Your pressuring it after its brain is fixed will only cause it to despise you and be as opposite from you and your ways as it can manage.

Window Shelf for Flower Pots
(From Popular Mechanics 1913)

On the ledge formed by the top part of the lower sash of the window I fitted a board 7 in. wide into each side of the casing, by cutting away the ends. I placed a small bracket at each end of the shelf, so that it would fit solidly against the lower window sash to support the weight of the plants.



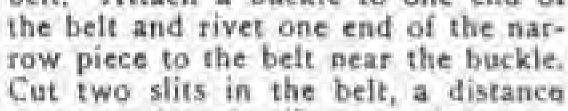
Shelf in Window

One of the brackets I nailed to the shelf and the other I held in place with a hinge, the reason being that if both were solid, the shelf could not be put on the window, as one end must be dropped in place before the other. Such a shelf will hold all the plants a person can put on it. When not in use, it can be removed without marring the casing.

(From Popular Mechanics 1915)

How to Make a Cartridge Belt

Procure a leather belt, about 2½ in. wide and long enough to reach about the waist, also a piece of leather, 1 in. wide and twice as long as the belt. Attach a buckle to one end of the belt and rivet one end of the narrow piece to the belt near the buckle. Cut two slits in the belt, a distance apart equal to the diameter of the cartridge. Pass the narrow leather piece through one slit and back through the other, thus forming a loop on the belt to receive a cartridge. About ¼ in. from the first loop form another by cutting two more slits and passing the leather through them as described, and



Two Pieces of Leather of Different Widths Forming a Belt for Holding Cartridges

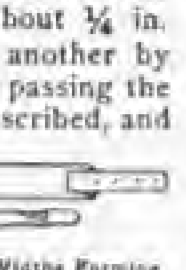
so on, until the belt has loops along its whole length.

The end of the narrow leather can be riveted to the belt or used in the buckle as desired, the latter way providing an adjustment for cartridges of different sizes.—

From Popular Mechanics 1915

A Vegetable Slicer

A tin bucket or can makes a good slicer for vegetables when no other slicer is at hand. A number of slots are cut across one side of the can, and the lower edge of each slot slightly turned out to form a cutting edge. The vegetable is placed against the top of the can and pushed down over the slots. Each slot will cut off a slice which falls inside of the can.



To Prevent Baking Ovens from Scorching

From Popular Mechanics 1915

A good method to prevent baking ovens from scorching or burning pastry is to sprinkle a mixture of sand and salt on the bottom where the pans are placed. This affords a way of radiating the heat evenly. The mixture also absorbs fruit juices, which may be spilled in the course of cooking. The covering is easily changed, which keeps the oven clean. The best proportion is half salt and half sand.

SURVIVAL GROUPS AND THE INDIVIDUAL

by Kurt Saxon

Survival, to the average person, is walking away from a plane crash or finding his way out of the woods after a camping trip that went wrong.

To some others, survival is escaping the divine retribution soon to be visited upon a sinful planet.

Still others see survival as overcoming the evil manipulations of alien socio-political enemies.

Then there are those who fear a nuclear holocaust or social upheaval and to them a place of temporary refuge is the answer.

Very few want to look at the overall picture.

The overall picture was illustrated a few years ago by some social scientists. They created a paradise for rats. The rats were put into an environment of good weather, abundant food and adequate space. Following their instincts, the rats bred like rats.

After a time, the only scarcity was space. This created in the rats a demand for identification with some rats and a rejection of other rats. Gangs formed, with each rat considering the rat in his own gang an ally and the rat from another gang an enemy.

As territory decreased, it was fought over by the gangs. Females of rival gangs were actually gang-raped. As little rats became more numerous they received less care. Mothers would often abuse and even kill their own nestlings.

As conditions became even more crowded, territory became less important. Pairing off for mating decreased. Any female became an object for gratification for any male. Finally, any rat was game. Some rats even came to prefer homosexuality.

In time, the experiment was completed and I suppose the social-scientists simply destroyed all those rats. But was that divine retribution? Was there a sinner among them? And could the smartest rat, a political rat, have solved their problems?

Even in this chaos there were some rats who were close to their mates, who still protected and showed affection to their nestlings. Could a rat with some sense of morality have benefitted them by preaching the coming of a perfect rat who would save the moral rats?

Nothing short of a system of enforced control of fertility could have held off the rats' doom. And unless it were applied long before their situation degenerated, the average rat would live out the remainder of its days a confused, perverted, human-like creature.

We have nearly reached the point at which the rat experiment was completed. The average human is a confused, perverted, mental defective. Social and environmental pressures are building up to the point where the outwardly stable will break and head straight up the wall along with those rats.

After several years of freakishly good weather, our planet's normal climate is returning. It will blight the tender hybrid food plants which have sustained our crowded cities. Unrenewable resources are running out and becoming higher priced as they do. Thus, fewer people can maintain a life of gentility and consequent morality.

The average person on our planet feels the effects of the mounting pressures. But he has no way of getting the whole picture. Without the whole picture, he can't be expected to understand what's really happening and to prepare accordingly. He must be content to accept the popular opinions given out by whatever news media serves him.

Although network television will run a special on climate changes, a special on mental defectives, a special on crime, a special on population growth, etc., not one network station will wrap them all up into one disaster special. The average person will not see all these specials. Spaced apart as they are, even if he should see them all, without survival orientation, he can't be expected to

THE SURVIVAL GUNSMITH

by Clyde Barrow

As our society continues to deteriorate and we return to simpler times, very few present occupations will have any value or importance. The barter system will soon prevail as the medium of exchange. Unless you expect to be able to provide all of the needed goods and services for yourself and your family, you need the means to trade for these necessities.

As a professional gunsmith, you are in an excellent position to guarantee your survival during any economic or social crisis. The gunsmith will become a vital member of any survival group or community. Your services will be sought by everyone owning or using a firearm. Gun sales have increased greatly in recent years. The majority of these new gun owners have neither the skill nor the facilities to repair their weapons.

If you aren't already a gunsmith, you will need a Federal Firearms License to freely practice the trade. See issue three, page 24.

When the availability of manufactured goods begins to slow and possibly ceases, you will be the sole source of supply for all firearms related items in your immediate area.

A supply of replacement parts and accessories, along with a small manufacturing and repair facility, will enable you to write your own ticket. You can trade your valuable services for virtually any need you may have; food, medicine, fuel, etc.

You must prepare now to assure that you will have sufficient supplies to meet these future needs. While the stockpiling of items like coffee, sugar and gasoline in times of inflation and general shortages is looked upon as hoarding, the prudent gunsmith should engage in precautionary buying of gunsmithing supplies. Many of these specialized materials may soon become scarce or unobtainable. I suggest that you sell whatever surplus possessions you now have and invest in the following items:

REPLACEMENT PARTS

While it is impossible to stock parts for all makes of firearms, a determination of the most popular guns in your immediate area will help to focus your efforts. You should also collect an adequate stock of parts to maintain all of your personal guns.

ACCESSORIES

The key here is bulk buying.

combine their findings into a whole picture of coming disaster.

So a person who is survival oriented can indeed feel alone. There is a natural urge to seek allies or refuge to help him to survive. Taking unfair advantage of this are survival hucksters. They are all doom shouters but all most of them really offer is an address where you can send them your money. Some promise you their own brand of political action. Some promise to pray for you, since you don't know God's language but they do.

Others buy a section of land out in the boondocks. They say that for X amount of dollars you can come there and find refuge when conditions in your area become intolerable.

For my part, I can exclude the political gangs and the "Divinely Inspired" from THE SURVIVOR. I can provide my findings and opinions and even a forum for the findings and opinions of others. I may unwittingly even promote the survival programs of fools or even frauds. So when you boil it all down, you are your only real hope.

The end of civilization, as we know it, may be worse than you can imagine. But living through the coming chaos and then helping to build a better system will be worth all the hardships ahead.

If that's your goal, as it is mine, you will choose your survival mates carefully. Just as carefully as you would choose a mate with whom to spend the rest of your life. Choose your survival mates, not for their agreement with your ideas, but their value to you in survival situations.

Say your political opinions are leftist and you are a chemist who can make excellent gunpowder. You meet a rightist who is a gunsmith. He knows a deeply religious person who is an expert at reloading. You three need each other.

Will you reject them because they disagree with you? Can you find two others with their skills who share your ideals? Can they? It's possible, but not probable, and you know it.

When you get together, express your philosophy. Hear theirs. Next, agree to disagree and then drop it. I don't mean shut up. I just mean you should never consider their agreement with you to be more important than their usefulness. This attitude will insure that you will not be stuck with any lovable, parasitic dummies who happily agree with you completely but can't do or won't learn a damn thing.

Groups who band together because of a common philosophy break apart for lack of mutually helpful skills. So forget Christian Communes, Marxist Collectives or Aryan Valhallas. In fact, the more divergent philosophies your members entertain, the less chance they will have to form little cliques and factions. Besides, you will be happily surprised to find how differing political ideas cease to matter when you are with people who can actually do something.

Aside from the consideration of survival mates, there is the consideration of the area and the type of area in which your chances of survival would be best. Should you pay $10,000 or more to someone who promises to provide shelter in some sort of survival camp when conditions in your area become intolerable? (If you have some money set aside, possibly for just such a situation, keep it at least until you've read my next editorial, "How to Become a Disaster Profiteer".)

Should you run for the hills, buy a farm, move to a small town or the suburbs? Or should you make your stand in the city?

Before running for the hills you should realize that there is no more habitable virgin territory on this planet. Wherever you are, any hunter you know will tell you that last season he had to go farther out for game than he did the previous hunting season. As things worsen, there will be more poaching, more game will be killed off and the surviving game will move further from inhabited areas.

The remaining game anywhere would just be a supplement to a poor garden plot scratched out in some clearing. Even Larry Dean Olsen would starve if he

Ammunition, cleaning materials, gun oil, reloading components, springs, screws, and other often needed materials can and should be bought in wholesale quantities. These can be sold or traded off in smaller units as needed.

Even if no true crisis occurs, it is an economic certainty that prices will only go higher, so bulk buying now is a wise business investment, at worst, and at best could prove to be your means of survival.

Some accessories, rifle scopes, reloading presses, etc., are too expensive for the average gunsmith to buy in bulk. I advise you to buy as many as possible at wholesale prices, and later trade them for other items you may need. Rifle scopes will be in great demand because they will help conserve ammunition which will soon become a scarce and precious commodity.

MANUFACTURING AND REPAIR MATERIALS

Often it will be necessary to repair an existing part or fabricate one completely from scratch. Gunsmith suppliers sell bulk units of assorted spring stock, high-carbon steel rod and gun steel.

Buy these raw material now in the largest, cheapest quantities you can. Any excess can always be traded off to mechanics, tool makers and farmers who will also need these materials for their prospective activities.

Thieves and looters may steal all of your guns. But they will probably leave individual parts and materials. And they can never steal your skills and knowledge.

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had to practice his woodcraft expertise on a permanent basis.

So woodcraft is only a temporary stopgap at best. Learn it if you can, but don't plan to depend on it.

I would advise you to buy a small farm. That is, if you know how to work. You do your job eight hours a day, five days a week, fifty weeks a year and call that work? If that's your idea of work, stay right where you are.

On a farm, you are a servant to your livestock. Nature is your boss. Your hours are determined by the weather and the seasons. If you know how to work, if you can toil around the clock to beat a coming storm, you can thrive on a farm and be happy. But before buying a farm, you ought first to learn how to succeed with a garden and a few rabbit hutches in your back yard.

If you are the average survival-oriented type, I would recommend a move to a small town. Take some marketable craft or skill with you. Try for a house with about an acre of land.

A suburban home with a quarter-acre of land would be chancy but would leave you with access to city benefits, while they last.

If you have to stay in a city, I would recommend a fireproof building which can be easily defended. Don't worry about neighbors. If they prove predatory you can eventually turn on them and secure the building for yourself and the people you need.

Stock up with weapons, trade goods and survival foods, whether whole grains or commercial survival packs.

If you locate on a farm or in a small town, your neighbors, regardless of their beliefs, will stand with you against invading outsiders.

In the suburbs or city, however, you can't depend on anyone but picked fellow survivalists. You start by picking someone of your acquaintance you know can be of use to you. He also knows someone, and so on. Get together with a few of these men and women who share your concern for the future and make it a regular thing, maybe one night a week. Hopefully, you can find from six to ten useful types in your neighborhood. If one or two live across town, arrange for a move when the time comes.

Even such a small group would make its presence felt when the rest of your neighbors were running around looking for leadership. In the meantime, be cool.

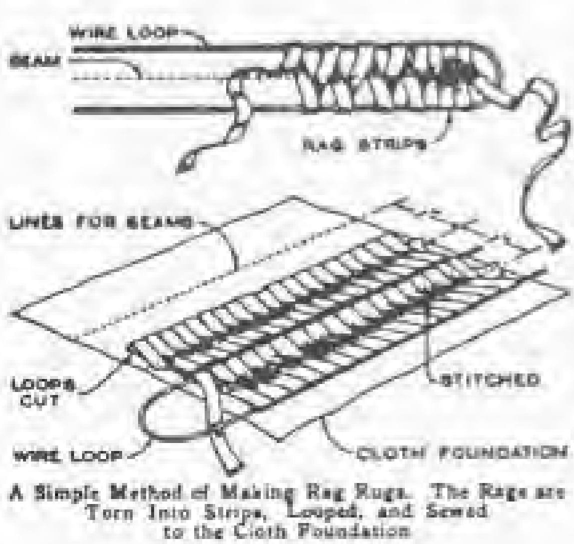
Assign one to collect arms. Let another collect reloading equipment and ammunition components. Another could stock trade goods. Even if you are in a wheel-chair, you could collect how-to books and be your group's survival librarian.

All you really have to be is needed. But if you don't fill a need, you'll be a liability.

From Popular Mechanics 1915

New Method for Making Rag Rugs

A beautiful rug, similar in appearance to the old-fashioned drawn rugs, but demanding far less work, can easily be made at home.



A Simple Method of Making Rag Rugs. The Rags are Torn into Strips, Looped, and Sewed to the Cloth Foundation

The only tools needed are a sewing machine and a long wire loop bent into the shape of a hairpin. The loop can be made from a piece of stiff wire, bent so that the sides will be an inch or so apart, this distance depending upon the appearance desired in the completed rug. A piece of strong denim, burlap, ticking, or similar material, is also needed for the foundation of the rug; if ticking is used, have the strips run crosswise, and if the foundation has no strips, it will need to be marked with parallel lines, about 1 in. apart, with a heavy pencil.

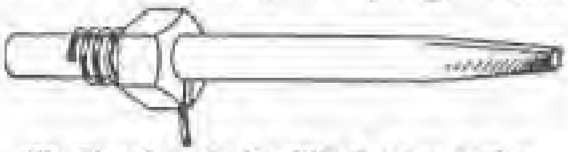
The rags used are torn into strips, as for carpet rags, although somewhat narrower, and they need not be sewed together. Take one of the rag strips and, fastening it to the rounded end of the wire loop with a safety pin, weave the strip around the wire, as shown in the drawing, so that the separate loops will be as close together as possible. Then take the foundation that has already been prepared, place the pin on the middle line, and sew the strip on in the sewing machine, running the seam through the middle, as shown by the dotted line in the drawing. When the strip has been sewed, the loop is drawn out and the result is a double row of cloth loops across the middle of the rug. This operation is repeated, first on one side and then on the other of the center row until the rug is completed. If one pinful of the woven strips does not reach all the way across, stop at the end, withdraw the wire, refill and finish the row.

After the rug has been entirely covered, the rows of loops are cut open with the shears. After a hard shaking the rug will have all the appearance of the tediously hand-drawn article.

How to Make Small Coil Springs

From Popular Mechanics 1915

Procure a nut, having a small thread that will admit the size of the wire to be used in making the spring. Cut a



The Threads in the Nut Will Guide as Well as Coil the Spring Evenly

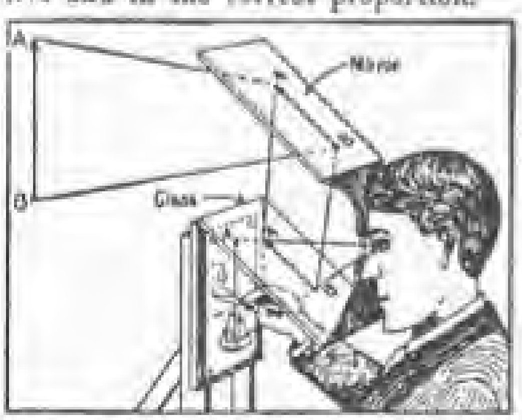
small notch to the depth of the thread where the thread starts, and procure a smooth rod that will pass snugly through the threads of the nut. Shape one end of the rod to fit a carpenter's brace, if there is no drill chuck at hand, and drill a hole in the other end to admit one end of the spring wire.

Bend the wire at right angles and insert the end in the hole. Place the end of the rod in the nut, which should be gripped in a vise, and turn the rod, at the same time seeing that the wire is guided into the notch cut at the start of the thread. The wire will follow the thread of the nut and make a perfect spring of an even opening throughout its length. Closed or open coils can be made by using a nut having the proper number of threads.—

Landscape Drawing Made Easy

From Popular Mechanics 1915

With this device anyone, no matter how little his artistic ability may be, can draw accurately and quickly any little bit of scenery or other subject and get everything in the true perspective and in the correct proportion.



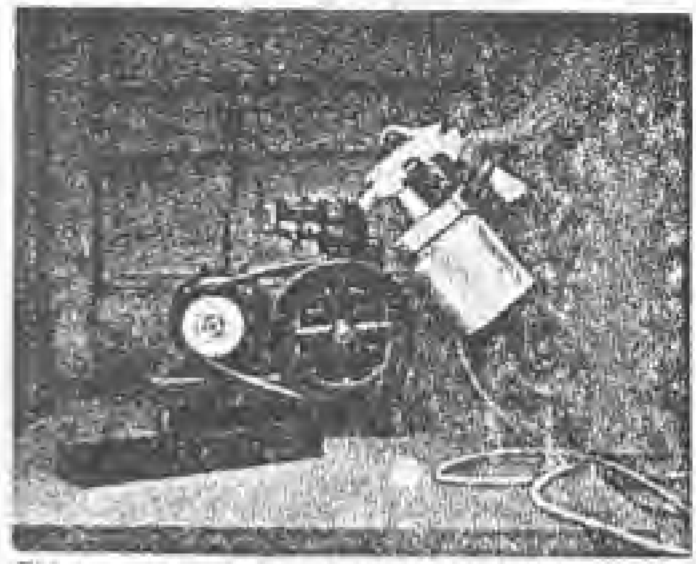
Drawing with the Aid of Reflecting Glasses

No lens is required for making this camera—just a plain mirror set at an angle of 45 deg., with a piece of ordinary glass underneath, a screen with a peek hole and a board for holding the drawing paper. The different parts may be fastened together by means of a box frame, or may be hinged together to allow folding up when carrying and a good tripod of heavy design should be used for supporting it. In order to get the best results the screen should be blackened on the inside and the eyepiece should be blackened on the side next to the eye. A piece of black cardboard placed over the end of the eyepiece and perforated with a pin makes an excellent peek hole.

In operation the rays of light coming from any given object, such as the arrow AB, strike the inclined mirror and are reflected downward. On striking the inclined glass a portion of the light is again reflected and the rays entering the eye of the operator produce the virtual image on the paper as shown. The general outlines may be sketched in quickly, leaving the details to be worked up later. This arrangement may be used for interior work when the illumination is good.

OLD REFRIGERATOR UNIT SUPPLIES AIR

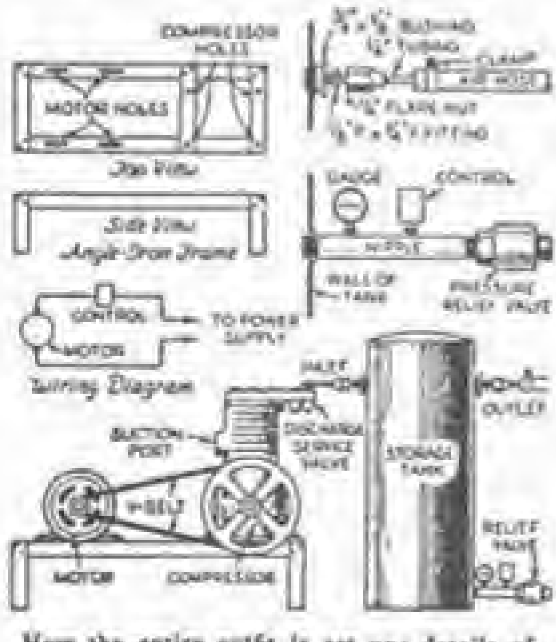
EVERY home workshop enthusiast can find many uses for a ready supply of compressed air. From parts that are probably available in your local power company's junk pile, a serviceable compressor and storage tank can be made. This old refrigerator unit was purchased for five dollars and an old pump tank and control from a junk yard for three dollars. The pressure gauge and pressure relief valve are not essential, but make a better job.



This compressor is from an old refrigerator and cost five dollars, and the tank was bought from a junk yard for three

Although the compressor shown is a twin, a single will do. Take the compressor apart, tighten the bearings if they are loose, and reassemble. The valves on most domestic compressors are located on a plate in the head. Polish the seats of the discharge and suction valves by rubbing the valve plate on a pieces of 400 emery paper lying on a flat surface. Put in new valve reeds and gaskets, and reassemble the head. Light motor oil should be used in the compressor.

If the bearings in the motor are bad, press in new ones. New brushes often help a motor and, if you have access to a lathe, the commutator should be turned down and polished. If you true up the commutator, cut out about 1/16 in. of the mica between the strips. The motor and compressor shown in the photograph are mounted on a board with pipe legs, but a frame made out of angle iron and strap iron is better. Slot the holes for the motor bolts so the belt may be tightened.



How the entire outfit is set up; details of the fittings and stand; and a wiring diagram

Most tanks have at least three holes; the one shown had three ¾-in. holes. With a bushing, reduce the size of the inlet and outlet so that a ⅛-in. pipe by ¼-in. flare fitting can be screwed into them. On the third hole use a ¾ by 6-in. nipple, and tap two holes into it to take ⅛-in. pipe threads. These holes are for the pressure gauge and the pressure control. The relief valve is screwed on the end of the nipple. Use litharge and glycerine on all joints.

Connect the discharge port of the compressor to the air inlet of the tank by a ¼-in. piece of copper tubing. The suction port of the compressor is left open.

Start the motor to find at what pressure the control shuts off the engine. On most controls, adjustment is made by turning a nut which varies the tension of a spring. Adjust the control to shut off at a convenient pressure, which in this case is 50 lb. The relief valve should be set to blow off at a pressure less than the rated working pressure of the tank.

No dimensions have been given because they can be arranged to suit the equipment at hand. After a little experimenting, you will be able to adjust the control to suit your requirements.

BEYOND THE SINKER-BASHER

By BRADLEY J. STEINER

There're more ways than one to skin a cat—or to stop an attacker. And if you are serious about your and your family's survival, you'll make it your business to learn these ways. Learn them before you need them. Be prepared!

The Kurt Saxon "sinker-basher" is a dandy, inexpensive, easily-concealed, and highly efficient personal defense weapon. Alas, with gun laws as they are (and worse, as they are getting) the aware, survival-conscious individual must often depend upon improvised weapons. (This will apply only until The Day, when he can bring out all of his cached goodies!). In this article I am going to go beyond the sinker-basher, and give my fellow Survivors some tips on improvised weaponry based upon my experience in unarmed and hand-to-hand combat—SELF-DEFENSE!

These little gems are all quite deadly, and each is very, very effective, when used as I shall describe . . .

1. The "home-made Yawara stick"
2. The "umbrella bayonet"
3. The "surprise-in-the-bag" (which I just **love** to teach to the lady of the house who is afraid to walk the streets without her husband and brother along for protection!)

In my experience of teaching personal defense and physical conditioning I have found that the most intelligent and alert people are immediately aware of the advantage in having SOME SORT OF WEAPON ALWAYS AVAILABLE. Especially is this true in such vermin-infested sewers and toilets as New York, where bongo-beating, drunken, screaming jungle savages rule the streets, apartment dwellings and the social order.

I must add this, too: even with a high degree of skill in unarmed combat (which I think is a MUST thing for every Survivor to have) the advantage of being armed is great. The rule of Survival Karate (my method) is this: use any available weapon first. Rely upon teeth, feet, elbows and hands last. Leave the gallantry for the movies.

In self-defense, as in any form of war, he who fights fair is lost. In defending against the unprovoked onslaught of some stinking pile of human excrement who happens to think you're an "easy mark" because you live and behave like a human being among the "tribes", he who fights fair is a horse's ass.

THE HOME-MADE YAWARA STICK

You don't need to spend over $10 for a good, killing Yawara-stick weapon. You can make one, with the help of a hacksaw, that costs about $1.50. It is superior to the best of the commercially-available models.

Go to a sporting goods store and buy a standard five-foot or six-foot steel (**solid** steel only, not pipe!) barbell bar. Don't spend extra for the wrench and collars, or for the cylindrical tube (the "sleeve") that is available with such bars. Tell the salesman you want the plain bar only.

When you take the bar home mark off six inch segments using a tape measure or ruler. Tape is handy to mark the bar. Now get your hacksaw and cut your bar down into six inch pieces. Each is a perfectly proportioned Yawara stick. Barbell bars are machined at the factory to be the right thickness for a comfortable grip.

If you saw well you should be through the bar in about five minutes' time. A five-foot bar gives you ten Yawara sticks, and a six-foot bar gives you a dozen! Sell 'em to friends at $3 each and you make a nice little profit while insuring that they have in their little hands a lovely instrument of mayhem—should they need it.

I suggest two "finishing up" procedures that will make your Yawara stick a completely professional item . . .

a. file down the ends of the bar so that there is no rough edge, following the hacksaw job.
b. use some attractive plastic tape to wrap the bar for a good grip.

Don't cover the ends of the Yawara stick.

Note: people with very small hands might find a 5" or 5½" stick more comfortable. The important thing is that, when the Yawara stick is held properly (see illustration) a slight end protrudes at both ends of the closed hand.

If you hold the stick very firmly, and if you know how to punch, you can deliver a wallop like a sledge-hammer blow! Unless you really do have some boxing or karate experience, however, I'd suggest you limit first-blows with the Yawara stick to two basic types . . .

1. Punch into the solar plexus (hitting hard, with a twisting of your entire body

into the blow as you direct the force upward into the opponent's body). This is a hook-type blow.

2. Punch into the groin and testicles.

Essentially, the Yawara stick ought to be used to JAB, employing either of the protruding ends. Keep the little darling concealed if you expect trouble, and don't let the creature who starts with you know that you're armed. (A good idea is to stand with arms **folded**—stick ready, but hidden from view.) Always stand slightly turned toward an opponent to protect your groin.

These are the best "jab points";

Temples, eyes, bridge-of-the-nose, sides of neck, solar plexus, groin, also, spine, nape of neck, kidney or scapula (if the opponent's back offers itself).

Without serious training over an extended period of time, no attempt should be made to use the Yawara stick against a knife-wielder. Since many of our city-dwelling skels carry blades, I suggest the following as a workable "last-ditch" defense:

Throw the Yawara stick—HARD!—right into the lout's face or upper body (stomach) as he approaches. The stick is a full pound of solid steel, and he'll feel it. Then kick him as hard as you can in the testicles, then, kick him again. Then, get away.

In future SURVIVOR issues I'll talk about unarmed defense at greater length; but for now, just remember that simple tactic.

In using the Yawara stick generally, employ fast, chopping motions, from the elbow down—never wide, swinging blows. Most of the street rats are experienced in fighting, and wide swinging blows that begin at a distance are easy to block.

THE UMBRELLA BAYONET

If you live in a city where scum rules, don't let your loved ones venture forth without their umbrella. Just in case it rains—or in case they're attacked.

The use of an umbrella is taught by some ju-jitsu and karate teachers, but I've done them all one better, by teaching it in my own, special "ultimate" form! In BELOW THE BELT! UNARMED COMBAT FOR WOMEN (my first hardback book on self-defense tactics and skills; available through Paladin Press) I urge the ladies to do the following . . .

a. Get a good, stout man's umbrella, and
b. File the metal tip until it's sharp as an ice pick.

Need I say more?

With such an umbrella in his hands, anyone—even a slight 90-pound girl like my wife—can put a speedy end to any barrel-chested skel who decides to put his mits where they don't belong.

The umbrella bayonet is a fine implement of protection to carry when for some reason you cannot carry a loaded gun.

Don't worry about the cops giving you any trouble. No one's ever been stopped because his umbrella looked suspicious!

Use of the umbrella sequence is taught in my book, but here is a fundamental attack that provides defense in many situations . . .

SEE ILLUSTRATIONS

The umbrella bayonet, like any weapon, must be used with maximum speed, the element of surprise, accuracy, and total ruthlessness.

In addition to the throat, the solar-plexus is a nice portion of the enemy's anatomy to pierce.

A final word of warning: When you're standing alone with your umbrella don't forget yourself and try to balance the end in your palm. Most unrewarding.

THE SURPRISE-IN-THE-BAG

Another invention of mine described in BELOW THE BELT!

For this tactic I recommend that you purchase a good, double-edged British Commando knife or, if you can afford it, the superior Gerber Mark II Survival (Combat) Knife. You should have one of these little "punk-jabbers" anyway, as standard Survival Gear!

Get a paper bag large enough to hold the knife, but not so large as to be cumbersome. A bag big enough to allow plenty of room for a nice-sized dictionary is good.

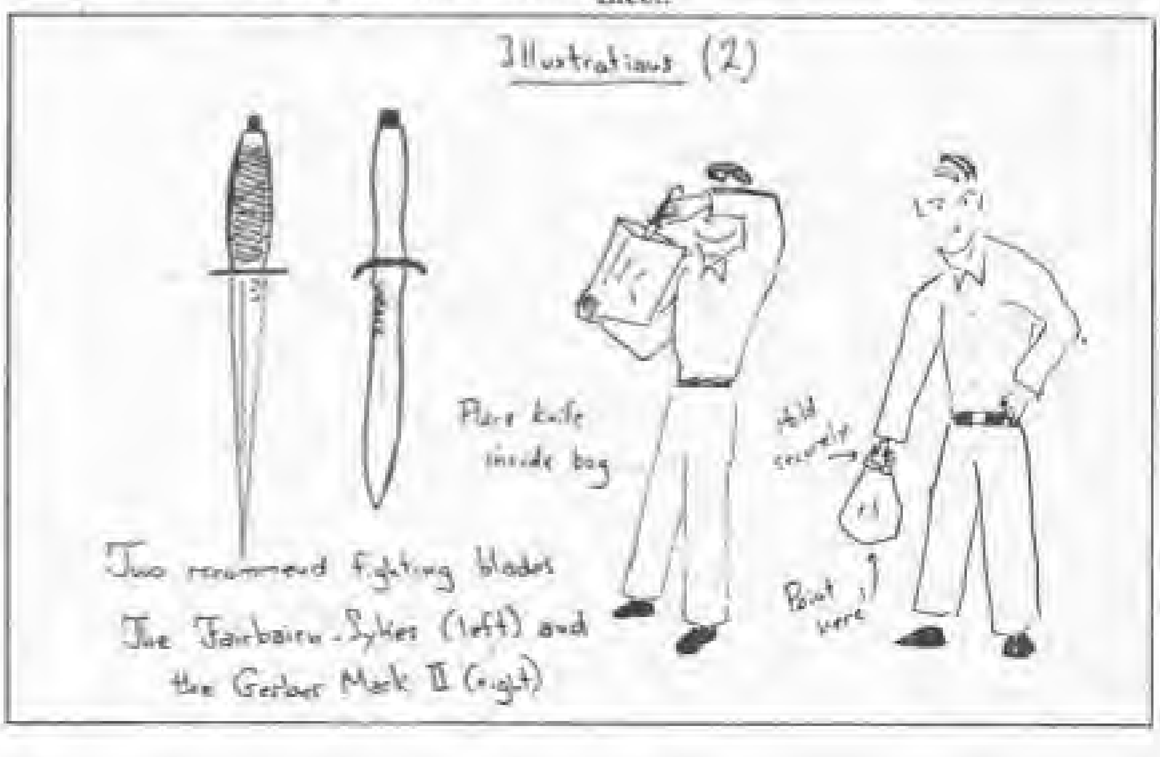
Take the knife out of the sheath, when you want it with you for protection, and place it inside the bag. Close the opening of the bag around the handle, and hold the knife. For all practical purposes, you are now fully prepared for action! The bag serves to conceal your weapon, but will in no way obstruct the blade's passage through your surprised opponent's guts.

I highly recommend this little gambit for women returning home alone late at night. What a blessing to enter a dim-lit elevator with your "trusty" pointed friend! Especially when some sack of vomit shows up beside you in the elevator and would like to get to "know" you better. By all means, acquaint him forcefully with your little bag! He'll never know (literally!) what stabbed him!

Note: a well-made fighting knife in skilled hands is second only to a heavy-duty sidearm as a defensive piece. But please, USE IT PROPERLY! The blade must be thrust in **deep**—right up to the hilt—and NOT withdrawn. Rather, it should be wrenched and twisted violently around inside the enemy's body. This is akin to performing careless surgery without bothering to use an anesthetic. It is very, very unpleasant to be the recipient of such an attack.

More will be said about knife-work in future issues of the SURVIVOR, but this little trick should keep you delighted for months on end. (Be sure to change paper bags frequently after use, for sanitary reasons.)

Persons sharing my interest in close-combat survival skills, and COMBAT-oriented martial arts studies should follow this column. You can't begin to imagine what goodies I have in store for thee!!



SURVIVAL RADIO

By RON LANK

I guess you know about the Japanese holdouts who continued to hang in there in the jungle for decades after World War II was over. What I'm trying to accomplish with this article is to prevent some well meaning Survivalist from killing an innocent woodcutter some time after the time of crisis has passed and the time of rebuilding has begun.

The only sensible way to keep in touch with the outside world would be by stuffing a small Japanese transistor radio into your packsack, along with some spare batteries.

We are now living in the period of quiet before the storm. Followng this will be the time of panic, for those who are not prepared. This will be followed by the time of rebuilding.

The problem for the individual Survivor hiding up in the rocks will be to learn when the panic people have finished using their lack of forethought to phase themselves out. It will then be time for the Survivor to come down and use his or her knowledge to help others with the rebuilding.

Trying to make contact on foot could be suicidal, as those whom you meet may be no better informed than you are and they may suspect your motives!

Some of the small town radio stations are bound to be missed by the checkerboard pattern of disaster. Give them a couple of weeks to get their standby gear into operation.

From up in the rocks, try when the sun is highest to catch their noon news program. At other times they may play music to help people like you to find their stations. Don't waste your batteries listening to music. News is what's important to you. If a noon search of your radio dial fails to turn up anything, try again long after sunset to catch a more distant radio station. If this fails, shut your radio off, remove the batteries, for a week or two and then try again.

Remember that you are not the only intelligent Survivor. There will be others. Different people will try different ways. Some of us will succeed. The better organized and financed Survival groups will enter the rebuilding phase in need of your assistance. When the time comes, go to them so that you may be given a lifetime career rebuilding the world.

If you know the manager of a local radio shop to be a reputable person, tell him you want a small, powerful radio so that you can catch the weather forecasts while you are on a planned long distance bicycle, motorcycle, or canoe trip. If you tell him of your real intentinns, he may feel jealous because he doesn't expect to survive, so he doesn't want you to either. So he may sell you a piece of junk, expecting you to stash it away without trying it out first. On the other hand, he may decide that you may become his savior and plan to tag along too.

Let it be believed that you are going to give the radio a real workout soon under circumstances where it had better perform, or he will have a justifiably infuriated former customer come in and give him a severe verbal thrashing in front of potential customers.

The vast assortment of good quality Japanese transistor radios which have been available since shortly after the end of World War II throw salt into the pain and suffering endured by those jungle postwar holdouts. If the Japanese had begun their production of transistor radios a few years earlier, a tremendous amount of unnecessary misery would have been prevented.

ARCHERY— ANCIENT SURVIVAL WEAPON

By Alfred Norton

For thousands of years man has used the bow for hunting, fishing and defense. Even the gods, such as, Diana, goddess of the hunt, and Eros, god of love, found this weapon useful. Today many primitive tribes in South America and Africa still employ this survival tool.

Archery equipment is cheaper than guns and ammunition. Although wood bows are adequate, fiberglass is best. For a beginning male archer, a 30 to 35 pound bow should be purchased. For a lady, a 24 to 30 lb. bow is appropriate. Aluminum arrows are not only stronger than wooden ones, but also more accurate. A bracer, or arm guard, protects one's arm after the bow string is released. Finger tabs are also useful. Both of these items are made of leather. A quiver simplifies carrying arrows. Finally, a cloth bag should cover the bow when it is not in use. Store the bow in a dry place to prevent warping.

When one hunts, one uses broadhead arrow tips. There are more than forty different kinds. The basic broadhead has a flat side with two cutting edges. The arrow kills game by severing the arteries. One often has to be within thirty yards of the target. One should have a bow that one can control. The average hunting bow is 60 to 66 inches long. One can either use a bow sight or three different colored pins indicating 20, 30, and 40 yeards range.

Carp is the easiest fish caught when angling with the bow. Of course, one can catch a variety of fish, including shark. Shallow water is necessary for bowfishing due to light distortion by the angle of refraction. Fishing tackle, reel, line, and fish arrow, can be purchased for less than ten dollars. The best fishing arrow is solid fiberglass. Since the target is within short range, feathers are not needed for the fishing arrows. One will have 1 or 2 barbs on the end of the arrow. Often regular fishing reels can be used on the bow. For fresh water fishing one should have a twenty pound line.

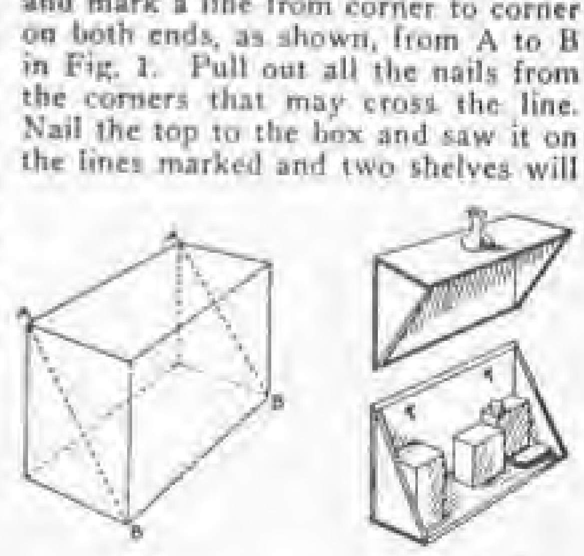
The bow has long been a weapon for English speaking people. Henry VIII of England had compulsory archery practice for all males up to sixty years old. Benjamin Franklin wished that the American armed forces used bows. In the fourteenth century the English beat the French by using longbows against crossbows. Roger Ascham, author of Toxophilus (1544), a book praising archery, received a lifetime pension from Henry VIII.

For all people planning to survive the coming fall, a longbow and tackle should be seriously considered. Not only is the bow a source of game and fish, but also protection for oneself and family.

From Popular Mechanics 1915

An Easy Way to Make a Shelf

Procure an ordinary packing box and mark a line from corner to corner on both ends, as shown, from A to B in Fig. 1. Pull out all the nails from the corners that may cross the line. Nail the top to the box and saw it on the lines marked and two shelves will



Two Shelves Made of One Box

be formed which may be used as shown in Fig. 2. Boxes dovetailed at the corners will make excellent shelves and look neat if painted.

(From Popular Mechanics 1913)

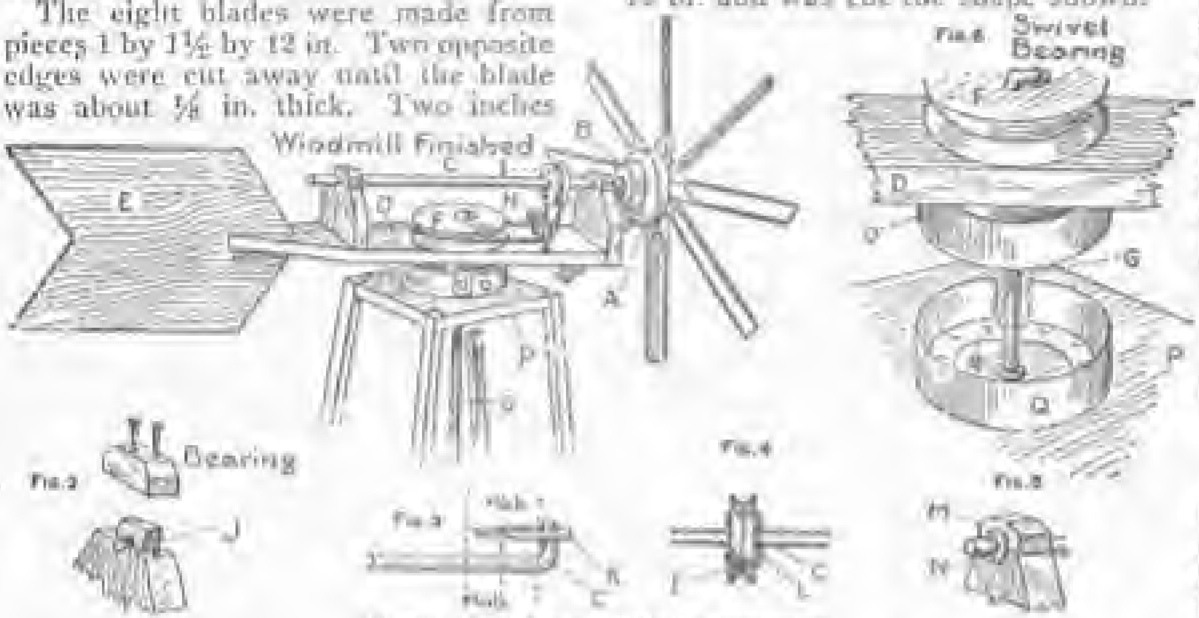
How to Make a Miniature Windmill

The following description is how a miniature windmill was made, which gave considerable power for its size, even in a light breeze. Its smaller parts, such as blades and pulleys, were constructed of 1-in. sugar pine on account of its softness.

The eight blades were made from pieces 1 by 1½ by 12 in. Two opposite edges were cut away until the blade was about ⅛ in. thick. Two inches were left uncut at the hub end. They were then nailed to the circular face plate A, Fig. 1, which was 8 in. in diameter and 1 in. thick. The center of the hub was lengthened by the wooden disk, B, Fig. 1, which was nailed to the face plate. The shaft C, Fig. 1, was ¼-in. iron rod, 2 ft. long, and turned in the bearings detailed in Fig. 2. J was a nut from a wagon bolt and was placed in the bearing to insure easy running. The bearing blocks were 3 in. wide, 1 in. thick and 3 in. high without the upper half. Both bearings were made in this manner.

The shaft C was keyed to the hub of the wheel, by the method shown in Fig. 3. A staple, K, held the shaft from revolving in the hub. This method was also applied in keying the 3-in. pulley F, to the shaft, G, Fig. 1, which extended to the ground. The 2½-in. pulley, I, Fig. 1, was keyed to shaft C, as shown in Fig. 4. The wire L was put through the hole in the axle and the two ends curved so as to pass through the two holes in the pulley, after which they were given a final bend to keep the pulley in place. The method by which the shaft C was kept from working forward is shown in Fig. 5. The washer M intervened between the bearing block and the wire N, which was passed through the axle and then bent to prevent its falling out. Two washers were placed on shaft C, between the forward bearing and the hub of the wheel to lessen the friction.

The bed plate D, Fig. 1, was 2 ft. long, 3 in. wide and 1 in. thick and was tapered from the rear bearing to the slot in which the fan E was nailed. This fan was made of ½-in. pine 18 by 12 in. and was cut the shape shown.



Details of Miniature Windmill Construction

The two small iron pulleys with screw bases, H, Fig. 1, were obtained for a small sum from a hardware dealer. Their diameter was 1¼ in. The belt which transferred the power from shaft C to shaft G was top string, with a section of rubber in it to take up slack. To prevent it from slipping on the two wooden pulleys a rubber band was placed in the grooves of each.

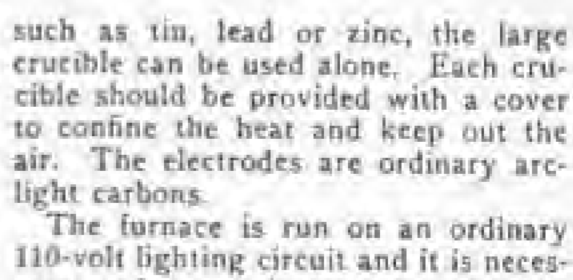
The point for the swivel bearing was determined by balancing the bed plate, with all parts in place, across the thin edge of a board. There a ¼-in. hole was bored in which shaft G turned. To lessen the friction here, washers were placed under pulley F. The swivel bearing was made from two lids of baking powder cans. A section was cut out of one to permit its being enlarged enough to admit the other. The smaller one, O, Fig. 6, was nailed top down, with the sharp edge to the underside of the bed plate, so that the ¼-in. hole for the shaft G was in the center. The other lid, Q, was tacked, top down also, in the center of the board P, with brass headed furniture tacks, R, Fig. 6, which acted as a smooth surface for the other tin to revolve upon. Holes for shaft G were cut through both lids. Shaft G was but ¼ in. in diameter, but to keep it from rubbing against the board P, a ½-in. hole was bored for it, through the latter.

The tower was made of four 1 by 1-in. strips, 25 ft. long. They converged from points on the ground forming an 8-ft. square to the board P at the top of the tower. This board was 12 in. square and the corners were notched to admit the strips as shown, Fig. 1. Laths were nailed diagonally between the strips to strengthen the tower laterally. Each strip was screwed to a stake in the ground so that by disconnecting two of them the other two could be used as hinges and the tower could be tipped over and lowered to the ground, as, for instance, when the windmill needed oiling. Bearings for the shaft G were placed 5 ft. apart in the tower. The power was put to various uses.

How to Make a Small Electric Furnace

From Popular Mechanics 1915

The furnace consists of a large flower pot containing an ordinary clay crucible about 6 in. in height, the space between the two being packed with fireclay. Two ¾-in. holes are bored through the sides of the crucible about half way between the top and the bottom. Holes corresponding to these holes are molded in the fireclay, which should extend several inches above the top of the flower pot. A smaller crucible is placed inside of the large one for use in melting such metals as copper, brass and aluminum. With metals that will melt at a low degree of heat,



Electric Connections to Furnace

such as tin, lead or zinc, the large crucible can be used alone. Each crucible should be provided with a cover to confine the heat and keep out the air. The electrodes are ordinary arc-light carbons.

The furnace is run on an ordinary 110-volt lighting circuit and it is necessary to have a rheostat connected in series with it. A water rheostat as shown in the sketch will serve to regulate the current for this furnace. Small quantities of brass or aluminum can be melted in about 10 minutes in the furnace.–

Preserving Flowers in Color and Form

From Popular Mechanics 1915

One of the most distressing sides of botanical study is the short life of the colors in flowers. Those who have found the usual method of preserving

Placing the Flowers on the Steel Pins and Pouring the Dry Sand around Them

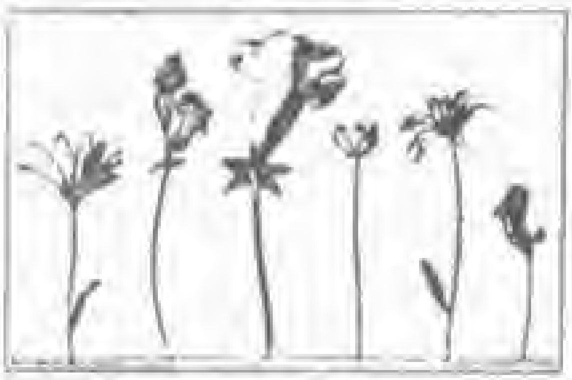
plants by pressure between paper unsatisfactory will be interested to learn of a treatment whereby many kinds of flowers may be dried so that they retain a great deal of their natural form and color.

The flowers should be gathered as soon as the blossoms have fully opened. It is important that they should be quite dry, and in order to free them of drops of rain or dew, they may be suspended with heads downward for a few hours in a warm place. It is well to begin with some simple form of flower.

A large, strongly made wooden box —one of tin is better—will be necessary, together with a sufficient amount of sand to fill it. If possible, the sand should be of the kind known as "silver sand," which is very fine. The best that can be procured will be found far from clean, and it must, therefore, be thoroughly washed. The sand should be poured into a bowl of clean water. Much of the dirt will float on the surface. This is skimmed off and thrown away, and clean water added. The sand should be washed in this manner at least a dozen times, or until nothing remains but pure white grains of sand. The clean sand is spread out to dry on a cloth in a thin layer. When thoroughly dry, it should be placed in a heavy earthenware vessel and further dried in a hot oven. Allow it to remain in the oven for some time until it is completely warmed through so that one can scarcely hold the bare hands in it.

Obtain a piece of heavy cardboard and cut it to fit easily in the bottom of the box. Through the bottom of the cardboard insert a number of steel pins, one for each of the flowers to be preserved. Take the dry blossoms and press the stalk of each on a steel pin so that it is held in an upright position. When the cardboard is thus filled, place it in the box.

The warm sand is put in a bag or some other receptacle from which it can be easily poured. Pour the sand into the box gently, allowing it to trickle slowly in so that it spreads



The Dried Flowers

evenly. Keep on pouring sand until the heads of the flowers are reached, taking care that all of them stand in a vertical position. The utmost care must be taken, when the heads are reached, to see that all the petals are in their right order. Remember that any crumpled flowers will be pressed into any position they may assume by the weight of the sand. When the box is filled it should be covered and set aside in a dry place.

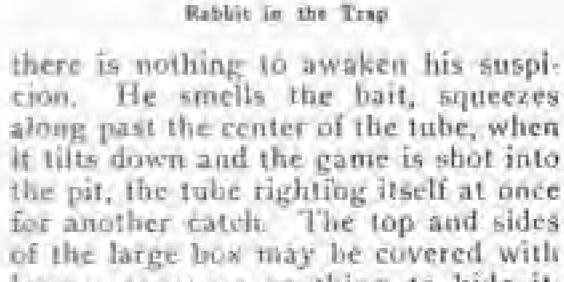
The box should be allowed to stand at least 48 hours. After the first day, if only a small amount of sand has been used, the material may have cooled off to some extent, and the box must be set in a moderately heated oven for a short time, but no great amount of warmth is advisable. After 48 hours the box may be uncovered and the sand carefully poured off. As the flowers are now in a very brittle condition, any rough handling will cause serious damage. When all the sand has been emptied, the cardboard should be removed from the box and each blossom taken from its pin. In the case of succulent specimens, the stems will have shrunk considerably, but the thinner petals will be in an almost natural condition. The colors will be bright and attractive. Some tints will have kept better than others, but most of the results will be surprisingly good. Whatever state the flowers are in when they are taken from the box, if the drying process has been thorough, they will keep almost indefinitely.

Flowers preserved in this manner are admirable for the decoration of homes. If they are exposed to light, care should be taken to see that the direct sunshine does not strike them, as it will fade the colors. Sprigs with leaves attached may be dried in this way, but it has been found that much of the intensity of the green is lost in the process.

A Home-Made Rabbit Trap

(From Popular Mechanics 1913)

A good serviceable rabbit trap can be made by sinking a common dry goods box in the ground to within 6 in. of its top. A hole 6 or 7 in. square is cut in each end level with the earth's surface and boxes 18 in. long that will just fit are set in, hung on pivots, with the longest end outside, so they will lie horizontal. A rabbit may now look through the two tubes, says the American Thresherman. The bait is hung on a string from the top of the large box so that it may be seen and smelled from the outside. The rabbit naturally goes into the holes and in this trap



Rabbit in the Trap

there is nothing to awaken his suspicion. He smells the bait, squeezes along past the center of the tube, when it tilts down and the game is shot into the pit, the tube righting itself at once for another catch. The top and sides of the large box may be covered with leaves, snow or anything to hide it. A door placed in the top will enable the trapper to take out the animals. By placing a little hay or other food in the bottom of the box the trap need not be visited oftener than once a week.

An Economy 'Boot Knife' & Some In-Fighting Survival Tricks

By Bradley J. Steiner

Americans have a cultural thing about knives as weapons. They don't, as a rule, generally care for them. Despite the few rare exceptions in our history (like James Bowie), bladed weapons were never especially popular with Yankees.

This is all very unfortunate, since good bladed weapons that have been designed for hand-to-hand combat are truly fine implements of personal defense. Not nearly as efficient as shoulder weapons or as the big-bore and combat handguns, I'll certainly concede—but still, VERY, very efficient.

The best choice (in my judgement) of an individual personal defensive arm would be, in the following order of preference, one of these weapons:

1. A well-made police riot-type pump shotgun, in 12 gauge, and loaded with 00 BuckShot loads. The shotgun is, I feel, number ONE as a defensive arm, providing there is sufficient warning before trouble strikes to get the weapon, and of course providing that you do not need a concealed weapon.

2. A Colt .45 caliber auto pistol loaded with good hardball ammo. The Mk. IV, the old 1911A1 and the Combat Commander are equally effective in trained hands. Unless you have a Gold Cup "Target" Auto already, I'd steer clear of that model for purely DEFENSIVE purposes.

3. A good fighting knife: I recommend Loveless and Randall for those who want knives that are works of art, as well as being fine weapons. Also, anyone purchasing a custom fighting knife must have plenty of $$$. These blades cost!

The best PRACTICAL choice for a fine fighting knife in full size is the Gerber Mark II Combat/Survival knife. Next is the Fairbairn-Sykes British Commando knife.

4. A strong hardwood stick, between 24" and 48" in length, and about 1"-1¼" thick.

So, as far as DEFENSE is concerned, the rule is this: get hold of a good, reliable combat firearm if possible. Otherwise, get a knife.

Carrying a stick for personal defense is not a bad idea, except . . .

a. to employ it effectively you need to devote considerable time to practice (much more than is necessary with a knife)—and it is not concealable.

b. if you are physically under-par or if there is a significant difference between the size and strength of you and your assailant (and there almost always is) then the liklihood of your opponent getting you is greater—even though you've got a "weapon".

c. the use of a stick is much less likely to really SHOCK and STOP an attacker. Remember that we are speaking about the use of improvised weapons in the most CRITICAL of EMERGENCIES—not in police use for controlling student demonstrators, or for scaring kids off your lawn. If the bastard who attacks you or some member of your family is not stopped AT ONCE, you're in pretty serious trouble.

The right use of a knife by the defender creates a chilling fear in any but the most seasoned combat experts and fighting masters. There is a psychological advantage to boldly confronting an attacker with cold steel in your hand and murder in your eye.

There remains but one valid reason for you not to have a stout "skel-sticker" with you constantly, after I assure you that you need not spend upwards of $60 for one: that is, they tend, in their full-length sizes, to be hard to conceal. Well, I've solved the price and the size problem for you.

Here is a method of acquiring a fine combat boot knife, dirt-cheap:

THE PERNA-VERSION
OF THE FAIRBAIRN-SYKES

My close friend, Bob Perna, shares my interest in mayhem, and its various forms. One day I remarked to him that I thought the old WWII Fairbairn-Sykes Commando Fighting Knife would make a dandy "boot knife", IF it was about 2" shorter in the blade. I let it go at that, not thinking any more about the subject. But I had planted the seed in Bob's fertile mind. Several weeks later Bob showed me a beautiful "boot knife" version of the F&S. Bob had cut one down himself, and, with a file, honed the blade to original sharpness.

Bob worked the blade down by using a file—nothing more. He first, as he explained it to me, made cuts into the sides of the blade, then worked at gradually filing right through, until about 2" was removed. Like this

The blade is important, and it should be fairly sharp. But the key thing is the TIP. The fighting knife is primarily a THRUSTING weapon. In sentry assault it is used on occasion to slash the throat—but this is a rare DEFENSIVE application of the knife in combat! The point must be stout and very sharp. If the rat you engage tries to grab the blade, in desperation, then you JERK it back, suddenly, and slice a few of his fingers, before piercing his heart or throat.

A hacksaw would probably make the cutting go faster through the blade, but Bob assures me that a file, and a few hours patient work will do the whole job nicely.

One nice thing about carrying the cheaper Perna-Version of the F&S, as opposed to carrying some high-priced Loveless or Randall boot knife is that you needn't be paranoid about losing it. And it matters little if you dirty the blade with some bongo-beater's syph-laden blood. You have a purely functional weapon—not a show-piece, like the true custom-made beauties that cost an arm and a leg.

You can purchase the modern-made version of the F&S through many mail-order houses generally under $15, or through large sport shops that carry a good line of hunting knives. Look for the stamp on the knife's cross-guard that says: SHEFFIELD, since that assures you of purchasing a genuine British-made blade. There is a cheaper model made here in the U.S.A. and it is doubtful whether it is reliable even as a letter-opener.

By cutting down the sheath that comes with your knife and re-stitching the bottom you can make a nice concealable holster. I have made an inside-the-pants holster for my boot knife (since I favor the waist as a carrying place, and I don't wear boots in New York). Bob, the "handyman" of leather work, has designed a beautiful shoulder-holster for the boot knife. No need to get fancy, though. Just carry your blade as is comfortable for you, and in a spot that will make it FAST into action. If you need a knife for combat, you need it FAST!

SOME "POINTS" ABOUT
KNIFE WORK

1. Grip the knife as though it were a fencing foil—not a hammer or an ice-pick.

2. DON'T square-off for a knife fight or let your opponent know that you're armed. GO FOR THE PIG! Fast, hard and with utter ruthless fury! GIVE NO WARNING.

3. Straight thrusting is always the rule. Wide, swinging arcs and slashes only expose you to a block, dodge or parry.

4. Thrust hard. The human body (even a punk's body) is surprisingly tough, as your first experience of piercing one will teach you. Thrust as though you were trying to put a dull stick, instead of a sharp knife, through the rat's carcass; this will give you that added "oomph.".

5. Do NOT make—or try to make—repeated stabs. Once the thrust is made, PLUNGE that damn blade into the skel right up to the hilt! Then twist and turn and wrench the blade around inside of him. He will either drop down dead within a second, or drop down unconscious in a second from the agony.

6. Main targets for a knife:

STOMACH
CHEST (HEART)
THROAT

The side of the neck is sometimes a good target, and I'll not fault you if you push your dirk into your opponent's groin; but by and large, the three HIT POINTS given above are where your thrusts should be directed.

I have no quarrel with anyone whose experience has taught him that it's a good idea to rub some poison into his blade, but I don't generally recommend it. After all, there's always the chance that you might nick yourself, and then what???? Also, keep this in mind:

The main thing is always to STOP the assailant dead, INSTANTLY. There is hardly any satisfaction in having him die three days or a week later, from his wounds—especially if he succeeds in making you die from yours. Unarmed and hand-to-hand combat is not a "match". It must be over before the turd who attacked you realizes that there's going to be any resistance at all from you. One-Two!!! I always advocate: Finish the job within 30 seconds. That's for beginners. The goal is to start—and finish—any combative action within the very second it occurs.*

The initial thrust/stab/twist action should also be the terminating movement of your personal defensive encounter. Don't aim for a twelve-round fight when your life or the life of your loved ones hangs in the balance. The longer any fight lasts the greater is the chance that you will lose it.

*Here, of course, I refer to the PRINCIPLE OF SPEED. I recommend THE PRINCIPLES OF PERSONAL DEFENSE by Jeff Cooper (published by Paladin Press) for an excellent dissertation on some base laws of combat survival.

In future articles we shall deal with more combat weaponry (improvised and standard firearm type stuff). Also, I have so many unarmed combat goodies for you that it makes my skin tingle. And more knife work... and mugging defenses... and so on.

Let me leave you now with one brief, but I think extremely important point, for the Survivor to fully understand. That is: ONE SHOULD NEVER CARRY ANY WEAPON UNLESS HE (A.) KNOWS HOW TO USE IT PROPERLY, and (B.) WILL UNHESITATINGLY USE IT, IF HE MUST. If you "wouldn't ever really use" your weapon, then don't carry it. Carrying a weapon as a show of force helps very little when circumstances make you actually NEED TO USE THAT FORCE. And permitting yourself to asininely "feel like a big, bad dangerous man" because you're armed (yet are inwardly determined not to engage in combat) is just to fool yourself. There are ways of developing confidence and determination in self-defense and combat weaponry employment. They must be utilized if you are reluctant to truly fight to save yourself. Be honest with yourself.

Proper mental conditioning for combat is AT LEAST AS IMPORTANT as physical conditioning through the learning of skills.

A New Yorker's Suggestion

by Bradley J. Steiner
Our Voice Crying in the Wilderness

Whether or not this Country ultimately faces Crisis Day (read: "Collapse Day") hinges, I think in large part, upon a critical decision that now rests (God help us) with our Federal Government. That decision is whether or not to provide financial (i.e. tax appropriated) aid to the rapidly crumbling, once-great City, New York.

If aid is provided by the Federal Government, then you'd better start looking - fast! - for a Survival Group to join up with. Thereafter, I can almost swear to you, chaos and tragic collapse will be not long in coming.

I live in New York. I will, hopefully by the time this issue of THE SURVIVOR reaches you, be living far from this "sewer". Twenty years ago New York was the only place for a writer/instructor like myself to live. Today, it is the last place on earth for any productive man to live. The living conditions in New York are so PROFOUNDLY TERRIBLE that, unless you've recently lived here for some months, or unless you have ties with others who live here, and who are very close to you, you simply cannot comprehend these conditions. Even if you (crazily) subscribed to, and received in the mail every day, the New York Daily News, you could not begin to fathom the unspeakable pig-sty/trash heap that New York has turned into.

The root-cause of the collapse and disintegration of New York into a sewage-dump of crawling excrement is WELFARE. Welfare, and EVERY SINGLE "welfare-related" thing. Like drug programs, day care centers (that encourage unwed mothers to get free tax-funded education), City Universities and community colleges that sponsor "open admissions", etc. etc. Consider, when you hear ape-brains like New York's Mayor Beame ask for YOU to be taxed so that the "Federal Government" can "help" New York: DURING THE FINANCIAL CRISIS OF OUR CITY, MANY, MANY POLICE OFFICERS AND FIREMAN WERE LAID OFF THEIR JOBS. NOT ONE SINGLE CREATURE ON WELFARE WAS TAKEN OFF THE ROLLS, AND NOT ONE CENT WAS CUT FROM THE WELFARE BUDGET! Men who risk their lives in apprehending human scum and criminals are regarded as "expendable", but skel-filth is considered INDISPENSABLE. It is all right for a police officer's or a fireman's children to live in hardship, and for a working man's family to be crushed financially, but it is not, according to the welfare-oriented growing police-state philosophy of New York, all right to take some of the puke off the "welfare band wagon" and let them FIND WORK to feed their worthless bodies!

Impudently, the political scum in New York and the human ballast that it represents turns to the rest of this great Country and DEMANDS that the working people of America be knocked to their economic knees to help perpetuate a system that is morally indefensible and economically reprehensible.

In addition to WELFARE, the Civil Rights Act is the other malignancy causing New York to slip into the swamps. Skels whose aim in life is to be "slick", "cool" and to "keep on truckin'" are regarded (now, LEGALLY) as being equal to normal, decent human beings whose aim in life is to live peaceful, quiet, secure and productive lives. A middle-aged and hard-working storekeeper who puts in twelve hours a day, six days a week EARNING his living, is remanded as "equal" to the swiny scum from the gutter that "bops" into his store from the street and harrasses and steals from him. Living, noisy, arrogant, putrid filth from jungles, sewers and swamps come to New York now in DROVES to "present their demands" for their "rightful cut" of the booty which is exacted from honest working people by a sub-animal bureaucratic turd that would better have never been born. The hard-working little businessman must "do without" so that each member of the herd of vermin can "do with".

New York is America's tragic, unnecessary living proof that WELFARE DOES NOT WORK, and that one cannot magically make animals equal to people by passing a law that says: "Animals are equal to people".

Now the Federal Government is "under pressure" to "help" New York. What does that mean?

It means that the fine and good people throughout America's lovely towns, communities, cities and states will be burdened with the bill for New York's atrocities. The farmer, the merchant, the housekeeper, the tradesman, the professional man—EVERYONE—will be drained and whipped into submission by Big Brother, so that creatures incapable of holding jobs as conscientious dishwashers can live on a "free" income, live in "free" luxury housing, and enjoy color TV's and new cars—ALL at the American worker's expense!

It means that WELFARE, the social cancer, and the rot that lives on it, will become an integral part of EVERY COMMUNITY—not just New York, once Federal aid is approved.

It means that human beings everywhere in our Nation will be forced to carry the weight of the human trash and ballast.

It means that when you need to sleep at night, so that you can arise early the next morning to go to work, the scum that YOUR TAX DOLLARS SUPPORT, and who are now YOUR NEIGHBORS, will keep you up all night with their raucous, senseless, blaring, crashing jungle music, and their stomping, leaping, jerking, bouncing, that, in the huts and jungle clearings of the dark corners of the earth, passes for "partying".

It means that polite, happy, bright and eager children—YOUR CHILDREN—will grow up in an atmosphere of drugs, knife fights, street gang wars, burglaries, rapes, muggings and arson—("Burn baby, burn!")—not to mention a gutter philosophy called "Machismo", which was imported from a culture recently emerged from the jungle, and that, as its basic tenet, worships indiscriminate sex, fist-fighting and intoxication as "Manliness", instead of those "foolish American virtues" called HONEST WORK, CREATIVITY, SELF-RELIANCE, and SELF-RESPECT born of SELF-SUFFICIENCY.

It means hell and despair and much, much, much worse. Don't let it happen.

I can offer the following as a sane alternative to our Government's helping New York to perpetuate the welfare state it started . . .

Let the United States President:

Offer ZERO aid and support of a financial/economic nature to New York. Let the welfare state reach, finally, the dead end it was inevitably headed for, in New York.

Then, PROMISE NEW YORK'S MAYOR AND GOVERNOR THAT IF, AND ONLY IF, THE SYSTEM IS DROPPED TOTALLY, New York will receive immediate troop assistance from the Army and Marine Corps. TO WHATEVER EXTENT IS REQUIRED and FOR AS LONG AS IS NECESSARY, to suppress the inevitable uprising of the savages who will, expectedly, protest the end of their freeloading ride.

Help New York to return to being the Capitalistic center and Free City of Opportunity that, a hundred years ago, it was. But offer no help, not even a kind word, in support of the perpetuation of the welfare state.

That is my suggestion. And, even as a New Yorker who knows that it is the best answer, I understand that it has no chance of gaining even a hearing.

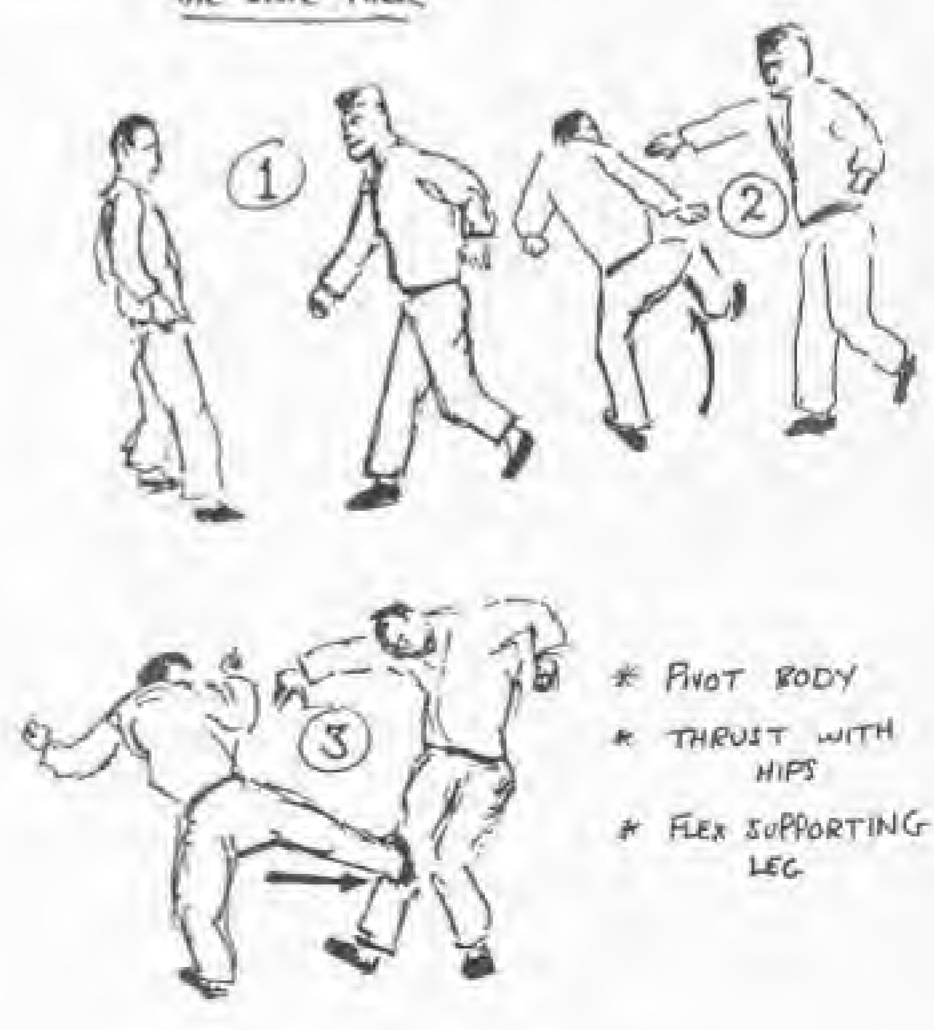
UNARMED DEFENSE SKILLS

By BRADLEY J. STEINER

If you have a weapon—any weapon—it should be used against an attacker in favor of resorting to unarmed combat. Only in novels and movies do we find fighters disregarding or ignoring their firearms, bludgeoning instruments or knives to engage a foe with their bare hands.

If your opponent has no weapon and you do, take advantage of your superior situation and ATTACK! Brutal as my philosophy may sound, it nonetheless remains the only effective one for critical survival emergencies, when your life and the safety of your loved ones hinges upon what you do in the face of aggression. DON'T FIGHT FAIR. STOP THINKING IN TERMS OF "DEFEATING" AN OPPONENT, AND START THINKING

The Side Kick



IN TERMS OF DESTROYING HIM, WHEN YOU ARE CONFRONTED WITH UNPROVOKED VIOLENCE.

Unarmed combat is "last-ditch" defense. It is what you do when you have no means of offering armed resistance, and when resistance must be offered. It is not the "gentle art" of sport judo, and it is not the "classical way" of traditional karate-do. It is desperate, bare-handed savagery aimed at obliterating an immediate violent threat to your existence.

I call my eclectic method of hand-to-hand combat "COMBATO". It is a compilation of skills derived from these basic sources: KENPO-KARATE, WESTERN BOXING, JU-JITSU, and MILITARY CLOSE-COMBAT TECHNIQUES. I won't engage in senseless debates about classical "proper" method, about Oriental terminology, or about the idea of how "right" or how "wrong" a conglomerate art is, and the usual idiotic ramblings that present-day "martial artists" enjoy beating their gums about, in order to convince each other that they really know their stuff. COMBATO is effective, simple, practical in-fighting designed for SURVIVAL. It works. It's worked for me, and it's worked for others, and it offers EFFECTIVE TECHNIQUES.

Now, about what you can learn NOW to be better prepared to protect yourself and those you love. In this article I shall cover several extremely practical and efficient skills that could easily save your life some day if you'll spend a little time learning them.

HOW TO KICK

If you learn this one single basic method of kicking you will be better-prepared than most people to protect yourself—in certain instances, even against a man with a club or a knife. This kicking manuever is applicable any time an opponent is in front of you or to your side. It is simple, direct, requires no stretching to achieve height, and it depends upon no martial arts experience or expertise. Nor do you have to be a superbly-conditioned acrobat to execute it. I will suggest a few effective methods of perfecting and practicing this simple kick, but first, let me explain its basic execution...

Assuming the opponent is directly in front of you, PIVOT to, say, your left, by shifting bodyweight onto your left foot, as you turn and bend—opposite to the opponent. Draw your right knee up, to about the height of your waist, and let the bottom of your foot face downward, toward the opponent's kneecap. Now lash out hard—with the full thrust of your hips and thigh muscles—and let your foot crash through the opponent's knee.

Throughout the kick, which should be withdrawn instantly following contact, the supporting leg has its knee bent slightly, to aid balance. Your body is bent back and away from the opponent, so you are both strongly balanced, and out of immediate harm's way of a hand blow or knife attack. You might catch a stab or slash on the arm, but hell, that beats getting a lung or your throat perforated.

This trick was taught to and used by the British Commandos, as well as our own Special Forces people. It is so effective and practical that it comes close to being a foolproof defensive technique, when executed correctly, with speed, force, accuracy and the element of surprise. All these things can be achieved by practicing the kick five minutes every day. I suggest you do so, alternating kicks with the left and then the right foot. You can practice in the air by just imagining an opponent. Don't worry about effectiveness, either. It takes little force to break the knee. Only about 70 pounds of violent pressure brought to bear in a direction opposite to the one that the knee joint was intended to bend. A child can exert such force easily. A grown man in reasonable shape can probably generate a good 200 -250 pounds of force after mastering this kick.

Practice kicking with the full bottom of the foot, and later progress to kicking with the foot-edge, as you perfect the move. Ideally, the kicking point should be the foot edge, close to the heel, for maximum penetration and destructive force. However, a kick that comes from a shoed foot, delivered with the full bottom of the foot, will do ample damage, be assured!

The best way to really develop an effective side kick is by kicking a tree or a brick wall. Wear shoes when you do this, incidentally, or sturdy sneakers. Kick low, aiming for an imaginary knee. Never kick above groin height, incidentally, if you want the kick to always be practical and efficient in real combat. Think of the knees and the groin as forming the body's low-area TARGET TRIANGLE. One healthy power kick landing on either knee or in the testicles will put bully-boy down for the count.

When the point is reached where you can kick a solid wall or a tree full-force, without losing your balance, you've developed a kick that will down Mr. Universe if it has to.

Combine your simple kick practice by kicking in the air—to develop control, form, and to learn the technique—and by kicking a solid object (tree, etc.) to develop confidence and power. NEVER actually kick anyone in practice. People take having their knee broken very unkindly, and the

Choke Defense

liklihood is that your "partner" would be unwilling to consent to future "workouts".

Spend some time considering how this beautifully simple and effective technique can be utilized. You will find that it can be applied even while sitting. Experiment. Practice.

There are of course more kicks than this one in COMBATO, and naturally I believe in rigorous training to develop profiency all-around; but anyone mastering the simple SIDE KICK, as I've described (not in formal karate fashion) will increase his basic readiness considerably.

FUNDAMENTAL CHOKE DEFENSE

NEVER attempt to pry someone's fingers off your throat. You'll be dead before you can get a secure hold on them . . . if he really intends to kill you.

NEVER attempt to break a front choke by using a double arm "wedge" as taught in many martial arts courses. . . you have a leverage DISadvantage here, if the attacker is strong.

As soon as contact is made—the second you are conscious of those hands starting to grip your throat—PIVOT to either side, and raise the arm opposite to the side which you turn, HIGH. Now, using the full force of your swinging bodyweight and the leverage of your arm against his fingers, CRASH your arm down, HARD, across his hands (see pictures) and break free of the hold. It is your entire bodyweight and the force of your sudden pivot vs. his fingers. He won't be able to hold.

As soon as the hold is broken, SNAP the arm you used to break the hold BACK, and whip the edge of your hand across either his nose-bridge or his throat—whichever offers itself at the moment. As soon as that blow "connects", shift your bodyweight onto the leg farthest from the opponent and smash his knee with a hard side kick. KICK AGAIN!

The key to learning effective escapes from holds and attacks is to LEARN TO APPLY THEM IMMEDIATELY, not after your adversary has had time to put his full power into applying his hold. I have dealt in this article with the choke hold because it certainly is one of the most dangerous attacks if you don't know what to do when it comes.

QUESTION:

"What can I do if I'm pressed up against a wall and I can't turn or pivot to apply the defense you described?"

ANSWER:

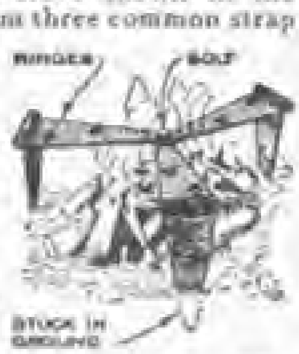
Grab hold of one of the opponent's arms at the elbow with one hand, as you bring your other hand up BETWEEN his attacking arms, and ram the fingers of that hand sharply into his eyes. DIG HIS EYES OUT. As the choke hold gives way, drive in close to the animal and kick him WITH YOUR KNEE, REPEATEDLY, IN THE TESTICLES, while holding securely to his arm where you grabbed him.

I cannot stress too strongly that UTMOST care must be applied when practicing these skills with a partner. Carelessness leads only to the chance of serious, permanent injury. DON'T PRACTICE FULL FORCE, AND DON'T TRY TO SHOW-OFF. A woman who was well into her fifties almost knocked me unconscious once, when she reviewed the basic choke defense I had taught her. She caught herself a fraction of a second too late, and I was (fortunately) fast enough to duck away in time to catch only a minimal blow across the head—which, believe me, didn't tickle.

I was struck even though I knew exactly what to expect, and even though she (partially) pulled back. Your opponent won't know what to expect, and you won't, unless you're an imbecile, pull back at all. So I leave it to you to decide how effective your moves will be.

Camp Stove Made from Three Hinges

The novel camp stove shown in the drawing is made from three common strap hinges. The hinges are fastened together at the center ends with a small bolt, and the other ends are sunk into the ground. The bolt should be flat-headed, and should be screwed up tightly to make the hinge supports as rigid as possible. This stove may be folded up when not in use, and occupies but little space in the camping equipment.



Popular Mechanics 1925

Protecting Trees from Insects

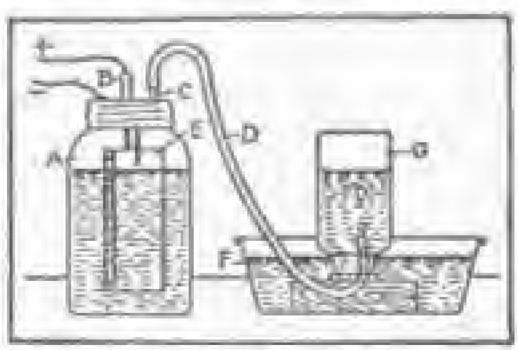
In summer, when it is desired that no ants, caterpillars, or other crawling insects, should climb the trees, some kind of a barrier is necessary.

The simplest, and one of the cheapest, methods is to place a wide band of cotton batting around the tree at some convenient height, fastening it to the tree with wire. The edges of the batting, protruding from underneath the wire, when fluffed, present an impassable barrier to any type of crawling insect or small animal, the cotton not affording a foothold for the latter.

SMALL ELECTRICAL GENERATOR

Popular Mechanics 1913

A small hydrogen generator may be made from a fruit jar, A (see sketch), with two tubes, B and C, soldered in the top. The plates E can be made of tin or galvanized iron, and should be separated about ½ in. by small pieces of wood. One of these plates is connected to metal top, and the wire from the other passes through the tube B, which is filled with melted rosin or



Hydrogen Generator

wax, to make it airtight. This wire connects to one side of a battery of two cells, the other wire being soldered to the metal top of the jar, as shown. The jar is partly filled with a very dilute solution of sulphuric acid, about 1 part of acid to 20 of water.

When the current of electricity passes between the plates E, hydrogen gas is generated, which rises and passes through the rubber hose D, into the receiver G. This is a wide-mouth bottle, which is filled with water and inverted over a pan of water, F. The gas bubbling up displaces the water and fills the bottle.

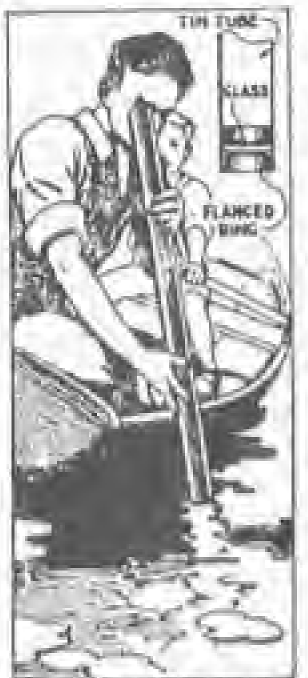
If the receiver is removed when half full of gas, the remaining space will be filled with air, which will mix with the gas and form an explosive mixture. If a lighted match is then held near the mouth of the bottle a sharp report will be heard.

If the bottle is fitted with a cork containing two wires nearly touching, and the apparatus connected with an induction coil, in such a manner that a spark will be produced inside the bottle, the explosion will blow out the cork or possibly break the bottle. Caution should be used to avoid being struck by pieces of flying glass if this experiment is tried, and under no condition should a lighted match or spark be brought near the end of the rubber hose D, as the presence of a little air in the generator will make an explosive mixture which would probably break the jar.

Popular Mechanics 1919

An Interesting Water Telescope

A water telescope is easy to make and will afford much pleasure in exploring plant or animal life in comparatively shallow water. The device is made by fitting a heavy glass disk into the end of a round metal tube, about 2 in. in diameter. The glass is fitted between two rings of metal, preferably with a small flange set against the glass. A waterproof cement is used to fix the glass between the rings. To use the "telescope," rest it on the side of a boat or other convenient place at the water, and set the lower end, containing the glass, under the water. Remarkably clear views may be had in this way.



From Popular Mechanics 1925

An Effective Cherry Picker

For picking cherries rapidly with a minimum of climbing, an effective implement can easily be made. A frame is made of stiff wire or light iron rod, the ends being brought together and forced tightly into a handle of the proper length. On the front of the frame a series of picking fingers, or hooks, are fastened, about 1/4 in. apart, so that the fruit cannot pass between them. Figures 1 and 2 illustrate two methods of attaching the hooks. Solder should be used in both cases, to make the fingers rigid. The device is completed by attaching a bag of close-woven fish netting to catch the fruit as it is plucked from the tree.

HOW TO BE A DISASTER PROFITEER

By KURT SAXON

Planning to profit from a disaster will give you an edge over those who simply plan to survive it. Attitude is of primary importance in determining if you will succeed with class and style or will just struggle along with the herd.

The improvident will shrug off the warnings. The paranoids will fix blame and do little else. Those with a backpack mentality will run for the hills. Anxious types will cast around for groups who will take them in on the basis of their goodness or because they have some cash money. These are losers and if they survive it will be by sheer luck.

But the one with the right attitude toward survival will start now to fit himself with an essential trade. He will gather the critical commodities, tools, and raw materials needed to establish himself in a position of importance. The disaster profiteer will prepare, not only to prevail, but to make his mark amid the ruins and to forge his dynasty for ages to come. That's the kind of thinking which will bring us through the coming storm.

The common image of a disaster profiteer is a person who corners the market on some critical commodity and then charges outrageous prices. Throughout history, people have taken unfair advantage of their less provident fellows. However, as bad as the disaster profiteers might have been, their foresight and/or greed often meant the survival of many who would have perished without them.

The breakdown of our society will see the rise of many such profiteers. But if you prepare to be such a profiteer, no matter how wealthy you become after the disaster, you may still be a person of honor and respectability.

To be a disaster profiteer you must fill an essential need. If all you have now is money, you might buy up critical commodities you know will be neither imported nor manufactured for some time after our present civilization ends.

Critical commodities will fall into three basic categories of importance. First are absolute necessities. Pharmaceuticals will head this list. Anti-biotics, anesthetics, narcotics and medicines will mean life or death and will command the highest prices. Any pharmacist would do well to hoard such absolute necessities while they are still in good supply.

If you are a pharmacist or a physician and have access to bulk pharmaceuticals, you must prepare to be well armed and with a stable group who will help you to defend your supplies. Your main danger will come from addicts, any one of whom would kill you and destroy your supplies just to get one lousy fix.

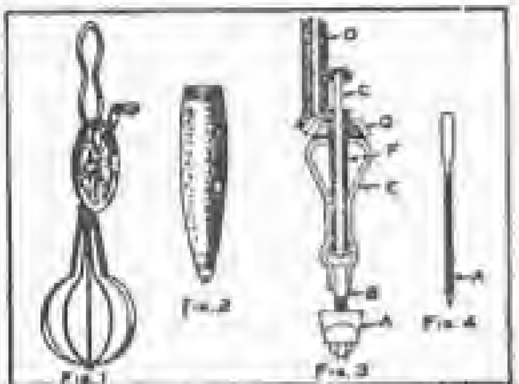
Next highest in value comes ammunition and weapons components. Whole bullets, bullet components, loaders, gun parts, rifle scopes, etc., would insure your security. A gunsmith would do well to mortgage his home and buy up all the gun-related items he can get.

Just consider: pharmaceuticals, weapon components and just about every other critical commodity you can think of will only rise in price. You won't be caught with a supply of goods you can't sell, either to private parties or to an established dealer. Hoarding is like having money in the bank, its interest growing through inflation. (This does not include gold, silver, diamonds, etc., unless you are equipped to put them to some industrial use).

Using the examples of pharmaceuticals and weaponry, we come to the difference between the professional disaster profiteer and the amateur. Say you manage to clean out a pharmacy but know little or nothing about medicine. Anyone who knows more about medicine would consider you incompetent to manage their useful distribution or trade and would take them from you, even if that meant shooting you. You might be safer by cleaning out a gun store with its weaponry and spare parts. But aside from the easily tradable guns, unless you were a gunsmith you couldn't make proper use of the valuable spare parts.

Home-Made Hand Drill
From Popular Mechanics 1913

In the old kitchen tool box I found a rusty egg beater of the type shown in Fig. 1. A shoemaker friend do-



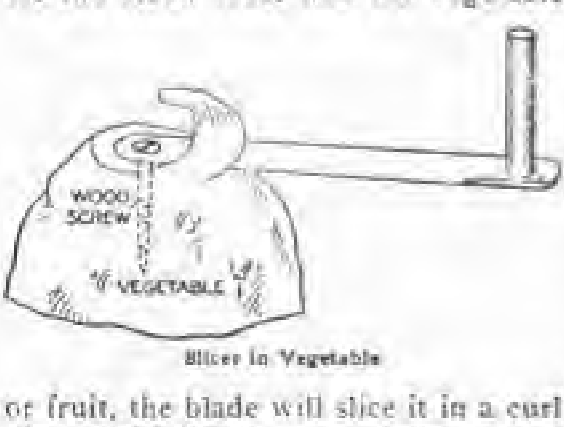
Details of Hand Drill Construction

nated a pegging awl, Fig. 2, discarded by him due to a broken handle. With these two pieces of apparatus I made a hand drill for light work in wood or metal. By referring to Fig. 3 the chuck, A, with stem, B, were taken from the awl. The long wire beater was taken from the beater frame and a wire nail, C, soldered to the frame, D, in the place of the wire. The flat arms were cut off and shaped as shown by E. The hole in the small gear, G, was drilled out and a tube, F, fitted and soldered to both the gear and the arms E. This tube, with the gear and arms, was slipped over the nail, C, then a washer and, after cutting to the proper length the nail was riveted to make a loose yet neat fit for the small gear. The hand drill was then completed by soldering the stem, B, of the chuck to the ends of the flat arms E. Drills were made by breaking off sewing-machine needles above the eye as shown in Fig. 4 at A, and the end ground to a drill point.

Popular Mechanics 1913

Vegetable Slicer

The slicer is made of a knife blade, screw and pin handle. The screw is soldered into the end of the knife blade. As the screw feeds into the vegetable



Slicer in Vegetable

or fruit, the blade will slice it in a curl of even thickness.

So being a disaster profiteer is not simply amassing a pile of essential goods. You must be needed just as much for your ability to properly use such materials as much as for their possession.

You should begin now to become a professional concerning any line you want to profit from. You should also organize, or become a part of, a local survival group. In this way, your specialty will be appreciated by people who will protect you and your goods. Anyone trying to rip you off would have to fight the whole group in order to get what you have without paying your price.

The average survivalist will not want to hold the immediate power of life and death over his fellows. I know I wouldn't. Happily, my library of formulas and processes and my knowledge of their use will make me a valued and protected member of any sizable grouo. In this way, knowledge alone would ensure me the best that any group had to offer.

So knowledge is the second critical commodity. Most modern knowledge will be useless when our civilization collapses and our level of applicable technology drops to about what it was a hundred years ago. Skills of the 19th century will be far more valuable in a few years than will the skills of any surviving nuclear physicist.

THE SURVIVOR should give you many ideas of 19th century technology you could start learning now. The science of a hundred years ago will be the science of the future.

The third category of critical commodities is simple trade goods anyone can buy and store. Walk through your local dime store and you will see hundreds of items, seldom considered now, which will be impossible to duplicate for some time after the fall.

Needles, thread, first aid supplies, knives, hatchets, ball-point pens, paper, cosmetics, etc., will be worth more than their weight in gold when they are no longer available. The investment of a few hundred dollars in such commodities would set you up as a survival group storekeeper.

When considering commodities, don't be put off by their present abundance. Your local dime store or supermarket, along with the other stores in your area, will be wrecked after looters go through them. Most of their contents will be lost through trampling, fire and being picked over by looters. Your best assurance of having what you need is by buying in wholesale quantities now.

You should see by now, that becoming a disaster profiteer does not require wealth. Nor does it require that you be grasping and greedy, demanding impoverishment as the price for your goods and services.

You can stay just as good and gentle and sympathetic as you are now. In fact, your good character and sincerity will keep you safe, even when you must drive a pretty hard bargain.

In future issues of THE SURVIVOR, easily learned survival trades will be outlined. Any such trade will make you indispensable to your group. That is the key to being a disaster profiteer. If you aren't needed, along with your goods, the temptation will be just too great to shove you aside and take your goods, even if this means killing you.

To Make Transparent Paper
From Popular Mechanics 1915

Transparent paper of parchmentlike appearance and strength, which can be dyed with almost all kinds of aniline dyes and assumes much more brilliant hues than ordinary colored glass, can be made in the following manner: Procure a white paper, made of cotton or linen rags, and put it in soak in a saturated solution of camphor in alcohol. When dry, the paper so treated can be cut up into any forms suitable for parts of lamp shades, etc.

Stones Broken by Hot Water

Any large stone whose presence is undesirable in the field or yard, may be broken up without the aid of explosives. The earth is dug away around the stone until about three-fourths of it is exposed. A fire is built against the stone and allowed to burn until the latter is thoroughly heated throughout. When a temperature approximating red-hot is reached, pails of cold water are thrown on the hot stone, which will crack open in pieces that one person will be able to remove without difficulty.

Survival Strength and Health

by Mike Brown
(Hero of Wheels of Rage)

IMPROVISED WEIGHT LIFTING EQUIPMENT

You've probably seen the weight-training and muscle building magazines with the Mr. America winners and their tremendous physiques. As works of art or for aesthetic value, I am as much an admirer of them as the next fellow interested in physical culture. Unfortunately, in purely survival situations, such physiques serve little practical purpose.

First, a tremendous physique requires a tremendous amount of food to keep it going. Have you ever seen one of those guys eat?

Second, the "showy" muscles that win contests aren't the important ones like feet, lower legs and grip.

For an illustration, suppose three of you are walking across country packing rations and weapons. One 240 lb. monster, to keep his strength up, will require enough food to feed several 170 pounders. Who is going to carry it? And where are you going to get more? Of course, if the weather is cold and the monster is carrying a bit of body fat (Most contest winners train to eliminate body fat) he'll need less food, because the fat forms an insulation.

In my own case, compared to my partner, I can stand in weather in a T-shirt, that he shivers in with a jacket. I'm short and fat, 6'2", 220 lbs. He's tall and thin, 6'8", 230 lbs. This is not an individual case illustration; when I got out of the Army in 1964 I weighed 160, and any temperature under 50 degrees made my teeth rattle.

So, decide whether you want to be a cold weather fatty or a warm weather beanpole and I'll show you how to go on from there.

In the meantime, let's set up some basic equipment and exercises. For openers, you'll want to strengthen your internal organs, feet and hands, in that order. Building endurance and strength serves a two-fold purpose; you can keep going longer and have a better chance of "making it" if you get hurt.

Probably the most famous example of "making it" was the 19th trapper, severely mauled by a bear and left for dead by his companions. Eating leaves, grass and berries, he crawled several hundred miles back to civilization.

In our own day, watch Japanese prizefighters on the Glass Toilet (TV). Their physical conditioning is so superb they shrug off punches that would hospitalize an ordinary man for a week.

To start your own training program, first get a pair of tennis shoes. Don't jog, RUN. Alternate wind sprints with cross-country runs. Twice a week you should work up to an hour of this type of exercise. If you start off slowly and increase speed, distance, etc., you'll soon notice your energy and reflexes pick up.

Don't run on concrete. You'll crack the bones in your feet and ankles. Most prizefighters run in sand if it's handy.

Over 13 years ago, my regiment (50th Infantry, 82nd Airborne Division) had an "exercise" against the Special Forces in South Carolina. Most of the Special forces we were up against had just completed a year of demolitions, weapons or whatever. Really knew their stuff. Most of us had simply been running four miles every morning in regimental P.T.

Most of the manuevers I participated in consisted of a platoon of us, wearing steel pots and full combat gear, charging after Special Forces troops. Usually they "ran out of gas" within a few hundred yards, and we just ran right over the top of them.

So in your beginning exercises, strengthen your calves and feet. If you're trying to get cross country with a heavy load on, you can't afford to have them go out on you.

Try this exercise:

1. Grip staircase with bare toes.

2. Stretch as far up and as far down as possible. Failure to stretch sufficiently can shorten your achilles tendons.

3. Grasp railing with one hand and place foot behind calf (illustration).

4. When you work up to thirty (30) times with each foot, get a bucket and gradually fill it with rocks, sand, or whatever, to increase the resistance (weight).

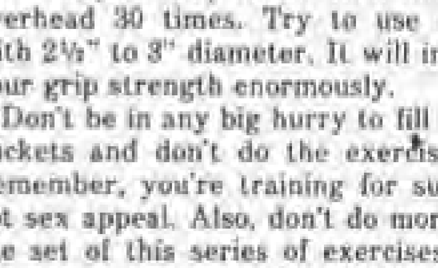
The next exercise is primarily to strengthen your internal organs, though it appears to be a leg exercise. This is the deep knee bend.

2.

Place the bar or pipe on your shoulder. Get into the squatting position. Stand up. Do this 30 times. You should be puffing like a steam engine on completion.

Keep your head up and your back straight and your tail down. Do this like you would imagine a West Point cadet doing it.

3.



Using the same pipe, drilled for buckets, pick it up off the floor and lift it overhead 30 times. Try to use a pipe with 2½" to 3" diameter. It will increase your grip strength enormously.

Don't be in any big hurry to fill up the buckets and don't do the exercise fast. Remember, you're training for survival, not sex appeal. Also, don't do more than one set of this series of exercises more than once every 48 hours. Give your body a chance to recuperate. If you still feel groggy at the end of a workout or on off days, do situps and leg raises.

One final note; if you've never lifted weights before, start out with only 10 repetitions of each exercise. Then jump five at a time until you hit 30. Then start increasing weight. If you do 30 squats and then aren't able to move the next day, remember, you were warned.

NEXT: A portable exercise device better than anything on the market. Also, how to gain or lose weight.

GAINING OR LOSING WEIGHT AND A PORTABLE EXERCISE DEVICE

By MIKE BROWN

Losing weight is fairly simple so we'll start with that subject first. All you have to do is quit eating. I don't mean smaller quantities; I don't mean diet; I mean quit eating. This may sound a little extreme but there is a two-fold reason for it.

1. It will give your body a chance to "clean itself out" and

2. It is good training for survival. A halfway healthy human being can function quite a few days on no food at all—hunger panic is more mental than anything else. A doctor during the Civil War found that by not feeding his wounded patients they healed much more rapidly—and none of his patients died of starvation.

Start going a day or two without eating and gradually work into longer periods. Break all of your fasts gently—don't go on a ten-day fast and then sit down to a seven-course meal. Your body can't handle it.

Once your weight is down to where you want it the fun begins. Trying to keep it there. Your body has a regulatory mechanism that will return your physique to "normal" almost immediately. And if you weigh 300 lbs. that's "normal". If you reduce to 200 lbs. and stay there for a year then that weight becomes "normal". In other words, if you go from 300 lbs. to 200 lbs. in six months and start eating normally for a 200 pounder you will—because of that mechanism—immediately start gaining weight until you're back to 300 lbs.

Now here is where a lot of people are going to hate me—overweight (fat) is more than just a physical problem. It is a character defect. People get fat because they cannot control an urge for self-gratification. No self-control, no discipline. Basically, fat people are selfish. I don't mean burly people, I mean FAT—pot bellies, double chins, the works. And people whose whole trip is self-gratification aren't going to do anything resulting in any sort of inconvenience. Like fasting.

GAINING WEIGHT

There are so many misconceptions about gaining (muscular) weight that it's hard to know where to start. Therefore, I'll list a few of them and try to dispel them one by one:

1. Exercise does not build muscle—it tears it down. The food you eat and the rest you get builds it back up with a little 'extra' for the next time.

2. Pure protein will not put weight on you. Protein, to be utilized, must burn one and one/third its own weight in fat. If bodyfat is all that's available you will lose weight.

3. It's not how much, but what you eat; if you eat a lot of starch (bread, pancakes, etc.) you will eventually get to the point where you start having headaches. The starch gets into the bloodstream and clogs the smallest blood vessels in the body—the capillaries in the brain. Eliminate all starch from your diet and your endurance will increase thirty per cent.

4. It's not how much of what you eat, but how you eat it. Slowly. A 5'9" 220 lb. friend of mine (Mr. Hawaii 1964) maintained his weight for several months on one banana and a quart of skim milk a day. It took him two hours to polish his meal off.

5. Calories don't mean a thing. Anyone who figures on gaining (or losing) weight by counting calories is acting from a serious misunderstanding of fact. If the calorie criteria was valid then a food extremely high in calories that could be absorbed directly into the bloodstream would make you big as a house, right?

Such a 'food' with extremely high calorie content is pure alcohol.

Now that you understand what doesn't work; let's examine what does and the reasons why:

1. Muscles convert chemical energy into mechanical energy.

2. The energy sources of muscle contraction are sugars and fats.

3. The secondary function of muscle is to maintain constant body temperature; a source of heat. Muscle behaves like rubber, giving out heat when stretched, reabsorbing heat when released.

4. Muscular heat comes from oxidation of carbohydrates.

So here is how you gain weight:

Drink whole milk (FATS)

Eat an orange with each meal and glass of milk. The orange (CARBOHYDRATES) also acts as a super digestive aid and the vitamin C it contains is crucial to building everything from blood vessels to new muscle tissue.

Sip honey throughout the day in small amounts (SUGARS).

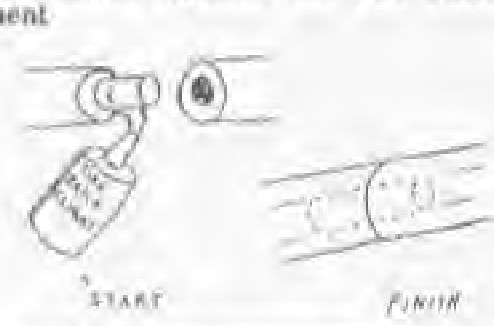
I went from 185 to 215 in three months eating like this so I presume it will work for you too. I am a hard gainer. I am not one of those fellows with a 'cast iron' stomach capable of making bodyweight gains on almost any swill.

A PORTABLE EXERCISE DEVICE

This is known as a 'cable set' or chest expander. The ones you see in the Sporting Goods Stores are usually either made of spring steel and very bulky and inconvenient or of rubber that wears out in a few weeks or months. This one here is made of surgical rubber, normally used for veins or arteries and good for a lifetime. Surgical rubber is over $.30 a foot and each cable should be 34" for the normal adult male so buy them only as you need them. The drawing should be self-explanatory.

Leather Handles
or Iron Rings
(for hands)

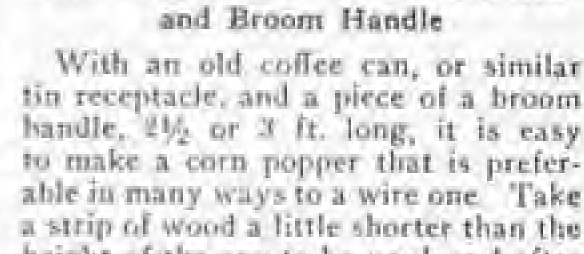
Plug is PVC or part of a wooden dowel or pencil.
Glue dowel inside tubing and then glue rubber halves together—use Tire Patch Cement



From Popular Mechanics 1919

Corn Popper Made from Coffee Can and Broom Handle

With an old coffee can, or similar tin receptacle, and a piece of a broom handle, 2½ or 3 ft. long, it is easy to make a corn popper that is preferable in many ways to a wire one. Take a strip of wood a little shorter than the height of the can to be used, and after boring two holes in it to prevent its splitting, nail it to the end of the handle. The latter is then fastened to the side of the can with two wire staples, as shown. Holes are made in



A Corn Popper Made from a Coffee Can, or Similar Tin Receptacle, and a Piece of a Broom Handle

the can top to admit air to the corn while it is popping.

SURVIVAL AND MENTAL HEALTH

by Cyrus Dickenson

Do you or a loved one have depression, neurosis, hyperactivity, learning disorder, mental confusion, chronic irritability, explosive behavior, migraine headache or short term memory loss? If you do suffer from one of these problems and are maintained by one or more of the many medications developed, manufactured and distributed by the existing social order, you might wonder how you or your loved one can survive a social collapse and an end to your supply of miracle drugs. Read on my friend; there is a way out.

In 1952 there were two revolutionary developments towards mental health discovered in North America. One was to be praised by the established leaders of psychiatric medicine, and the relatives of those afflicted with serious mental disorders, and even some of the ill themselves. The other development was doomed to obscurity, condemnation, and some laughs (except for those who were fortunate enough to be exposed to this development). The first, of course, were the phenothiazines; miracle drugs. And they were, as they replaced physical restraints and locked wards with chemical straightjackets. Free at last from a cell but, for most, a life of slow motion, little imagination, interest, or drive. In short, a life of reduced effectiveness and of reduced survival capabilities.

The second development, as obscure as its discoverers was a laugher. What was this discovery by Abram Hoffer and Humphry Osmond, while working in a Canadian government hospital in Saskatoon Sascatchewan? Vitamins! Vitamins? Yup, that's it. Hoffer and Osmond fortunately did not have training as psychiatrists so did not try to "talk" their patients out of their illness. They considered that mental disorders were like any other illness, to be treated like chicken pox, cancer, etc., and to not "blame" the patient or his relatives as if they wanted to be sick. They found that people suffering from perceptual distortions, such as in schizophrenia, had faulty adrenal glands which, under stress, produced the wrong chemical (adrenochrome). This chemical has properties nearly similar to L.S.D. and causes mild to severe psychedelic distortions in taste, time, sight, sound, touch, etc. They also discovered that by giving niacin or niacinimide (vitamin B3) in very large doses on a daily basis the dangerous manufacture of adrenochrome by the adrenal gland was arrested, returning one's brain to normal functioning.

They then discovered that by giving equally large amounts of ascorbic acid (vitamin C) that this aided the recovery, as this natural substance acts in the body and brain as a detoxifyer. Thus, any adrenochrome that lingered in the brain, or was still being produced, would be broken down into harmless substances. This approach, unlike the use of phenothiazines, completely corrected the mental illness (so long as one stayed on these vitamins) restoring previous functioning, or, as it often was reported, even better than any previous functioning.

Three important steps are accomplished by weaning one's self off of his or her medications and onto mega-vitamins. Number one: The level of functioning will be greatly increased. Number two: A great leap away from dependency on Big Brother will have been achieved. Medications are controlled by physicians and the drug industry. Patent rights control the manufacture, distribution, and accessability of these drugs. Vitamins, on the other hand, cannot be controlled by physicians (they tried passing laws to gain control but failed). They can be purchased over the counter or through the mail from thousands of outlets. The drug industry has no patent rights as they are natural substances found throughout nature.

Actually, this is one of the biggest reasons vitamins are rarely prescribed by physicians. The drug companies don't push them on the doctors as they do their own brand name medications, for which they can charge anything they want. So, you can stockpile vitamins easier. Number three: There are virtually no serious side affects when taking vitamins in concentrated forms (with the exception of synthetic vitamin D, the kind found in milk, and vitamin A when taken at levels of 100,000 I.U. and greater for long periods of time). Prescription drugs, on the other hand, can cause side effects at times, worse than the disease to be corrected. Many times, a person has to take extra medication to reduce the side effects of the primary drug.

I want to talk about "stress" at this point, because understanding stress, what it means to us, and how it affects our survival, can give an individual the best chance of survival with his or her individual mental and physical capabilities. Stress is not something to be avoided. The only way to avoid stress would be to do nothing at all. All human activity involves stress, from a game of tiddleywinks to a passionate embrace. But this can be defined as the stress of pleasure, challenge, fulfillment. What we all want is the right kind of stress for the right length of time, at the level that is best for us. What we don't want is distress! Excessive or unvaried stress, particularly frustration, becomes distress. And this, in turn, can lead to ulcers, hypertension, and mental or physical breakdown.

One of man's greatest mistakes is to only look "outward" for the cause of his distress. He often fails to consider looking inward, so I want to make the distinction. Many of us, when in distress on a day to day, long term basis, (sometimes a whole lifetime) deal with it only by blaming other people. Often the distressed gives up on his goals, desires, and ambitions. His expectations are not met. He may have to move out of a city or large population center where his family, friends, job or educational opportunities abound and to settle for a quieter (if not more boring) rural world of people and events. He knows something is very wrong but just what it is may be vague. He may become more and more embittered at others for causing him to have to retreat into a less interesting, less secure lifestyle.

If, on the other hand, it was safe for him to look inward (as well as outward) for what has been distressing him, his approach towards dealing with his overall survival could be quite different. For example, if he looked inward (for physiological distress) and recognized that he was not crazy but that his brain was not working at full efficiency (poor or unpredictable memory, confusion, irritating hallucinations, periodic blank mind, distracting headache, unexplained lethargy, etc.) he then might direct his coping skills towards strengthening, fortifying, and balancing his body chemistry (internal environment) so as to correct those disorders.

That is to say, if now his mind is working at its best, his whole mental outlook will brighten. If my memory doesn't fail me I can be confident, even authoritative, around others. If I'm not confused I can absorb information in a logical clear way and of course I can use this information towards my survival. I can become a useful resource to others. This will give me confidence, uplift my spirits, pull me out of depression and despair, lower my fears that I might not survive a social crisis. So this is important.

If I can somehow correct these internal imbalances I can halt my retreat from the rest of the world, can become somebody, can take pleasure in knowing I'm capable of not only caring for myself but for others, can tackle stress (the problems of life) not just as obstacles but because it feels good to solve problems. I'd be able to do more than one thing at a time instead of hanging on to just one objective at a time. I would be capable of maintaining my job, caring for my family, helping my neighbor, and putting extra time into a hobby, all at once and enjoying it. So, if we can fortify our physical body, we can handle (1) more kinds of stress, (2) for longer periods of time, (3) at a higher level.

But I stated earlier, "if it were safe to look inward" one could do so and so. Those who have mental problems such as those mentioned would be foolhardy to tell just anyone about them. First, they would probably misunderstand. Secondly, they might assign the wrong reason (eg. blame the person for his illness and tell him to do the wrong thing for it.) Sometimes they just won't believe you. They might say "Oh, there's nothing wrong with you but your attitude," or, "keep your chin up." After a few responses like those, one learns not to share his inner fears.

Now one can learn how to correct these biochemical imbalances that can so reduce his capabilities of coping successfully. And he can be confident if he needs assistance from a physician (often he would not need one), for there are now over one-thousand doctors and psychiatrists who have broken away from traditional American medical practice towards one of prevention through nutrition and meganutrient therapy. They have recognized emotional disorders to be caused by imbalances in the body chemistry and that they can be corrected by taking the right natural substances, at the correct amount for each individual's special needs. He will listen to your complaints, believe and respect you, and prescribe vitamins, minerals, amino acids (protein) and a special diet. Little or no emphasis will be placed on any emotional "hang-ups" as he knows that as the chemistry in the brain comes into balance any twisted thinking will straighten itself out in time without psychoanalysis or digging into one's past or childhood. They even feel that to do this would work against the patient's recovery.

I have mentioned a special diet and if our government took the responsibility of restricting the use of refined sugar, artificial colors, flavors, binders, fillers, preservatives, and all the other chemicals in our foods we wouldn't need a special diet. But of course we do. If you do, or even if you don't feel you suffer from inefficient or malfunctioning brain chemistry, the first and nicest thing you should do for yourself is to stop eating refined foods. The absolutely critical one s are white sugar, brown sugar, powdered sugar, alcohol, coffee, white flour, and all white bread, white rice, or any other foods that are stripped of their vitamins and minerals. These empty foods rob our bodies of vitamins and minerals already in our system which are needed to fuel, build, and repair each individual cell. Eating and drinking these so called foods on a daily basis are the cause of the degenerative diseases more and more prevalent today in most industrial societies. I'm talking about cancer, heart disease, diabetes, and alcoholism just for starters.

Getting back to our topic of emotional disorders, these same "foods" can cause any of the possible symptoms of mental distress including schizophrenia, neurosis, and psychotic behavior as well as any lesser degree of distress in certain individuals.

We now need to replace what we've taken away. Replace refined foods with whole foods. For example, eat whole grain cooked cereal. Eat whole grain breads. Eat whole fresh fruit instead of concentrated juices, especially when sugar is added. Stick to cooking from scratch. Don't rely on special packaged convenience foods. Learn to think your way through periods of low energy. That is, think protein instead of relying on a craving for sweets. Eat lots of small protein snacks throughout the day instead of relying on coffee, candy, cakes, smoking, and other refined or sweet foods to keep your blood sugar or energy up.

If you eat a lot of these nutrition stripped foods I know you don't feel your best. You may not even know what feeling good is all about. I also say you will feel better in two weeks or less if you will completely leave these items out of your diet and replace them with whole foods and several small protein meals throughout the day. Of course I assume you will round out your diet with the other essential foods such as lots of fresh and steamed vegetables, vegetable and animal fats, and the whole grains or carbohydrates. I must add that for some people there will be further obstacles which may interfere with your highest mental functioning such as poor intestinal absorption or assimilation, and allergies. Improving the diet may help these problems as well.

I recommend that before one starts out on this approach, begin a serious educational program to learn the nutritional path towards good health such as what and where to buy wholesome foods. How to prepare, store, and cook them. And to learn better than anyone else how your specific body metabolism works. It's easier than you think.

With the accumulation of that knowledge you can supplement your diet with vitamins, minerals or other nutritive substances that your particular body may need in excess of what you can get in your diet. If you are now on prescription medications, do not stop taking them. First, study up from the book list to follow. Then ask your doctor to slowly reduce your medication after you are well into your diet and supplement program. If he doesn't believe in preventive medicine through diet and supplementation, or if he tells you that sugar and white bread is good for you I would certainly find another doctor. If you believe you have serious mental distress but have not had a mental breakdown or have not had one recently you can safely try the meganutrient approach.

The following is a partial but excellent list of recommended reading to start you on your way to better health and a more secure and enjoyable life regardless of the social order.

Abrahamson, E.M. and Pezet, A.W. Body, Mind, and Sugar. New York: Pyramid Publications, 1971.

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Pfeiffer, Carl C. Mental and Elemental Nutrients. New Canaan, Conn. The Publication Committee of the Brain Bio Center, Princeton, N.J.:Keats Publishing, Inc., 1975.

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Selye, Hans. Stress Without Distress. New York: The New American Library Inc., 1974.

Stone, Irwin. The Healing Factor Vitamin C Against Disease. New York: Grosset & Dunlap, 1972.

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THE END AND THE BEGINNING

By MARTIN DONNELLY

There was no mushroom cloud. Nothing exploded, or crashed. There was no dramatic detonation, thunderclaps did not occur nor did the heavens open, rivers kept their banks. The telephone dialing systems continued to click automatically, the electric lights burned. Nobody knew, at first, that anything was happening.

I didn't know either. I'm an old man, and old men are supposed to be full of wisdom, but I was no wiser than anybody else that day. I dozed comfortably in my armchair, secure in the certainty that my granddaughter would be home soon to fix my supper. And she was, and she did. Nothing was happening.

But it had begun to happen, and I began to learn that it had. The next morning Mrs. Phillips, our neighbor, came to borrow some aspirin for her arthritis because the drug store had unaccountably run out of it. That evening my granddaughter was late in getting home from work because her regular bus had never showed up and she had had to wait for another. My favorite television program was replaced by an old movie. As we were getting ready to go to bed, the lights flickered two or three times. I began to get a feeling in my old bones that something was going wrong.

But it all took place very gradually. So slowly that no one was alarmed at first, me included. Life went on. It was only that everything slowed down. Mrs. Phillips never did get any aspirin from the drugstore. My granddaughter began to ride her bicycle to work because she couldn't depend on the bus. There was an announcement on the radio that because of a temporary power shortage all radio and television stations would go off the air at nine o'clock in the evening.

On the third day my granddaughter came back home an hour after she had left for work and said, "There's nobody at my office. The building is locked up and I couldn't even get in."

While we were talking about this, Mrs. Phillips came to the door and said, "May I use your telephone? Mine is out of order and I have to call my doctor. My arthritis. . ." But our telephone was out of order too.

And at last my old brain, clogged though it was with age and torpor, began to function. I began to add things up. The commodity distribution system failing. Power going out. Communications cut. It was all coming apart. Not dramatically, gloriously, in one big blinding flash. Slowly and grindingly. The system was creaking to a stop.

There had come to be too many people, we were all of us too greedy, we had scourged the earth of its good things, taken the top off of life and called it civilization, forgotten that the essence of living is simply surviving.

I said to the two women, "Pack up. Take what you can carry. We are leaving here."

They looked at me incredulously but they moved. I went to the basement and got my survival equipment. It was pitifully inadequate and I was ashamed of myself for having left it lying there for ten years unchecked. It wouldn't be much use, I was afraid. I had myself become complacent, lulled into thinking that it wouldn't really happen in my lifetime. But now it had happened. Now an old man had to try to begin to live again, with whatever tools he had or could find or could make.

We went to the ranch, and had just enough gas in the pickup truck to make it. We walked from there to the cave. I was pleasantly surprised to find that the sleeping bags so long in storage were still comfortable and warm. And, the next morning, that canned dried fruit and un-dehydrated coffee made a good breakfast.

But I was feeling a growing sense of hopelessness just the same. As I looked at the supplies in the cave I found them pitifully inadequate, and cursed myself at not having added to them as I had planned to do. Moreover, I had only the two women to help me carry what we had to the lake over the mountain. My granddaughter Cynthia was a good girl but frail. Mrs. Phillips was almost as old as I.

We had to try, though. I made up packs for us all, thinking disconsolately that I would have to come back at least twice more, and we set forth. It took us until four in the afternoon to get over the mountain and down into the valley, and when we got to the lake my chest was hurting.

There was good news. Cynthia cried, "Oh, look! The Wilsons are here!" And indeed the Wilson family was there waiting for us, having come over the ridge on the other side of the lake. There was bad news: they were standing there, two adults and four children, with the clothes they had on their backs and nothing else.

"Hijacked," Rob Wilson said bitterly. "They took our truck and didn't even bother to shoot us."

More bad news: the portable generator I had stowed under the floor of the cabin was ruined. My fault; I hadn't packed it properly, hadn't been there to check. The packing had been chewed away by varmints and what was left was a corroded mass of copper. No power. No radio. No pump.

The next day we scored a modest success, in that Rob Wilson and I made it to the cave and brought back more than half of the remaining canned goods. But the next day Rob sprained his ankle going down the mountain, and I had to leave him to hobble back while I went on alone. To see the smoke from the burning ranch house.

And to make a mistake. Thinking they had not found the cave, I went in. There were two men there. The big bearded one said, "You're not going to try to shoot us, are you, Dad? With that scattergun you've got hung on your shoulder?" and raised his rifle.

No, I wasn't going to try to shoot them with the 12-gauge slung over my shoulder. I shot them with the .44 Magnum I drew from my belt. I had handloaded the cartridges myself, and a little too hot; the concussion in the confined space of the cave nearly collapsed my eardrums. The 240-grain slugs from the Model 29 blew holes the size of golf balls in the chests of the two men.

I emptied the contents of my stomach on the floor of the cave at sight of what I had done. There was no strength in me to pack the other supplies I had meant to get. I only managed to snatch the hand-cranked radio transmitter from where I had hidden it. The effort of stepping over one of the bodies to get the radio was almost too much for me, and I left the cave empty-handed otherwise.

The trek back to the lake was a nightmare I scarcely remember. When I got there at last my chest was on fire. I knew finally that I was an old man and useless. Everything I had done had been wrong. I had not prepared properly for survival, and neither I nor any of the people who had trusted me would survive. And I had killed two fellow human beings, no matter what manner of men they were. I had failed.

Dimly I remember that Cynthia looked anxiously at my gray face and heaving chest, and guided me stumbling to my sleeping bag in the cabin. After that, consciousness was like a flickering candle and I lost all track of time. Cynthia was always there. Mrs. Phillips too. I remember seeing Rob Wilson leaning on a cane once or twice; he brought with him a small boy who looked at me with round eyes and said, "Don't be sick any more, please get all well."

I still find it hard to believe that a full week passed before I became fully aware again. But Cynthia told me so. She was looking healthy and fit and not frail at all. Even more astonishing, Mrs. Phillips was there too and seemed to have grown twenty years younger. And there was a young man with a doctor's stethoscope around his neck. They were all smiling at me.

"Look out the window," Cynthia said, helping me to sit up. "See what we got after we cranked up the radio you brought."

I looked out the window. There were people everywhere, all busy doing things. A helicopter stood at rest by the shore of the lake. There was a truck—I wondered how it had got there until I saw the new corduroy road it had traveled—and men were unloading things from the truck. Two small prefab buildings were going up nearby.

Out of the corner of my eye I saw that Mrs. Phillips was approaching and holding out a bowl of soup, and smiling at me. I could smell the soup and it smelled good. I would eat it with pleasure, *I knew*. But for the moment I turned my eyes back to look out the window. I wanted to see everything while I still could. For despite all the smiling faces around me, I knew that I was an old man and that the fluttering sensation I now felt in my chest would grow and grow.

What I wanted to see out the window, what I took a dying man's final joy in seeing, was the beginning of a new civilization. What I saw was survival.

From Popular Mechanics 1913

Forming Coils to Make Flexible Wire Connections

When connections are made to bells and batteries with small copper wires covered with cotton or silk, it is necessary to have a coil in a short piece of the line to make it flexible. A good way to do this is to provide a short rod about $\frac{1}{8}$ in. in diameter cut with a slit in one end to hold the wire and a loop made on the other end to turn with the fingers. The end of the wire is

Forming Wire Coils

placed in the slit and the coil made around the rod by turning with the loop end.

A PHILOSOPHY FOR SURVIVALISTS

by Kurt Saxon

You need a specific set of attitudes to keep you on course toward any goal. You must feel right about what you're doing. Otherwise, you might feel guilty about going your own way while people around you are united in doing nothing, and suffering from it.

But why should you survive, and even prosper, when your fellows are dealing with a standard of living which gets lower all the time? Why shouldn't you share their situation and even deprive yourself of your survival program so that a few others might have a little more comfort in the hard times ahead?

After all, things might change for the better. Those who maintain confidence in their appointed leaders might be right.

The climate is said to be changing but there are still bumper crops here and there. Fuel is said to be getting scarcer but the big gas guzzlers are even more in demand. The population is still growing but the welfare system seems to be keeping up with it.

Pollution is getting worse. Herds are dying or being slaughtered because of chemicals misapplied. Resorts are being closed because fish caught by vacationers can't be eaten. Whole populations of people are endangered and many groups sicken who work at certain factories.

But the government is cracking down. Laws are being written and penalties are being applied.

If we only stand together in common trust, our leaders can turn us toward a new era of progress. All they really ask for is our trust. If we could only drop our selfish egos for a while we could pull together and solve our problems. But without trust and submission to the social ideal, we are to blame for any lack of success in the system.

The above are common reassurances and admonitions fed to the public by the politicians and their stooges in the news media. Most people swallow such garbage by the bucket. After all, it's a lot easier to put your faith in someone besides yourself if you don't have much of a self to begin with.

But if you have a well-developed feeling of self-worth you will reject any plea to unite around anyone, especially those urging you to sacrifice your own interests to those of the majority.

As any system begins to decline, there are always those who are ready to take it over "for the common good". Their appeal is always to the poor, the disenfranchised, the helpless, the weak. They plead for your trust and cooperation and while you tighten your belt, they tighten their stranglehold on the economy.

After all their public assurances that they are working on the problems, you notice that they aren't really doing anything. But they share a philosophy you haven't been let in on and the philosophy they have dosed out to you just makes you feel guilty for not trusting them more.

You've got to have a philosophy which combats theirs. You've got to stop feeling guilty for their failures. You've got to see where they're taking the sheep-like populace so you can head in the opposite direction.

I have my own philosophy of life and, of course, you have yours. Our philosophies seldom deal with the whole picture. So it is convenient to borrow a philosophy which puts us in the picture concerning how we will, or will not, be used by our political and bureaucratic manipulators.

A dandy philosophy I chanced on a few years ago was that by Ayn Rand. This philosophy was beautifully expressed in her story, "Atlas Shrugged". The title illustrates Atlas, holding the world on his shoulders. He finally gets fed up with the dummies he is supporting and so simply shrugs, sending the world crashing to the floor.

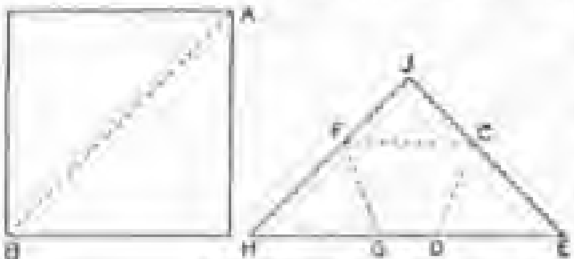
Atlas Shrugged is 1168 pages long. I don't say this to discourage you from tackling it. Actually, once you get into it and find you like it, you'll be overjoyed that you have so much good stuff ahead to read. And fine reading it is. I'm into my fifth reading and find I get more out of it every time. Bradley Steiner, our self-defense expert, has also read it several times.

Atlas Shrugged concerns the total breakdown of society due to the demanding parasites allowed to thrive as a system becomes more affluent. Those bringing

From Popular Mechanics 1919

Starting Garden Plants

In starting small plants to get them hardy and ready to plant in the early spring provide separate receptacles of paper, then the plant can be set out



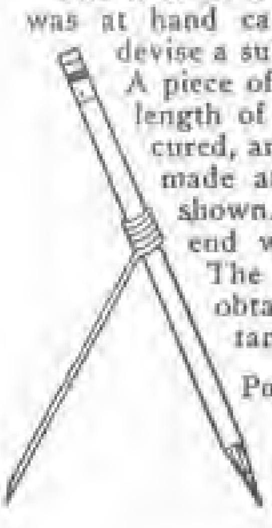
The Paper Cup Starts One Plant and When Reset No Damage Results from the Change

without trouble and it will grow as if it had never been moved. Procure some heavy paper and make the cups as shown in the sketch.

The paper is cut into squares, the size depending on the plant, and each square is folded on the dotted line AB. This forms a triangle of a double thickness. The next fold is made on the line CD, bringing the point E over to F. Then the paper is folded over on the line FG, bringing the point H over to C. This will leave a double-pointed end at J. The parts of this point are separated and folded down on the sides which form the cup as shown.

These cups are filled with earth and set into earth placed in a box. The seeds are planted within the cups. When it comes time for transplanting, the cup with the plant is lifted out and set in the garden without damage to the plant roots. The paper soon rots away and gives no trouble to the growing plant.

An Emergency Pencil Compass



The need of a compass when none was at hand caused me to quickly devise a substitute for the work. A piece of stiff wire, about the length of the pencil, was procured, and several turns were made around the pencil, as shown. The lower straight end was filed to a point. The wire can be bent to obtain the radius distance.

Popular Mechanics 1915

about the affluence in the first place, are condemned for having a higher standard of living than those who do nothing to deserve any living at all.

As pressure mounts for the producing class to share the wealth, more producers are put out of business. Then the hero, John Galt, goes visiting the most productive members of society. He assures them that it is useless to fight people who have nothing but needs and the socialistic laws to force their betters to cater to those needs. They are advised to drop out of the system and retire, even if all they take with them is their ability to begin again once the parasites' game has collapsed.

Well, able people in critical areas of the economy start dropping out nationwide. They close their factories and the Liberals in control find that they and their parasitic constituents can't make the factories go. Poor babies!

Then the rule of the Liberals becomes even more oppressive and they begin trying to force the able to stay and produce. Drop-outs are considered criminals and enemies of the people.

The most able of the drop-outs are hidden in a super-secret hideaway known as "Galt's Gulch". It is a neat village with all the comforts of a metropolis. All the best people are there. The smartest, the most skilled, the most fun to be with.

Galt's Gulch is located somewhere in Colorado. It has some sort of refraction shield emanating from it. From the air, it looks like just another part of the forest. But a pilot actually seeing Galt's Gulch and trying to land there would only fetch up in the branches of some tall tree. Galt's Gulch would be about seven miles away from its refracted image.

Most of the characters in Atlas Shrugged are sort of overblown composites of types. They are either totally good or totally evil, refreshing in these times of lovable rapists, gentle child abusers and well-meaning politicians.

One of my favorite characters is Ragnar Daneskjold. He is a pirate who highjacks aid ships carrying goodies to this or that Peoples' State. He is generally misunderstood.

Anyway, Atlas Shrugged is the only book which describes the complete collapse of a system, with all the details. This alone, makes Atlas Shrugged highly instructive to Survivalists who know little about how our socio-economic system is balanced.

As you read the story, published twenty years ago, you will realize that the government-imposed terrorism of Atlas Shrugged is being implemented all around us today. You'll recognize our modern politicians in action page after page, as if they had memorized the book and adopted the villain's roles.

You don't have to believe long-range forecasts of shortages, bad weather, over-population and other calamities in THE SURVIVOR. You don't have to be far-sighted to compare the chaos of Atlas Shrugged with the chaos we see even today.

You don't have to be a social scientist to see how penalizing the productive on behalf of the non-achievers leads a system to ruin. You can see it happen in example after example and compare Ayn Rand's descriptions with what comes over your nightly TV news.

After reading Atlas Shrugged, you will know why you should survive and prosper regardless of the suffering going on around you. You won't share a crust with someone who thinks your sacrifice is his due.

You will stop looking for morality and ability in politicians or seeing them as leaders in any sense. Forget climate change, if that doesn't register with you. You'll see food production being cut by inefficiency and government interference.

It doesn't really matter whether or not our planet is really running out of fuel. Shortages are guaranteed by political manipulations we see today which could have been copied from Atlas Shrugged.

Government restrictions against business and industry "for the common good" and to break up monopolies, is strangling our economy and even now, putting it in the hands of the least competent. Atlas Shrugged details how such things happen. Now you can look around you and see how these very same practices are costing the jobs and livelihoods of millions today.

You will also see how uniting in trust around a grinning do-gooder will put you in lock-step with a bunch of morons, marching into an economic abyss. Submitting to the common will, today, is the same as walking up the slaughterhouse ramp after the Judas goat.

You may not be as neurotic as I or share some of my more extreme anxieties.

CALVES, STEERS, AND OXEN

by Ron Lank

One of the most useful animals ever to come under man's domestication has been the ox. You've heard the saying, "Strong as an ox", many times, probably never stopping to think of the massive strength that those words imply. What they imply will be of immense value to the survivalist.

"Strong as an ox," or a team of oxen can become extreme massive strength directly under your personal control, to do the heavy jobs which have been presently, temporarily taken over by machines.

A bull calf is a young male of any of the cattle family, or a male cow. After a bull calf has been castrated he becomes a steer. With his sexual potency no longer able to develop he becomes increasingly muscular instead of horny. If you don't have a job for him, he becomes a meaty candidate for your dinner table.

If you take him to your plough and hitch him to it, instead of to your dinner table, he is now an ox.

An ox is a castrated bull with a lifetime of hard labor in his immediate future. A steer is a castrated bull which has no employment in his future, other than a trip to your dinner table.

When the coming setback hits, many farmers will be unable to prevent their more fleet footed cattle from escaping. In the forefront of the panicky hordes will be these cattle fleeing from their human pursuers. Most of these cattle will be overtaken and shot during the chase. With occasional gunfire to spur them on, the fleeter footed cattle, particularly the beef breeds, will remain in front.

Able to live off the land to a degree unmatched by their untrained human counterparts, these refugee cattle will be able to outdistance everyone except you. Those people who were unprepared, who cut loose with a volley of shots at a slow moving cow will suffer their inevitable fate.

Left behind will be the strong fast moving cattle and you. Soon it will become time for you to chase these cattle toward large snares which you have made from salvaged power lines, and other wire and rope which you have been able to procure. These snares will be tied to stout trees and placed to intercept the woodland trails. Some cattle will be caught. Also caught will be horses which have eluded everyone except you, for you are by now an experienced trapper.

You are about to start a farm, or perhaps you prefer to re-start an industry. You will need oxen to help you with your heavy labor. You may also want a horse or two to help you with the jobs requiring less strength but greater speed. You, your oxen, and horses have a great deal of work to do. Get busy.

This is probably for the best. But you should at least know what is going on around you and relate it to what forces are shaping your own future.

Atlas Shrugged will tell you what those forces are and show you, by fictionalized examples, just what happens when they are applied.

When you finish the book you won't have a new philosophy, necessarily. It will be your own philosophy, but clarified and put into a useable pattern by one of the greatest social philosophers of our century. You can then put your own words and observations to some of the most rational ideas of our age.

You will then find not only comfort, but purpose, in knowing that your motivation toward survival is the greatest strength in our nation today. If you've ever had fantasies of being great and extremely worthwhile, they will be realities long before you've finished Atlas Shrugged.

Although Atlas Shrugged is an indictment of our whole parasitic system, libraries have not gotten around to banning it. It seems too long for the average reader to tackle so they let it be. I don't think it would be banned, anyway, but I'm sure it won't be on the "recommended books" list of any Federally funded library.

Build Your Own Blacksmith Shop

by Ron Lank

After the impending crisis has hit, and the immediate effects have passed, the rebuilding era will have to begin with the blacksmith shop. The blacksmith shop will become the basic form of industry from which the tools for all other forms of industry, and farming will originate. Virtually every tool used will be either salvaged from our present era, or built by the blacksmith.

The blacksmith will have plenty of material to work with in the form of wrecked cars and material brought to him from garbage dumps for reworking into something useful. In many cases the tools and goods forged by the blacksmith will be superior to their counterparts available today. With all the essential work which he will be given, the blacksmith will have no time for planned obsolescence.

In other cases, the blacksmith's products will be adequate. A knife built by the blacksmith will be contemptibly inferior to that produced by today's knife makers. It will, however, serve adequately in the hands of a farmer who needs it to butcher a steer. An axe built by the same blacksmith will provide

BE SURE YOU HAVE A GOOD CHIMNEY

BLACKSMITH'S FORGE COPIED FROM AN OPERATING FORGE AT UPPER CANADA VILLAGE NEAR MORRISBURG, ONTARIO, CANADA

RON LANK
KINGSTON, CANADA

firewood for its owner and his family.

I have included a drawing showing how a forge is built. I have not included a scale because I'm leaving it up to the blacksmith to decide on the dimensions of his forge. In this drawing the blacksmith himself operates the bellows, using a lever and two ropes.

The work load will be such that it will probably be necessary to replate this with a forge so large that an employee or a desperate customer will have to be put to work continually operating a much larger bellows.

The operation of the forge will remain the same. Air brought in through the bellows will blast upward through the hearth which will consist of an iron grate overlaid with burning coals. As more heat is required, the bellows will have to be worked faster and faster, bringing the piece of metal on top of the coals up to the desired working temperature.

Behind the blacksmith will be his anvil and hammer. He will then place the heated metal on the anvil and pound it toward the desired shape. When the metal cools too much to be worked further it will have to be reheated for another pounding. If an employee is continually operating the bellows, several pieces of metal may lie on the hearth while each one in turn is being pounded.

Just be sure you've got a good chimney that draws well, to keep the fumes out of your shop.

The best fuel for the hearth is coal with a high sulfur content. At present this sulfur coal is deliberately bypassed because of the air pollution it creates. This accidental conservation will work for your benefit.

If you can't get sulfur coal, or ordinary coal, you can try using charcoal or tamarack.

Tamarack, also known as Larch, is the best wood to burn. Tamarack puts out such extreme heat that it is unsafe to use in an ordinary wood stove. A blacksmith's stone and mortar hearth is built to withstand such heat, so for everyone concerned it will be best to give the local blacksmith a monopoly on the available tamarack.

The blacksmith will have more important things to do with his time than gather scrap metal and tamarack. It will have to be up to his customers to supply it to the blacksmith, along with food and trade goods in exchange for the work which the blacksmith will perform for them.

To the right of the hearth is the water trough. Iron can be tempered by spearing it into the water, then moving it quickly in a figure eight pattern.

Iron can be hardened by spearing it into the water and holding it still.

Files may be made by first pounding the iron to the desired shape. Let it cool, exposed to the open air, so that it will be soft. Scratch lines in it with a piece of hardened iron. Reheat it, and spear it into your water trough, holding it still until it hardens.

Iron may be case hardened by heavily saturating moist clay with chimney soot or charred wood until you have a black putty. Place the heated iron on one slab of this compound, then bury it under a second. Remove it sometime later, after you know it has cooled. In so doing, you have increased the carbon content of the outer surface of your iron.

This is the traditional method that the Japanese have used for hardening their Samurai swords. It will work quite nicely on your customer's butcher knife. I suggest that you sharpen the blade while air dried soft before you case harden it.

From Popular Mechanics 1925

A Cheap and Serviceable Windmill

In localities where the prevailing wind blows from one direction, the windmill indicated in the engraving can be built for a fraction of the cost of a mill of the conventional type. As shown in the photograph, the

Where the Prevailing Winds Blow from the Same Direction for Most of the Year, This Simple Windmill Can be Built and Operated at Practically No Expense

vanes are made of corrugated iron held in flat-iron frames which are bolted to the hexagonal axle, made by shaving down a log. The power of the windmill is conveyed to the pump, as illustrated in the detail drawing, by means of a crank in the end of the axle, which operates the wooden beam connected to it and the top of the pump rod.–

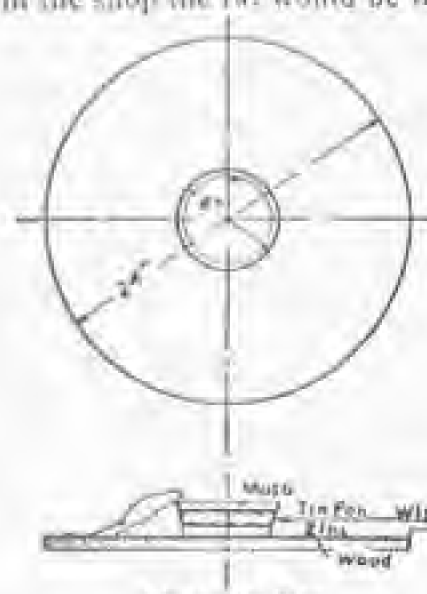
From Popular Mechanics 1919

Electric Rat Exterminator

Some time ago we were troubled by numerous large rats around the shop, particularly in a storehouse about 100 ft. distant, where they often did considerable damage. One of the boys thought he would try a plan of electrical extermination, and in order to carry out his plan he picked up an old zinc floor plate that had been used under a stove and mounted a wooden disk 6 in. in diameter in the center. On this disk he placed a small tin pan about 6 in. in diameter, being careful that none of the fastening nails made an electrical connection between the zinc plate and the tin pan.

This apparatus was placed on the floor of the warehouse where it was plainly visible from a window in the shop where we worked and a wire was run from the pan and another from the zinc plate through the intervening yard and into the shop. A good sized induction coil was through connected with these wires and about six dry batteries were used to run the induction coil whenever a push button was manipulated.

It is quite evident that when a rat put its two fore feet on the edge of the pan in order to eat the mush which it contained, that an electrical connection would be made through the body of the rat, and when we pushed the button up in the shop the rat would be thrown



Electric Rat Trap

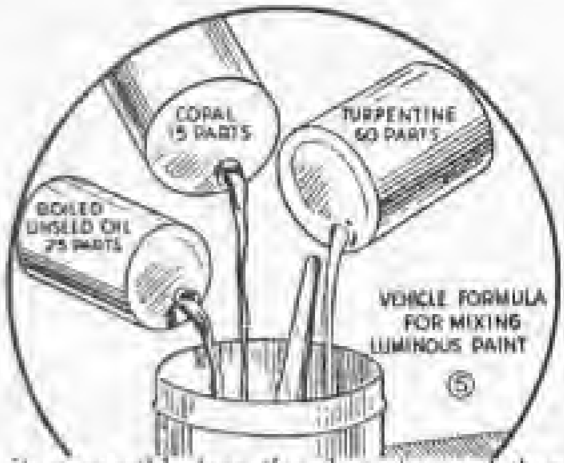
2 or 3 ft. in the air and let out a terrific squeak. The arrangement proved quite too effective, for after a week the rats all departed and the boys all regretted that their fun was at an end.

LUMINOUS PAINT is easy to make

Novel and practical uses for this paint make it a profitable sales item

YOU can make luminous paint in any quantity—even enough for covering the walls and ceiling of a den or workshop is no more expensive than good wall paint. At night the room will glow with a soft, mysterious light. Small quantities can be made with very simple equipment, a clay pipe and bunsen burner as shown in Fig. 1, being the only equipment needed.

The chemical ingredients must be ground thoroughly as in Fig. 3, then mixed by repeated sifting, Fig. 4. The formula given in Fig. 2 is sufficient for making up a number of 2-oz. batches. Use only the chemically pure grade of calcium oxide. Should there be a trace of iron present, it will cause unsatisfactory results. To mix the bismuth nitrate with the other chemicals, dissolve in water, 5 grains, and then use only one-fifth of the solution. After the compound has dried, pack as much of



it as possible into the clay pipe and then cover with several layers of asbestos moistened with water glass to insulate against loss of heat in the upper part of the bowl. Then bring the bowl to a low, red heat over the bunsen burner and hold at this temperature for 15 min. At the end of this time, raise the flame to bring the bowl to a bright red or white heat for an additional 15 min. Then allow the pipe to cool slowly. After this treatment the chemicals will have changed their form and must be re-ground to a fine powder and sifted as before.

To make an easy-brushing paint, the luminous powder can be mixed with either a water or spirit varnish. Gum arabic dissolved in water to the consistency of varnish makes a suitable vehicle where the paint is to be applied indoors. A more flexible and durable vehicle is a spirit copal varnish, which can be bought ready prepared or mixed as in Fig. 5.

You'll find many uses for the paint. For example, brush it on the back of adhesive tape and then cut the tape in small squares or disks. It will stick practically anywhere. Pull-chain pendants can be made by painting the inside of a short piece of glass tubing, allowing it to dry, then plugging the ends and adding a screw eye. For novelty effects, amateur theatricals and the like, you can make gowns and other garments of cheesecloth and coat them with the luminous paint. Remember that if garments or masks have been packed away for some time, they must be hung up before using so that the paint can "drink in" light. To make the luminescent quality serve more practical purposes, paint it on corks or labels of bottles containing poison. Clock hands and numerals also can be given an application with a small camel's-hair brush. By coating the inside of the lid of a fishing-tackle box you can always find just the plug, spinner, or leader you want, even though it is quite dark. Sometimes it's handy to have the numerals on a yardstick, rule or flexible tape show in dark corners. If you use this paint on walls, reduce the solution to an easy brushing consistency so that you can be sure of a uniform application. It should be remembered also that luminous paint gradually loses its effectiveness.

HOMEMADE WORKBENCH

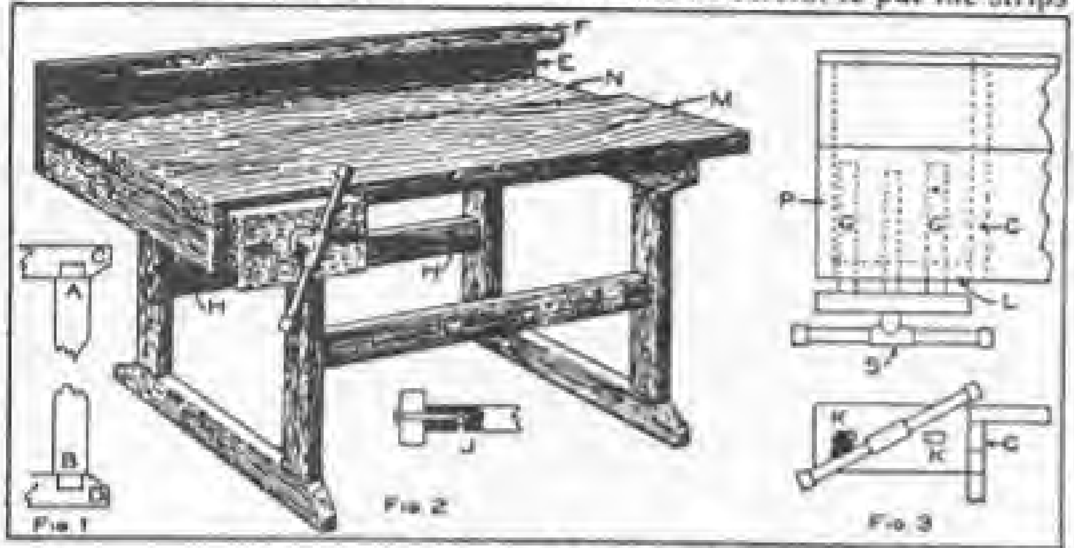
Popular Mechanics 1913

The first appliance necessary for the boy's workshop is a workbench. The average boy that desires to construct his own apparatus as much as possible can make the bench as described herein. Four pieces of 2 by 4-in. pine are cut 23 in. long for the legs, and a tenon made on each end of them, ½ in. thick, 3½ in. wide and 1½ in. long, as shown at A and B, Fig. 1. The crosspieces at the top and bottom of the legs are made from the same material and cut 20 in. long. A mortise is made 1¼ in. from each end of these pieces and in the narrow edge of them, as shown at C and D, Fig. 1. The corners are then cut sloping from the edge of the leg out and to the middle of the piece, as shown. When each pair of legs are fitted to a pair of crosspieces they will form the two supports for the bench. These supports are held together and braced with two braces or connecting pieces of 2 by 4-in. pine, 24 in. long. The joints are made between the ends of these pieces and the legs by boring a hole through each leg and into the center of each end of the braces to a depth of 4 in., as shown at J, Fig. 2. On the back side of the braces bore holes, intersecting the other holes, for a place to insert the nut of a bolt, as shown at HH. Four ⅜ by 6-in. bolts are placed in the holes bored, and the joints are drawn together as shown at J. The ends of the two braces must be sawed off perfectly square to make the supports stand up straight.

In making this part of the bench be sure to have the joints fit closely and to draw the bolts up tight on the stretchers. There is nothing quite so annoying as to have the bench support sway while work is being done on its top. It would be well to add a cross brace on the back side to prevent any rocking while planing boards, if the bench is to be used for large work.

The main top board M, Fig. 2, may be either made from one piece of 2 by 12-in. plank, 3½ ft. long, or made up of 14 strips of maple, ⅞ in. thick by 2 in. wide and 3½ ft. long, set on edge, each strip glued and screwed to its neighbor. When building up a top like this be careful to put the strips together with the grain running in the same direction so the top may be planed smooth. The back board N is the same length as the main top board M, 8½ in. wide and only ⅞ in. thick, which is fitted into a ½-in. rabbet in the back of the board M. These boards form the top of the bench, and are fastened to the top pieces of the supports with long screws. The board E is 10 in. wide and nailed to the back of the bench. On top of this board and at right angles with it is fastened a 2½-in. board, F. These two boards are ⅞ in. thick and 3½ ft. long. Holes are bored or notches are cut in the projecting board, F, to hold tools.

Details of the vise are shown in Fig. 3, which is composed of a 2 by 6-in. block 12 in. long, into which is fastened an iron bench screw, S. Two guide rails, GG, ⅞ by 1½ in. and 20 in. long, are fastened into mortises of the block as shown at KK, and they slide in corresponding mortises in a piece of 2 by 4-in. pine bolted to the under side of the main top board as shown at L. The bench screw nut is fastened in the 2 by 4-in. piece, L, between the two mortised holes. This piece, L, is securely nailed to one of the top cross pieces, C, of the supports and to a piece of 2 by 4-in. pine, P, that is bolted to the under sides of the top boards at the end of the bench. The bolts and the bench screw can be purchased from any hardware store for less than one dollar.

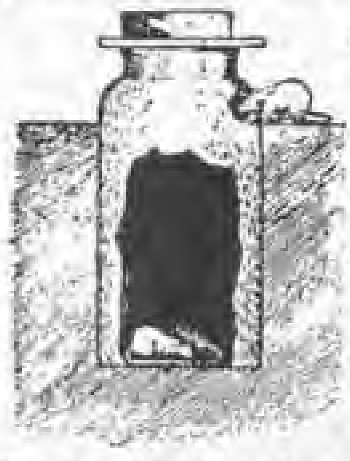


Details of Construction of Homemade Workbench

(From Popular Mechanics 1913)

A Novel Rat Trap

A boy, while playing in the yard close to a grain house, dug a hole and buried an old-fashioned fruit jug or jar that his mother had thrown away, says the Iowa Homestead. The top part of the jug was left uncovered as shown in the sketch, and a hole was broken in it just above the ground.



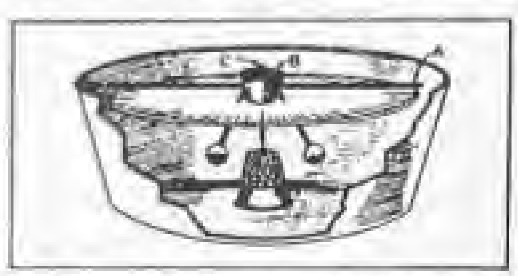
The boy then placed some shelled corn in the bottom, put a board on top, and weighted it with a heavy stone.

The jug had been forgotten for several days when a farmer found it, and, wondering what it was, he raised the board and found nine full-grown rats and four mice in the bottom. The trap has been in use for some time and is opened every day or two and never fails to have from one to six rats or mice in it.

From Popular Mechanics 1913

Homemade Mariner's Compass

Magnetize an ordinary knitting needle, A, and push it through a cork, B, and place the cork exactly in the middle of the needle. Thrust a pin, C, through the cork at right angles to the needle and stick two sharpened matches in the sides of the cork so that they will project downward as shown. The whole arrangement is balanced on a thimble with balls of wax stuck on the heads of the matches. If the needle is not horizontal, pull it through the cork to one side or the other, or change



Magnetized Needle Revolving on a Pin

the wax balls. The whole device is placed in a glass berry dish and covered with a pane of glass.

SOME NOTES ON CRYSTAL RADIOS

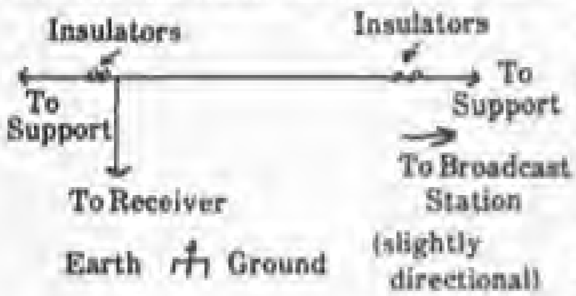
By JOHN NIX

Crystal radio parts: Modern Radio Labs., P.O. Box 1477, Garden Grove, Calif. 92642 (Catalogue 25c) Philmore Mfg. Co., Inc., Inwood, N.Y. 11696 (No catalogue info.) Real antique parts: Bill Baker, Rt.3, Box 1134, Troutdale, Ore. 97060 (No catalogue info.) Kilbourne & Clark Crystal Detector Stands, 1920's era: Art Trauffer, 120 4th St., Council Bluffs, Ia. 51501. (Has other stuff but again, no catalogue info. Ed.)

Note: Crystal sets can be used on short wave bands.

Antennas are important. The longer the antenna, the better. Or, as the old-timers put it, "If your antenna didn't blow down last winter, it was too short."

One of the best antennas for crystal sets is the inverted L antenna. It looks like this:



The telephone line antenna: Solder a piece of copper wire to a 4" x 8" piece of copper foil and sandwich between two 5" x 9" pieces of cardboard. Connect the lead to the antenna post and place the sandwich under your telephone.

Antennas work by capacitively coupling the radio to the telephone lines which act as a long wire antenna. It may not work with a crystal set.

One reason you may be disappointed with crystal radios is that you may have used a set of "Low Impedance Earphones". These are often used on small transistor radios when the speaker is not desired. These earphones were designed to generate the necessary magnetic fields from relatively large currents.

High Impedence Earphones are designed to react to much smaller currents; as much as 500 times smaller.

Low Impedence Earphones are marked 4, 8, or 16 Ohms. High Impedence Earphones are marked 1000 or 2000 Ohms. Sometimes the word, Ohms, is replaced by the Greek letter Omega (Ω). Sometimes the earphones are marked 1kΩ or 2kΩ. That means they are one and two kilo (thousand) Ohm earphones, respectively.

In the past, some 10kΩ and 20kΩ headsets (earphones) were made. They are rather rare.

Detectors: The following materials may be used as detectors: Galena (a Lead Sulphide ore), Iron Pyrites, fool's gold (Ferrous Sulphide), Coal, Carborundum (a synthetic abrasive).

This is by no means a complete list of what can be used. But as a general rule, any small chunk of metal ore might have a spot that would serve as a detector. Finding it will be the fun part.

The detector can be mounted in a blob of Wood's Metal (a low melting point alloy) or a cup of Mercury. Or you could fit it in a shotgun shell base and hold it in place with crumpled metal foil.

Another crystal set was the WW II G.I.'s Foxhole radio. It used a coil of wire from a stolen earphone wrapped on an empty toilet paper tube. A bayonet stuck in the dirt was its ground, while the detector was a blue razor blade and a piece of pencil lead wired to the pointed part of a bent safety pin.

Still another detector was the electrolytic detector in which a hair fine platinum wire just touched the surface of a small cup of Nitric Acid. When the current flowed in the wrong direction, a small bubble of gas was formed, blocking the flow of current.

Finally, a last form of detector, the microphonic detector, exists in which a steel needle is balanced across two knife edges.

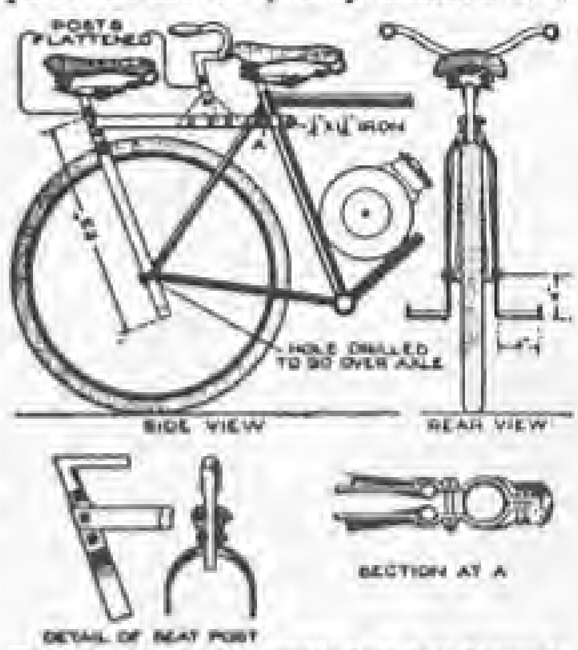
Tanning Rabbit Skins

Rabbit furs can be made up into garments or used for garment linings, as well as for the trimmings on muffs and other fur pieces. Most attempts at tanning these skins have not been very successful, but the following process has been found to give satisfactory results: First, the flesh side of the hide is gone over and all possible flesh is removed by scraping, great care being exercised against cutting through the skin. After scraping, rub in salt, roll up the pelts, and put them away for 24 hours. A solution of 1/2 oz. of sulphuric acid, 2 lb. common table salt, 4 oz. powdered alum, and 5 gal. water is mixed in a large container. After the ingredients have been thoroughly dissolved, the mixture is stirred and the hides placed in it. The container is covered and set away. The hides are allowed to remain in the solution for nine or ten days and should be stirred around two or three times a day during this period. When the hides are removed, they are washed with warm water and soap, this process being repeated two or three times. The hides are then tacked out and stretched, and the flesh side wiped dry with woolen cloths. When dry, the flesh side is gone over with fine sandpaper, using care against rubbing too deeply. This completes the process, and the hides are ready to be cut and worked as desired.—

From Popular Mechanics 1913

Rear Seat for Motorcycle or Bicycle

A rear seat mounted on a light support that can be quickly attached to a

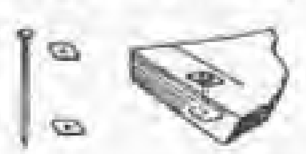


This Light-Weight Homemade Rear-Seat Fixture Is a Convenience for a Strong Bicycle or Motorcycle

strong bicycle or a motorcycle is handy, and one like that shown in the sketch can be made in the home workshop. The supporting frame, consisting of two main sections forming a fork over the rear axle, and a brace extending to the bicycle frame, are made of 1/4 by 1 1/4-in. strap iron. The seat and the handlebars are supported on posts of the usual type, flattened at their lower ends, and riveted to the fixture. The lower ends of the fork are bent to form foot rests. The detailed construction of the seat post and the method of clamping the brace at A are shown in the smaller sketches. The fastenings of the seat and handlebar posts are made with rivets or bolts.

Binding Magazines

To bind magazines for rough service, proceed as follows: Place the magazines carefully one on top of the other in order, and space the upper one, near the back edge, for two rivets, marking off



three equal distances, or, perhaps, the center space longer than the other two. Make two holes through all the magazines on the marks with an awl, or drill, then drive nails of the right length through them. Use small washers on both ends of the nails under the head and at the point, which is cut off and riveted over. This makes a good, serviceable binding for rough use.

A Nut-Cracking Block

From Popular Mechanics 1913

In the sketch herewith is shown an appliance for cracking nuts which will prevent many a bruised thumb. To

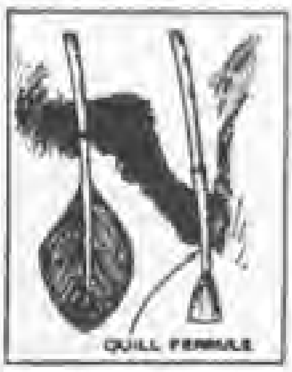
Holes in Block for Nuts

anyone who has ever tried to crack butternuts it needs no further recommendation. The device is nothing more than a good block of hardwood with a few holes bored in it to fit the different sized nuts. There is no need of holding the nut with the fingers, and as hard a blow may be struck as desired. Make the depth of the hole two-thirds the height of the nut and the broken pieces will not scatter.–

Paintbrushes Made from Feathers

From Popular Mechanics 1925

The method one lady used to keep her children supplied with brushes for their water-color work, in the absence of "regular" brushes, is shown in the drawing.



A feather of the desired size is selected, and all but one inch is stripped from the midrib, or stem. The hollow quill at the larger end of the stem is cut off and cleaned out with a piece of wire, and is then slipped over the feather to form a ferrule. Glue may be used to hold the feather in place, if desired.

Popular Mechanics 1915

Planting Seeds in Egg Shells

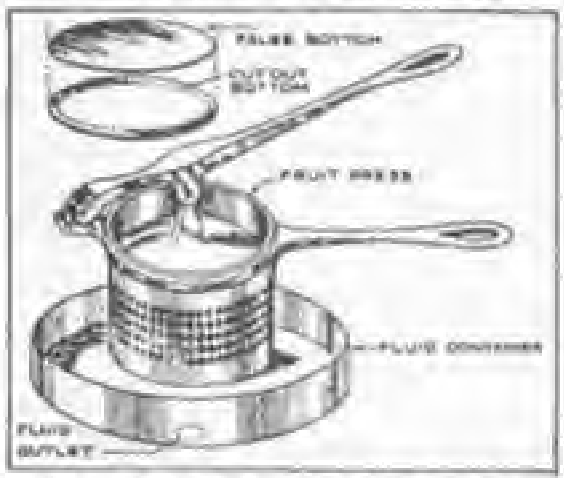
When growing flower plants from seeds, start them in halves of shells from hard-boiled eggs. When the time comes to transplant them, they can be easily removed by allowing the dirt in the shell to become hard and then breaking off the shell, whereupon the plant is placed in the ground.

A pasteboard box provided with holes large enough to support the egg shells can be used to hold them, unless egg crates are at hand. Two large seeds such as nasturtiums and sweet peas can be planted in one shell, and four seeds of the smaller varieties.

Fuel from Garbage and Sawdust

From Popular Mechanics 1925

An ordinary fruit press, or potato ricer, can be used for making fuel briquettes



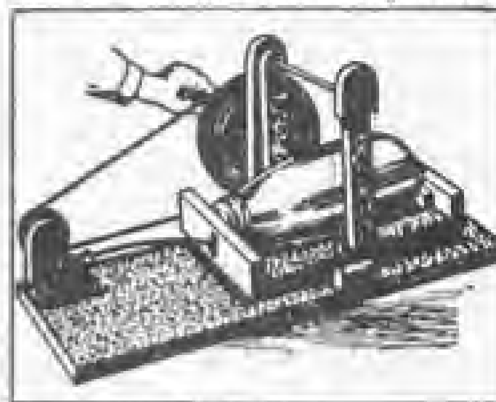
Sawdust or Other Combustible Refuse, in Combination with Oil, is Easily Compressed into Fuel Briquettes in an Ordinary Hand Fruit Press or Potato Ricer

from sawdust, or other combustible refuse, by compressing it together with kerosene. The bottom of the press is cut out, leaving a flange about ¼ in. around the edge, and a loosely fitting false bottom, made of a disk of sheet metal, is placed inside over the opening. The material to be compressed is mixed with kerosene in a pail, and the oil-saturated material is filled into the press and pressure applied, the surplus oil running off into a suitable container, as indicated in the drawing. After the briquette has been compressed, it is pushed out by pressure against the false bottom. The briquettes are set aside to dry, and may be used alone or in combination with other fuels.–

(From Popular Mechanics 1913)

Home-Made Small Churn

Many people living in a small town or in the suburbs of a city own one



Making Butter

cow that supplies the family table with milk and cream. Sometimes the cream will accumulate, but not in sufficient quantities to be made into butter in a large churn. A fruit jar usually takes the place of a churn and the work is exceedingly hard, the jar being shaken so the cream will beat against the ends in the process of butter-making. The accompanying sketch shows clearly how one boy rigged up a device having a driving wheel which is turned with a crank, and a driven wheel attached to an axle having a crank on the inner end. This crank is connected to a swinging cradle with a wire pitman of such a size as to slightly bend or spring at each end of the stroke. The cradle is made with a cleat fastened to each end, between which is placed the fruit jar, partially filled with cream. The jar is wedged in between the cleats and the churning effected by turning the crank.–

To Remove Grease from Machinery

A good way to remove grease or oil from machinery before painting is to brush slaked lime and water over the surface, leaving the solution on over night. After washing, the iron is dried and the paint will stick to it readily.

In removing grease from wood, common whitewash may be left on for a few hours and then washed off with warm water, after which the paint will adhere permanently.

TOYS FOR A CASHLESS CHRISTMAS

by Kurt Saxon

Survival is a family occupation and the sooner you get your kids caught up in it, the better. Homemade toys, as opposed to plastic junk, will promote a basic sense of values in your child. To lay the groundwork for this sense of values, you can start by putting Santa Claus back into Christmas.

Christmas used to be the time to give the kids their supply of toys for the year. Such toys were made to last; sturdy, usually handmade and highly individualized. They were often made by the parents. In villages, the clockmaker, blacksmith, carpenter and other tradesmen would make toys for sale around Christmas.

Children of the last century loved such toys. Many have been passed down to collectors today after having been played with by generations of your elders when they were children. Those handcrafted toys were easily credited to the workmanship of Santa and his helpers.

In the last few decades, toys have become so commercial that you would be hard-put to find a child who actually believes that Santa made them. They are advertised on TV every day, all year, with the manufacturer's name written and spoken in every commercial. And before Christmas, the stores hire a lot of winos to impersonate Santa Claus, who would never have allowed his troops to turn out such rubbish.

With toys being promoted all year round, there's really no season for them any more. So Christmas toys are made to be all used up during the holiday season.

It's a kind of orgiastic sacrifice to the commercial toy companies. The toys aren't made to last for more than a few days and they don't. Most of them are plastic with battery-driven insides. Only in rare occasions does such a toy last long enough to renew its batteries.

Such toys, apart from the thrillingly dramatized TV commercials, are boring. They leave nothing to the imagination. Sure a little girl's dolls now urinate, defecate, throw-up and go into hysterics. But so does the little girl. So how can she fit the disgustingly real doll into her beautiful fantasies? After all, a cornhusk doll can be a princess, but a Betsy Wetsy doll is just a slob.

Concerning the Six-Million-Dollar-Man, Mr. Spock and other bendable, super-hero dolls for boys. Well they come apart a lot faster than the writers of TV commercials would have you believe. So such toys are usually broken within a week, mainly due to carelessness caused by sheer boredom.

The same goes for the elaborate plastic battleships, missiles, helicopters, etc.

Kids are fascinated by these things. There's no denying that. They've also been led to expect them and if they don't get them they're going to scream and yell.

I know I did the first time I didn't get a pile of popular toys for Christmas. Around Christmas of 1941 Dad was laid off and his employer brought a Christmas basket with a ham and such. Mom gave me a 10 cent onion bag of odd-sized colored blocks and a 10 cent modeling clay set. (The same deal would cost about $3.00 today)

I naturally raged and stormed, but when I settled down that afternoon, I found them to be more fun than anything I'd gotten the last Christmas. Kids love to get elaborate toys, but they only really play with simple toys. That clay lasted for months and I kept and played with those blocks for years.

You might explain to your kids that this year their toys will come from Santa. They won't be the mass-produced garbage the poor kids on the block get. They will be fun toys that are made especially for them and no one else will have toys like them.

For about $10.00 you can get from the dime store a scroll saw, small hand saw, small hammer, nails, hobby paints and whatever else you need. When you've finished making all the toys, you can wrap the tools as a gift for one of the kids.

You can find scrap wood down any alley and thin, orange crate wood behind any supermarket, free for the taking.

With this, you can make blocks, forts, boats, a doll house and furniture, animals, etc. Any mother can make scrap dolls which are much cuddlier and friendlier than any Barbie doll or whimpering, clicking robot.

Don't worry about your children's acceptance of homemade toys. Next issue, I'll write a story explaining how Santa is coming out of retirement only for the children of survivalists. In the meantime, get the tools, collect the odds and ends of scrap wood, cloth, etc., and start work on some of the stuff here. Next issue will also carry more samples of easily made toys from the past.

Your first project might be blocks. Just cut some scrap lumber into several dozen odd-sized squares, triangles, etc., sand off the splinters and paint the blocks. Collect different sized tin cans, wash and paint them. Gather up thread spools. They're great for wheels, tops, shooting toys, etc.

In this volume of THE SURVIVOR is the crossbow, arrow sling and catapult on page 44. Page 41 has a good whistle. On page 62 is a level for the tool kit. Also for the tool kit, page 103, figure 840, you can make a bow drill just like the Indians used to drill holes in wampum. Also on page 100 is a keen blowgun. The flutter ring on page 116 would be worked on every visitor to your home for weeks.

If you are at all handy, the steamboat on page 108 would make your boy the envy of all his friends. And the paddleboat on this page would get your kids in the tub at the drop of a hat.

Then there are boomerangs on page 19 and 113 For the little weight lifter, there is an exercise outfit on page22and dumbbells on page 155. The emergency magnifying glass on page 153, along with a few flies, seeds, salt and other specimens will help keep a little scientist fascinated for hours. The lensless microscope in this issue can be made using cellophane instead of celluloid or mica, both hard to get these days. If you have some glass tubing you can make a permanent microscope for nothing. (page 157) pretty much like the first microscopes ever made.

On page 154 there is a spool bow. A set of these, painted different colors, could make your child a real success among his friends.

While waiting for the next issue, watch those toy commercials. If you make it through one Saturday morning, you'll probably feel that kids shouldn't have such fragile trash in the first place. And the prices on that junk! I think it's bad for a kid, knowing a toy costs quite a bit of money, yet accepting its destruction so soon after he gets it. It's a wasteful attitude at best, and to a survivalist it's suicidal.

So a few spare evenings making your childrens' toys will also do a lot for you. It will save you a lot of money, best spent on necessities. It will improve skills, although most of these toys can be made by an amateur who has never made anything before.

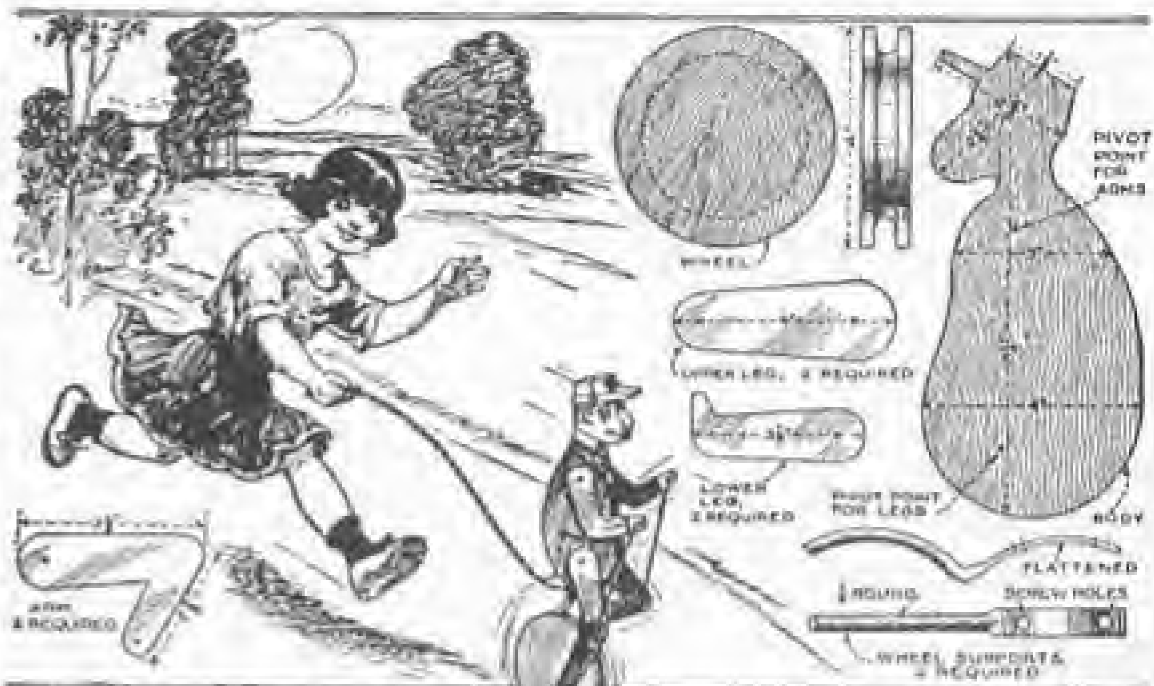
There is also the pride you will see in the eyes of your children. Those old enough to know you actually made their toys will really appreciate you. Kids are so used to parents who only buy things, that in their eyes you will be a creative genius who really loves them. You'll be special and a super parent in the eyes of the neighborhood kids.

So get your scrap and tools and paints together and set aside a few evenings to use them. After the initial disappointment of not getting the expected breakables has passed, your kids will settle down to really playing with real toys.

Making a Cycling Monkey

Popular Mechanics 1925

By L. R. BUTCHER



An Ingenious and Almost Unbreakable Toy That will Please Any Child: Nothing but Common Wood and Sheet-Metal Working Tools Are Necessary for Its Construction

A FEW ordinary tools and a little skill are all that is required to enable any boy to make the animated toy shown in the illustration; this will not only make a splendid toy for little brother or sister, but any boy, or group of boys, can make a sufficient number to earn quite a little pocket money, if the work is well done and attractively finished.

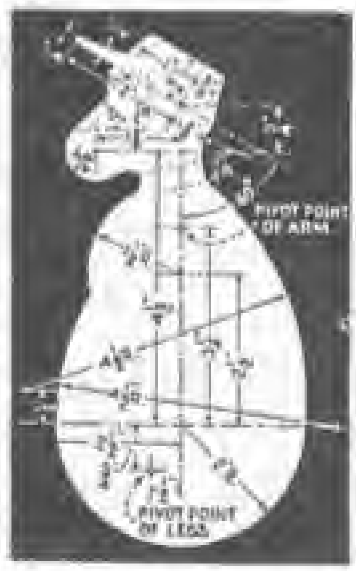
Any good soft wood, 1 in. thick, and free from knots or other imperfections, can be used for the body. A vertical center line should be marked on the stock first, and all measurements for laying out the body made from this line. It is not at all necessary to follow these dimensions closely; the body can be made as much larger or smaller as desired, while keeping to the same general proportions.

Each arm is made in one piece, each leg in two, 20-gauge sheet metal being used. Blue-annealed sheet steel is better for this purpose than galvanized iron, which does not hold paint well. Almost any kind of scrap metal can be used—strips cut from an old auto body, for example, are excellent for the purpose.

The wheel may either be made from one piece, 1 in. thick, or built up; the one-piece construction is the stronger, and should be used whenever possible. This is a wood-lathe job, but if no lathe is available, any woodworker will turn one out at very slight cost. The groove around the wheel accommodates the wheel supports; there is no axle.

Round iron or cold-rolled steel, ¼ in. in diameter, is used for the wheel supports. One end of each support is flattened and drilled for screws for attachment to the body, the remainder being curved to fit in the wheel groove.

The toy is assembled by first fastening the wheel in place, allowing a slight play between wheel and supports. The wheel should be placed a little in front of the center line of the body.



The lower ends of the legs are then pivoted to screws driven into the wheel at a distance of 1¼ in. from the center, so that, when one leg is extended, the other is raised. Ordinary tinners' rivets are used as pivots for the knee joints, and screws at the points where the legs and arms are attached to the body. The end of each arm is linked, by a short piece of wire with an eye bent at each end, to the knee joint, causing the arms to move up and down as the toy is pushed forward. Two pieces of heavy wire, twisted together and attached to the rear of the body, form the tail and the handle to push the toy.

The maker may use his own taste in painting the toy, but whatever color scheme he decides to follow, the face should be strongly marked. The completed toy is very sturdy, in fact almost unbreakable, and will please any child.

THE RETURN OF SANTA CLAUS

by Kurt Saxon

Santa sat in front of his TV set and grumbled. He had been grumbling for thirty years and was not fit to live with at all.

He had a fresh bump on his head he got from grumbling at his wife. He had smears of blue all down his front because he had grumbled at his helpers and one had dumped a bucket of blue paint on him.

The trouble was that Santa and what helpers he had left had nothing to do. So he grumbled and his helpers grumbled and paint got spilled and everything was a mess.

The TV showed just lots and lots of toys made of plastic and metal with batteries and everything. Dolls had voice boxes and said silly things children got tired of hearing. Everything broke or was boring after only a little while.

Of course, Santa hadn't made those junky toys and wouldn't make them if he could. So when junky toys came out, Santa had gone on strike and wouldn't do anything except grumble.

The toy companies could make ever so many toys just by pouring melted plastic into molds. Such toys weren't fun for long and they broke in a week or so but they were pretty and children thought Santa brought them. When Santa grumbled and refused to deliver such junky toys, the toy stores hired people to wear his same clothes and say they were him.

Then Santa stopped delivering even the toys he and his helpers made. This was because the Army got radar and in 1947 he and his sleigh were identified as an Unidentified Flying Object and he was shot down over Toledo. This didn't hurt him because he is magic. But it made him so mad he just gave up and went home.

So for thirty long years he had just sat watching TV and grumbling. Most of his helpers left him to work at McDonalds or the Alaska Pipeline.

Then all the toys were made by the big toy companies who made the same toys for every kid in town. There were Spock dolls and G.I. Joe dolls and Betsy Wetsy dolls. And no child had any toys that were different. They were no fun.

The men who wore Santa's clothes stood on the corners and asked the children what they wanted. The children said they wanted the junk they saw on TV, because they didn't know any better, you see.

Their parents heard what toys they wanted and bought them from the store instead of ordering them from Santa. Parents don't know much about toys any more. When they were children the junky toys started coming out so they never had any good toys themselves.

Then the letters started coming to Santa. Most letters to Santa had been going to the Fire Department or the Salvation Army. They had done a good job giving toys to children since Santa retired so he hadn't gotten any for years.

The new letters were from children whose parents had no money to spend on junk. They weren't poor or anything. They just spent their money on things the family needed. They were Survivalists.

Most of the letters asked for toys that would last a long time. Or if they did break, they could be fixed instead of having to be thrown away. Mainly, they wanted toys that were different and which everyone would know were theirs.

This all made Santa very happy. He rounded up all his helpers and got to work making some real toys. Then he loaded his sleigh and took off for the homes the letters came from.

It was fun for Santa to be flying around delivering toys like in the old days. He didn't even mind flying over Military bases. He had seen an Errol Flynn war movie once where they threw out strips of aluminum foil when they were over their targets. The aluminum foil showed up on the radar screens as lots of things up there instead of just one sleigh. This way, the gunners didn't know what to shoot at.

Then the Air Force sent up jet fighters to see what was causing the disturbance. A squadron made a pass over Santa and he waved and some of the pilots waved back.

Their captain on the ground radioed the head pilot and asked what was up there. The pilot said, "It's Santa Claus and a sleigh and reindeer and everything. They're moving right along, Sir".

The captain said, "Johnson, there isn't any Santa Claus. Whatever you think you see, shoot it down."

Johnson said, "You're out of your tree, Sir. We're none of us going to shoot down Santa Claus. Besides, he's just landed on a house roof".

They argued back and forth and Santa just went on his way. From then on, he flew close to the ground so the radars didn't show him on their screens. He also had to fly low so he wouldn't scare pilots of private planes and airliners.

Things are different in the air since Santa flew thirty years ago. What with Military planes, TWA, private planes, missiles and even Flying Saucers, Santa has to do a lot of dodging and so can't deliver to everyone any more.

So now he only delivers to children of Survivalists. So if your toys are hand made and different from the TV toys, you can be sure Santa himself brought them.

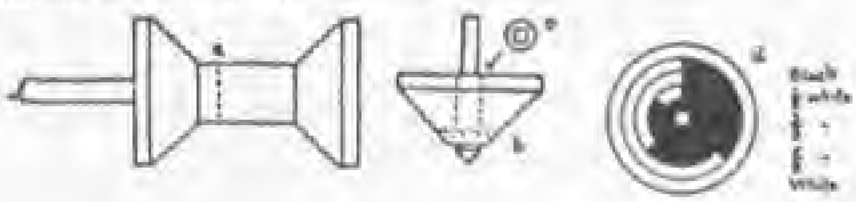
TOY-MAKING

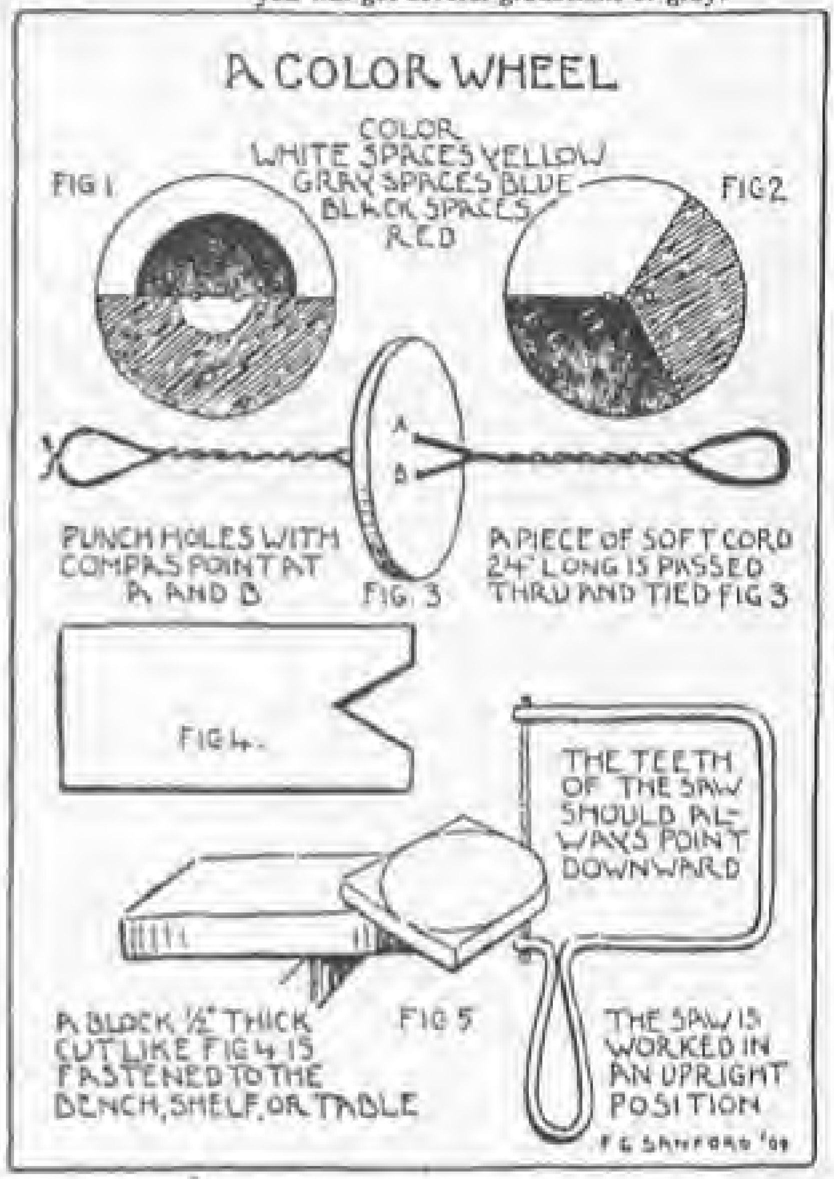
From Our Wonder World 1914

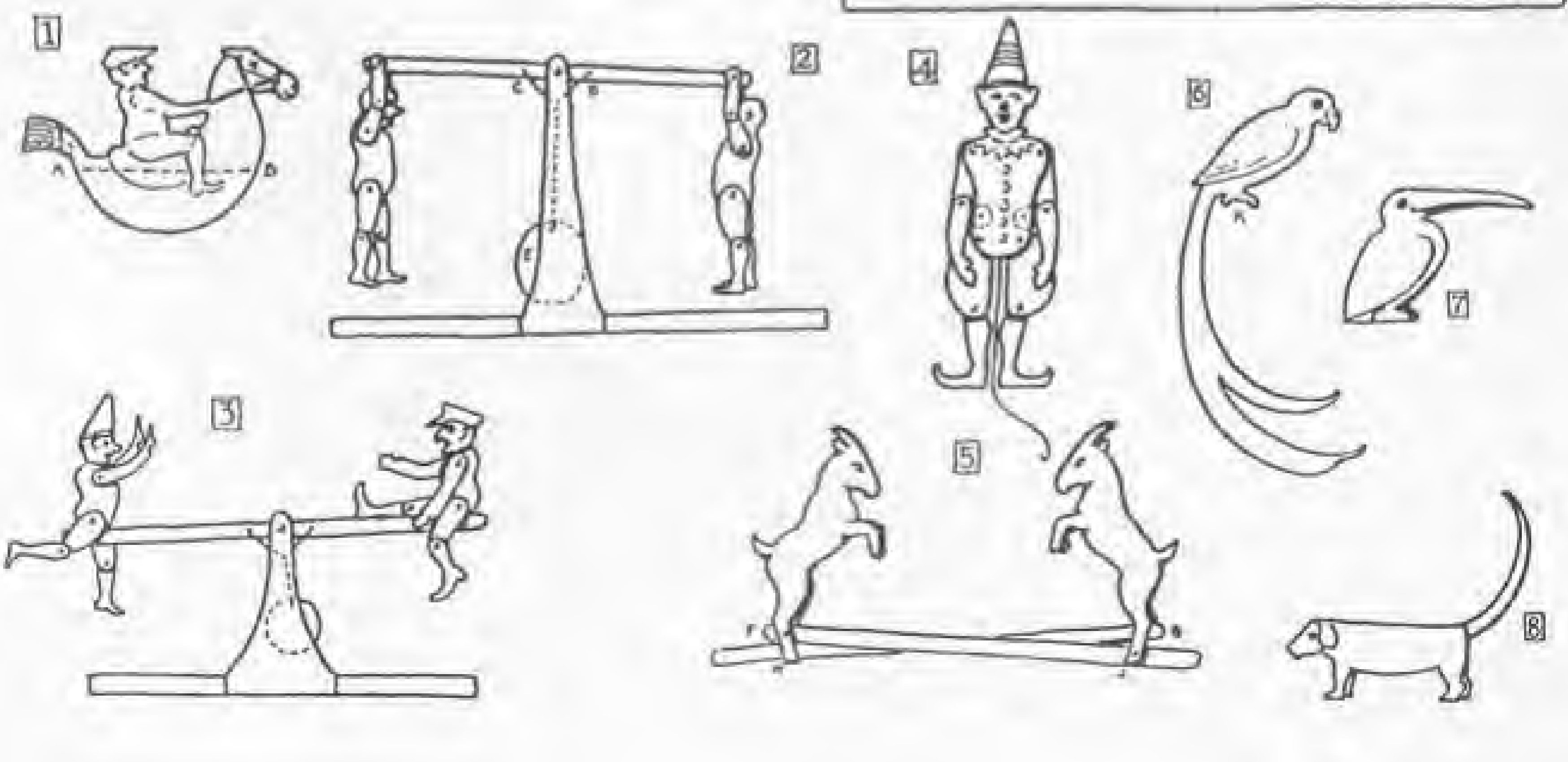
But the making of "things that work" is even better fun than the making of things that can be worked. This plate shows amusing toys made by German school children.

1. A HOBBY-HORSE may be made from three pieces of thin wood, or one piece of thin wood and two pieces of cardboard. The central piece is cut off at A–B. 2 and 3 are two forms of a SEE-SAW. The construction is evident. The weight may be made from sheet lead. 4 is a JUMPING-JACK similar to that described below. 5. Two PLAYFUL KIDS should be made of thick wood. When the legs are pivoted to two flat rods, G–H and F–J as indicated, the heads of the kids will butt. 6, 7, and 8 are GROTESQUES. The parrot will balance on a string.

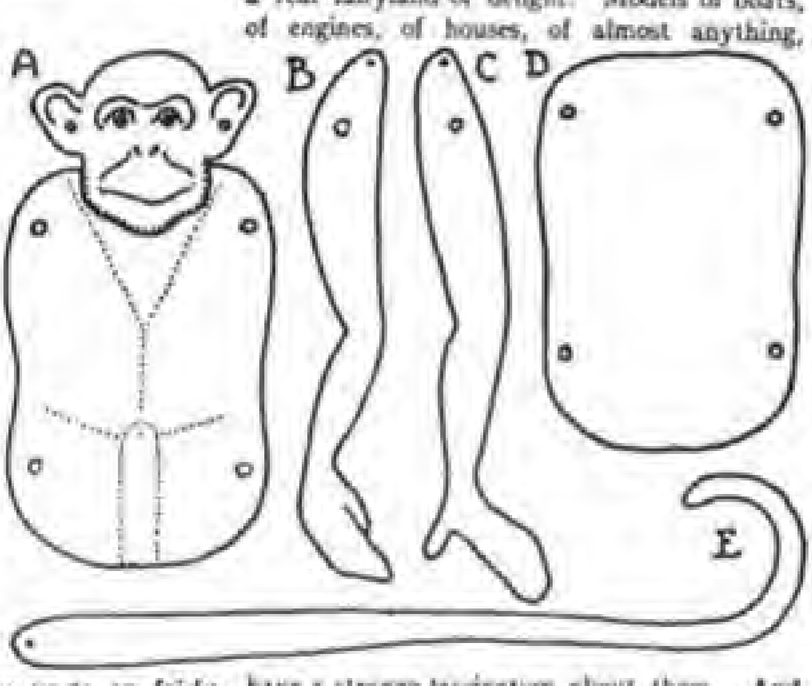
A COLOR WHEEL like the above can be made of cardboard or of very thin wood. Two and one-half inches is a good diameter; have the string holes just ¼" from the center, and loop a four-foot length of very flexible cord through them. With the compasses mark off three rings and color them with crayons or water-colors, having two or three different colors in each ring. When the wheel is spun, the colors will mix and form new colors. A more ambitious wheel, like the one in the large illustration, may be cut from ¼" basswood or soft pine or cigar-box cedar. You can either paste colored segments of paper on the wood, or paste white paper on and color it. The wheel is kept whirling by starting with it as in Fig. 3 and alternately tautening and loosening the strings. A three-inch diameter works well. Color discs like the one below may also be spun on a top. To make the top, select a spool with deep flanges; whittle a stick to fit tightly in the hole. Drive in the stick and saw the spool off ½" inside the flange at a. Drive the stick in a quarter inch more and cut the whole down as shown at b. Cut off the stick above to leave a ¾" spindle. Square the spindle so that the color disc, when fitted over it, will not slip. Make the disc of cardboard, two inches in diameter. If you follow the diagram and use black and white as the colors, you will get several gradations of gray.







Before we go farther we ought to learn something more about the SCROLL SAW. A saw like that in the diagram may be bought for twenty cents, the blades selling for about ten cents a dozen. It will pay you, however, to get a more expensive saw, for the work is much easier if the crook of the saw is long. In fact, the longer it is, the better. It should reach back far enough to rest against the upper arm, because it is conveniently steadied when resting there. Scroll-saw blades are very delicate, and must be treated with consideration. The best rule is to keep a light grip on the handle, and never on any provocation to force the saw when it does not want to go. Remember that a new blade is very sharp, so that if it refuses to cut, the fault is yours: you have twisted it so that it binds in the groove. Cutting along a straight line is easiest of all. You need only see that the blade moves straight up and down with as little wavering from side to side as possible, and that the wood is moved by the left hand towards the saw, instead of the saw being pushed forward. Cutting large circles is about as easy as straight-line cutting. As an experiment, begin with the simpler parts of the CHEERFUL MONKEY that adorns this page. The plan here given is complete; but it is hardly large enough for a really respectable jumping-jack. The first thing then is to enlarge the parts either with a pantograph or by the method described on page 338. Doubling the size would be about right. Enlarge the parts on fairly heavy brown paper, cut them out carefully, and paste them on the wood that is to be used, making sure to reverse one of the arms and one of the legs. Be sure about this—the reversing—it will save trouble. If you then simply cut around the patterns, the paper will form an excellent finishing surface for the wood. When you lay the patterns on for pasting, have long parts like the arms run with the grain. They will be very weak and breakable if they run across the fibers of the wood and not with them. Begin by cutting out the back piece. Then try an arm. If you start down the comparatively straight side of the arm you will be safe until you come to the crook of the wrist. At this comparatively sharp curve let the blade do a good deal of moving and the wood very little. That is, keep the saw going as usual, but move the wood slowly. Particularly must this be done as you saw around the finger-tips. When you saw out the front body piece and come to where the head meets the body you will have to move the wood around almost a full turn while the blade stays in one place. To make the turn as sharp as possible, let the back of the blade bear on the wood, rather than the teeth. If at any point in a curve your saw sticks, it is either because you have turned too fast or because you have failed to keep the blade vertical. When the parts are all cut out, bore holes in them, as shown in the diagram, with a bradawl. Then fasten heavy black thread to the inside ends of the limbs and tail, tying and arranging them so that when the toy is completed, and the limbs are hanging down, the threads will lie as do the dotted lines. Small brass-headed nails should be run through the holes and bent to bind the parts together,—not too tightly, though. The last touch is to take pen and ink or brush and paints and create the most monkey-like grin you can for the big-eared little fellow.



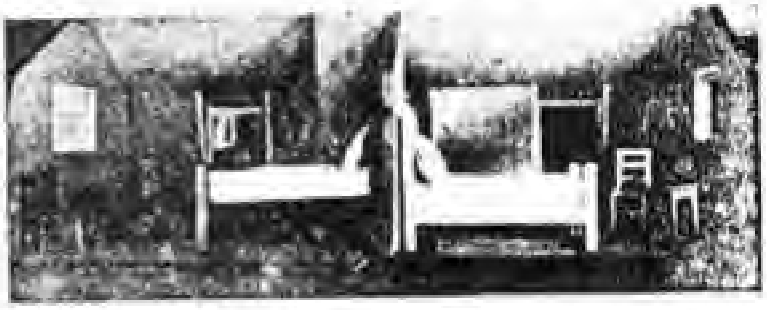
When we come to Mrs. Doll and little Miss Doll seated in their own little chairs and at their own little table, we enter a real fairyland of delight. Models of boats, of engines, of houses, of almost anything, have a strange fascination about them. And if we have made the models ourselves how much more we shall like them.

If we were makers of real full-size FURNITURE, the first thing we should have to do would be to lay in a supply of wood; and the second thing, I suppose, would be to get orders for our wares. Let us be model workmen, and go at our work in the most approved style. We undoubtedly have sundry pieces of basswood left over from the making of previous toys, and these will be very useful. We ought also to have on hand a goodly stock of cigar-box cedar; in fact we should keep our eyes open for all the clear-grained thin wood that comes our way. We should in addition obtain some of the very smallest brads, and either a bottle of ready-to-use glue, or a glue-pot. In case there is a good deal of gluing to be done, the glue-pot is best. Now, you cannot be too careful to have a good glue-pot. It is a sort of small iron double boiler, with an outer pot for boiling water—to be kept boiling over the fire—and an inner pot in which the glue is kept at just the right heat all the time. The hardware dealer sells dry chips of glue; buy a quarter-pound, half-fill the pot with chips, and pour in water enough to cover them. More water may be added if the glue proves to be very thick when it melts. It is an excellent thing to have a glue-pot in the house. Once every four months you should put the glue-pot on to boil and gather all the chairs and other wooden articles that need to be tightened in the joints. As said before, glue should be allowed to set two days before the articles are put to any strain.

So much for the manufacturer's stock. Now for the orders: The best way to secure a flourishing demand for furniture is to build a house,—in this case a doll's house. The house may be very satisfactorily made of a str..g grocer's box that is not too deep. Before setting in the one or two floors, decide where the stairs are to come and cut openings for them. Handsome stairs may be made of a piece of straight narrow board with treads glued upon it. Material for the treads you can get if you will go to a wood-working shop and ask in magic phrase for some "strips chamfered off of planking." The wood-worker will look at you curiously, wondering where you learned the terms of his trade; and then he will point you to the pile of waste, where you can find lengths of wood "triangular in cross-section" (this is geometrical magic). You will see how short pieces of this wood may be glued on the slanting board to make very real stairs. It pays, by the way, to be on neighborly terms with the wood-worker who lives nearest your home,—and for that matter with the painter and the blacksmith too. These men won't mind your *quietly* watching them; and they will be glad to help you with advice and various materials,—if you don't "pester 'em." You know what I mean by that. Perhaps we cannot be too certain that you fully understand this. A man's work is so important that he may have to scold even you.

The house may be topped off with a slant-roofed attic; with partitions; with windows of glass or oiled paper, paper window-bars being pasted across; with leather-hinged doors; with real wall-paper put on with flour paste (or tube paste thinned with water); with bits of carpet; with rag-rugs that your mother will show you how to make; with coats of white paint and shellac; and so on and so on.

The illustrations on these pages will suggest patterns for several styles of furniture. It is to be desired that each room should have a complete set in some one style. You will notice how attractive the set on this page looks because it is all of one kind. If you should want more ideas for chairs, tables, and the rest, you could write to some of the large furniture manufacturers who advertise and who will send you catalogues full of pictures.



When once you have decided on a particular pattern, draw it out on heavy paper, allowing a piece of pattern for each piece of wood, unless, of course, two parts of the furniture are just alike, as in the case of most chair sides and table ends. In making the pattern for a table end like that in the picture above, you will find it handy to fold the paper, draw a pattern as if for one-half of the end, cut the double sheet, and then lay it out flat. By drawing the pattern in such a way as to bring the fold in the center of the completed object, you will get both sides of it just alike.

When the various pieces have been cut out, and the carvings or decorations added, they should be sandpapered wherever necessary. Decorations like those above may be cut with the scroll saw or with a round-edged chisel called a gouge. The convenient thing about small furniture is the fact that its parts need not be jointed one into another, it being enough simply to use glue, making what a carpenter would call a butt joint, — that is, a joint in which the butt of one piece simply rests flat against the piece it is nailed or glued to. Before setting about the gluing, mark with a pencil where the various parts are to go, marking on the sides of a chair, for example, where the seat is to rest. Then, when you apply the glue and put the parts together, there will be no awkward mistake.

Some kinds of wood will look very presentable if simply given a coat of brown or green or red water-color. If you do not like the "dull finish" that results from water-colors, add a coat of shellac. Shellac is almost colorless, and just adds a water-proof coating to the color beneath. Varnish might be used, but it is far less convenient than shellac. You will not want to use ordinary paint, as shellac and stains and water-colors are thinner and better suited to such small objects. You might use the tube oil-colors, but they are costly.

THE "LAME DUCK"

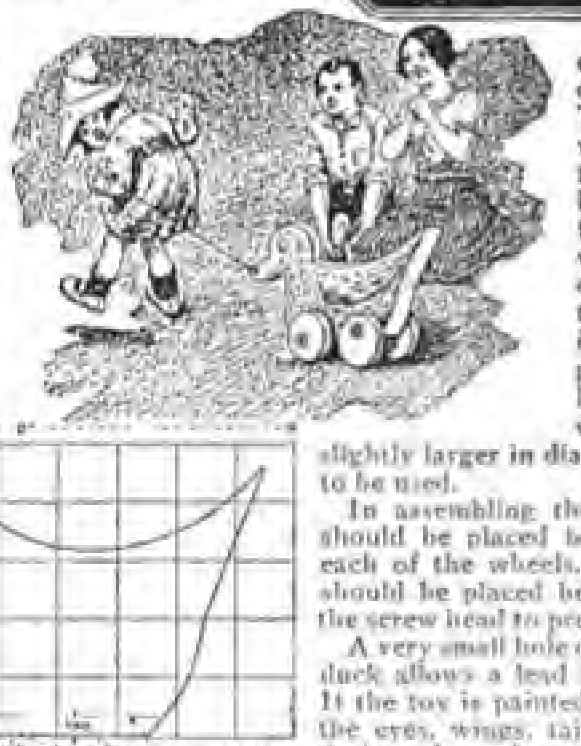
By LOWELL R. BUTCHER

Popular Mechanics 1915

THE "lame duck" is a toy that will delight the heart of any child. When pulled across the floor by the lead string, the duck will do a number of amusing things. It will wobble back and forth, sidewise, and will sometimes combine the two movements at the same time. By placing the four wheels that support the toy off center, a number of surprising actions are made possible.

The body of the toy is made of 2-in. material; 1-in. finished lumber may be used instead, but the 2-in. thickness will place the wheels farther apart, and there is less danger of upsetting the finished toy. Unless several of the toys are desired, in which case it is best to cut out a cardboard pattern, the body can be laid out directly on the board chosen for that purpose.

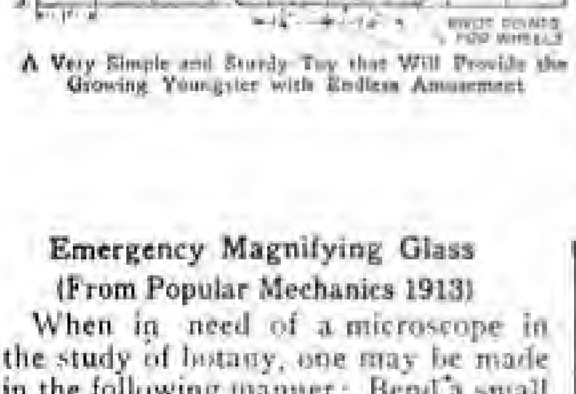
The toy shown in the photograph was made from a block of wood 5 in. wide, 9 in. long and approximately 2 in. thick. By marking the block off into 1-in. squares, as shown in the diagram, the shape of the duck can easily be sketched in by referring to the illustration. A scroll or keyhole saw is best for sawing out the body shape.



Four wheels of ½-in. material are sawed or turned to an outside diameter of 1½ in. The holes for the wood screws that fasten the wheels to the body are drilled ¼ in. from the center of the wheels. The location of the pivot points of the wheels on the body is shown in the diagram. Naturally, the holes through the wheels should be slightly larger in diameter than the screws to be used.

In assembling the toy, a thin washer should be placed between the body and each of the wheels. Likewise, a washer should be placed between the wheel and the screw head to prevent needless friction.

A very small hole drilled in the bill of the duck allows a lead string to be attached. If the toy is painted with some care, and the eyes, wings, tail feathers, etc., made darker than the remainder, the resemblance will be better. The completed toy is sturdy, with no complicated mechanism to go wrong, and the "rollicking" action given by the eccentric wheels is amusing to the old as well as the young.



A Very Simple and Sturdy Toy that Will Provide the Growing Youngster with Endless Amusement

Emergency Magnifying Glass
(From Popular Mechanics 1913)

When in need of a microscope in the study of botany, one may be made in the following manner: Bend a small wire or the stem of a leaf so as to form a small loop not larger than the ordinary drop of water. When this is done place a drop of clear water in the loop and the microscope is complete. This temporary device will prove valuable where a strong magnifying glass is not at hand.

Loop Inclosing a Drop of Water

From Popular Mechanics 1925

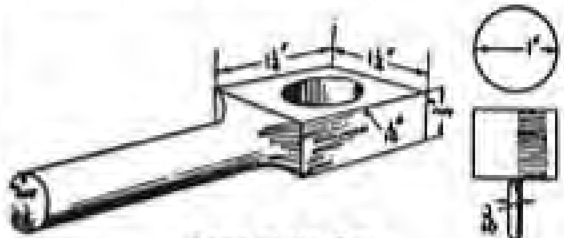
Beads from Rose Petals

Necklaces made from rose-petal beads are not only attractive in appearance but have a delightful rose odor. The petals are gathered, and chopped finely with a knife; if a food chopper is available, the results are better. The chopped petals are placed in an iron vessel of some sort. Should this be somewhat rusty it is really an advantage, since the rust (iron oxide) tends to make the beads a richer black in color. The petals should be allowed to stand for about a week after they have been chopped. Do not allow them to become dry; if there is any tendency toward this, a little water may be sprinkled over the mass. At the end of the week, sufficient water is stirred in with the petals to make a soft mass. The beads are made by rolling bits of this mass between the thumb and finger. While still soft, each bead is pushed onto a piece of wire or a hatpin and allowed to stand for several days until quite hard.-

Popular Mechanics 1913

An Austrian Top

All parts of the top are of wood and they are simple to make. The handle is a piece of pine, 5¼ in. long, 1¼ in. wide and ¾ in. thick. A handle, ¾ in. in diameter, is formed on one end, allowing only 1¼ in. of the other end to remain rectangular in shape. Bore a ¾-in. hole in this end for the top. A 1/16-in. hole is bored in the edge to enter the large hole as shown. The top can be cut from a broom handle or a round stick of hardwood.

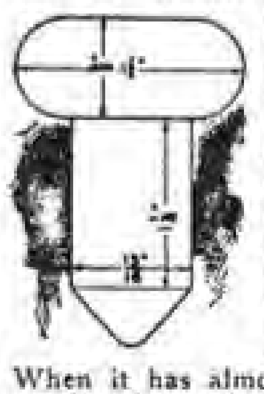


Parts of the Top

To spin the top, take a piece of stout cord about 2 ft. long, pass one end through the 1/16-in. hole and wind it on the small part of the top in the usual way, starting at the bottom and winding upward. When the shank is covered, set the top in the ¾-in. hole. Take hold of the handle with the left hand and the end of the cord with the right hand, give a good quick pull on the cord and the top will jump clear of the handle and spin vigorously.

Top Spins by Whipping

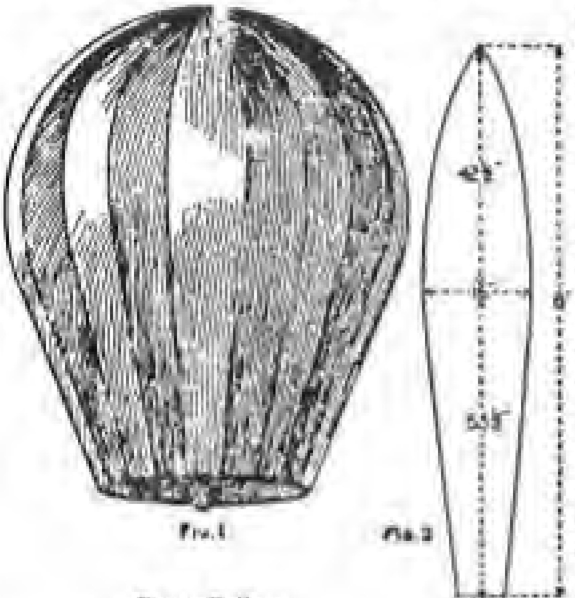
A top that will keep spinning as long as it is "whipped" is easily made from a piece of hard wood by following the dimensions shown in the drawing. For a whip, use any piece of soft cord about 2 ft. long, tying one end of it to a stick of about the same length. Wrap the cord around the top and carelessly toss it out, to make it spin. When it has almost stopped, "whip" it gently; the cord will wrap itself around the top, and drawing the whip away gives the top a new start.



From Popular Mechanics 1913

How to Make Paper Balloons

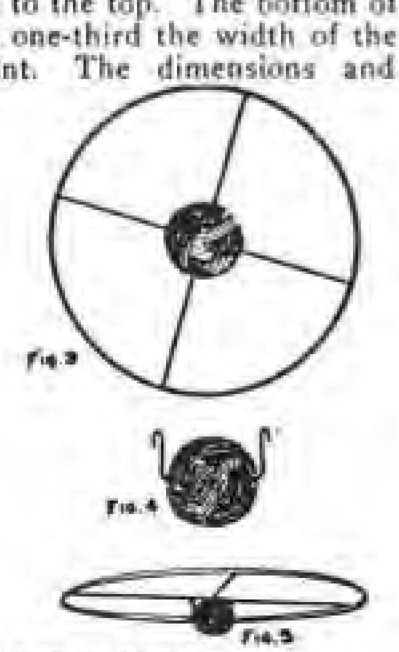
Balloons made spherical, or designed after the regular aeronaut's hot-air balloon, are the best kind to make. Those having an odd or unusual shape will not make good ascensions, and in most



Paper Balloon

cases the paper will catch fire from the torch and burn before they have flown very far. The following description is for making a tissue-paper balloon about 6 ft. high.

The paper may be selected in several colors, and the gores cut from these, pasted in alternately, will produce a pretty array of colors when the balloon is in flight. The shape of a good balloon is shown in Fig. 1. The gores for a 6-ft. balloon should be about 8 ft. long or about one-third longer than the height of the balloon. The widest part of each gore is 16 in. The widest place should be 53½ in. from the bottom end, or a little over half way from the bottom to the top. The bottom of the gore is one-third the width of the widest point. The dimensions and



Pattern and Parts to Make Balloon

shape of each gore are shown in Fig. 2.

The balloon is made up of 13 gores pasted together, using about ½-in. lap on the edges. Any good paste will do—one that is made up of flour and water well cooked will serve the purpose. If the gores have been put together right, the pointed ends will close up the top entirely and the wider bottom ends will leave an opening about 20 in. in diameter. A light wood hoop having the same diameter as the opening is pasted to the bottom end of the gores. Two cross wires are fastened to the hoop, as shown in Fig. 3. These are to hold the wick ball, Fig. 4, so it will hang as shown in Fig. 5. The wick ball is made by winding wicking around a wire, having the ends bent into hooks as shown.

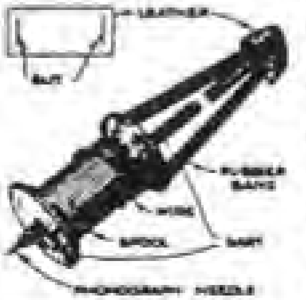
The balloon is filled with hot air in a manner similar to that used with the ordinary cloth balloon. A small trench or fireplace is made of brick having a chimney over which the mouth of the paper balloon is placed. Use fuel that will make heat with very little smoke. Hold the balloon so it will not catch fire from the flames coming out of the chimney. Have some alcohol ready to pour on the wick ball, saturating it thoroughly. When the balloon is well filled carry it away from the fireplace, attach the wick ball to the cross wires and light it.

In starting the balloon on its flight, take care that it leaves the ground as nearly upright as possible.

From Popular Mechanics 1925

Spool Bow for Shooting Darts

A good substitute for a bow and arrows, and one that is much easier to make and use, is made from a large spool and a wide rubber band. The rubber band is cut in the center and a piece of leather, ⅛ in. wider than the band, is slitted at each end. This piece of leather is slipped over the rubber band, as shown in the drawing; then the ends of the band are bound to opposite sides of the spool with fine wire or strong cord. The darts are made from small, round sticks with an old phonograph needle for a point. The darts should fit loosely in the hole of the spool. If available, butcher's skewers may be used instead of the needle-tipped darts, and the trouble of making them will be saved.

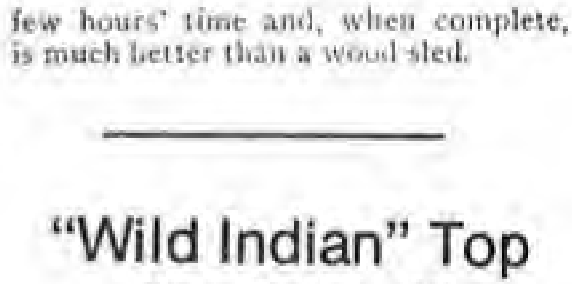


Popular Mechanics 1913

Hand Sled Made of Pipe and Fittings

The accompanying sketch shows how an ordinary hand sled can be made of ¾-in. pipe and fittings. Each runner is made of one piece of pipe bent to the proper shape. This can be accomplished by filling the pipe with melted rosin or lead, then bending to the shape desired, and afterward removing the rosin or lead by heating. Each joint is turned up tightly and well pinned or brazed. One of the top crosspieces should have right-hand and left-hand threads or be fitted with a union. Also, one of the top pieces connecting the rear part to the front part of each runner must be fitted in the same way. The top is fastened to the two crosspieces.

Such a hand sled can be made in a



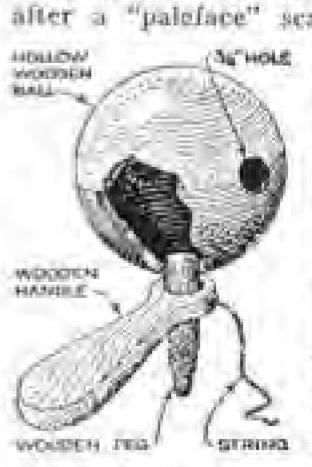
Parts Made of Pipe Fittings

few hours' time and, when complete, is much better than a wood sled.

"Wild Indian" Top

Popular Mechanics 1925

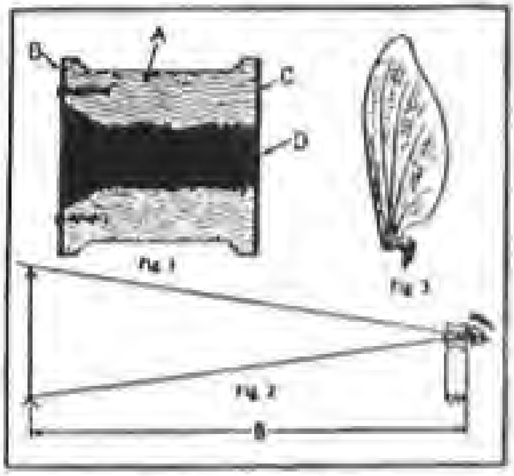
A wooden top that will hop across the floor and howl like an Indian in full cry after a "paleface" scalp, can be easily made by the amateur wood turner. The top consists of a hollow, two-piece wooden ball, which is turned from a piece of soft pine. A hole is drilled through the shell of the ball at one of the center marks and fitted with a hardwood peg having a slightly rounded end, as shown. At right angles to the peg, a ¾-in. hole is drilled. To spin this top, a wooden handle, such as the one shown, is required. The top string is wound around the peg, and the end is brought through the hole in the handle, as indicated. A quick jerk on the string sets the top in motion and pulls it free of the handle.



A Microscope Without a Lens

Nearly everyone has heard of the pin-hole camera, but the fact that the same principle can be used to make a microscope, having a magnifying power of 8 diameters (64 times) will perhaps be new to some readers.

To make this lensless microscope, procure a wooden spool, A (a short spool, say ½ or ¾ in. long, produces a higher magnifying power), and enlarge the bore a little at one end. Then blacken the inside with india ink and allow it to dry. From a piece of thin



Detail of Lensless Microscope

transparent celluloid or mica, cut out a small disk, B, and fasten to the end having the enlarged bore, by means of brads. On the other end glue a piece of thin black cardboard, C, and at the center, D, make a small hole with the point of a fine needle. It is very important that the hole D should be very small, otherwise the image will be blurred.

To use this microscope, place a small object on the transparent disk, which may be moistened to make the object adhere, and look through the hole D. It is necessary to have a strong light to get good results, and, as in all microscopes of any power, the object should be of a transparent nature.

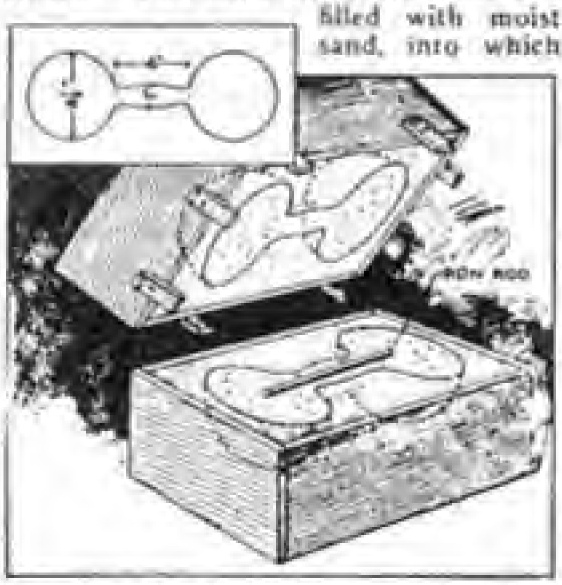
The principle on which this instrument works is illustrated in Fig. 2. The apparent diameter of an object is inversely proportional to its distance from the eye, i. e., if the distance is reduced to one-half, the diameter will appear twice as large; if the distance is reduced to one-third, the diameter will appear three times as large, and so on. As the nearest distance at which the average person can see an object clearly is about 6 in., it follows that the diameter of an object ¾ in. from the eye would appear 8 times the normal size. The object would then be magnified 8 diameters, or 64 times. (The area would appear 64 times as large.) But an object ¾ in. from the eye appears so blurred that none of the details are discernible, and it is for this reason that the pin-hole is employed.

Viewed through this microscope, a fly's wing appears as large as a person's hand, held at arm's length, and has the general appearance shown in Fig. 3. The mother of vinegar examined in the same way is seen to be swarming with a mass of wriggling little worms, and may possibly cause the observer to abstain from all salads forever after. An innocent-looking drop of water, in which hay has been soaking for several days, reveals hundreds of little infusoria, darting across the field in every direction. These and hundreds of other interesting objects may be observed in this little instrument, which costs little or nothing to make.

From Popular Mechanics 1925

Dumb-Bells Made of Cement

Dumb-bells of any weight and size may be made with little trouble from ordinary cement. Two mold boxes are made and filled with moist sand, into which



Dumb-Bells Cast in Sand Molds may be Weighted to Meet Individual Requirements of Age and Strength

the pattern is pressed. After removing the pattern, the mold is thoroughly greased with heavy oil or light grease, to prevent the sand from sticking to the cement. The mold is then filled with cement mortar. Before the cement has completely hardened, a small iron rod is placed on the lower mold, as a reinforcement for the handle. The molds are then placed together, until the cement has completely hardened.

A dumb-bell made to the dimensions given will weigh approximately 10 lb. Heavier or lighter bells may be made by imbedding suitable-sized pieces of wood or metal in the ends.—

A Simple Aerial Toy

An interesting little toy that involves no more than a small piece of tin and an empty thread spool can be made in a few minutes. Two small wire brads are driven into one end of the spool, at diametrically opposite points, and the

heads are clipped off, leaving studs, ¾ in. long. A "whirler" is made from a piece of tin in the form of an airplane propeller, the blades being bent in opposite directions, as indicated. Holes to permit the propeller to make an easy fit on the studs are provided at the proper points. In use, the spool is placed on a shouldered stick, slightly smaller than the hole of the spool; then about 4 ft. of strong twine is wrapped around the spool and the propeller is placed on the studs. Holding the spool by its shaft, in one hand, the string is given a sharp pull, and the propeller flies off into space.

Popular Mechanics 1915

A Merry-Go-Round Pole

An inexpensive merry-go-round can be made of a single pole set in the ground where there is sufficient vacant


The Ropes being Tied to the Wheel Rim will Easily Turn around the Pole

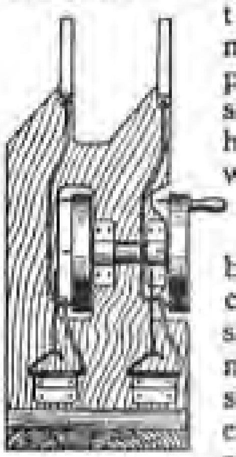
space for the turning of the ropes. The pole may be of gas pipe or wood, long enough to extend about 12 ft. above the ground. An iron wheel is attached on the upper end so that it will revolve easily on an axle, which may be an iron pin driven into the post. A few iron washers placed on the pin under the wheel will reduce the friction.

Ropes of varying lengths are tied to the rim of the wheel. The rider takes hold of a rope and runs around the pole to start the wheel in motion, then he swings clear of the ground. Streamers of different colors and flowers for special occasions may be attached to make a pretty display.

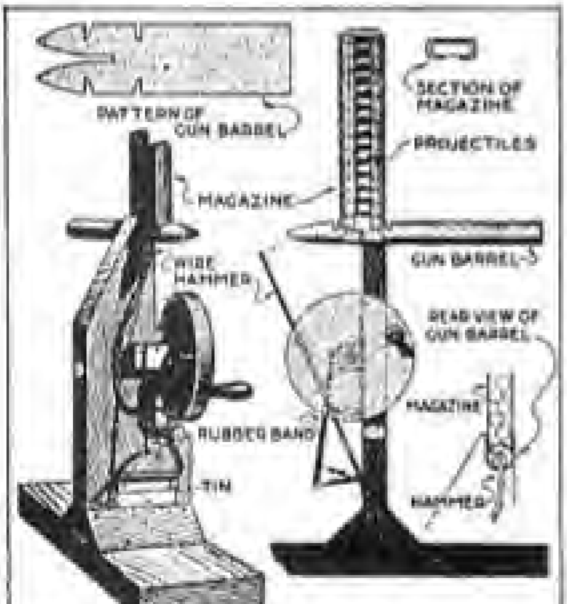
Toy Machine Gun Fires Wooden Bullets

Popular Mechanics 1915

For use in the mimic battles which most boys like to stage in this war time, an interesting mechanical toy that a boy can easily make of materials picked up in the workshop, is a machine gun having a magazine for wooden bullets, and which can be made as a single or a double-barrel gun. The construction of the single-barrel arrangement is detailed in the sketch and the modification for a double-barrel gun is shown in the smaller diagram. It is a duplicate of the first type, suitably mounted as shown. The gun is fired by turning the crank on the wheel and the bullets can be quickly replaced in the magazine at the top.



The support for the gun is made of



The Machine Gun is Fired by Turning the Crank at the Wheel, the Pins on the Latter Drawing Back the Hammer, Which is Hooked Up with a Rubber Band

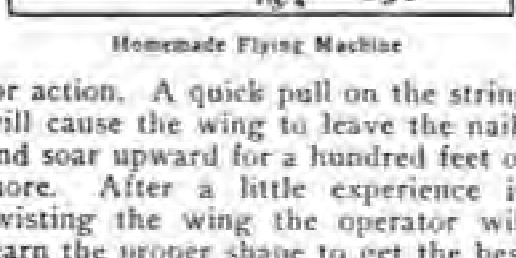
wood and braced strongly at the base. The gun proper is set into the top of the vertical piece, as shown, and the magazine, which is bent from a piece of tin to the shape detailed in the sectional view, fits on top of the breach of the gun. The hammer, which drives the bullets, is made of a piece of stiff wire bent to the shape shown. The lower curved end is connected to a small nail set on a block at the shaft of the wheel. To fire the gun, the hammer is drawn back by contact with the small nails set into the side of the wheel. As the wheel is turned, the nails grip the hammer and then suddenly release it, driving out the lowest bullet each time. The bullets are piled in the magazine, as shown in the detailed view at the right, where the rear view of the gun barrel is indicated.

How to Make a Toy Flier

From Popular Mechanics 1913

While a great many people are looking forward to the time when we shall successfully travel through the air, we all may study the problem of aerial navigation by constructing for ourselves a small flying machine as illustrated in this article.

A wing is made in the shape shown in Fig. 1 by cutting it from the large piece of an old tin can, after melting the solder and removing the ends. This wing is then given a twist so that one end will be just opposite the other and appear as shown in Fig. 2. Secure a common spool and drive two nails in one end, leaving at least ½ in. of each nail projecting after the head has been removed. Two holes are made in the wing, exactly central, to fit on these two nails. Another nail is driven part way into the end of a stick, Fig. 4, and the remaining part is cut off so the length will be that of the spool. A string is used around the spool in the same manner as on a top. The wing is placed on the two nails in the spool, and the spool placed on the nail in the stick, Fig. 5, and the flier is ready



Homemade Flying Machine

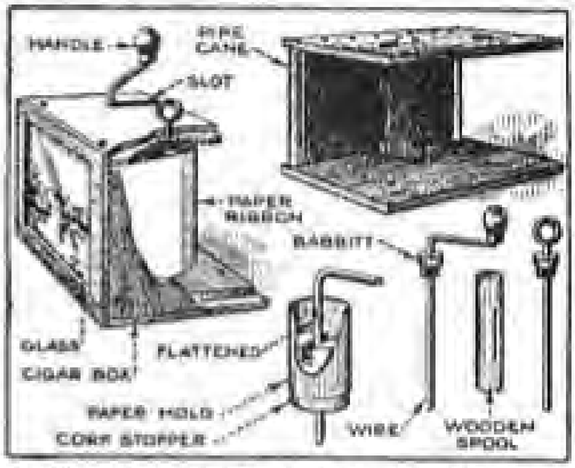
for action. A quick pull on the string will cause the wing to leave the nails and soar upward for a hundred feet or more. After a little experience in twisting the wing the operator will learn the proper shape to get the best results.

Be very careful in making the tests before the wings are turned to the proper shape, as the direction of the flier cannot be controlled and some one might be injured by its flight.

"Moving-Picture" Toy for Children

Popular Mechanics 1925

A very interesting "moving-picture" toy for the small child can be made of cigar



A "Moving-Picture" Toy for the Small Child, That Is Instructive as Well as Amusing, and That can be Very Easily Made from Scrap Materials

boxes, some wire, babbitt or lead, and a few pieces of pipe cane.

A rectangular opening is cut in the bottom of a cigar box, of the size made to contain 100 cigars, and a piece of window glass, cut to fit, is placed behind the opening and held in place by tacks. A frame, shown at the upper right, made of cigar-box wood, fits neatly into the box; this holds the picture ribbon against the glass and carries the spools on which the ribbon is wound. A piece of pipe cane is mounted at each corner of the frame, to serve as a roller.

The spindles, one of which has a crank formed on one end, are made of No. 9 galvanized wire, and are provided with babbitt or lead "keys" to turn the wooden spools on which the ribbon is wound. To make these keys, a portion of the wire should be flattened, as shown. A cork stopper is then taken, and, after a groove is cut in the top and a hole drilled through the center, it is pushed on the wire directly underneath the flattened portion. By wrapping heavy paper around this cork, a cup is formed, into which the babbitt can be poured. The wooden spools upon which the ribbon is wound can be made from old film spools, cut at one end to fit the babbitt key.

Children can be amused for hours with this little toy, which can be made instructive as well as amusing. Pictures cut from the comic or rotogravure sections of newspapers, and pasted to the ribbon in order, make very interesting moving pictures of this kind, although, of course, any suitable pictures may be used.

How to Make a Monorail Sled

Popular Mechanics 1915

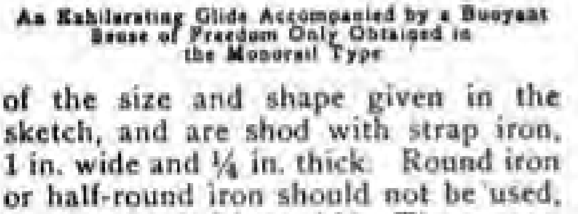
A monorail sled, having a simple tandem arrangement of the runners, is very easily constructed as follows: The runners are cut from 1-in. plank

An Exhilarating Glide Accompanied by a Buoyant Sense of Freedom Only Obtained in the Monorail Type

of the size and shape given in the sketch, and are shod with strap iron, 1 in. wide and ¼ in. thick. Round iron or half-round iron should not be used, as these are liable to skid. The square, sharp edges of the strap iron prevent this and grip the surface just as a skate.

The top is a board 6 ft. long and 1 in. thick, securely fastened to the runners as follows: Blocks are nailed, or bolted, on either side of the upper edge of the rear runner and the top is fastened to them with screws. The runner is also braced with strap iron, as shown. The same method applies to the front runner, except that only one pair of blocks are used at the center and a thin piece of wood fastened to their tops to serve as the fifth wheel.

The hole for the steering post should



The Construction is Much More Simple Than Making a Double-Runner Bobsled

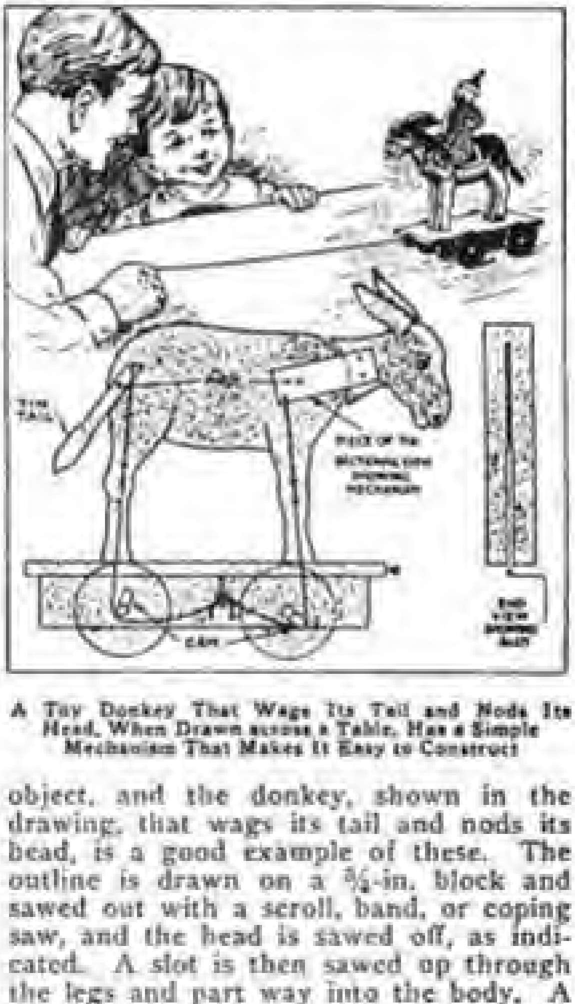
be 6 in. from the front end and a little larger in diameter than the steering post. The latter should be rounded where it passes through the hole, but square on the upper end to receive the steering bar, which must be tightly fitted in place.

In coasting, the rider lies full length on the board with his hands on the steering bar. This makes the center of gravity so low that there is no necessity for lateral steadying runners, and aside from the exhilarating glide of the ordinary sled, the rider experiences a buoyant sense of freedom and a zest peculiar to the monorail type. Then, too, the steering is effected much more easily. Instead of dragging the feet, a slight turn of the front runner with a corresponding movement of the body is sufficient to change the direction or to restore the balance. This latter is, of course, maintained quite mechanically, as everyone who rides a bicycle well knows.

From Popular Mechanics 1925

Toy Donkey Nods and Wags Its Tail

The most popular toys are those that move in imitation of some well-known



A Toy Donkey That Wags Its Tail and Nods Its Head, When Drawn across a Table, Has a Simple Mechanism That Makes It Easy to Construct

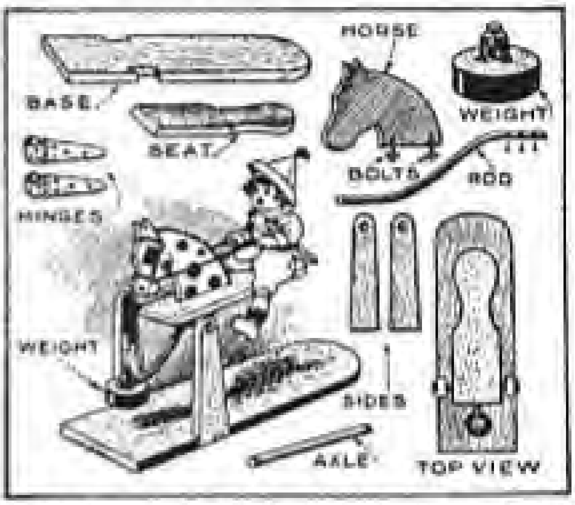
object, and the donkey, shown in the drawing, that wags its tail and nods its head, is a good example of these. The outline is drawn on a ¾-in. block and sawed out with a scroll, band, or coping saw, and the head is sawed off, as indicated. A slot is then sawed up through the legs and part way into the body. A similar, but narrower, slot is cut in the back of the head, and a strip of tin is used to connect the head to the body, as shown. A piece of tin, cut to the shape of a tail, is similarly attached in the slot behind; both the tail and the tin strip which connects the head to the body are pivoted to the latter with small brads. Motion to the head and tail is imparted by wires which connect the parts to a screweye underneath the wheeled base on which the figure is mounted. Flat strips of wood with rounded edges, which are attached to the revolving axles, strike the wires as the toy is pulled across a table and cause both head and tail to move up and down. The animal may be decorated as desired.

From Popular Mechanics 1925

Seesaw Built for One

A single child, seeking means of entertaining itself, has a hard time in getting any pleasure out of the ordinary seesaw.

The drawing shows a combination of seesaw and rocking-horse that can be used by one child. The construction is quite simple, the dimensions and weight of the counterweight being varied to meet different requirements. The seat is supported on an iron axle by a pair of strap hinges, one end of each hinge being bent to fit around the axle. The counterweight, which may be an iron casting, or



A Combination of Hobbyhorse and Seesaw That Makes It Possible for a Lone Youngster to Entertain Himself; A Counterweight is Provided for Balancing the Weight of the Child and Seat

a block of cement, is attached to a curved iron rod fastened under the front end of the seat. The counterweight should be a trifle heavier than the combined weight of child and board, and a little experimenting will be necessary to strike the correct balance. The exact mass of the weight can be found by first attaching a bucket or bag of sand to the end of the rod, and adding or removing sand until the proper weight has been found.

Popular Mechanics 1913

How to Make a Small Microscope

Theoretically a simple microscope can be made as powerful as a compound microscope, but in practice the minute size required by the simple lens to give the highest power makes it almost impossible to be used. However, a lens having a reasonable magnifying power can be made in a few minutes for almost nothing. Take a piece of glass tubing, heat one place in a hot flame, hold one end and pull on the other and draw the heated place down to a fine string as shown in Fig. 1. Take about 3 in. of this fine tube and heat one end which will form a glass bead as shown in Fig. 2. This bead is the lens. When in this form it can be used only in an artificial light coming from one direction, but if you take a piece of card-

Lens Formed by Heat

board and bore a hole in it a little smaller than the bead on the glass tube which is forced into the hole, Fig. 3. you can use this mounted lens in ordinary daylight. In this case a mirror must be used to reflect the light up through the lens. It is difficult to see anything at first, as the lens must be held very close to the eye, but in practice you will soon learn to see the object as it appears enlarged.

If you soak a little dried grass or hay in water for a few days and look at a drop of this water, germs in various life forms can be seen. The water must be put on the lens. One thing to remember is that the smaller the lens, the greater the magnifying power.

Skates Made of Wood

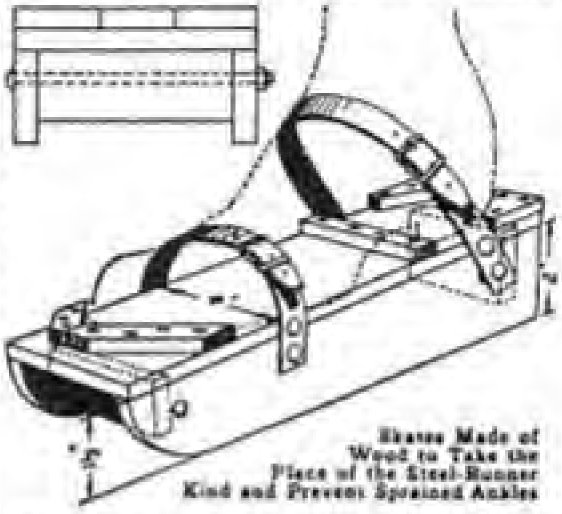
Popular Mechanics 1915

Skates that will take the place of the usual steel-runner kind and which will prevent spraining of the ankles, can be made of a few pieces of ½-in. hardwood boards.

Four runners are cut out, 2 in. wide at the back and 1½ in. wide at the front, the length to be 2 in. longer than the shoe. The top edges of a pair of runners are then nailed to the under side of a board 4 in. wide, at its edges.

A piece of board, or block, 2 in. wide is fastened between the runners at the rear, and one 1 in. wide, in front. Two bolts are run through holes bored in the runners, one just back of the front board, or block, and the other in front of the rear one.

Four triangular pieces are fastened, one on each corner, so that the heel and toe of the shoe will fit between them, and, if desired, a crosspiece can be nailed in front of the heel. Straps are attached to the sides for attaching



Skates Made of Wood to Take the Place of the Steel-Runner Kind and Prevent Sprained Ankles

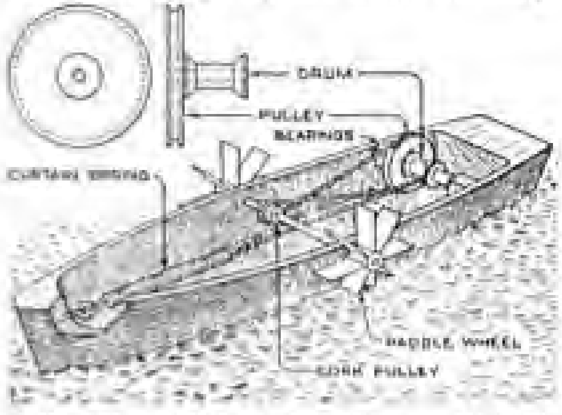
the skate to the shoe. Both skates are made alike.

Spring-Propelled Toy Boat

From Popular Mechanics 1925

A length of shade-roller spring forms the motive power for a model side-wheel boat, the hull of which is built along the usual lines for such craft.

The paddle wheels are mounted on a stiff wire shaft, on which a cork pulley, about ½ in. in diameter, is forced, the wheel assembly being mounted amidships. The pulley-and-shaft assembly,



A Spring-Propelled Toy Boat That can be Easily Made for the Entertainment of the Children. There Are Few Parts to Break or Get Out of Order

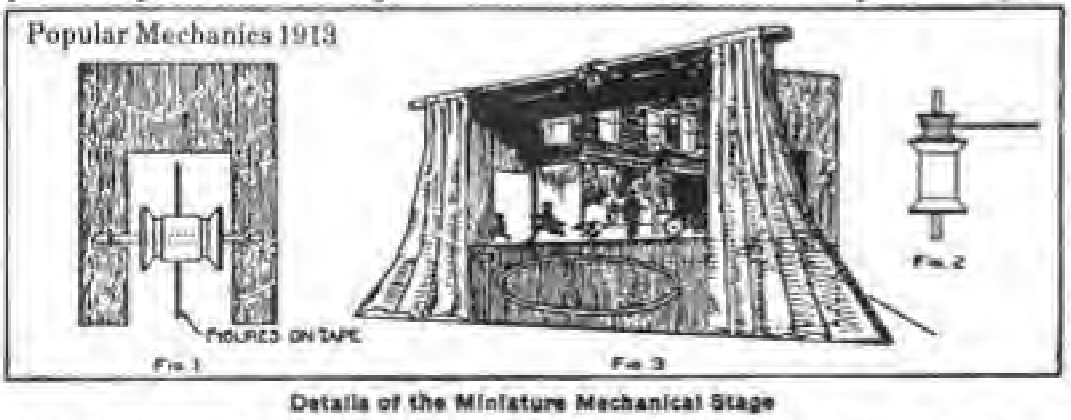
mounted at the stern, consists of a grooved pulley tacked to the end of a spool, the whole revolving smoothly on a shaft made from a wire nail.

The spring is cut to such a length that, when one end is secured at the stem, the other will reach halfway to the pulley axle at the stern. One end of a stout string is tied to the free end of the spring, the other end being fastened to the spool with a small brad. Power is transmitted to the paddle wheels by means of a string belt.

The craft is "wound up" by turning the paddles backward, until the spring has been stretched to double its length. By using two or more pulleys, to increase the ratio of revolutions of the paddles to the drive pulley, such a boat can be made to develop considerable speed and make quite extended voyages.

How to Make a Miniature Stage

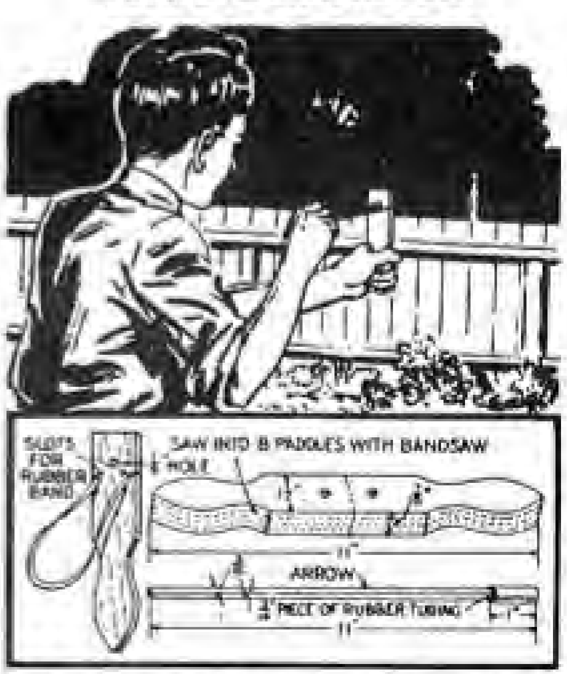
A good smooth box, say 8 in. wide, 10 in. high and 12 in. long, will serve the purpose for the main part of this small theater. Cut two rectangular holes, Fig. 1, one in each end and exactly opposite each other. Place a screw eye about ½ in. from the edge on each side of these openings. Fit an axle in the screw eyes and fasten a spool to the middle of the axle. On one of the two spools attach another smaller spool, Fig. 2, to be used as a driving pulley. Cut out the front part of the box down to a level with the top of the spools.



Details of the Miniature Mechanical Stage

Connect the spools with a belt made from tape about ¾ in. wide. On this belt fasten figures cut from heavy paper and made in the form of people, automobiles, trolley cars, horses and dogs. A painted scenery can be made in behind the movable tape. The front part of the box may be draped with curtains, making the appearance of the ordinary stage, as shown in Fig. 3.

Rubber-Band Gun Shoots Arrow Several Hundred Feet



Making these guns in quantities and selling them to merchants offers the craftsman a neat profit

Easily produced in quantities, these guns offer the home craftsman a chance at

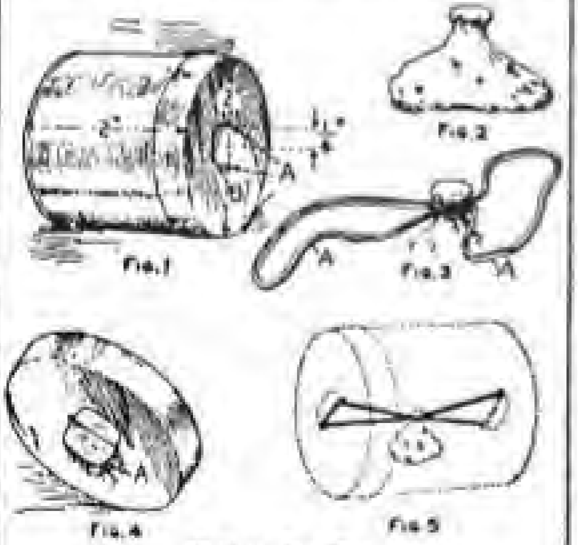
 THE SURVIVOR Vol. 1

spare-time profits by making them up and selling them to merchants and manufacturers for prizes with their products. Cutting eight at a time, you can turn out a large number an hour on the average band saw. White pine is used, and a ⅞-in. piece 11 in. long is sawed to the shape shown and drilled, after which it is ripped into four 3/16-in. strips on the band saw. Then the strips are stacked, the slots for the rubber band made and the stack cut in half. The arrows, which are also 11 in. long, can be sawed out a number at a time by stacking several thicknesses of the stock, and it's merely a matter of seconds to tip them with inch lengths of rubber tubing.

(From Popular Mechanics 1913)

How to Make a Child's Rolling Toy

Secure a tin can, or a pasteboard box, about 2 in. in diameter and 2 in. or more in height. Punch two holes A, Fig. 1, in the cover and the bottom, ¼ in. from the center and opposite each other. Then cut a curved line from one hole to the other, as shown at B. A piece of lead, which can be procured from a plumber, is cut in the shape shown in Fig. 2, the size being 1 by 1⅛ by 1¼ in. An ordinary rubber band is secured around the neck of the piece of



Rolling Can Toy

lead, as shown in Fig. 3, allowing the two ends to be free. The pieces of tin between the holes A, Fig. 1, on both top and bottom, are turned up as in Fig. 4, and the ends of the bands looped over them. The flaps are then turned down on the band and the can parts put together as in Fig. 5. The can may be decorated with brilliant colored stripes, made of paper strips pasted on the tin. When the can is rolled away from you, it winds up the rubber band, thus storing the propelling power which makes it return.–

PRACTICAL *Marionettes* MADE FROM OLD INNER TUBES

By Florence C. Drake
Popular Science Monthly – Sept. 1935

YOU'LL like to make puppets by the method described in the accompanying article—it's so quick and easy and effective. Most homemade puppets are too stiff, but these are very flexible.

Mrs. Drake, who devised this ingenious new type of marionette, is a puppeteer of many years' experience and a teacher of the art of making marionettes. Her puppets have been exhibited at Columbia University, New York, and in the DeYoung Museum, San Francisco, Calif.

A simple and inexpensive way to prepare puppets . . . Two types of controls . . . How to tie strings

MARIONETTES of a picturesque, flexible, and entirely practical type may be made from discarded inner tubes. They cost practically nothing, and the method of construction is simplicity itself.

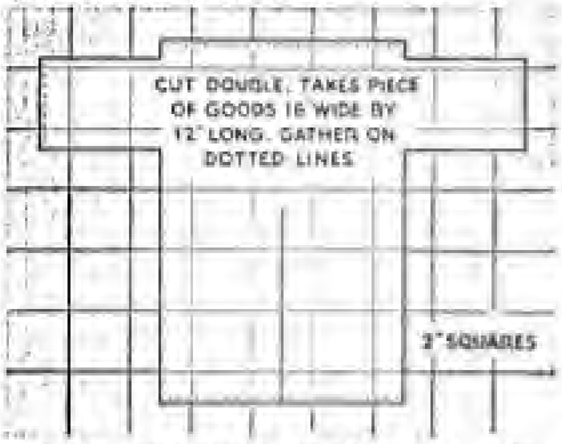
Directions will be given in detail for a clown puppet. When the general method is understood, original puppets can be devised at will. These can be costumed characters or amusing grotesque figures of rubber alone. The number of fantastic animal creatures one can make in this way is legion.

If there are no old inner tubes in the garage to be cut up for this purpose, a supply may be had at most tire repair shops for a few cents each and often merely for the asking. It is surprising in what variety of soft, lovely colors they come—cream, fawn, terra cotta, blue, and black. When other colors are required, bathing caps, hot-water bags, and other cast-off rubber articles will furnish a supply. The face of the clown, for example, is of white rubber from an old bathing cap.

The materials required for the clown are, in addition to the rubber, cotton for stuffing the head, screw eyes, scraps of wood, some cigar-box wood, a spool of carpet thread, a spool of fine copper wire, wooden dowels, sheet lead or shot, paints and colored ink. The tools are simply scissors, pliers, coping saw, drill, and a paper punch

of the type used for punching tickets.

First cut a piece of inner tube of sufficient size and clean it carefully with soap and water. While the rubber is drying, you can make the patterns. Draw the full-size designs of the various rubber parts on stiff paper, place these on the material, trace around the patterns, and cut the pieces out of rubber.



How to cut out the clown's suit. A colorful neck ruff and sleeve frills may be added

Grotesque head made entirely of rubber with fur for the hair and mustache. Inside, a large spool fills it out from ear to ear. *At right:* Mrs. Drake operating the clown

The body, arms, and thighs of the clown are all in one piece. There are two leg pieces, two upper and two lower foot pieces, two hands, and the front and back of the head. These are cut from the inner tube with the exception of the hands and head covering, which are thin white rubber.

Three wooden parts are also required — a shoulder piece whittled to a blunt point at each end as shown, a shorter and wider hip piece (these may be 3/8 or 1/4 in. thick), and a round tapered stick about 2½ in. long to stiffen the head.

To assembly the puppet, punch holes where indicated by the dots on the patterns and cut the various slits. Then slip the arrowhead ends of the various parts into the corresponding slits (D to D and E to E). The holes A A, B B, and C C are to be laced together with thin wire, carpet thread, or thongs of rubber.

Attach pieces of lead to the soles with wire (or use shot sewn in cloth). Then slit the upper part of each foot as indicated by the crossed lines and lace it to the sole. Lace the foot to the leg by means of the three holes marked F in each of the leg pieces.

Draw the features with black ink and add spots of red as desired. Sew face and back of head together, leaving an opening at base of neck. Fill with soft cotton, push in the round, tapered stick as indicated by the dotted lines, and drive in wire nails to hold it in place.

Put a screw eye in the end of the head stick. Draw a 7-in. length of copper wire through the screw eye and bend together at both ends. Slip the ends through the hole in the rubber at *G*, then through the wood shoulder piece. Each end is then bent back at right angles and firmly tacked to the underside of the wood. Allow enough wire to give free movement to the head. Two screw eyes are inserted through the rubber into the wood shoulder piece near the ends at the points indicated by dots; these are for the shoulder strings.

The simplest way to make the clown's suit is to follow the pattern given. It is cut double and takes two pieces of goods 16 in. wide and 12 in. long. Gather the cloth where indicated by the dotted lines, and add a neck ruff and sleeve frills of red netting or other suitable material.

Two dowel sticks 9 in. long may be used to control the puppet. Slight incisions are made ¼ in. from the ends on both rods, and two extra ones 3½ in. from the ends. To the outer ends of one rod are tied the leg strings, and to the inner incisions are fastened the arm strings. The other control rod supports the head and body, the outer incisions carrying the head strings. If a back string is desired, notch the center of the stick in the exact middle.

A more elaborate type of control is shown in one of the diagrams. Experienced puppeteers now prefer a small, light control about the length of the hand and as wide as the span of the thumb and little finger—usually about 8 by 9 in. Cigar-box wood cut in strips is excellent for the purpose. Small holes are drilled in the ends through which strings are passed and securely tied.

Large holes are made in the piece marked No. 4 to hold a thong of rubber tubing that slips over the hand and supports the control and puppet, leaving the fingers free for working special strings.

For the hand strings, wire loops are inserted in, or fastened to, the front of piece No. 1 so that they project a trifle, making it easier to lift the string. This string is continuous and runs through a loose brass ring between the two wire loops. The leg piece (No. 2) is detachable, and should slip easily over a nail projecting about 1 in. from piece No. 1. Pieces 1, 3, and 4 are tacked and glued together. The control may be hung by wire, leather, or any strong material. It is best to keep the puppet hanging up. Never lay a puppet down without winding the strings around the control.

The length of the strings varies. It depends upon the individual puppeteer and the particular stage. Cut the shoulder thread 3 in. longer than double the distance from the control to the marionette's shoulder. Hold the marionette upright with its feet on the floor, tie one end securely to the marionette's left shoulder, tie the other end to the right shoulder, cut the string exactly in half, pass one end through the left hole in piece No. 4 of the control, tie securely, and do the same with right string.

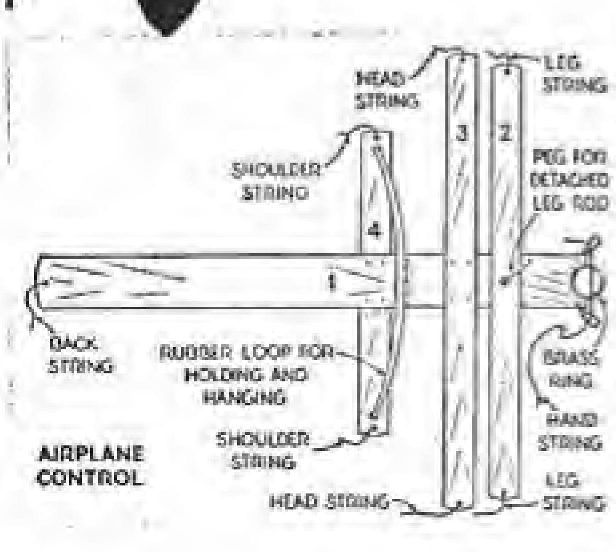
Tie a string to the head back of the

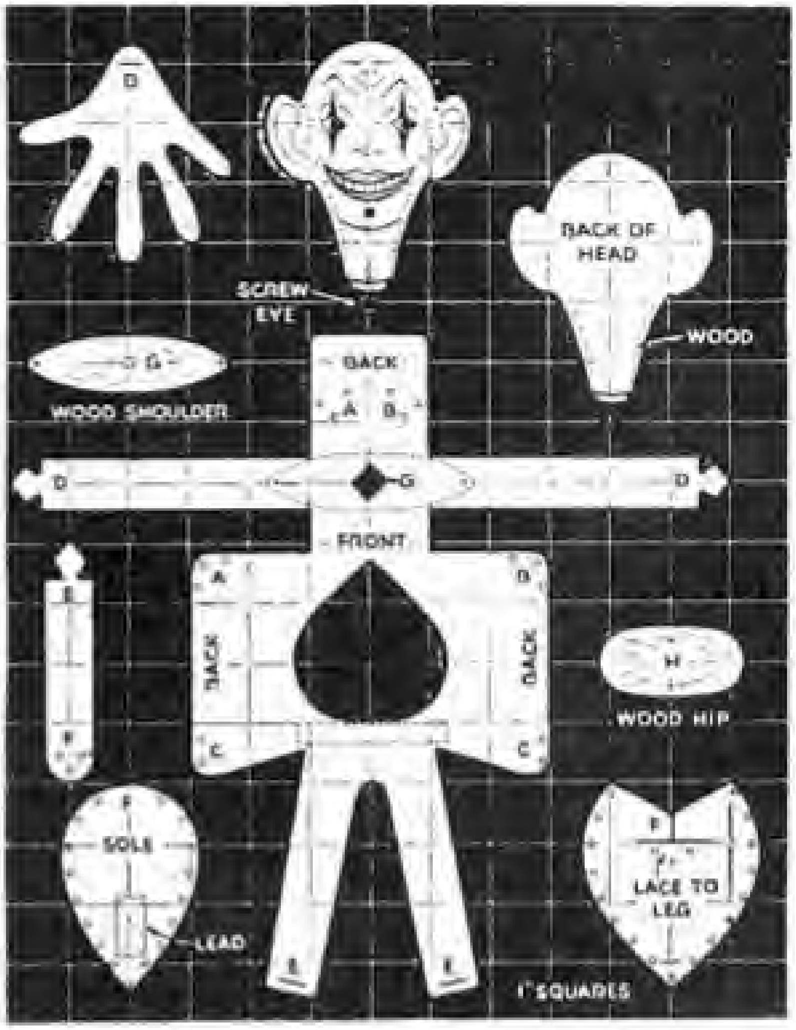
left ear, measure double the distance from that point to the control with head erect, allow 3 in. extra, and cut the string. Cut in half, pass left string through hole in left side of No. 3, and tie. Repeat on right side.

Be sure the weight of the body hangs from the shoulder strings. If these are slack, the head strings are supporting the marionette, and the head movement will be stiff. If the head strings are too far forward, the head will be drawn back too much; if they are placed too far back, the head will fall forward. For a pompous, strutting character, place the strings forward. For old age, or a hunchback, set the strings far back.

Next, tie a string to the left hand through palm and thumb, measure up to the control and back, allow 3 in., cut and pass the free end through the left loop of the main control, then through the brass ring, down through the right loop, and tie to the right hand. Tie a string to the marionette's back, a little above the waistline. Use a needle to draw it through the costume if necessary. Draw the string through the hole in the back of the main control bar and tie securely. In the same manner, tie strings to left and right legs above the knee joints, and tie through holes in the detached bar marked No. 2.

Weird all-rubber puppet for novelty acts and, below, the recommended type of control





It's great fun to give a circus at home with these

COMICAL *Animal Puppets*

By Florence Fetherston Drake

Popular Science Monthly — Dec. 1935

WITH a clown and a comical animal or two, a whole puppet show may be staged. Animals always delight audiences, and, if made frankly humorous, they require less skill to operate than any other type of marionette.

How to make a clown was told in a previous issue (Page 17 of VICTORIA) and here are performing seals, a lion, an elephant, a dachshund, and other amusing beasts, all made from discarded inner tubes. In some cases the joints are formed with arrowhead cut-outs and slits, in others by stitches or wire. Spools or hollow cylinders of proper size are used in heads and bodies, and through these the strings are drawn. Where stuffing is necessary, cotton, excelsior, or crushed tissue paper may be used. The parts of the bodies can be sewed (overseamed) together, using large stitches so as not to tear the rubber, or they may be held with thongs cut from tubing and drawn through holes about 1/4 in. from the edge and 3/4 in. apart, made with a paper punch of the type used by conductors.

The materials required are as follows: Discarded inner tubes (the rough side is used outward in most cases), old bathing caps, colored rubber balls, old hot-water bottles, and any other available scraps of rubber; bits of fur and feathers; spools; cigar boxes from which to make controllers; carpet thread for stringing puppets; material for stuffing, such as cotton wadding, excelsior, and crushed tissue paper; buttons, beads, and spangles for eyes and harness ornaments; rubber pencil ends in various colors from which to cut rings for eyes; lead shot, sheet lead, or sand to weight parts; nails, brads, and small screw eyes.

Few tools are needed. A drill, scissors, ruler, knife, punch, hammer, coping saw, and large needle are sufficient.

Performing seals are the simplest to make, as they require only four main pieces each, as shown in the drawings. Cut slits in the body for the fins. Attach eyes, which may be either beads or rings; then sew the body along the back except for about 1 in. of the head and 2 in. at the tail. Sew the underside for a similar distance, from head to tail, after pushing the padding material in through this opening. It is advisable to weight the tail with a piece of sheet lead, which may be held in place by sewing through the tail to form a pocket.

The control to which the strings are tied is a dowel stick about 20 in. long. The second control is 12 in. long, and to this is tied the two strings which pass through the hole in the wooden ball. The end of one of these strings is sewed to the nose of one seal; the second, to the nose of the other seal. By tipping this stick, which should be held in the right hand, the ball will bounce up and down from one nose to the other in the most surprising way.

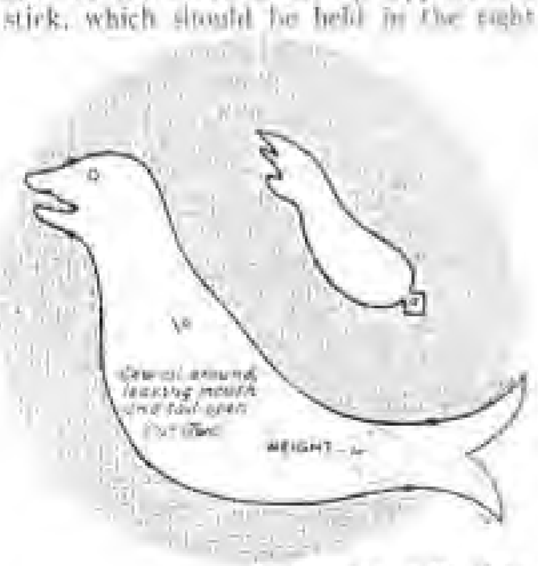
It is advisable to wax all threads. Not only does it make them stronger, but also less likely to tangle. A drop of shellac put on every knot with a toothpick or other pointed tool will insure the knots' holding.

The seals should be nailed through the tail (where the lead is) to a board or to the floor of the stage, preferably about 20 in. apart, otherwise they will bob about when the ball is worked. They can also be fixed to two cones from which the tops have been cut. If these are weighted with sand or stones, they will hold their places. You have seen similar stands at the circus. Painted in gay colors, they will enliven the act.

Of course, the manipulation must be practiced by the operator before he attempts to give a performance before an audience.

Slow smooth movements should be striven for. Pauses are effective and give contrast.

The lion requires a three-piece body, head, tail, two-piece forelegs, and one-piece hind legs. Arrowheads are cut where indicated on the drawings and slipped into slits. The head is attached by three strips ¾ by 3 in. with arrowheads at each end. One end is slipped through a slit in the body, the other end through a slit in the neck. The body should first be sewed where indicated, then the legs inserted in slits cut in the body, and the tail joined in the same manner. Before attaching head to body, sew the nose and two jaw pieces together, tack back the ears and the eye triangles, and sew or glue hair where it is to go. Stuff the body loosely and slip spools on both the head and the body. With



Performing seals that toss the ball from one to another in an amusingly realistic manner. All the puppeteer has to do is to manipulate the right-hand stick

A wooden frog 17 in. long. The joints are hinged with wire. The lower part of the mouth is a continuation of the body, but the head is pivoted so that it opens

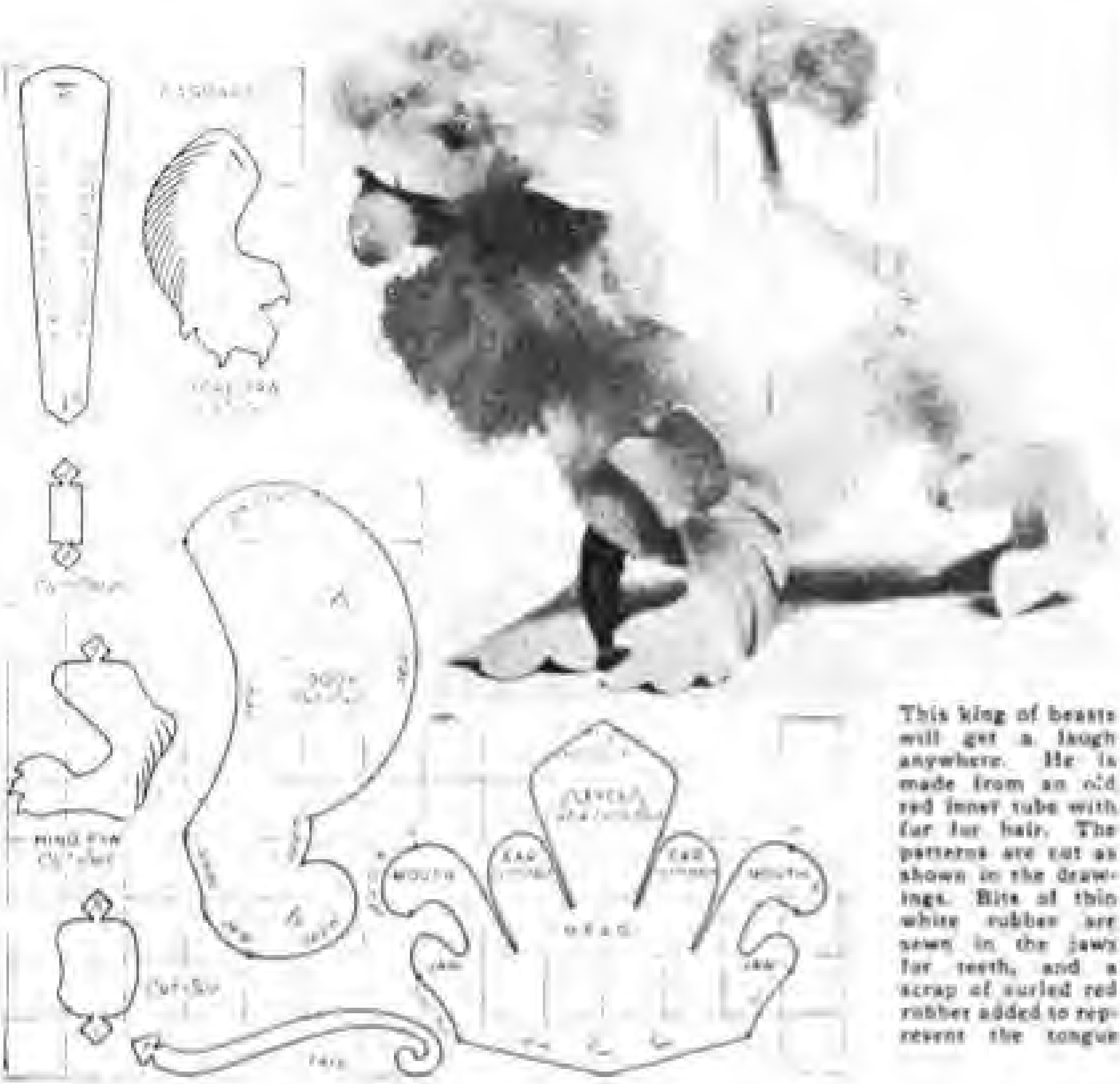
a large mouth, pass a 30-in. length of carpet thread through rubber and spool for fastening to the controller.

The controller for the lion or any four-footed animal may consist of a main stick about 1½ in. wide and the length of animal, and a crosspiece 8 or 10 in. long. The cross stick is fastened about 1 in. from one end of the main stick. Drill two holes in the front corners of the main stick, two more at the edges about [illegible] in. back, and two others [illegible] in. from the front end. The latter are to hold the rubber thong beneath which the hand is slipped when manipulating the puppet and by which the puppet is hung when not in use. Drill another hole in the middle back end, and two more 2½ in. from this end. Attach the strings as shown.

These sizes and spaces, of course, are approximate. The size and shape of the animal determines the placing of holes and strings. No two figures are exactly the same. Balance and flexibility are very important.

A study of the illustrations will show how the elephant and other animals are assembled. One example of wooden construction—a frog—is also given for those who wish to attempt that more difficult type of animal puppet.

The acrobatic tomcat all ready to perform

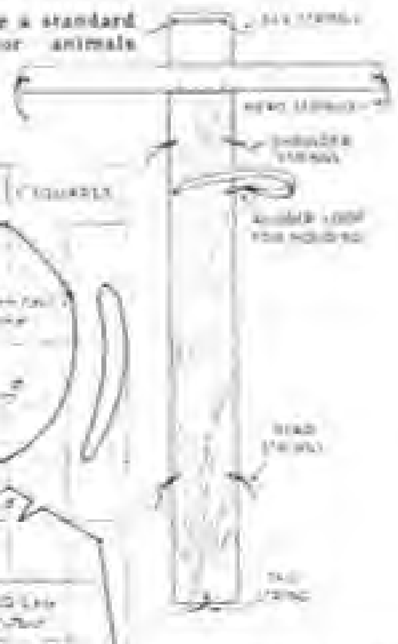


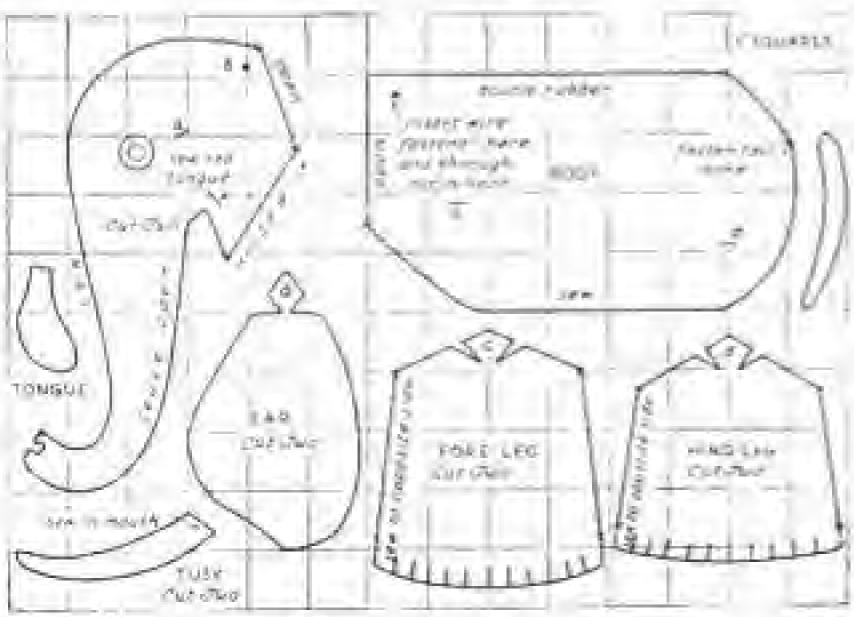
This king of beasts will get a laugh anywhere. He is made from an old red inner tube with fur for hair. The patterns are cut as shown in the drawings. Bits of thin white rubber are sewn in the jaws for teeth, and a scrap of curled red rubber added to represent the tongue

Dachshund made from inner-tube rubber. The visible part of the body is one piece, but there is also a bottom piece, stitched up. Spools are inserted crosswise between the legs, front and back. A standard animal controller is used

In following articles Mrs. Drake will tell how to make heads and bodies for marionettes of standard types with which complete shows may be given.

How to make a standard controller for animals





The elephant is cut from a dark gray inner tube with the rough side outward

Cardboard cylinders stiffen the body and legs

THE ART OF MAKING Lifelike Marionette Bodies

Materials and tools . . . Various types of joints . . . Costuming . . . How to string puppets . . . Hints on their manipulation

By Florence Fetherston Drake
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MARIONETTE bodies may be **made in several ways for use with heads of the type described next month.**

1. Sewed and stuffed with kapok or cotton, and weighted.
2. *Papier-mâché* shell bodies, filled and weighted.
3. Of wood (scrap pieces and dowel sticks) whittled to shape.
4. Best of all, carved from softwood, but this takes more knowledge and artistry than the others and therefore should follow experiments with one of the simpler methods.

In this article the third method will be described. It is a practical way to make the average puppet, but, of course, not all puppets. Every puppet is an individual problem and should be regarded as such. Give it the characteristics called for in its part in the play. Consider the proportions, weight, and gestures. Do not be too realistic, however; poor imitation is not art. Elimination of nonessentials is important. Simplify everything.

For the normal figure, puppets are about six heads tall. The body is two heads long, and from hips to feet is three heads. This one-two-three proportion is easily remembered. The hips divide the figure in half. Hands and feet are equal to the length of the face from the hair line on the forehead to the chin. Legs are divided into three parts: thigh, leg, foot. Leg and thigh are about the same length—one and a half heads long. Upper arm and forearm are practically similar. The width of the hips is more than the width of the shoulders in women's figures; less in men's figures. In making a lean figure, exaggerate the thinness; in a fat one, exaggerate the width. A glance at any group of Tony Sarg's figures will show what is meant.

Waggle Bug from "Wizard of Oz"

Since all properties and stage settings must be made to the same scale as that used for the puppets, it is important to adhere to a certain scale. If an 18-in. puppet is used to represent a figure 6 ft. tall, the scale is, obviously, 3 in. equals 1 ft. If the puppet is 15 in., the scale is 2½ in. equals 1 ft.; if 12 in., the scale is 2 in. equals 1 ft.

The size of a puppet depends upon where it is to be shown. One third the height of the proscenium is good. From 15 to 24 in. is the average height. When puppets are larger, much of the illusion is lost and they become difficult and awkward to operate.

Make a rough sketch of the figure you intend to copy—front and side views. No matter how crude this may be, it will help.

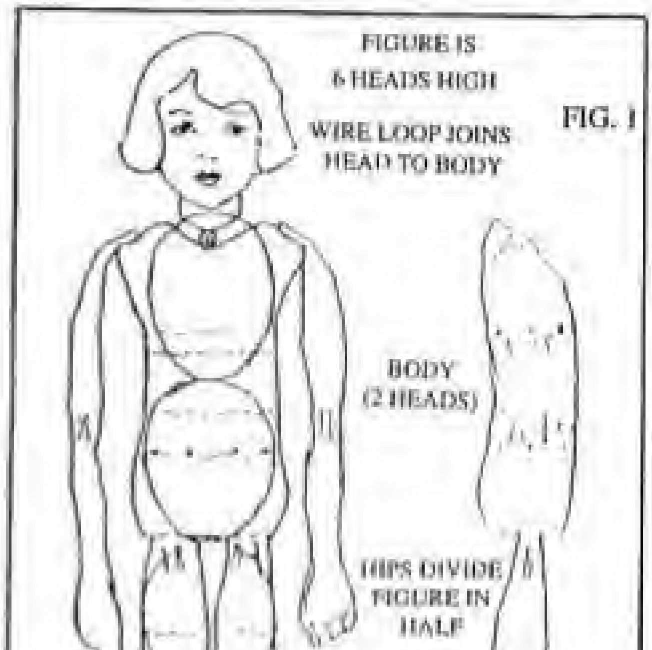


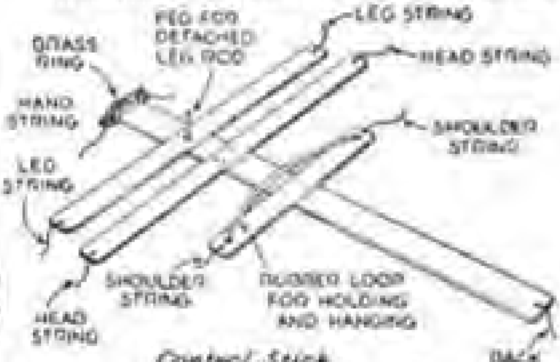
FIG. 1

Soft white pine is the wood to use. At almost any lumberyard you can buy, for a dime or two, odds and ends of wood that serve the purpose admirably. You will also need ¾- and ⅛-in. dowels; small and medium tacks, brads, and nails; very small and medium screw eyes, commonly designated as 217½ and 215½; fine and medium sandpaper; a sharpening stone or emery for keeping a keen edge on your knife; adhesive tape; narrow tape for the back of knee joints to prevent the legs from bending forward; spools of No. 20 copper and No. 16 tinned wire; small pieces of thin tin or brass for hinges; muslin for joining hip and shoulder pieces and legs to hip piece; and sheet lead, dress weights, or sinkers to weight figures.

The essential tools are: coping or fret saw, small and medium size hammers, pocketknife, chisel, awl, small gimlet or hand drill, flat and round-nosed pliers, flat and round files, razor blade and holder, scissors, ruler, vise, and clamps.

In the spotlight are figures of Thomas Jefferson and Benjamin Franklin. The puppet at the left—William's son from "Alice in Wonderland"—requires a controller like that shown just below it

Fig. 9



Control Stick (airplane type)

Fig. 10

Fig. 11

Fig. 14

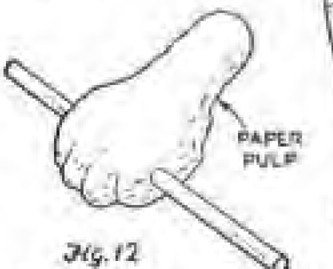


Fig. 12

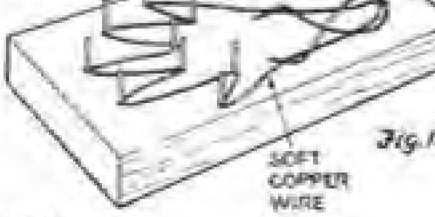


Fig. 13

The wooden parts need not be finished too carefully except in cases where the arms, calves of legs, or perhaps the neck are exposed. All parts should have the edges rounded and be sandpapered to prevent cutting through the costume and to assure smooth action. Tack a piece of sandpaper around the end of a block of wood about 1 by 2 by 8 in., and another piece around a portion of an old broom handle; these will be helpful in finishing your work. Hold the wooden parts firmly in the vise while working on them. You will accomplish more in a shorter time and with less exertion than if you try to hold the parts.

Shoulders. Whittle this piece from a block as wide as the shoulders and as thick as the body through the chest. It should extend slightly below the armpits. Slope the shoulders and cut quite a hollow for the neck, leaving it high in the back but sloping well down on the chest (Fig. 2). In the middle toward the back, drill hole through which the wire may be drawn. Leave a loop at the top to which the head is attached. Bend the ends of the wire back and tack firmly (Fig. 3). Length of neck should accord with character of figure.

Hip Piece. Whittle according to your sketch as to depth and width (Fig. 4). Use muslin or the ribbed top of a stocking to join chest and hip pieces, tacking it as necessary (Fig. 5). It is sometimes advisable to weight the hip piece as in Fig. 6. A puppet so weighted will sit better.

Legs. Cut ½-in. dowel to length and whittle roughly to shape, tapering toward ankle. Choose from Fig. 7 the hinge you prefer to use. All hinges need a tape strip in back. The thigh is formed from a short piece of dowel around which is tacked a piece of muslin about 3 in. wide and 5 in. deep. The end of the muslin is tacked to underside of hip piece (Fig. 8).

Duchess and baby from Mrs. Drake's set of marionettes representing characters in "Alice in Wonderland." The heads are modeled from newspaper pulp as described in an article published last month. The body construction is as illustrated by the sketches

The feet may be modeled on the leg with paper pulp as in Fig. 9 or whittled from wood like Fig. 10. If modeled, it is necessary to cut thin wooden soles and nail them to the lower leg dowels. When dry, boots or shoes may be simulated by pasting on paper, cloth, or leather, or by painting. Feet of wood are excellent, especially if hardwood is used, as it weights the parts. Be sure to get them large enough. The drawings show different ways of joining them to the legs. An ankle joint is not always necessary (see A, Fig. 7). Women's figures rarely need them; and if long skirts are worn, even leg strings are omitted.

Arms. Only the forearm need be stiff. The upper arm is a hollow tube of muslin, slightly stuffed (Fig. 11). Hands modeled of paper pulp are satisfactory. If the character is to wield a tool or weapon of any kind, a hole is left through which handle can be thrust (Fig. 12). Hands should be expressive in shape as well as in action. A hand can do marvelous things when controlled by a clever manipulator. It can show shaky old age, nervous excitement, calm repose, strength or weakness. It can fence, spar, draw a sword, swing a hammer on an anvil. A rhythmic song sung at the same time helps the action.

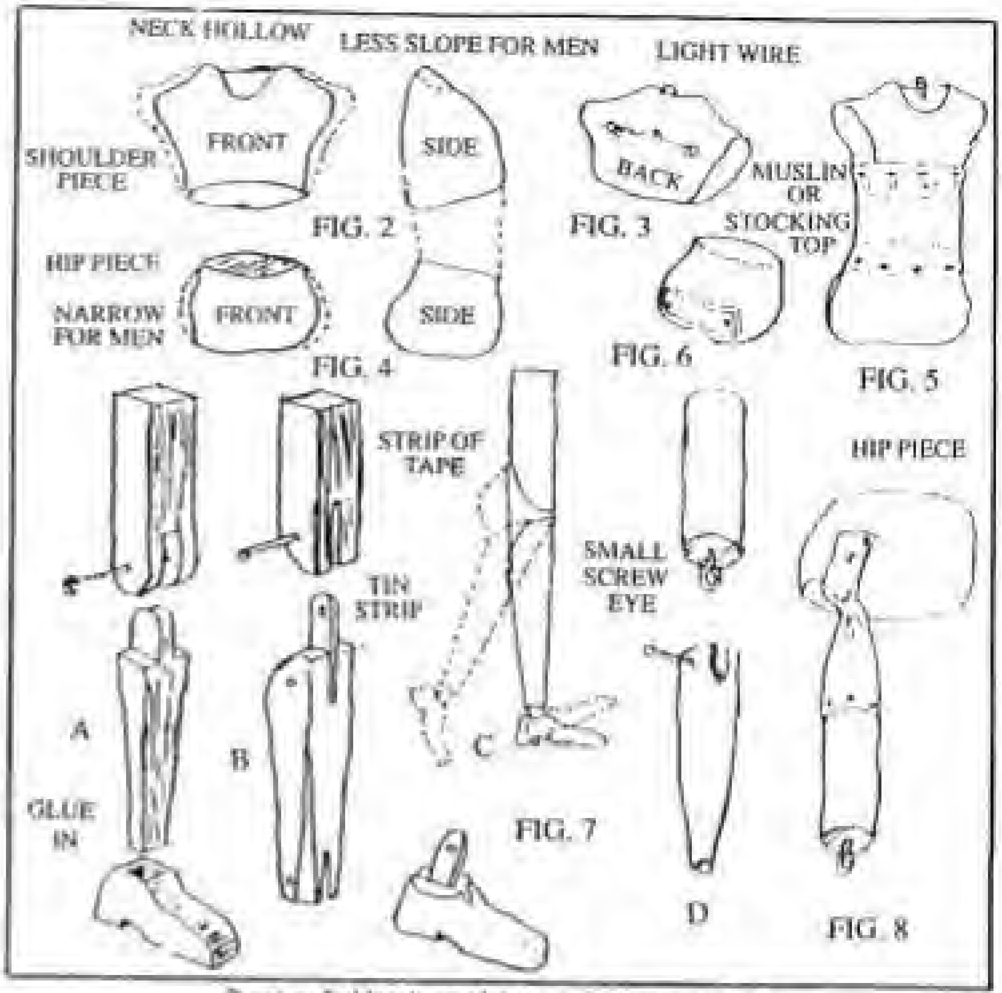
Hands may also be shaped in fine wire as in Fig. 13 and wrapped with adhesive tape, muslin, or crêpe paper, later being painted and shellacked. A piece of ½-in. tape about 4 ft. long may be used to wrap each hand, fingers, and arm, leaving a loop of wire exposed at the elbow for connection. Instead of tape, hands may be wrapped with narrow strips of flesh-colored crêpe paper. Wind tightly and use paste whenever necessary (Fig. 14). Sew the forearm and hand to the upper arm, and tack this part to the shoulder. Finger tips should reach halfway between hips and knees.

Costumes. It is great fun looking up native costumes for your marionette actors. Make clothing of soft materials; thick or stiff fabrics hamper the puppet's work. Keep the clothing loose so that the puppet moves easily. Use gay colors where possible and characteristic caps and headdresses.

Controllers. Experienced operators now often simplify them, preferring two sticks 9 in. long made of ½-in. dowels. To one is attached, by means of grooves or notches sawed near each end and in the middle, the two head strings and the string to center back. To the second stick the leg strings are tied near the ends, and 1½ in. farther in, are tied the hand strings.

If a T-shaped controller is preferred, cut ¾-in. wide strips from cigar-box wood, the main piece being the length of the operator's hand and the crosspiece equal to the span of the hand—approximately 7 by 9 in. An extra piece 8 in. long is needed for the leg strings. It requires a small hole in the center to slip over a wire nail or peg on the main piece. Cut a ¾-in. wide strip from an old inner tube, and draw it through holes drilled in the crosspiece to form a loop for supporting the puppet. This leaves the operator's fingers free for manipulation. When not in use, the puppet is hung by this loop.

Stringing a Marionette. This is done after the puppet is dressed. When stringing, hang the puppet about 50 in. from the floor. The string is run taut to every place but the back and legs, which should be a bit slack so that the control may be slipped over a brad without disturbing the feet when they are to re-



Front and side views of a typical marionette body.

main motionless or when the puppet is seated. Use heavy black linen thread or any strong waxed thread.

There are five screw eyes to be put on the body before the puppet is dressed, and two on the head, as follows: Two for the shoulder strings; one on the back, just above or just below the waist; one on each leg just above the knee joint; and one back of each ear. The screw eyes for the head are usually just above the ears, but they must be placed so that the greater weight of the head is in front. When the shoulder strings are pulled, the head then bends forward instead of back. For a pompous strutting character, place the screw eyes forward; for old age or a hunchback, set them far back. Between these two extremes is the normal place.

The strings are sewn through the clothes, never fastened directly to them. The hand strings are fastened between thumb and first finger.

The length of the strings depends on the height of the puppeteers' bridge above the puppet stage. About 50 in. is an average length from the control stick to the feet of the puppet. First suspend the controller at the exact height from the floor that the combined height of the marionette and the strings is to be. To find this distance, measure the puppeteer from waist to feet, and to that length add the elevation of the bridge from the stage floor, if it is raised.

Cut a piece of thread 3 in. longer than double the distance from the controller to the marionette's shoulder, as the marionette is held upright with its feet on the floor. Tie one end securely to the marionette's left shoulder and the other to the right shoulder. Cut the thread in half and attach these ends to their places on the controller. The marionette is now supported upright. Tie a thread to the screw eye in its head near the left ear, measure double the distance from this point to the controller, with the head erect; allow 3 in. extra and cut the thread. Tie the other end to the right ear loop, cut the thread in half, and fasten the ends to the controller.

The head is now supported. Be careful that the weight of the body hangs from the shoulder strings; if these are slack, the head strings are supporting the whole marionette and head movements will be stiff or impossible.

Next, tie a string to the left hand, measure up to the controller and back, and allow 3 in. extra, cut, pass the free end of the string through the proper controller hole, and tie to the right hand. This string or thread is continuous. Arms are raised by placing a finger under the string and lifting it. A ring may be slipped over the string at this point so that it may be lifted more conveniently.

Tie a thread to the back screw eye, using a needle to draw it through the clothing if necessary. Draw this thread up to the hole in the back of the main control bar; cut and tie securely. By lifting this string, which is slack, the puppet can be made to bow.

In the same manner, secure the strings to the knee screw eyes, and tie them to the extra crosspiece of the controller. Legs and arms should hang limp when not in use. To make the puppet walk, tip the leg rod of the control up and down.

The marionette is now strung and ready to manipulate. For strings to work tricks or to control extra movements, extra holes may be drilled in the controller where required.

It is best to keep puppets hanging up. Never lay a puppet down without first winding the strings around the control to prevent tangling.

Manipulation. Hold the controller in the left hand by the stock, close to the crosspiece, if it is T-shaped. Tip and tilt the control, and also pull the shoulder strings with the first finger. In other words, learn to do all you can with the left hand before using the right hand at all. The right hand is used for the leg control (or walking stick) and for the hand strings. Manipulate all strings close to the controller; never reach down under. The puppet who is supposed to be speaking should be in movement while doing so; the others must be still.

Puppets are limited in action. If they are overtaxed, they soon become ridiculous. There are certain things they do well, flying, for instance. They grieve and die with heartrending realism. Their head and arms make the most expressive movements. They should all kneel and sit well.

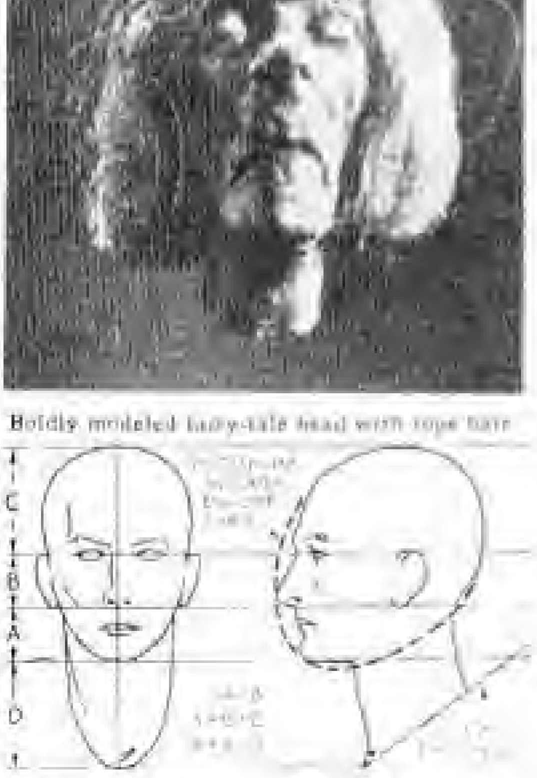
Avoid long speeches; they are rarely successful. Fairy tales, no matter how worn out the plot may be, take on new life when acted by puppets. Better have but few characters in the play, as only two or three can be well managed on the stage at one time.

Due to the difficulty of restringing, it is necessary to make two puppets alike if it happens that the costume must be changed.

Try to have nothing on the stage in which the strings will become entangled, and don't forget to keep everything as simple as possible. Strings that get tangled, stage properties that fall or move about, back drops too detailed in treatment, all these distract attention from the characters.

The curtain should rise and fall many times. Have puppets enter and leave often. A puppet can leap twice his height in the air when surprised. Let another go out dancing a hornpipe. In a two-man show, an animal, creeping up behind another figure, is always pleasing.

Boldly modeled fairy-tale head with rope hair



Front and side views of an ideal head. This is the foundation for modeling any character

Puppet Heads

MODELED FROM NEWSPAPER PULP

The secret of making good papier-mâché ... It's also useful for decorations, imitation carvings, and model scenery and accessories

By Florence Fetherston Drake

Popular Science Monthly — 1936

BY FAR the easiest and most practicable method for the beginner to make marionette heads is from *papier-mâché*—newspapers soaked in water and mixed with wall-paper paste. This material is, indeed, something with which every home worker should be familiar. It costs next to nothing, is easily modeled or cast into almost any form, takes paint well, and is light in weight yet almost indestructible.

The examples illustrated are all heads or masks for puppets of the conventional type. By the same method, however, you can make decorative heads or masks to hang on the wall, heads for character dolls, ornaments of various kinds, imitation carvings for furniture and woodwork, scenery for model railways, accessories for ship models and other types of models, and all sorts of odd-shaped articles that are not easily carved from solid wood or cast in plaster or metal.

There is only one secret for working successfully with *papier-mâché*, and that is to have the pulp of exactly the right consistency. Crumple single sheets of newspaper one at a time (about seven sheets for a head) and soak in water. If convenient, use hot water and soak overnight. Tear the paper into shreds or rub it on a washboard until it is as fine as possible. Drain all the water you can without pressing or squeezing it. Then you are ready to mix it with the paste.

Use wall-paper paste preferably; it costs about fifteen cents a pound in the form of a powder. Otherwise, make paste by mixing flour and water to a thin, creamy consistency. Pour on boiling water and stir constantly. Let it boil for two or three minutes. It is cooked like starch and, when cold, should be as thick as custard. While it is fairly satisfactory, the commercial wall-paper paste is better.

Now mix the paste and paper pulp in the proportions of approximately one part of the paste to two of pulp. Press the water out by squeezing the mixture in a heavy stocking. When ready for modeling, it should look and feel like clay. If it sticks to a board or the hands, it is in no condition to model. Work it in a heavy cloth until it could be handled with gloves and not stain them.

Here are the tests for good *papier-mâché*:

1. If there are traces of water noticeable when you press your finger into it, squeeze the pulp more; it is too wet.

2. If it cracks open when you press your fingers into the pulp, it is too dry and needs more paste.

3. If there are lumps in it, pull them apart or discard them.

4. If it adheres to the hand, it should be worked more thoroughly.

5. Paper pulp that is in the proper condition will not shrink appreciably. It is the evaporation of excess water that causes shrinkage and excessive roughness.

Nothing is more futile than to use pulp which is not just right. You might as well model a head of mud if it is slimy, or with soap if it is too hard or too dry. The first step in handling a portion of the pulp is to make it into a ball and work it. When right, it will instantly obey the pressure of your fingers, and you will be able easily to mold eyes, nose, mouth, and all details of a head. It will be found as responsive a medium as clay, if these suggestions are followed.

The paste should not be worked in until shortly before pulp is to be used. The longer the paper itself soaks in water, the better. It seems to ripen. My own practice is always to keep a jar of it on hand. It remains sweet and fresh for a long time if there is no paste in it.

Puppets should be made individually, and the bodies varied according to the heads. It is, therefore, advisable to make a rough drawing of the whole figure. Width of shoulders, length of torso, and length of arms and legs vary with different types. Character is also shown in the hands and the size of feet, which should be made to correspond with the head and body.

The human head is about a seventh of the height of the whole figure. That its character may be seen, the puppet head is generally larger—one sixth of the height. If larger than this, it may dwarf the body, giving the effect of a midget. If, on the other hand, it is made less than one seventh of the height, the figure will appear heroically broad and tall.

For a large audience in an auditorium, 24-in. puppets are large enough. For living-room groups, the figures should be smaller, detail greater, and coloring more delicate. Large puppets must be broadly treated, colors vivid and every detail emphasized. Reduce the face to fewest and simplest lines. Eliminate all nonessentials. Then the face will seem to change expression with proper lighting and the mood of the play. Only extreme simplicity can achieve this result.

The foundation for the head, or "armature" as it is called, is a stick, such as the end of a broomstick, with a wad of paper tied around the end. While modeling, it is advisable to fix the end of stick in a vise at an angle. Even better is a heavy block of wood about 6 by 6 by 6 in. with a hole bored in it at an angle, just off the vertical, to hold the stick. A cross section of a log of wood answers the purpose.

Any one should be able to mold an egg-shaped mass, small end down, on the stick. The better this oval is shaped, the easier it will be to model a good-looking head. With a pencil or pointed stick, lightly score a line lengthwise from top to point. Another line at right angles to this and halfway down marks the place for the eye sockets, the tops of the ears, and beginnings of the nose. Dividing the space between eyes and chin gives a line for end of nose and lobes of ears. Halfway between this and the chin is marked for the mouth. The throat is the length of the face and almost as wide as the face. Familiarize yourself with these proportions, which are normal, then depart from them as necessary.

A head is five eyes wide and three noses long. One's thumb, ear, and nose are all the same length. The thumb plus the ear plus the nose are equal to the length of the face. Place your thumb on your nose with the second joint of the thumb at the tip of the nose. Your thumb nail will touch just above border of your nose. Measure your ear with your thumb; it is the same length. Place the heel of your hand on your chin and lay the hand over the face; you can nearly touch your hair. Note that the hand is the same length as the face. Observe the difference between the heads of men and women, of age and of youth. Study the nose in the front view, quarter side view, and profile. There are about six kinds of noses. Eyes may be placed straight, may slope up or down, be sunken or protruding, and round, oval, or triangular. Ears also vary greatly. The ears of old men appear very long. Chins are normal, protruding, receding, pointed, or round. Faces are often narrow across forehead and broad across jaws, or vice versa, if not normal.

Models everywhere! Every human being is a model for a puppet. Look at the outline of faces, especially the jaw line. Notice the curve of eyebrows. Note the planes that catch the light and those that cast the shadows. Watch the shape of faces under different emotions.

Start with an average head. Having formed a good oval and marked the lines, press with the thumbs to form sockets for eyes, making both at once. Press more deeply toward the nose. Next make small depressions each side of the mouth line, adding pulp to mold the lips. Add a lump of pulp for the nose and model it. If necessary, add more pulp to brow and cheek; this depends upon the face you are copying. Work a little on one side and then on the other, keeping your form balanced. Never finish one side or one feature at a time. The chin will probably need more pulp. In adding pieces of pulp, work and press them in well; also be sure that they are of the same consistency, because small amounts of pulp dry out more quickly than does the head. Very large noses may be modeled over heads of nails. In Pinocchio, for instance, a straight 2-in. brad is driven in and the pulp worked around it.

When the modeling is fairly satisfactory, give the face a coat of flesh-color paint. Use distemper, kalsomine, tempera, or poster paint, never oil colors, which shine and reflect light and give no texture. A jar of tan color, one of orange poster paint, and a box of ordinary water colors or set of tempera colors answer every purpose. Ecru or cream forms a better base than white. Mixed with a touch of orange, it gives a good general flesh color.

A marionette representing the character of Macbeth with head modeled from *papier-mâché*

The color will give an effect of nature and show up some of the faults in the modeling not evident in the gray pulp. Correct these faults. Let the head dry a day; it will still be in a moldable condition. Give it another coat of paint, after which model the necessary finishing touches. Keep all broad and simple.

Three or four coats of paint may be necessary. Do not apply paint thickly; let it soak well into the pulp and so retain the texture. A slight roughness is to be desired.

Should the head appear too rough when dry, or if a smoother, more finished effect is desired, it is a simple matter to cover the head with a layer of paper. Paper toweling, wrapping paper, or note paper will serve. Wet the sheet and sop up the excess water. With a flat brush or a sponge, cover both sides of the paper with paste. Tear—do not cut—it in pieces about the size of a postage stamp and cover the face and throat with these, overlapping them. When dry, this covering forms an excellent surface for painting.

Dry the head for a day or two, preferably in the sun. Should the flesh color not be satisfactory, repaint. A touch of sienna gives a darker flesh, appropriate to men; gray indicates age. When this coat dries, the features may be put in. Avoid dark spots of color, because they appear to be holes. Now add mauve and green-brown shadows for the eye sockets. Paint the eyeballs white and, when dry, add spots of blue-brown or black, according to your model. For certain effects eyes are sometimes outlined with dark lines around the entire oval, but shadows cast by the modeling are usually to be preferred. Do not attempt to paint eyelashes.

Hair is a great improvement. It may be made of yarn, cloth, fur, or frayed rope. Crêpe hair sold by the yard at theatrical shops will be found useful. It comes in many colors at about forty cents a yard. A quarter of a yard will make many wigs. Shellac is better than glue for attaching the hair. Sometimes it is necessary to make a sort of skull cap of stocking and sew the hair to this, after which it can be pasted on the head.

When all is finished, the stick and part of throat must be sawed off on a diagonal line.

In our next article will be shown how this is attached to the shoulder piece of the body at the proper angle to give best action. Various joints will be described, as well as the assembling of all parts of the body.

A head is built up by forming an egg-shaped lump of pulp around the end of a stick and modeling it just like clay. After this is dry, it is colored with ordinary pastel paints.

HOW TO MAKE A DANCING SKELETON, A JUGGLER, A DWARF THAT CHANGES INTO A GIANT, A PIANO PLAYER, A GHOST, AND OTHER AMUSING NOVELTIES

Alice opens out like a telescope and gives her audience another stunt to wonder about

Mozart at the piano. His hands are of sheet lead, covered with two layers of muslin

TRICK *Marionettes* WILL ENLIVEN YOUR PUPPET SHOWS

Popular Science Monthly — Nov. 1936

MARIONETTES that will perform all sorts of amusing tricks can be made without difficulty, once the secret of their construction is understood. Ball tossing, for instance, is a simple trick. Then there is the skeleton that disjoints his limbs and throws his head into the air, and the dwarf who grows into a giant. Various adventures of Alice in

Wonderland also can be portrayed.

For ball tossing, drill a hole through a wooden ball and run both strings through it, passing the ends through the palms of the marionette's hands and knotting the ends, as in Fig. 1 of the drawings. Tie the other ends to an extra 12-in. stick. By tilting the ends of the stick alternately, the ball will fly up and down. There is less friction if the string is waxed and the hole in the ball is burned through with a red-hot wire, instead of being drilled.

Two balls may be used—one on each hand, or on one hand and the opposite foot. A puppet lying on the floor, with strings attached to each toe and passing through a ball, can kick the ball up in the air from foot to foot, as shown in Fig. 2. Instead of a plain ball, a 10-in. bar with a ball at each end can be used, as shown in Fig. 3. The strings pass through the bar near the ends and through the puppet's hands, with a small knot between each hand and the bar. When the puppet carries the bar, the outside strings are pulled tight, while either hand can be lifted from the ball by pulling the inside strings.

A skeleton, the bones of which fall apart at will, requires more strings than usual (Fig. 4). The No. 1 strings support the body and are attached to the shoulders, then passed through small screw eyes on each side of the skull to prevent the head from turning; No. 2 strings control the legs; No. 3 strings control the hands; No. 4 strings are fixed to the top of the arms and passed through holes in the collar bone; and No. 5 strings are attached to the top of the legs and passed through small holes at the hips. The No. 6 string is fixed to the top of the skull by means of a small screw eye, and passes through another small screw eye in the controller *A*. Then it is tied to a ring, button, or small piece of wood that may be easily grasped.

Figure 5 shows a side view of the skull. The jaw is separate from the rest of the skull and is held loosely in place by a small screw at each side. A vertical hole halfway through the skull allows it to rest on top of the spinal column. A suitable hole is made with a red-hot wire just large enough for the string to pass through, the string being fastened to the top of the spine with a small screw eye.

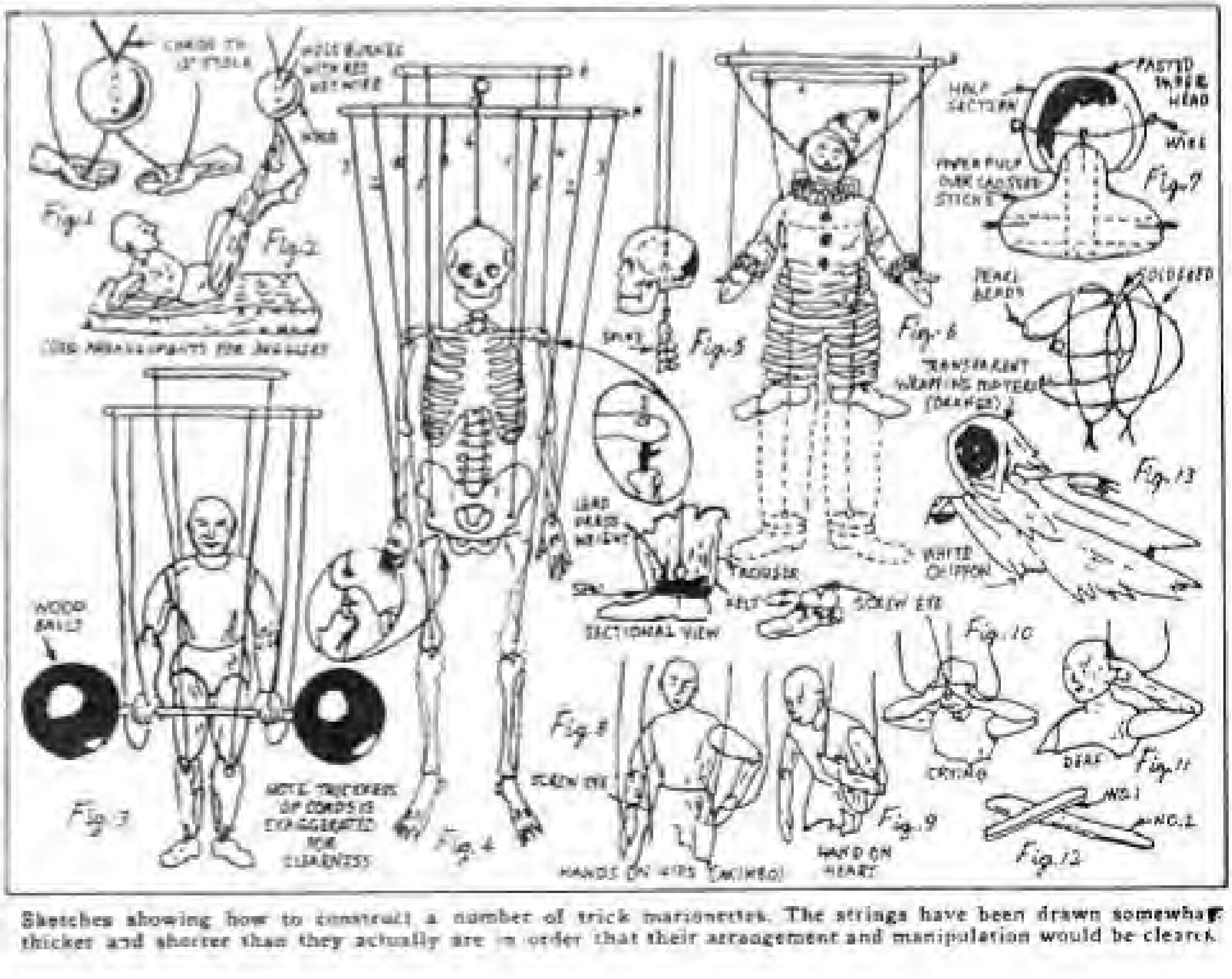
By shaking the skull slightly, the jaw is made to move as though chattering. The skeleton can be danced around the stage, suddenly stopped, and the head lifted out of sight into the flies by pulling No. 6 string by the ring. If the controller *B*, to which the No. 4 and 5 strings are attached, is lowered, the arms and legs fall away from the body. They can be made to do shivering, shaking movements in mid-air as far away from the body as the length of the strings permit.

When these evolutions are finished, the limbs join with the body again, the skull falls down on the spine, and the figure dances off. Make the marionette dance over the stage in a low light against a dark background. By alternately raising the ends of *B*, the skeleton waves its arms and legs about. Pull up the center string that supports the head so it will float and then drop it back into place.

The ribs, feet, hands, arms, and legs are made of firm cardboard. The jaw can also be made of cardboard, and the rest of the head and figure carved out of wood or cork. If the entire head is made of wood, the jaw will click as it shuts. The ribs can be made of covered wire if that seems easier to do. Several coats of dead white paint are needed, and luminous or phosphorescent paint may be used, if desired, to give a still more uncanny effect. It is unnecessary to have this figure anatomically correct; instead, strive to make an effective, entertaining puppet.

An amusing figure called the "giant dwarf" is shown in Fig. 6. There is no body inside the costume except the shoulders. The strings attached to controller *A* pass through screw eyes in the shoulders, are drawn through the costume, and tied to screw eyes in the feet. From controller *B*, strings are attached to the head behind the ears and a second set to the hands. The feet are cut from wood and at each heel a lead dress weight is held in place by a screw eye. These are covered with two disks of felt, and the trousers are then sewed to the felt to hold them in place.

Another "Alice in Wonderland" trick. Father William shows his son how young he is by standing on his head. Two extra strings are tied to his heels.



Sketches showing how to construct a number of trick marionettes. The strings have been drawn somewhat thicker and shorter than they actually are in order that their arrangement and manipulation would be clearer.

By raising the leg control *A*, the figure will fold up and become a dwarf; by lowering the stick, it becomes a giant. An effective use of this idea is as a jack-in-the-box. A box, large enough to hold the figure when dwarfed and gayly painted, has a string attached to the front of the lid. Pulling this string lifts the lid, and out jumps the dwarf, who can be made to hop about in an engaging way and suddenly loom up as big and important as a giant. The head of the clown (Fig. 7) is hollow, being made like a mask. It reaches only a bit below the mouth so as to leave a large opening. This permits free movement over the point of the throat, where there is a screw eye through which a wire passes. It is looped back of each ear as shown.

Whenever a puppet's hand must be drawn to any special place, an extra string is usually passed through the hand and through a hook or ring at the desired spot. To place hands on hips, akimbo, sew a small metal ring to each hip (Fig. 8). Tie one extra hand string to the tips of each hand, not through the palms, run it through each ring, and draw it up above the controller. Let the hands hang straight down at the sides and tie the strings together. Put a thumb tack in the center of the main rod and slip the string over this when not in use. When this loop is raised, the hands will fly to the hips. When the regular hand strings are raised, they will fly out again.

On the same principle, a gallant may be made to put his hand on his heart as he bows, by attaching a ring to his chest and passing the hand string through it (Fig. 9). A deaf man will cup his hand behind his ear if a ring or screw eye is placed to direct the movement (Fig. 11), and a child appears to be crying if his hands are brought up to the eyes (Fig. 10).

One of the photographs shows a knight drawing his sword from its scabbard. A string passing through a hand and attached to an object will draw it out, as in this case. In the same way, a handkerchief can be pulled out to wave as occasion demands.

TWO scenes from *Alice in Wonderland* are shown in the photographs. Alice may be made to "open out like the largest telescope." If you already have a modeled head you can use, just glue a strip of firm cardboard around the throat, paste muslin over this, and paint a flesh color. Cut a piece of soft white fabric to fit the body and nail it to the shoulders, tapering it to fit the throat above and making a small turnover for a collar. Glue or paste this around the cardboard and drive in a few tacks for extra security. Tie an extra string to a screw eye driven in the top of the head and attach this to the center of the stick that controls the strings fastened near the ears. This string must be longer than the others; in fact, very slack so that the head, when loose, will drop down on the shoulders in a natural position. By lifting the string, the neck will be elongated. The famous Scaramouch is often shown with this extension throat.

Father William appears in one of the photographs showing his son how young he is by standing on his head. This stunt is performed by attaching a string to each heel and tying these to an extra control stick. If an airplane control is used (Fig. 12), drive a nail through stick No. 1 just back of No. 2 to hold the regular leg stick, and one just in front of No. 2 for the heel stick, so it can be slipped over the nail when not in use and thus be out of the way.

The marionette piano player shown in another of the photographs is made exactly like those described in previous articles in this series (see note at end of this article) except that the hands are made more carefully to fit them for pounding the keys. The hands from the wrist down are of sheet lead, each finger and thumb cut separately; then the hands are covered with two layers of muslin, glued on. Between the first and second layers, the hands are built out a bit with cotton to give them the required thickness. They are attached to wooden lower arms with wire loops, which should have muslin glued over to form a hinge. Finally the hands are given a coat of flesh-color paint.

Draw the hand strings through the center of each palm and bend the lead fingers at an angle to the middle joint so the hammer touch can be given. In manipulating, it is important for the puppet to sit firmly on a bench or stool.

Ghosts and phantom figures, made as suggested in Fig. 13, are always entertaining. Fine copper wire is used to form the framework for the head. Two pearl beads are strung on the wires to form eyes, and the back of the head is covered with a triangular bit of orange-colored cellulose. A square piece of chiffon or some other diaphanous material is folded to form a triangle, the middle part being attached to the head. Wire-covered hands are sewed to the two upper points halfway from the throat. Only one controller is needed.

A knight draws his sword from its scabbard. This is done with a string through his hand

Constructing Simple Marionette Stages

Popular Science Monthly — March 1936

MARIONETTE stages are of many types, simple and complex. If it were possible, I should have every one start with an outdoor theater. There is nothing more delightful, and it is quite easy of achievement.

We shall begin, however, with a small portable stage that may be used in the average doorway (marked Fig. 1 in the drawings). It consists of the frame, proscenium, back, back drop, two wings, and a bridge formed of two soap or apple boxes. A plank should be nailed across these to prevent their slipping. This stage is designed to be used on a kitchen or card table, the top of which forms the stage floor. Clamps are needed to hold the front and back upright parts firmly to the table.

From the top of the doorway to below the top of proscenium, a screen of some kind is needed (Fig. 9). This may be a window shade or a drapery. A similar one should be used from the table top to the floor.

The stage curtain may be drop, draw, or draped, as you prefer (Figs. 2, 4, and 7). The drawings show the details of the two former. The draped curtain is so rarely used, no description of it is given.

Draw curtains are those hanging in folds and separating in the center. Whatever material you use should be light in weight and lightproof. If not the latter, they will need to be lined—an unnecessary trouble.

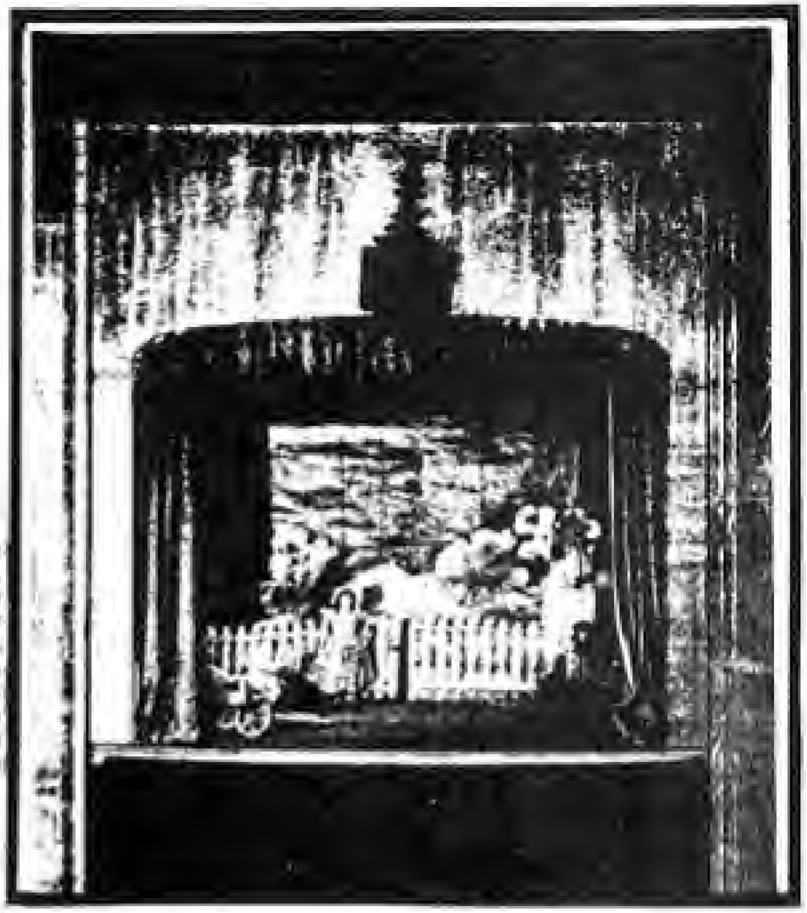
If properly dyed and brushed, unbleached muslin makes a delightful curtain, having the effect of rich old velvet. Never, however, use real velvet, as it deadens the sound of the speakers' voices. The fabric chosen should harmonize in color with the proscenium. Cut two pieces about 10 in. more than half the width of proscenium opening and about 4 in. longer. Allow a few extra inches for hems on all sides.

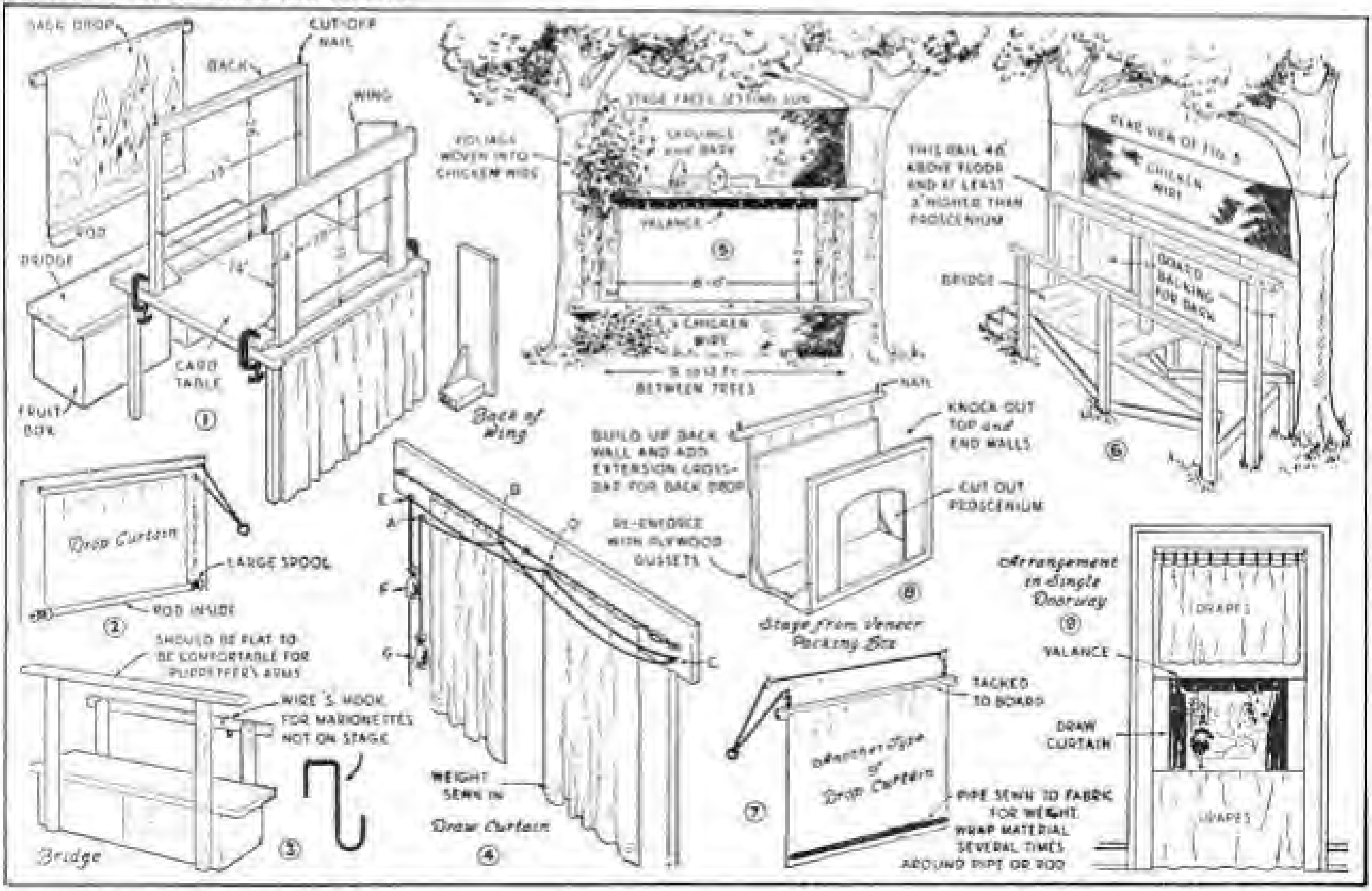
Eight or nine rings are sewed to the top of each curtain where pleats are made. The rod or wire on which the curtain hangs is held by a screw eye at each end, and one in the center. Place the rod 2 in. above the arch so that the rings will not be seen by the audience. The rings should slide freely, therefore if wire is used, it must be very taut. A small turnbuckle at one side may be necessary.

THE teaser, or valance strip, if used, should be cut about 6 in. deep, and long enough to be either gathered or pleated. It is tacked across the top arch of the proscenium so that about 4½ in. show. This is, of course, immovable and should be fixed in place before the curtain is arranged.

To rig a draw curtain, cut a piece of stout cord about two and a half times the

This marionette stage constructed by Mrs. Drake is set up in a double doorway. The stage floor is of wood, and the puppeteer's stand or bridge consists of two soap boxes with a plank nailed on to serve as a platform





Sketches showing the general arrangement of a marionette stage for use in a doorway; a bridge, various curtains and drapes, and an outdoor stage height of the proscenium, and wax it thoroughly with paraffin. Tie one end, for the time being, to a nail at the lower left side of the back of the proscenium; then thread the free end through screw eye *A* in Fig. 4, pull the cord tight, and sew it to curtain ring *B*. Be careful not to pull the curtain away from the center. Pass the cord through screw eye *C*, then bring it over to *D* and sew it to the ring, which also should be at the center of the proscenium. In other words, the curtain should be entirely closed. Now pull the cord tight. These two center rings should meet very closely in the middle. Finally, carry the cord through screw eye *E*.

Now that the curtain is rigged, free the end of the cord from the nail and attach a small sinker or other weight here and at the other end of the string. The curtain then should open when *G* is pulled and close when *F* is pulled.

Marionettes are operated by strings from an elevated platform behind the back drop, called the bridge. It should have a rail in front, on which the operator leans and rests his arms when working the puppets (Fig. 3). Another rail at the back prevents operators from inadvertently stepping off the bridge. It also gives a place to hang puppets when not on stage by means of S-shaped wires. The back drop, which should, where possible, be higher than the proscenium and broader as well, screens the puppeteers' bodies and legs. The floor of the bridge should be 10 to 20 in. higher than the stage floor and about 18 in. wider if possible. It may be formed from two or three apple boxes nailed to a plank, or by two small stepladders held together by wide boards and braced.

A stage set up in a double doorway is shown in one of the photographs. It can also be used independently, with screens or draperies forming the sides and top.

The proscenium arch is cut from three-ply wood and braced by strips of wood in back. Chinese gold paper covers the front, and a decorative mask adorns the center. The wooden floor is covered with grayish tan duvetyn drawn tightly over all edges. Its neutral color makes a good ground color, and the fabric has the advantage of deadening sound, so the marionettes move over it noiselessly.

The curtains are made of a closely woven soft silk fabric—a warm tan color. Its sheen gives it a pleasing metallic light.

At either side of the stage floor at the front is a plug for a small standing stage lamp, called "olivette." A reflector, 6 in. in diameter, on an extension cord can be used from the top or lower part of the stage, as desired. Footlights are no longer used on the real stage, and few marionette theaters have them. They are considered to be old fashioned and inartistic.

IN THE *Language of Puppeteers...*

PROSCENIUM. *The picture frame or stage opening.*

FLY RAILS. *Rails on the upper stage from which hanging scenery is suspended.*

BACK DROP. *Screen of wall board or hangings (drapery) about 2 ft. back of the proscenium.*

BRIDGE. *Section where puppeteers stand when working the marionettes.*

TEASER. *Narrow valance above stage curtain. It is fixed and forms a straight line across the proscenium opening.*

STAGE CURTAINS. *These screen the proscenium opening.*

STAGE APRON. *Part of stage floor, usually curved, that projects in front of curtain. It is not always used.*

WINGS. *Sidepieces or narrow strips set at an angle, attached to the stage floor with clamps or suspended from above, and painted to accord with the stage sets.*

CYC. or CYCLORAMA. *A curved back drop, usually colored sky blue.*

PUPPET RACK. *Contrivance for holding the marionettes that are to be used in performances. The back part of the bridge is usually used for this purpose. In smaller theaters, clothes trees serve the purpose.*

An out-of-door stage can be set up between two trees as in Figs. 5 and 6. Stout wires and chicken netting are nailed to the trunks to support the framing. In the netting are woven branches (preferably hemlock) above the proscenium and at the sides. Have an opening 45 in. high and at least 7 ft. 6 in long if possible. This height is three times that of a 15 in. marionette, but 24-in. puppets may also be used. The floor, which is made of tongue-and-grooved boards, should be about 2 ft. high and 2 ft. deep. No matter how long or high you make your stage, it must never be over 27 in. deep, which is about the length of the operator's reach.

Outdoor effects are easily achieved in a theater of this kind. Rocks, small bushes, ferns, moss, mushrooms, and flowers give lovely effects. Have the stage face the setting sun so that the light will not shine in the eyes of the audience.

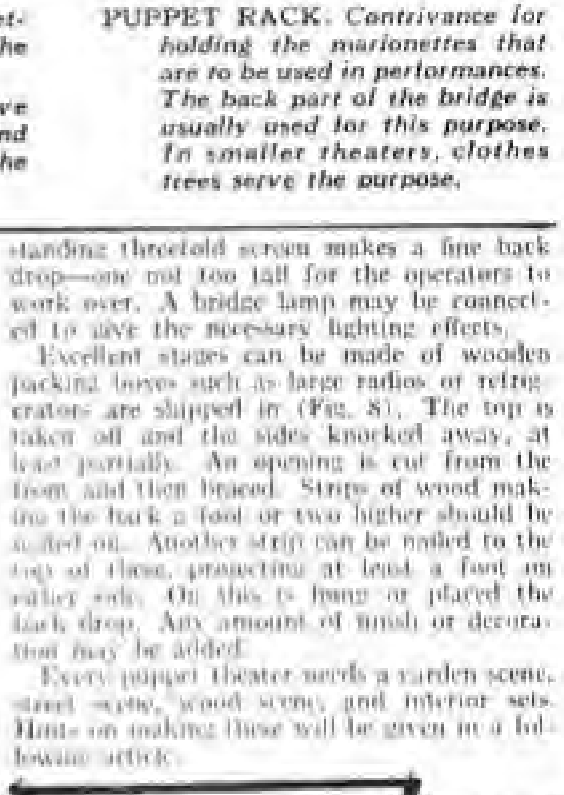
The sides of marionette stages should always be left open and clear for the easy entrance and exit of marionettes and their strings.

An ingenious theater devised by one of my pupils is in a hall opposite the top of a flight of stairs. The balustrade across the landing screens the legs of the puppeteers, and a valance from the ceiling hides their heads and arms. The audience, limited to between ten and sixteen, sits on the rising stairs.

A small stage may be easily arranged in a window—one opening upon a porch, for instance. The upper sash is curtained (or the shade pulled down), leaving the lower part with its sash raised for the stage and proscenium opening. Any table the height of the window sill will serve for the stage floor. A standing threefold screen makes a fine back drop—one not too tall for the operators to work over. A bridge lamp may be connected to give the necessary lighting effects.

Excellent stages can be made of wooden packing boxes such as large radios or refrigerators are shipped in (Fig. 8). The top is taken off and the sides knocked away, at least partially. An opening is cut from the front and then braced. Strips of wood making the back a foot or two higher should be nailed on. Another strip can be nailed to the top of these, projecting at least a foot on either side. On this is hung or placed the back drop. Any amount of finish or decoration may be added.

Every puppet theater needs a garden scene, street scene, wood scene, and interior sets. Hints on making these will be given in a following article.



Side view showing wings and back drop

Mrs. Drake demonstrates the ease with which her portable stage can be carried around when closed. At the left is the same stage set up for use but before the curtains, back drop, and various accessories are added

Stage for doorway with decorated proscenium, curtains, wings, and painted back drop

Stage Sets *and* Scenery *for* MARIONETTE SHOWS

Popular Science Monthly - April 1936

Florence Fetherston Drake gives hints on making and painting back drops, trees, buildings, and interiors . . . How to get professional effects with simple materials

ALL sets for marionette shows should be simple, with as few distracting details as possible. Only what is essential to the play should be put in. Let both the color and the design be bold and definite so that they may be clearly seen from a distance by the audience.

Every setting must give the actors enough room to move about in and have the necessary exits. It should be a well-composed picture and related, if possible, to the scene that follows. This can be achieved, for example, by means of an exit into a castle or house to carry the interest of the audience into the next scene. Doorways that open upon courtyards or give glimpses of distant landscapes, and windows that open upon gardens are charming details.

As practically all types of sets and scenery require painting, a few hints on colors and their use will be given before the actual construction of the scenery is taken up.

Aniline dyes are excellent because they are so strong that very little gives a rich color. They can be bought by the ounce and mixed as necessary with water. Avoid the more expensive varieties and those that are soluble only in alcohol.

Dry tempera colors, which are sold by the pound in great variety, are also good. A quarter pound of each spectrum color is all you will need. These colors generally have enough adhesive in them to work well; should any be found to rub off when dry, add a little paste.

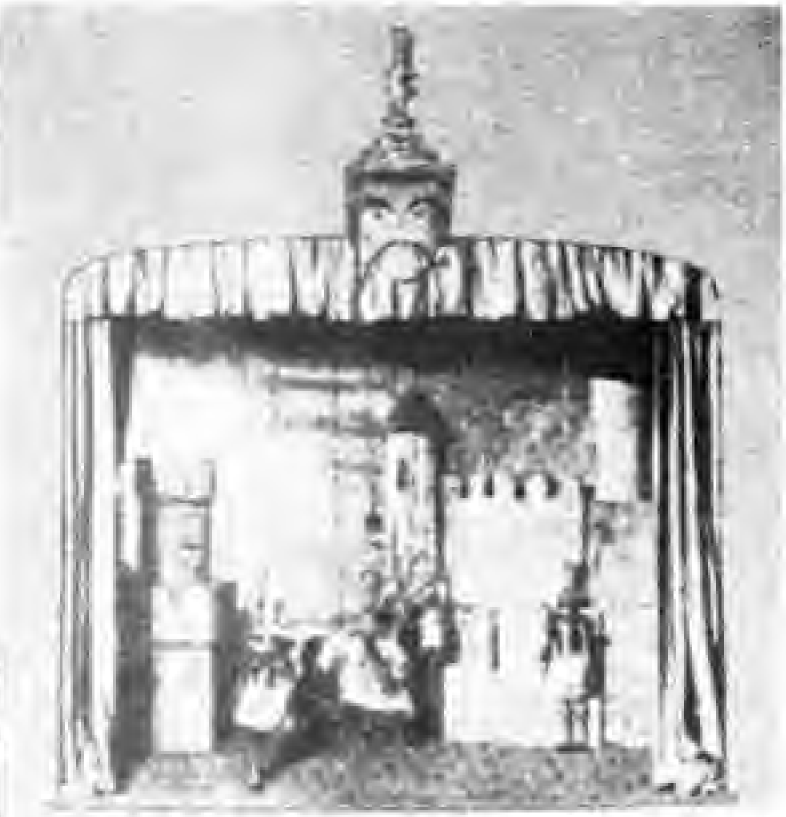
Never use ordinary oil paints for stage work because their shiny surface is objectionable. If, however, they are thinned with turpentine or gasoline until they become stains, they give a dull surface and can be used.

Mixing colors beforehand is likely to give a muddy result. The first coat should be pure, flat color, and the second coat should be put on in stripes or spatters so that the other color shows through. Under proper lighting, this gives what artists call "vibration" and makes the color "live." For instance, a bright orange coat with short strokes of brown over it gives a brilliant golden brown. In the spatter method, a brush full of color is held in one hand and the ferrule is struck against the palm of the other hand, thus flinging the paint from the brush over the body color. Sky effects are obtained in this way. Another method is to soak a sponge in color, wring it out, and pat it over the body color. The application of color with a commercial sprayer also has its uses.

COLORS may be toned down by using black, gray, or white with them. Adding black gives a shade of a color; adding white, a tint. Combining one color with a small quantity of another color makes a hue. We speak of an orange hue of red or a greenish hue of blue. Harmony of values can be obtained by using a variety of tints and shades of one color or several hues of different colors arranged at a fixed level. Stage sets and properties are usually better if painted under the lighting conditions in which they will be seen.

For the back drop, walls, and wings, you may use heavy paper, fiber wall board, or canvas or muslin stiffened by a thin coat of size. Even better than these is an insulating composition board with a surface like rough canvas. It does not warp noticeably and is so

The castle scene shown at the right was made by Mrs. Drake from wooden and cardboard panels on which yardage goods are wrapped, pasteboard cylinders, tin cans, cigar boxes, corrugated board, shade sticks, and advertising cardboards. The fairy setting below is another example, and the sketches give the methods



light that a picture wire stretched from side to side of the stage will support it. Its surface is such that the farther away one is, the greater the apparent depth of the scene painted on it.

Measure the height and width of the back drop and wing frames of your stage. With charcoal lightly sketch the design on wrapping paper. Step back about ten feet to see if the general arrangement, perspective, and proportions are correct. Make corrections, lay the sketch flat on a table, and complete it.

With white chalk or charcoal draw the ground plan on the stage floor—towers, walls, and the like. Perspective is obtained by differences in size and color value.

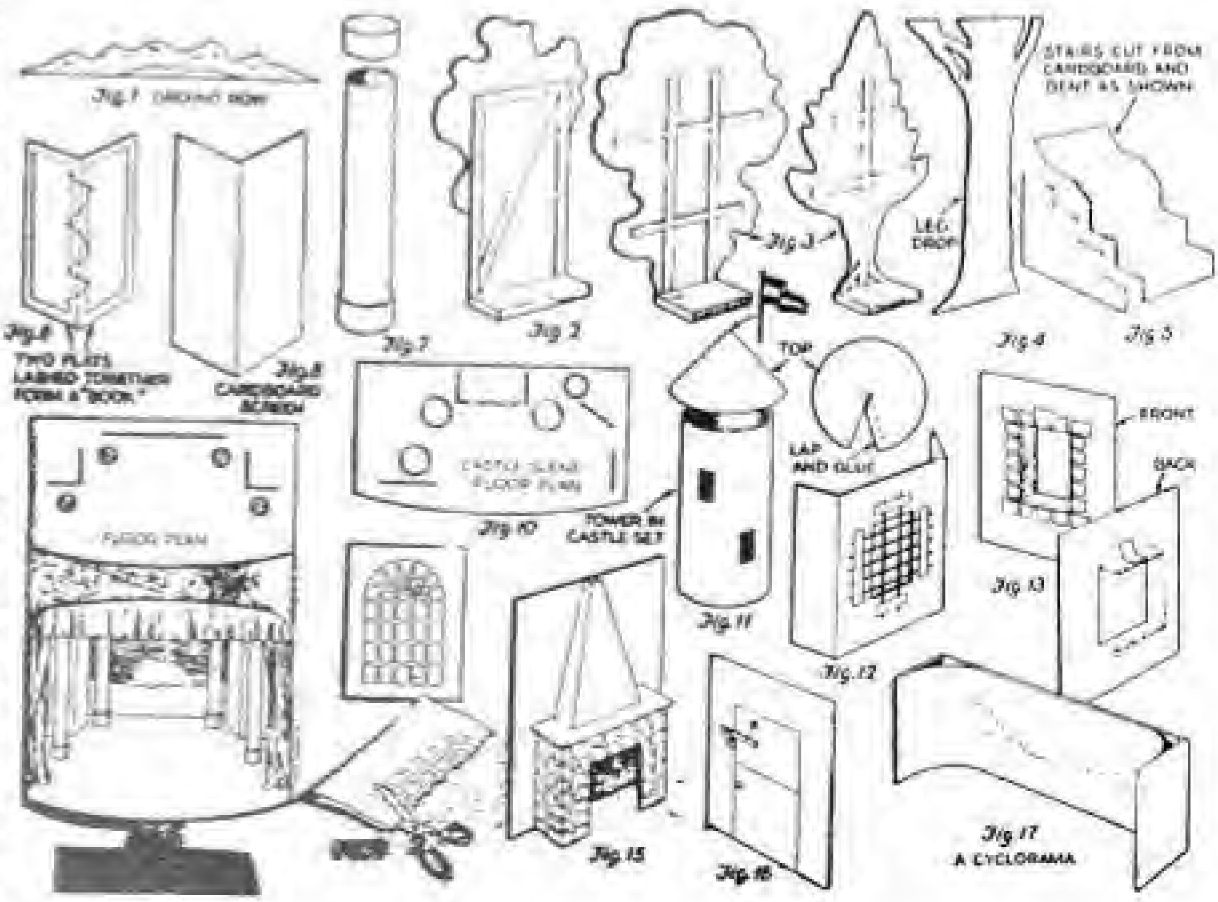
When this preliminary planning has been done, you can go to work making and painting the scenery as suggested in the accompanying drawings.

If muslin is to be used for the back drop, thumb tack a piece the size of the back stage on the wall or a drawing board, transfer the design you have prepared, and color it with crayons. When finished, spread newspapers on the floor or a table, place the muslin face down, and pass a hot iron lightly over it without pressing heavily. This will be found easier, as a rule, than sizing the muslin and painting the scene with tempera colors, but either method may be used.

TWO strips of wood (thin battens) are fastened together with screws along the bottom of the back drop, with the muslin between them. For the top make a hem, run a curtain spring through, and fasten each end to hooks or nails at the side of the stage. Tie a few inches of cord at each end of the spring and make loops to be slipped over the hooks.

If the crayon decoration is too faint and delicate for your purpose, try decorating the muslin with oil colors diluted with gasoline. House paint will do. Commence with the lightest tint and work up to the darkest shades. Test the colors on extra pieces of muslin kept for the purpose. This paint will not crack, and no size is necessary.

Leg drops, which are single side drops (Fig. 4) and valances may be used with the back



drops. A ground row (Fig. 1) is a set piece of wall board or cardboard resting on the stage floor between the acting zone and the back drop. It is often seen as a hedge or as a row of distant hills. Profile flats (Fig. 2) are screens with irregular tops and sides, made by forming a rectangular screen and then cutting the shape out of cardboard and attaching it. Formal trees (Fig. 3) can be made by cutting the silhouette in cardboard, adding paper or felt leaves, and painting all green. A decorative tree may have silver leaves and golden fruit.

Scenery is of three kinds: 1. Hanging scenery, including draperies, leg pieces, eyes., drops, borders, and ceilings. The last are not often used in puppet theatres because they interfere with strings. 2. Scenery to bear weight. Except for occasional two- or three-step stairs (Fig. 5), scenery to bear weight is seldom used. 3. Standing scenery. About half of all scenery now stands on its own feet, and most of this consists of flats, the elements used for walls. One frame is a flat; two frames lashed together makes what is called a "book" (Fig. 6).

The scale of everything on the stage should be a bit enlarged rather than diminished.

A setting with a picturesque picket fence and a gate that can be opened by the puppets

Draped-curtain settings have great artistic possibilities; they can suggest columns, trees, and other things. For foreground trees, the material must be twisted in order to suggest the main tree trunks, and garlands of twisted material used to indicate the slender branches. The foliage consists of several layers of curtains with the edges cut out in layers and scallops.

Structural sets of blocks, cylinders, cones, and "books" give a very modern effect (Figs. 7, 8, and 9).

Columns and towers are easily made by rolling a form from stiff paper and pasting gray, white, or cream-colored paper around them. Brownish paper towels are fine for this. It is sometimes necessary to weight the forms with sand.

Sheets of green blotting paper are admirable for lawns. It need not be new; the ink lines and spots, with a few lines in crayon added, improve the effect.

The castle scene (Fig. 10) is made entirely of corrugated board cartons, with oatmeal boxes for the towers (Fig. 11). (The corrugated side of single-surfaced corrugated board makes good roofs, and log cabins for small stages can be made of it.) The castle and walls are given a coat of grayish brown tempera color and, when dry, touched up with accents of dark colors to suggest blocks of stone, and with green for vines and bushes at the base. A mountain may be cut out of cardboard and pinned to the sky drop, if desired.

Squared paper will be found helpful in making your rough sketches. By dividing into squares a picture to be copied, one can easily repeat it on squared paper, enlarging it to any degree necessary, even though one is not an artist.

It is easy to see just what part and which lines go into each square. Divide the space on the paper into the same number of squares as those drawn on the original. They may be twice, three times, or four times as large, according to one's requirements. Number each square, both on the picture itself and on the paper. Beginning at the upper left-hand square, number them across; then start drawing on the same square of the copy and repeat from square to square.

IT MAY happen that the picture one wishes to copy cannot be marred by pencil lines, in which case square off a piece of tracing paper and attach it firmly over the picture. Another method which does not damage the original illustration is to use a pantograph, if available.

A garden scene is useful in ever so many plays. Make two sides of a house by bending a piece of corrugated board, mark a door and some windows, and, if desired, add a little porch with rose vines and a bench near by. This house is to be placed at left side of stage. With a sharp knife score the sides of the windows and cut through the top and bottom line, also on a vertical line drawn in the middle. By folding these parts back against the wall part, you will have solid shutters. These will look well painted apple green. Paste strips of paper on the back of the opening to imitate the small panes. Light showing through at night then gives a realistic effect. If the door is cut around top, one side, and bottom and scored on the other side, it will open and shut. This, too, may be painted green with black handle and hinges. The walls you can color as you prefer.

A garden usually needs a wall, and this may also be made of the corrugated board. Do not have it too high as it is better to have a pretty landscape on your back drop that may be seen above the wall. A large tree in back with limbs overhanging, and some bushes and smaller trees in the foreground, are desirable. Natural vines can be trailed over the wall the day you give your play. Branches from natural bushes make fine trees. An opening in the wall gives variety and affords an excuse for a pretty gateway.

TREES may be made from bits of untwisted rope for trunks, with the strands divided at the top to make the branches. A sand effect for stone castle walls and roads is obtained by covering the parts with thin liquid glue and, before it dries, sifting sand thickly over it, later shaking off the excess.

For rocks, crumple some gray or tan color paper and then pull it slightly apart till you have a mass such as you wish, and sand it as just suggested. A few lines with crayon may improve it. Colored wrapping papers may be used in various ways, so salvage every variety you get.

One of the photographs on the opening page of this article shows a fairy back drop with the parts cut out of wrapping paper colored in rainbow hues and then applied by sewing with long basting stitches to blue tarlatan (transparent muslin or net), which forms the face of the drop. It is touched up with lines and dots of silver paint. Light shining back of the trees and mountains and through the cut-out windows gives a delightful effect. A ground row is placed a few inches in front of the drop, back of which puppets may be made to walk.

Those drawings not heretofore referred to are self-explanatory. Figure 12 is a window grating of heavy black thread held with gummed paper; Fig. 13, a window in a stone wall; Fig. 14, a lattice window pane; Fig. 15, a fireplace; Fig. 16, a Dutch door in two parts with a workable latch and string; and Fig. 17, a blue cyclorama.

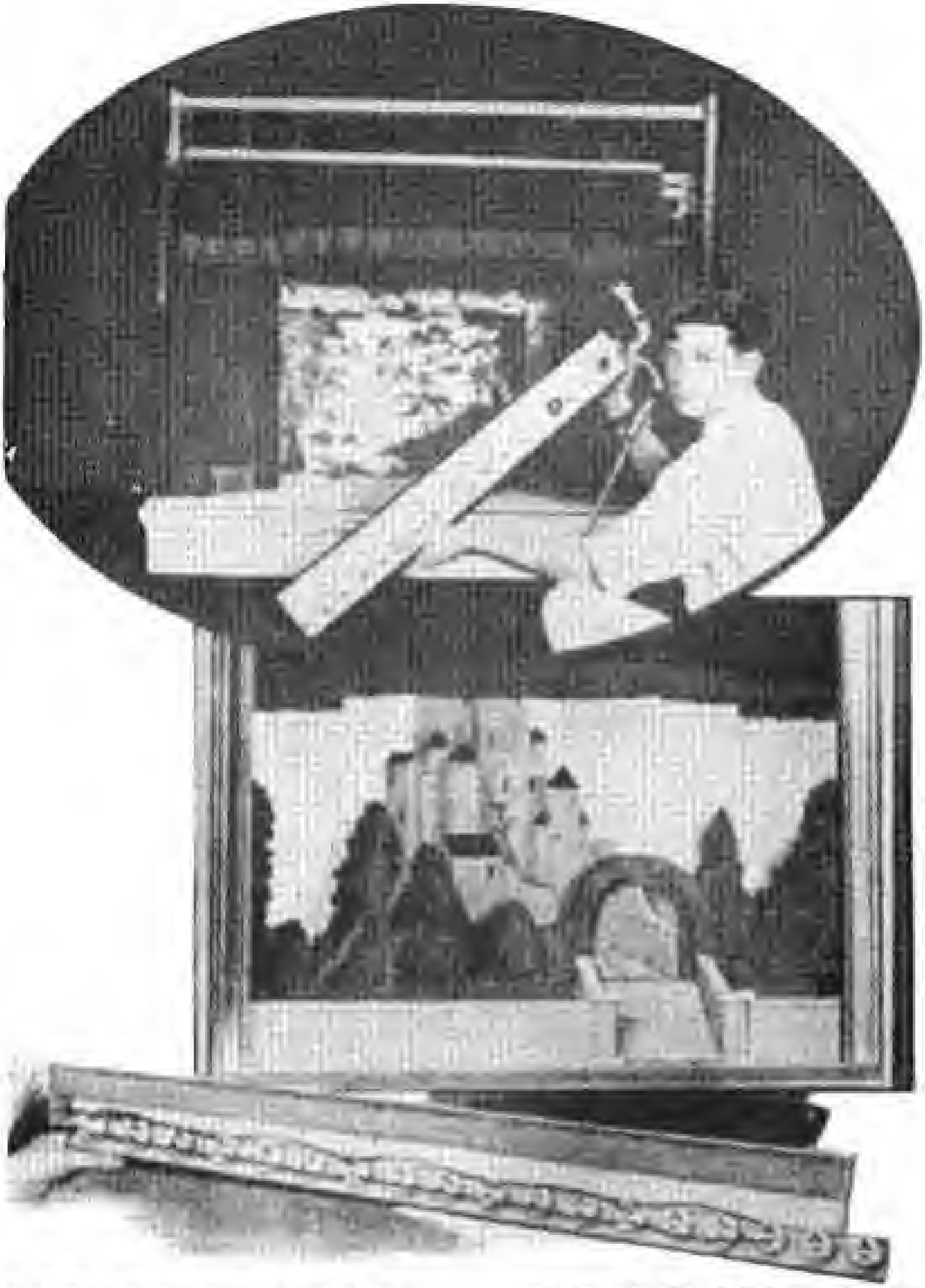
Benjamin W. Hicks *tells*

How to Light Your Miniature Stage

Popular Science Monthly — April 1934

TO achieve the most realistic effect with any miniature stage, you should install lighting equipment similar to that used on a regular stage. Complete control of the light is essential, and each circuit should be provided with separate dimmers or rheostats. The border and footlights should be wired for three colors—red, blue, and either amber or clear. Of course, if your stage is an exact model of any particular stage, choose the same colors that are used on that stage.

The accompanying illustrations and following instructions are intended to apply to the miniature stage described in two previous articles (P.S.M., Feb. '34, p. 57,



A border light (in oval), a castle set copied from a picture with a blue "eye" in the background, and a light-socket strip before being fastened in its trough. One of the three color circuits is wired

and Mar., p. 73), which was built on the scale of 1 in. equals 1 ft., but the same principles can be used for a model of any size or design.

Good stage lighting does four things, namely: Illuminate the stage; show the time of day and the season of the year; give the stage depth with light and shade; and provide the proper psychological effect with color lighting. Blue represents cold or night; red, fire and hate; green, spring and hope; black or a dark stage, death, night, or crime.

The equipment necessary includes two border lights, footlights, and a switchboard. Flood lights and other small lighting fixtures can be added from time to time as needed.

Most of the materials (see list on page 87) can be purchased from a local supply house or electrical dealer. The tin work can be done at the neighborhood tinner's for a reasonable sum if one is not equipped to do it at home.

Footlights give a continuous strip of light across the front of the stage and should be constructed so as not to obstruct the view from the front. They are made as follows: First, bend the trough as shown in the drawings from a piece of galvanized iron 36 by 12½ in. Make the ends and solder them in place. The 36 in. long inside strip for holding the sign sockets is next made. Be sure it fits properly before inserting the sockets. Remove the retaining rings from the sockets and fasten them in place, making certain the sockets will not turn. Wire every third socket as shown in one of the photographs, using asbestos-covered wire. When all three circuits are wired, solder all terminals so there will be no loose connections. Tape the wires where they come through the tin, and use insulating bushings to keep the tin from cutting the wire.

With the light strip in place, drill four holes through the trough and through the edge of the light strip, being careful not to hit the sockets and wire with the drill, and fasten in place with ¼-in. sheet metal screws, which will cut their own thread as they are screwed in. Instead of using the screws, you may solder the strip in place. Next solder small hangers so that the footlights will not fall through the hole made in the floor of the stage when the trough is set in place. A strip cut from the stage floor about 4 by 36¼ in., as close to the front as possible, is necessary to set the footlights in.

The border light (see drawing) is hung from the top of the stage. It is made like the footlights, except that the trough is of a different shape. The small flood light shown is simple to make and will be useful for lighting scenes from the side, as well as for special effects.

The switchboard is made of white pine lined with ⅛-in. asbestos board. The front and back panels are made of asbestos wood ¼ in. thick. The box is 4 by 13½ by 17 in., and the front and back are each 13 by 16½ in. The switches and rheostats are mounted directly on the front panel. The receptacles supplying current to the different pieces of equipment are mounted in the top edge of the box. These receptacles can be purchased at the ten-cent store and are the type used for floor plugs. They are installed through holes 1⅛ in. in diameter. All wiring is inclosed. The back should be drilled full of ¼-in holes for proper ventilation, as the rheostats get quite warm when in use for any great length of time. The wiring inside the switchboard should be done only with asbestos-covered wire, and all connections should be carefully soldered. The wiring diagram on page 76 shows how the wiring is done, and one of the photos gives a picture of the switchboard with the back removed.

Splice the lamp cord carefully to the proper wires coming out of the border and footlights. Solder each joint, then tape it first with rubber tape and finish with regular friction tape. Next, fasten a regular drop-cord plug on the other end and mark each one. Plug into the switchboard and then plug the switchboard into the house supply. When all lights are on, only 540 watts of electricity at 110 volts are used. A heavy drop cord will carry the load safely. *Never overload the rheostats*, as they burn out quite easily. Never connect more than 60 watts to each rheostat.

The most important thing in regard to stage lighting is the effect of colored lights upon painted surfaces. Because of the lack of pure color in both lamp dyes and pigments, one must carefully consider the action of light on the painting so as not to spoil the effect desired. Blue light on buff, and red on green give a muddy and undesirable color. Because of the variation in color pigments and dyes, it is difficult to describe the effect of lights on painted objects; therefore it is possible only through experiment and experience to obtain the desired results.

On the switchboard, the red, blue, and clear circuits have a separate switch, which can be used to turn out the colors not wanted in any special scene. Another switch is used to control all the lights.

Three useful sets are illustrated—an interior set, a castle set, and an outdoor scene using a simple set house and set tree, both being quite easy to make.

The interior set is one of the most interesting to make. The walls are cut from a single piece of wall board, laid out as shown in one of the drawings. The doors are cut out and hung with cloth for hinges. The walls are painted a light tan and spattered with red and blue. The spattering is done by filling a stiff brush with paint and drawing a knife blade across it so as to throw off a spray of small spots. Woodwork and doors should be painted brown. A border is necessary to mask off the top of the set and give the effect of a ceiling. The furniture can be made or purchased at the five-and-ten-cent store and repainted brown. Pictures for the walls may be prepared by mounting old cards and magazine pictures on cardboard and painting a frame of gold or black. Windows in such a set may be cut out and covered on the back with gauze.

List of Materials

54 Intermediate base sign sockets ($6.48).

54 Intermediate base S-11 sign lamps, 10 watts, 110 volts, in colors as follows: 18 red, 18 blue, 18 clear or amber ($13).

4 Toggle switches of type illustrated ($1).

9 Receptacles and plugs ($1.35).

9 Rheostats, each 110 volts, 60 watts ($15.34).

60 ft. No. 18 asbestos-covered wire for inside of footlights and border lights; 15 ft. No. 14 asbestos-covered wire for inside of switchboard; and 75 ft. No. 18 lamp cord to carry current from switchboard to borders and footlights ($2).

3 Insulating bushings ¾ in. in diameter and 1 bushing ½ in. (10 cents).

Wood for switchboard: 2 pc. ¾ by 4 by 17 in., and 2 pc. ¾ by 4 by 13½ in. (10 cents).

Asbestos wood for switchboard: 2 pc. 3/16 in. by 13 by 16½ in. (78 cents).

Tin, No. 26 gage: 3 pc. 36 by 2¾ in. for socket strips; 2 pc. 36 by 11¼ in. for making border trough; 1 pc. 36 by 12⅞ in. for footlight trough; 1 pc. 12 by 13 in. for ends ($3, including bending).

Solder (10 cents).

Paint: Flat white for inside reflectors; flat black for outside switchboard and borders; color to match stage floor for outside footlights.

Note: The prices in parentheses are what the author paid in Omaha, Nebr., and are given only to show the approximate cost. There will be considerable variation depending upon the quality of equipment purchased and local trade practice.

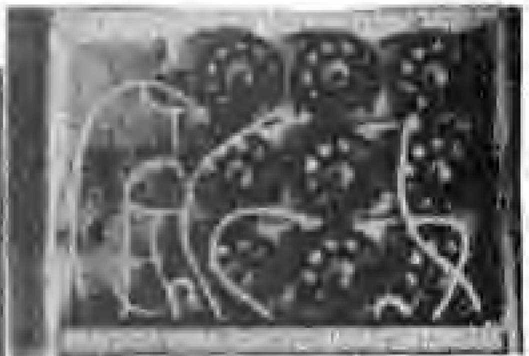
The doors of this set are cut so they can be opened; the window is backed with gauze

The castle set illustrated on page 76 was copied from a picture to show that stage settings may be adapted from illustrations in magazines or catalogues. A blue cyclorama forms the background. The castle and hedge are cut-outs made of wall board. The steps, wall, and posts are made of wood. These pieces are interchangeable with any other set.

The other outdoor scene contains only two new pieces, a set house painted on pressed wood composition board and a set tree of wall board. The other pieces—the "cyc," wall, and wood wings—were used in other sets.

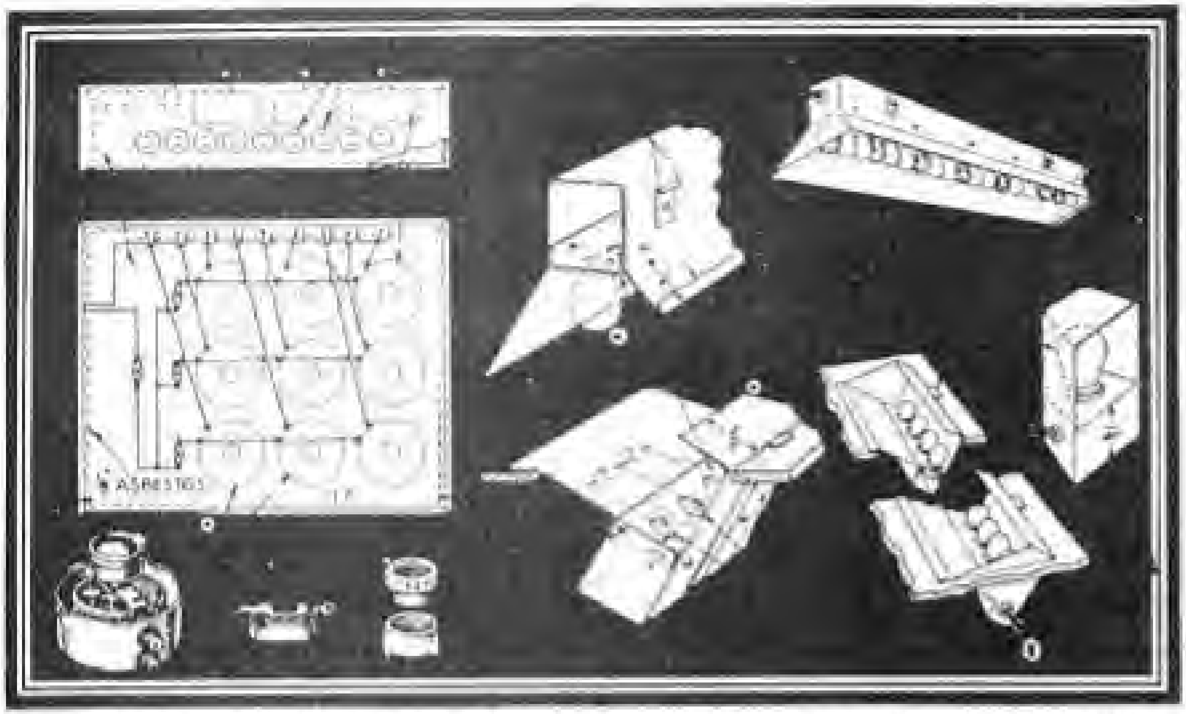
Success in any line of work or play comes from practice. Stagecraft is perfected in the same way. Only by experiment with the miniature stage is it possible to become really efficient in its use.

The walls of the interior set are cut out of a single piece of wall board as shown in a drawing near the end of this article. Toys repainted brown are used as furniture. The outdoor scene below contains a house of pressed wood composition board and trees cut from wall board



Switchboard with back removed to show rheostats, main switch, and color switches

Footlights, border lights, flood light, and switchboard with four switches, rheostat knobs, and receptacles in edge



Plan view and upper edge of the switchboard; and sketches showing how the footlights, border lights, and flood lights are made. Compare these with the photographs at the bottom of page 85

Lighting the Miniature Stage

FLORENCE FETHERSTON DRAKE

Tells How to Create Atmosphere for Marionette Dramas

Oriental scene with footlights, two lower floods, and one upper. The producer is Roger Hayward, Pasadena, Calif. At right: A light with muffin-tin reflector

Popular Science Monthly — July 1936

LIGHT—vibrant, pulsating, atmospheric—is the heart of any stage picture. Much has been said about the intricacy of stage lighting, but it is not really difficult. The fundamentals may be learned in an evening and, so far as the miniature or marionette stage is concerned, the necessary equipment costs little and is easily assembled.

Before considering the practical side, it is necessary to ask just what does light do in the theater. First, it illuminates stage and actors. Second, it indicates, through suggestion, effects of nature, hour, season, and weather. Third, it helps to paint the stage picture through heightened color values as well as by manipulation of masses of light and shadow. Fourth, it lends relief to the actors and to the plastic elements of the scene. Fifth, it helps act the play by symbolizing its meanings and reenforcing its psychology. One light may combine several or all of these functions.

The lighting of a play is a psychological and temperamental matter as far as the audience is concerned. Its effects are as subtle as music. Until recently practically all lighting was direct, the lights being used full blast for comedies and dimmed for tragedies, but stage lighting has become an art and today is one of the most important factors of stage design.

There are two methods of stage lighting: direct and indirect. With the latter there is no glaring illumination, and atmospheric effects can be obtained much more effectively than with the direct system.

If the light is too intense, too brilliant, every illusion of depth is destroyed and under it actors and stage sets appear flat. Depth and solidity are obtained by contrast of light and shadow. Light can obscure any parts of the stage and reveal what it will. If we know how to use it, there is no end to the effects light can achieve.

Light comes from a definite direction, determined outdoors by the position of the sun; indoors, by windows and lamps. Hence in a stage setting the light must have a definite direction. While there may be more than one direction, only one should be obvious.

Stripped to essentials, stage lighting is but a multiplication of a single unit—a housed bulb, a dimmer to control its intensity, and a switch. For the marionette theater almost any lamp with a reflector that concentrates the rays will serve for stage lighting.

One type of flood lamp or "olivette," as it is called, is shown in Fig. 1. It is a sturdy, portable, open box affair. The reflector is a small muffin tin, and the lamp is a tiny 15-candle power automobile headlight. Current is supplied through a small transformer.

One of these flood lamps is used on each side of the proscenium opening, plugged in an outlet at the side of the stage floor. The standards are made of sheet metal (galvanized iron). A strip 1½ in. wide is doubled over to form a slot into which a slightly narrower strip is telescoped on the principle of an adjustable brass curtain rod; in fact, such a rod might be used. A 3-in. disk of lead ⅜ in. thick forms the base to which the strips are secured. All parts are painted dull black with the exception of the inside of the muffin tin, which is the reflecting surface.

Colored gelatin screens can be slipped in back of the crossed wires shown in Fig. 1. These colored screens are fairly durable and quite inexpensive.

THE flood light and the spotlight are often used together, the latter to light the center of stage, the former to give a sort of half light for atmosphere. These lamps may be standing or they may be clamped to bars above the stage or at the side. Such portable lamps are sufficient on our small stages. The bulbs can be permanently fixed as in Fig. 2, if desired.

An effective set of footlights (Fig. 3) can be made by bending a strip of tin about a long block of wood to form a trough in which to set small electric lamps, or a string of

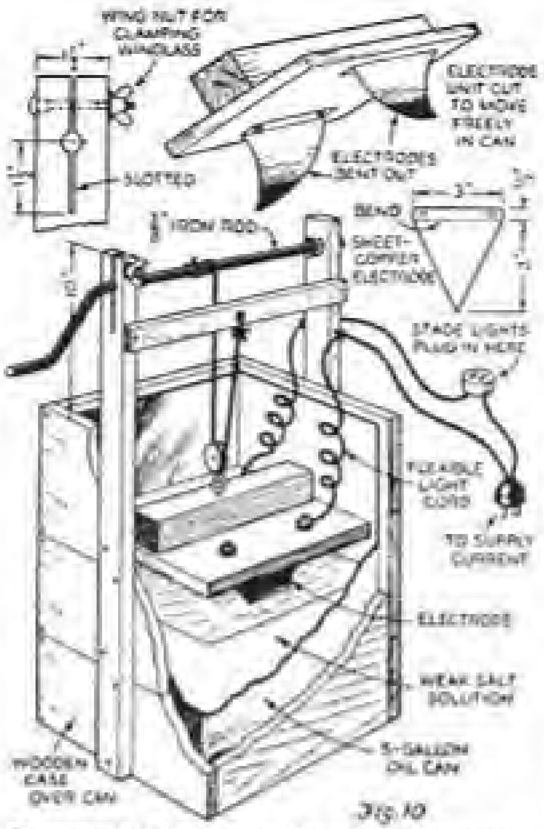
Christmas-tree lights may be used satisfactorily.

Spotlights and flood lights can be constructed from discarded tin cans. It is advisable to make several of these, using a can large enough to hold a 40- or 60-watt lamp when the lid is placed on. With an ordinary can opener cut a square hole in the lid of the can (Fig. 4). Stretch several elastic bands over the lid before it is replaced; they are used for holding the gelatin screens.

The socket, if metal, must be covered with tape to prevent a short circuit. Push the socket through the hole in the can and screw a lamp into the socket, thus preventing it from slipping out of place. A block of wood nailed to the side of the can will keep it from rolling and hold it to the stage floor (Fig. 5). For ventilation a few holes should be punched in the bottom.

Lights of this type may be hung from different parts of the stage if wires are attached to the cans.

Another kind of light is shown in Figs. 6 and 7, made from a pound coffee tin from which the printing has been removed. A hole is cut in the lid, a yoke and a porcelain socket attached, and you have a spotlight. Remove the lid, and you have a flood. The socket, having a piece of friction tape put over the screws to prevent a short circuit, is fitted tightly into one side, leaving the base outside. This raises the bulb so that the light is directly in line with the opening in the lid. A 50-watt clear lamp of the P-19 type is used. It is the same size and shape as an ordinary 25-watt frosted bulb. Paint the inside of the can and lid with a good, heat-resisting flat black (such as black ground in Japan drier) with the exception of the back end, which serves as a reflector. Color slides are slipped into horizontal grooves as indicated.



Homemade light dimmer for marionette stage

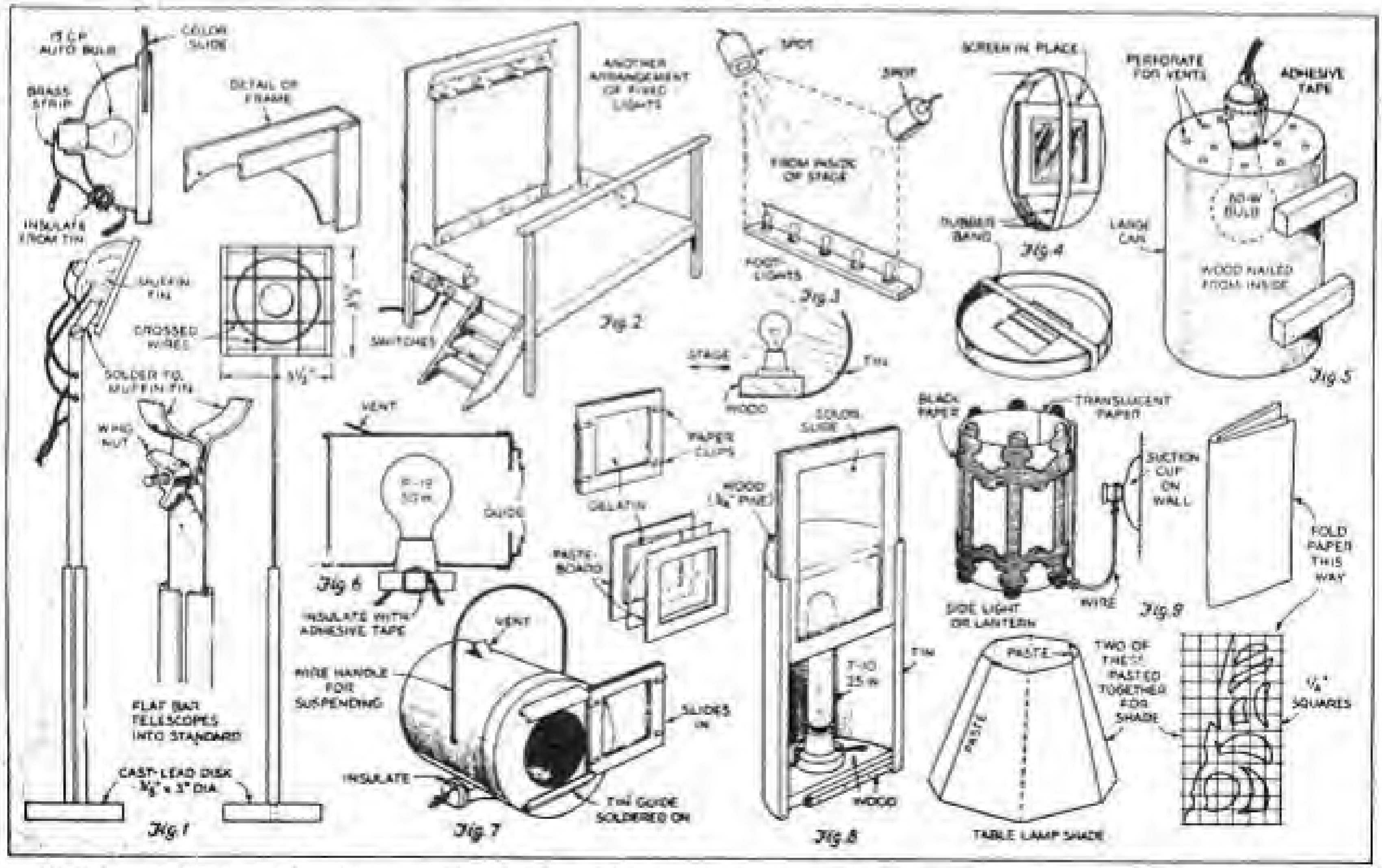
Figure 8 shows another type made to stand on the stage floor. Sheet tin and wood are used in its construction. The toppiece of wood should be covered with tin to avoid scorching.

Individual lamps are generally better than footlights and borders except occasionally when it may be necessary to light a sky cloth evenly for a ground row.

The primary colors of lighting are red, yellow, and green. By combining these in the right proportions, any color light can be produced. This applies to light, not to pigment colors.

Colored lights may be produced by lamps, the bulbs of which have been dipped into colored dyes, or by silk or gelatin screens. The latter today is the more popular method. The screens are easily made by cutting frames of cardboard just large enough to cover the opening in the spot or flood. Two frames are needed for each color, between which a square from a sheet of gelatin of the desired color is put; paper clips hold all together. Electric bulbs of 25 or 40 watts may also be coated directly with dyes sold for the purpose. The lighted bulb is dipped in the liquid and left alight until the dye coat has thoroughly dried.

Color lighting may take several hours of experimenting for a single scene. Ask yourself if the scene takes place outdoors or in, also the time of day and season of year. For outdoor effects use yellow, amber, and white light with an occasional red or blue. The glow of sunset is more colorful and interesting than the garish light of noon. For indoors in a simple cottage or a medieval interior, the lighting should be soft to suggest candles or torches; yellow and blue overhead with red, blue, white, and amber in footlights. A gay scene needs bright lighting. Fireplaces call for a warm light.



Sketches of various types of equipment used by Mrs. Drake. It is essential, of course, that all wiring be well insulated to avoid fire hazards

MYSTERY is suggested by blue and violet lights. An interesting effect is a dark tree that in fancy turns into a white ghost or into a silvery fairy. This may be achieved easily by using two slides, one with the gaunt tree, one with the figure, and slipping these, one after the other, in front of the lamp that floods the light background.

If in a dance you wish large grotesque shadows on the background, use only footlights. These may, if used with discretion, give effects of charm and mystery.

In modern interiors table lamps and wall-bracket lights are often needed. Tiny Christmas tree bulbs may be connected and used under shades made as suggested in Fig. 9. Note the suction cup on the wall to hold the lantern. These may be had for five cents each.

A homemade dimmer, shown in Fig. 10, may be built from a 5-gal. oil can, two pieces of sheet metal, an iron bar, and odd bits of wood. The top is cut from the oil can and a wood base built to set it in. Two wood uprights support a light windlass to raise and lower the electrode unit. By means of a thumb nut the windlass can be clamped in any position. A pulley is used to permit finer adjustment than if the windlass cord were tied directly to the electrode unit.

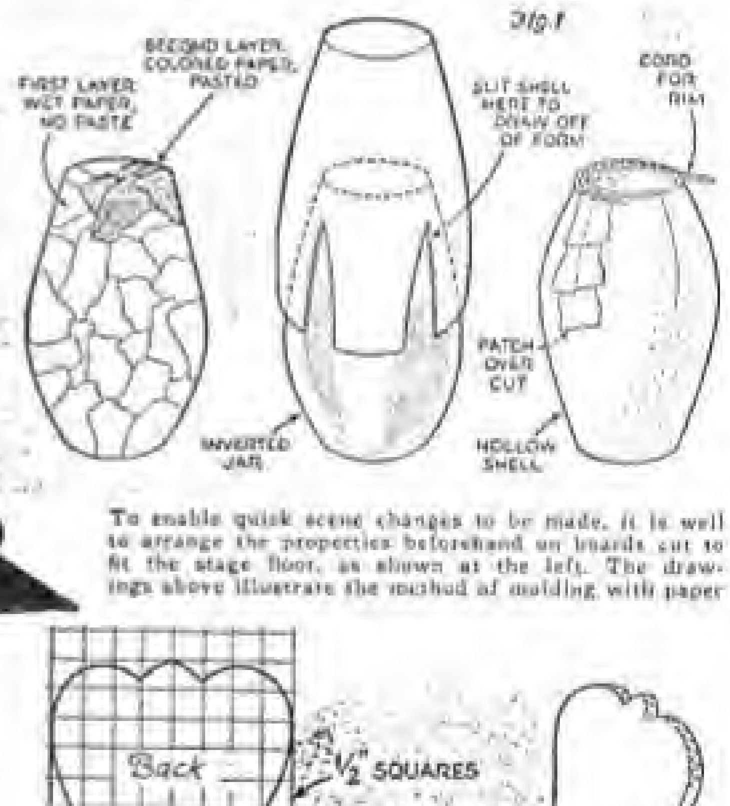
The two electrodes taper down from the top, and the ends are bent out from the center, so that as they are lowered into the weak salt solution more surface is afforded for conductance at a gradually decreasing distance, thus increasing the current. The best method to obtain the solution is to start with plain water and keep adding table salt a very little at a time until the desired effect is obtained.

SHORT CUTS IN MAKING

Properties *for* Marionette Shows

Popular Science Monthly — May 1936

By Florence Fetherston Drake



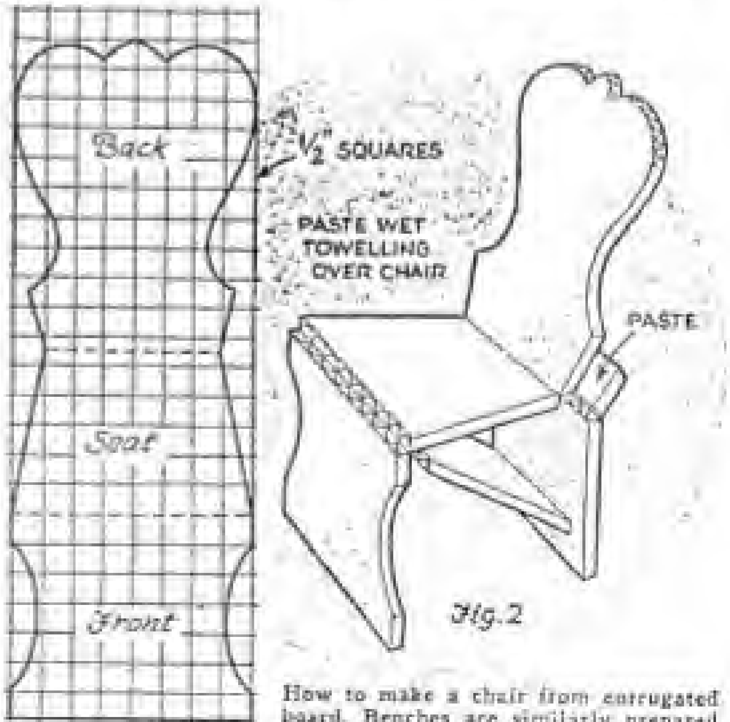
To enable quick scene changes to be made, it is well to arrange the properties beforehand on boards cut to fit the stage floor, as shown at the left. The drawings above illustrate the method of molding with paper

FOR making properties for a marionette stage there is nothing better, simpler, or quicker than paper modeling. Anything from a bird to a large dragon, from a teacup to a throne, can be imitated in this material. The cost is nothing, and the tools required are few.

This method can be combined with the paper-pulp process fully described in a previous article in this series (P.S.M., Jan. '36, p. 57). The equipment necessary is two piles of newspaper, one of white and one of colored sheets, a bowl of thin wallpaper or flour paste, another bowl of water, and a soft flat brush large enough to paint the paste on quickly. The advantage of using alternate white and colored paper is that you can determine how many layers have been applied.

Some kind of support is needed for the wet paper while it is being built up. One plan is to build up a rough armature or skeleton of folded paper, metal, or cardboard, which acts as a support for the object being made. Later it can be removed or not, as desired. The chairs and bench illustrated were made in this way, the cardboard and paper skeleton being retained. Another idea is to use bowls, trays, bottles, boxes, and the like for the foundation. Jars for an Aladdin setting may be made in this way over jars of appropriate size and shape as shown in Fig. 1 of the drawings.

The moist paper can be made to take the shape of any object upon which it is placed. By laying on other strips of pasted paper, the shape will be retained. It forms a stiff substance like cardboard. When dry, the whole is easily removed from the mold. Should the objects used as a mold be of a shape from which the shell cannot be removed without breaking, it may be cut where necessary. These cuts should be made when only two or three layers of paper are in place and



How to make a chair from corrugated board. Benches are similarly prepared when the paper is perfectly dry. Lift it from the mold and carefully join the cuts with pasted paper; then make the shell as thick as necessary, adding perhaps three more layers.

To make the jars needed in an Ali Baba scene, for example, you will require a vase of simple shape about 10 in. high for 12- or 15-in. puppets (see Fig. 1). The newspaper is torn into pieces about the size of the thumb joint. Have a pile of white and one of tinted newspaper so they may be pasted on alternately. Turn the vase upside down and cover the bottom first, working down. The first paper layer is applied wet, but not pasted, so that it will not stick to the shell when it has to be removed later, and it should cover the entire form. Now, with the tip of the paste brush, lift a bit of white paper and apply it to the base of the jar, pasting it lightly. Add another piece overlapping the first, and continue until the entire surface is covered. Start again, this time using the colored paper, and cover the entire surface. Be sure the paste goes on the piece of paper already on the jar. Other dry pieces are added and are brushed with paste when in position until three layers have been applied. It should then be set aside to dry thoroughly, after which it is cut in several places and removed from the mold.

Several other layers are pasted on; three or four should be enough. When dry, the edges of the jar are trimmed and sandpapered. If a rim is desired, it can be made by using a soft, heavy cord, pasted in position around the top. Finally color with red and brown poster paints to give an Oriental effect. Shellac if you wish, though this is not essential. When using these jars, attach them firmly to a plank or to the floor, or weight them with sand.

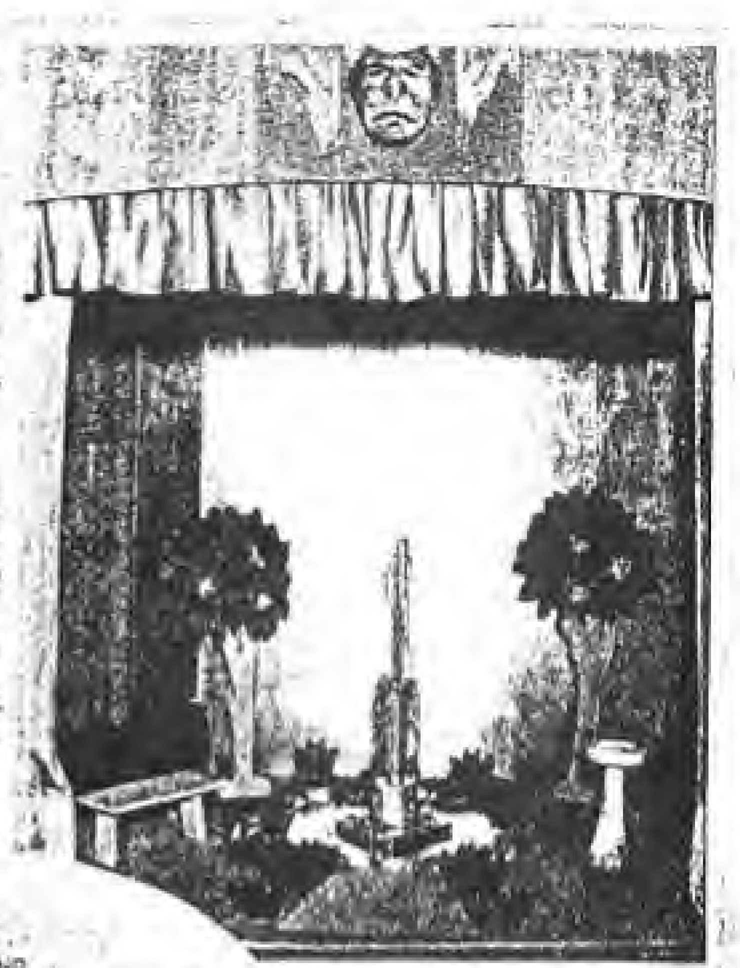
Chairs and garden benches may be made of corrugated pasteboard, then covered with three layers of pasted paper toweling and painted (see Fig. 2).

Molds, when needed, may be articles found around the house or shop, pans or plaster forms, or they may be built of clay, wax, or soap. For larger objects, the frames may be made of cigar-box wood. Balls of paper tied together work out well for certain forms—a pumpkin for Cinderella, for instance.

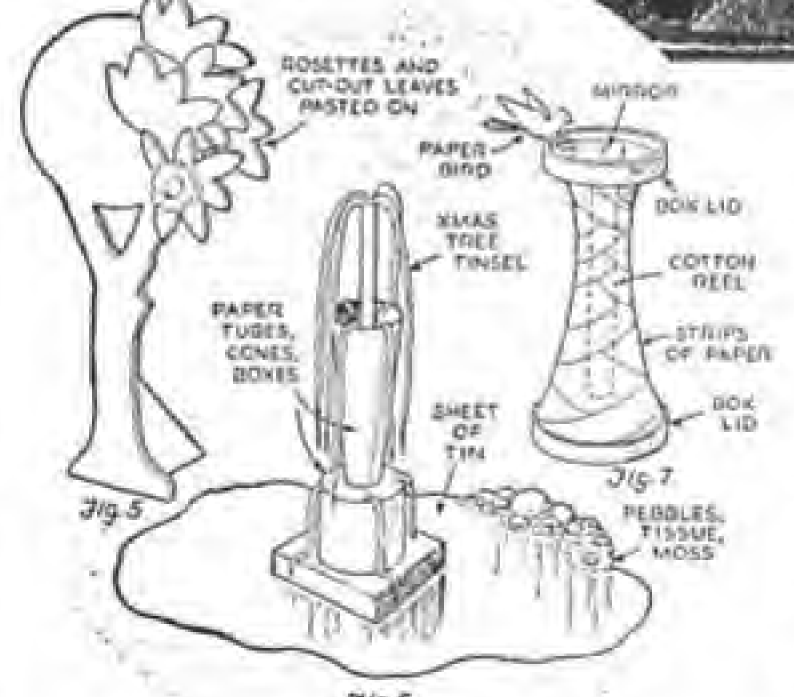
Goose for the circus scene shown at right. The backdrop is white, with strips and disks of bright red muslin sewn on. The clown is able to give a ball-juggling act

It sometimes happens that small objects should be hollow, in which case bags of sand are used, the sand being emptied when the article is finished.

In making animal heads, full-size drawings should first be made, showing front and side views, as was described in an earlier article on making marionette heads. Paper is then crumpled into the general shape and tied. After binding strips have been pasted on to hold the mass, the paper and then the fabric (usually Canton flannel for animals) is pasted on. The goose in the circus set illustrated in one of the photographs was made in this way. To make the neck flexible, small spools were strung



The trees in this scene are flat disks with green paper pasted on, and the pool is merely a sheet of tin. The bird bath is made of box lids, a reel on which cotton had been wound, and a round mirror

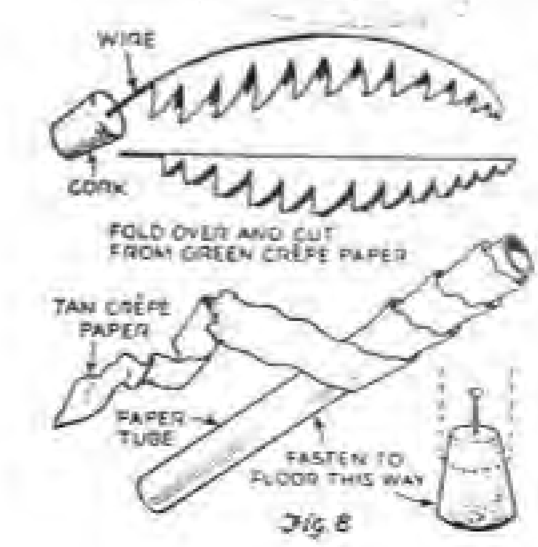


on soft cord and inserted in the throat as in Fig. 3. No paper was pasted here; the Canton flannel over the spools forms the head and neck. Legs are of dowels or wire; web feet and bill of wood colored orange.

Wooden furniture is easily constructed from cigar-box wood, cheese boxes, or thin plywood. Use a coping or jig saw to cut the curved portions (Fig. 4). Toy furniture from the five-and-ten-cent stores may be used if of the right proportions, but not otherwise.

Actual chair seats are about 17 in. high and table tops 30 in., so if your puppets are 12 in. tall, for example, which is approximately one fifth adult size, these small sets should be scaled accordingly; thus one fifth of 17 is approximately 3½, which should be the height in inches of the chair seat. Sizes of bureaus, fireplaces, bookcases, and other pieces should be calculated likewise. Do not bother with small fractions; keep to the general ratio. When using figured fabrics for curtains or hangings, be sure the design is in scale.

The trees



shown in the photograph of a formal garden set are flat disks covered with green paper pasted on and lined with darker color, and a few rosette flowers are added (see Fig. 5). The decorative hedge foliage is made in the same way.

An irregular circle of sheet tin (Fig. 6) forms the pool in this set. It is outlined on the edges with small stones, pebbles, and thin green moss. The fountain is made of various shaped boxes and reels glued together, all silvered and draped with Christmas tree tinsel.

The bird bath consists of two round box lids glued together on a cotton reel, then covered with pasted paper and painted (Fig. 7). A round mirror set in the bowl resembles water and reflects the paper birds.

The coloring of this set is brilliant. The trees, leaves, and hedges are sapphire blue outlined in black; tree trunks, violet; flower rosettes, cerise; all against a silver screen background. This threefold screen is covered with Chinese silver paper. Put paste on the screen, not on the paper, to prevent the screen from being pulled out of shape.

Stained glass windows, which are often necessary for settings of certain periods, are easily made of architects' tracing paper. If the outline of the design is painted with waterproof ink, the colors can be added in the spaces. The black ink outlines give the appearance of leaded glass.

Palm trees (Fig. 8) are made with paper tubes for trunks, a cork being inserted in the top. A 2-in. wide strip of tan crêpe paper is wound diagonally around the tube. A dozen or so wires are cut the length of the leaves, and long slashed leaves of green crêpe paper are folded over and pasted on the wires, the ends of the wires are pushed into the cork, and the leaves are then bent into the required shape. Another cork can be pinned to the floor of the stage and the tube trunk slipped over it.

Peach trees are made of branches dipped in glue and then rolled in wheat flakes, dyed pink. Care must be

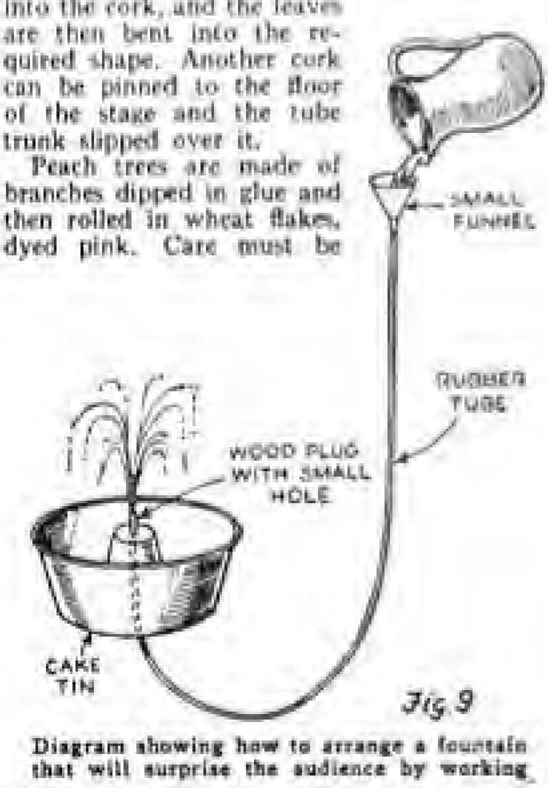


Diagram showing how to arrange a fountain that will surprise the audience by working

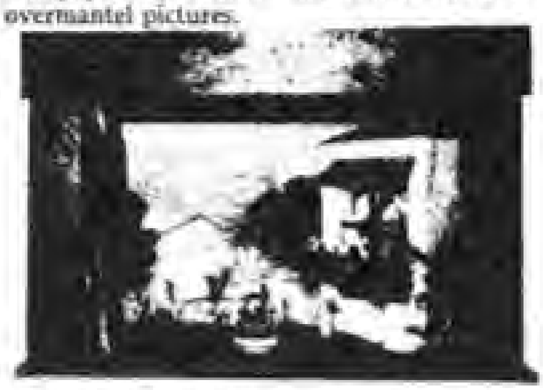
taken, however, that they be placed where puppet strings do not catch. Yew trees are constructed of sponges, dyed green.

In the diagram marked Fig. 9 is shown a working fountain that requires only a cake tin, a funnel, and a length of rubber tubing put through a hole in floor.

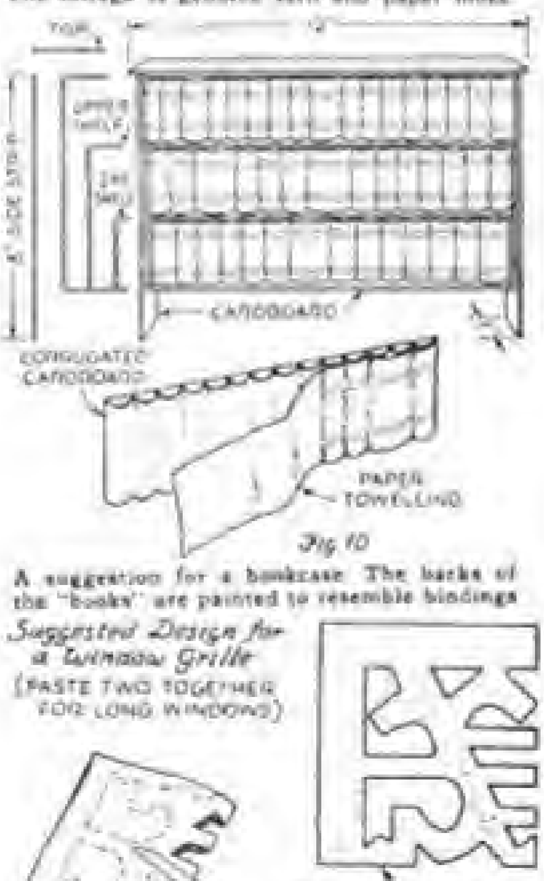
Fireplaces are of many types. A red bulb on an extension cord let down the chimney gives a satisfactory effect of fire, and can be used between logs or among chunks of coal.

Figure 10 illustrates the construction of bookshelves. To fill them, cut strips of corrugated pasteboard 1½ in. wide and as long as the case and apply with the grooved side out. Paste paper toweling over the corrugations, pressing it down between them, first in consecutive grooves, then skipping one, two, or three to represent book backs of different thicknesses. Paint in gay reds, greens, and other colors.

Old-fashioned rag rugs are easily imitated by marking the design with crayons on coarse sandpaper. The same idea can be used for overmantel pictures.



This view illustrates one way to make a garden scene attractive. Note the window box. The foliage is genuine fern and paper moss.



A suggestion for a bookcase. The backs of the "books" are painted to resemble bindings

Grilles in church windows, ornamental ironwork for side lanterns, and the like, are cut from paper as illustrated in Fig. 11 and in the photograph of the church set.

In representing metallic surfaces, do not cover them with metal, but paint the objects brown for gold, gray for silver, blue gray for steel, red-brown for copper. Then apply metallic paint for the high-lights only. Scrumble high-lights over a dark base. For objects of this type, *papier-mâché* is best shellacked before painting.

A stock outside scene may be given variety by introducing a house, which will greatly change the effect. Window boxes are charmingly effective. Glue a long cardboard box, cut in half, under the sill; then fill it with wax or soap in which to stick the wires of artificial flowers. These, like all else, must be kept to scale.

Pot-cover knobs make fine feet for bureaus, chests, and similar pieces. Large brass paper fasteners are satisfactory door knobs. Old-fashioned clothespins cut to suitable length may be used for bedstead legs as well as for other pieces. Miniature glass bottles make good lamp bases.

When stage furniture is made of cardboard boxes, choose cardboard that is so tough and firm it will bend readily without breaking. *Passe partout* binding is useful in this wc. Always draw an exact pattern first, cut this out and lay it on cardboard, then draw around it. A piece of glass is useful on which to score the lines. Keep your knife sharp.

Commercial paste of the so-called "gluey" type is excellent, being easier and cleaner to use than glue and stronger than ordinary library paste. Many pieces can be held gether with brass paper fasteners.

The trunks of palm trees may be made by wrapping 2-in. wide tan crêpe paper around mailing tubes, and the leaves imitated with green paper and wire

Stained-glass window and iron grille. The grille was cut from paper as in the drawing

Hand Puppets

Popular Science Monthly
February 1937

HOW TO MAKE AND MANIPULATE THEM

By
Florence Fetherston Drake

A puppet theater can be set up in a doorway, in this case a wide one with folding doors. Mother and son are presenting a Christmas play

Head and arms move when you wriggle your fingers, and your wrist serves as a very flexible waistline

HAND puppets are simpler to make and easier to operate than string-controlled marionettes. They have the additional advantage of being able to present a drama on the simplest of stages or on no stage at all—a window, a door opening, or even a

 THE SURVIVOR Vol. 1

break in the shrubbery outdoors.

The body of this kind of puppet or guignol is really the hand of the puppeteer inclosed in a cloth bag. Arms and legs, if any, are attached to the bag. The shortness of the arms and the queer anatomy, which must be disguised by drapery, are handicaps, to be sure, but anyone who intends to take up puppetry seriously should try both types before deciding which suits him the better.

Even very young children can be taught to make hand puppets from paper pulp or rags and produce entertaining little plays. In fact, no matter how they are made, hand puppets seem to be born, as it were, with a genius for acting.

Their size, which is determined by the human hand over which they are stretched, varies but little. The usual height is 18-in. —the length of the operator's forearm and hand plus half the length of the puppet's head. The heads are generally 4-in. long, including the neck. The width of the shoulders is the space between the operator's thumb and middle finger. His wrist is the puppet's waist.

Heads for hand puppets are made in various ways, but in all cases it is necessary to prepare rough sketches, actual size, for both profile and full face. Paper pulp may be used as described for marionettes in a previous article (P.S.M., Jan. '36, p.57). The stick which forms what is called the armature must be a trifle larger than the operator's forefinger, so that when it is removed and discarded, the head will fit on the finger easily and comfortably. In this case no extra tube is needed.

Wooden heads may be made as shown in the drawing of Mr. Punch. The center is cut from soft wood with a fret saw, and the four thicker pieces for the sides of the head and the cheeks and ears are whittled to shape, sandpapered, and then glued or nailed to the centerpiece. Depressions are filled with cotton batting or similar material soaked in paste, or with paper pulp, and finally covered with stockinet drawn tightly over the whole face. Stitches to accent the features are sewed here and there with a large needle and stout thread, and these also hold the covering.

Choose a brownish flesh-color stockinet for Mr. Punch. When rouge is rubbed on the nose and cheeks, and a few lines of black crayon are added, this will give the desired effect. The cap is made of felt and the costume of gayly colored fabrics.

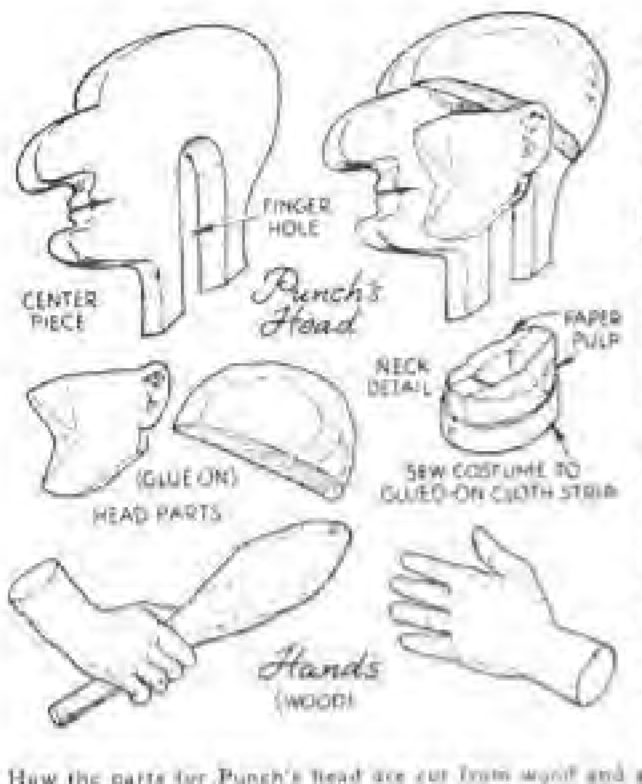
The head can, of course, be whittled from a single block of wood, in which case the hole for the forefinger is gouged out. It must reach halfway up the head.

Another delightful and simple method is to carve the head from a large potato or turnip. Cut the features boldly; exaggerate them. Large noses are cut separately and held on by pins. All will be greatly softened when covered with paste-soaked paper toweling (see P.S.M., May '36, p. 20). Five layers of paper will be found sufficient. Alternate the layers: first a layer of soft newspaper, then one of tough paper toweling. The toweling should be the final layer because it gives a fine surface for painting upon. After this has dried thoroughly, which may take several days, the potato is carefully dug out, leaving the hollow head. Fill the front with sawdust mixed with a little whiting and glue; then plaster the entire inside of head with this mixture and while it is still soft, insert a suitable tube, letting it reach to about the eyes, which are in the middle of the normal head.

A tube foundation is needed for other types of hand-puppet heads. Simply make a cylinder of tough, flexible cardboard from 2 to 3 in. long to fit loosely over the index finger. Wrap and tie the tube with strong string, and cover it with several layers of paste-soaked paper toweling until it fits snugly into the neck of the head. When dry it will be found securely anchored. Around the base of the tube it is advisable to add a

Below: Policeman with stuffed head and leather hands, Toby the dog, and a doctor with stuffed rag head and hands of felt. The sketches at right illustrate a variety of methods

At right above are a stick puppet after the Javanese (carved from balsa wood); Mexican character with an unpeeled potato for a head; Scaramouch with a potato head covered with paper pulp; and, in the foreground, potato-carved head plastered with paste-soaked paper



How the parts for Punch's head are cut from wood and assembled; sketches to aid in carving his hands, and, above, a photograph of Punch, Judy, and the baby ready to perform

come entangled. For jeweled headdresses, use colored gum drops pinched and cut to form the jewels of the crown. Rub the sugar coating off a bit so as to show the rich color beneath.

Hands, too, are made from a variety of materials: Carved wood for wooden-headed puppets as in the drawing of Mr. Punch. Wood pulp or cardboard, either covered with cloth or left uncovered. Wire covered with tape (see P.S.M., Feb., '36, p. 64). Felt or leather, folded and sewed as shown in an accompanying drawing.

All hands should be fastened into cardboard tubes from

1 to 1½ in. long, made to fit the thumb and finger tip. Finally, the hands must be firmly fastened into the sleeves of the costume. Puppet arms may be elongated by means of additional cardboard tubes placed over the fingers.

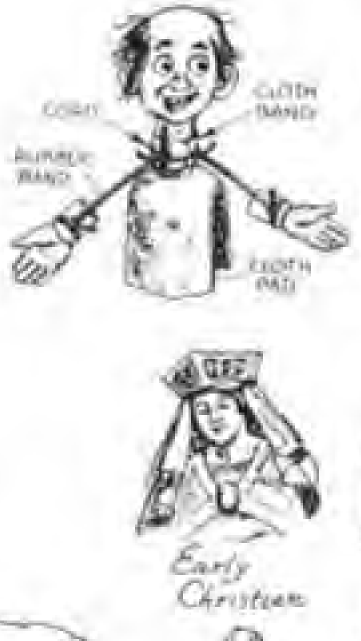
For finishing the various parts, tempera paint is preferable to oil paint because it dries without any glow; poster paints answer well, too. If oil paint is used, mix it with turpentine to dull its gloss. Two or three coats

may be necessary.

eyebrows and lips. Add last a touch of shellac or glue to eyes and teeth to make them glisten.

For a hand-puppet theater three things only are essential: a screen or a curtain to hide the operator, a background (curtain or back drop) to make the figures and faces stand out, and a strong light arrange above and in front to shine directly on stage and puppets. While a makeshift theater can be arranged in a window or a doorway, it is advisable to have a well-planned stage on which various experiments in scenic and lighting effects may be tried out.

Nothing is better suited to this type theater than a threefold screen. For the uprights, get six lengths of ¾ by 1¾ in. by 6 ft. 6 in. pine or cypress, dressed on all four sides. For the crosspieces of the two end frames, you need four similar strips 3 ft. long; and for the crosspieces of the center frame, obtain four pieces 3 ft. long. Make a full-size drawing of the ornamental toppiece *A* and the floor-piece shelf *B*, both of which should be cut from ⅝-in. thick wood. These, as shown in the drawing, are made to come off so that the screen will fold flat. Six double-swing screen hinges hold the panels together.



Suggestions for making characteristic headdresses to represent various historic periods

roll of soft muslin. This is sewed to the tube with a large needle and carpet thread. To this the garment is to be attached.

Hair, and the headdress as well, can be modeled on with pulp or carved in wood. Cotton or rags wet with paste give good effects. Wigs and beards can be made from almost anything—frayed rope, fringe, zephyr, raffia, cloth, and even metal pot cleaners. Anything, in fact, is better than human hair. Heroic personages demand sculptured hair. With hand puppets, the most elaborate headdresses can be used because there are no strings to be-

Coloring can give as much expression as modeling. In emphasizing expression, make sure that it, as well as the color, carries across the room. White, yellow ocher, and a touch of vermilion give a normal complexion, with accents of red added to the corners of eyes, nostrils, and ears. Use blue or violet shadows in eye sockets, and sweeping dark lines for

The side panels and the lower part of the center panel may be filled in with a lightweight fiber wall board or with sateen gathered on brass rods at top and bottom. Use your taste regarding the color scheme. The frame should, of course, be painted in harmony with the covering. Three screw eyes are used at each side of the top strip of the side panels to take metal rods or heavy wire. These wire braces hold the wings rigidly and also support the back drop and drapes for either a deep or a shallow stage, as need be.

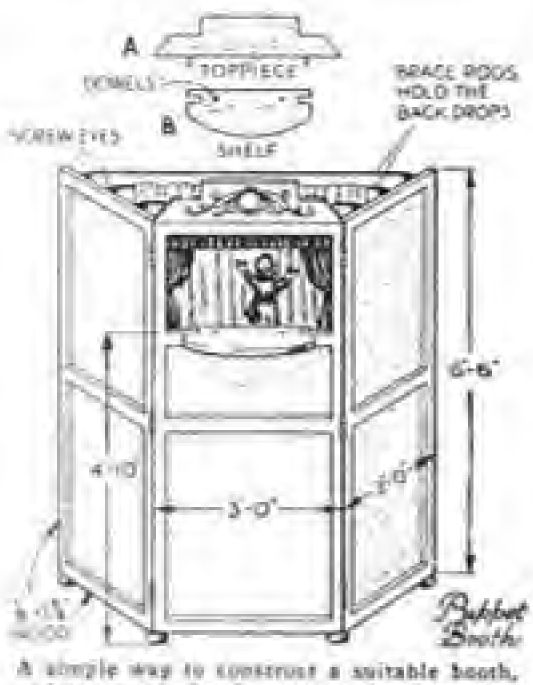
In hand-puppet booths, where most of the floor is trapdoor, furniture, when used, must be prevented from falling through. It should be mounted on thin pieces of wood and attached to the apron (shelf *B*) or to a strip of

Puppeteer Seated and Standing

wood across the back of the stage with iron turn buttons or small wing nuts, which can be screwed to the stage floor in convenient places. It takes only a moment to turn these fastenings over the edge of the thin wood.

The costume should be large and long enough so the operator's hand is not crowded for room or his wrist left exposed. The bending of the wrist (the puppet's waistline) is flexible enough to represent a variety of movements.

The clothes and body of a hand puppet are, of course, one and the same thing. The foundation garment is a straight skirt or shirt about 13 in. long and 18 in. wide, doubled. Gather or pleat the material around the neck, and then sew or tack it about the throat of the puppet. Before doing this, sew in the right sleeve 1 in. down from the neck and the left sleeve 2 in. down, because the middle finger forms the right arm and the thumb, the left. This, of course, must be reversed if the puppet is used on the left hand.



A simple way to construct a suitable booth, and two methods of operating hand puppets

A small cushion or block of wood is often hung by tapes to the puppet's neck in front so that it can be held firmly by the puppeteer's two unused fingers. This contrivance holds the puppet's head and body more firmly and also makes its chest more shapely. Capes, collars, and scarfs improve the effect of the arms, disguising their short length.

Headdresses are very important. They can add distinction and character, as well as indicate the country and period.

Gestures must flow smoothly one into the other, without haste. Study gestures before a mirror. Time must be given to study, experiment, and rehearsal. Only the puppet who is speaking should move. Let there be no movement lacking in meaning. A serious fault is to hold the puppets too low; let them enter with all the body visible. The action should be down stage, and the puppet must be held vertically.

The length of the play should be from ten to twenty minutes. Have no monologue over fifteen or twenty words. Appropriate music is the salvation of many a performance.

The height of the platform determines whether you operate standing, kneeling, or sitting. Many now are experimenting with the latter position and find it less tiring. A semitransparent back drop is used, and through this it is quite easy to see the puppets although the manipulator himself cannot be seen. There should never be any light back stage.

Most holiday *productions need just two finger puppets at a time. Let the children make their own puppets—for their favorite stories—and their plays will have special appeal*

These are finger-tip puppets

Sunset — Dec. 1960

Small children enjoy performing at home with these finger puppets and miniature stage as much as they delight in acting in Christmas school plays.

The stage is just a cardboard carton from the grocery store with its top cut off. It rests upside down on four ¾-inch dowel legs, so the operator's arm will have ample room to move from below. Staple the legs up the inside edges of the box. Cut the stage opening from the front of the box with a sharp knife, and reinforce across the bottom with a glued-on piece of yardstick. Paint the inside of the box black, and cover the outside with burlap or other fabric. A cloth drape, stapled to the front and two sides, hides the stage legs and the operator's arm.

Bodies of the puppets are obtained from

the pasteboard cones that are used as string bobbins, or from rolled-up and glued cones of construction paper. Paint them or costume with cloth scraps. Adding small bells gives them a gay sound. Any household glue will hold the sequins, cotton hair, bead eyes, and hats.

Puppets *can be as simple or elaborate as the children wish. Black back of stage is decorated with gummed metallic stars*

Heads *are styrene foam balls. Other materials are cloth scraps, pipe cleaners, cotton, sequins, tiny bells. Four puppets can be operated on one hand—with practice*

It's easy *to decorate the puppets' wax-covered heads; there's no need to use glue*

To give finished head *a lifelike look, make shallow cuts to form features; round off jagged edges with side of knife blade*

These are paraffin puppets

Sunset — December 1968

Puppets like this twosome make nice additions to any puppet theater and are surprisingly quick and easy to make. Good "stocking stuffers" for small children, they require little more than scraps of yarn and fabric, styrene foam balls (available in most variety stores), paraffin, an assortment of buttons and beads—and, of course, imagination.

To make the puppet's head, carve a hole about 1¼ inches in diameter and about ½ inch deep into one end of a medium-sized styrene foam ball (about 3 inches in diameter). Shape a neck out of a piece of lightweight cardboard (about 1½ by 4 inches); roll and tape it into a cylinder and push it into the carved hole.

Using a small kitchen knife or the sharp edge of scissors, carve eyes and nose in the styrene foam. (Or you may want to make features out of felt scraps or but-

Impale *puppet head on a pencil point for easy dipping in wax. Spin pencil between fingers to even wax coating, hasten drying*

Attach *yarn hair and other features to head with a little molten wax; hold them in place with pins until the wax hardens*

tons and attach them with molten wax as a finishing touch to your puppet.)

Melt a bar of paraffin in the top of a double boiler, or in a coffee can placed in a saucepan of boiling water. Add a small piece of orange crayon, stirring wax until it assumes an even flesh tint.

Dip the head in wax, making sure it is completely covered; remove and wait a few minutes for wax to harden. Repeat dipping and drying until head acquires a thick, shiny surface (about six or seven times).

Attach yarn hair and button eyes to the head with molten wax, securing them in place with pins until wax is set.

Cut out and stitch seams of the puppet costume, leaving opening at top large enough for cardboard neck.

A piece of felt protruding from the base of the head makes a convenient tab for stitching costume to head. To make a tab, wet the center of both sides of a felt square (about 3 inches square) with white glue. Remove card cylinder from head and place felt square over one end; push this covered end into hole. Let stand until glue sets (about 30 minutes).

Slip costume over the neck and stitch it to the felt tab.

You shape, bake, paint baker's clay

Sunset — December 1968

Baker's clay, an inedible dough, is a material used in the very old art of ornamental baking. Painted with water colors and sprayed with clear plastic or lacquer, it makes Christmas ornaments that have great charm.

To make the clay, combine 4 cups of unsifted flour, 1 cup of salt, and 1½ cups of water in a bowl. Mix well to form a stiff dough (add more water if necessary), then remove to a board and knead for about 5 minutes.

Use a rolling pin to roll the dough out to ⅛-inch thickness (don't make the ornaments too thin), then cut the shapes with a knife or cooky cutter. Lift each one to a cooky sheet and decorate with little balls or ropes of dough or use any handy kitchen tool to create textures—for example, dough pushed through a garlic press for hair or evergreen branches. Finally, make a hole with a pencil point at the top of the ornament for a hanger.

Bake the ornaments in a preheated 350° oven for about 1 hour or until hard—use a tester to be sure they are done—then remove from the oven and transfer to a rack to cool. To finish, paint the ornaments with water colors or poster paint, then give them a coat of clear varnish, lacquer, or plastic. This will prevent their getting soft and spoiling. NOTE: *Don't try to double the dough recipe, and use it up within about 4 hours.*

DARROW M. WATT

Cut shapes *from dough, decorate, bake*

HOW TO CUT YOUR FOOD BILL BY HALF OR MORE

Prices here are from 1972

by Kurt Saxon

I've had feelings of insecurity about food for as long as I can remember. It was my jerky dad's fault. He left our valley and our wonderful peasant heritage to join the wretched ranks of the proletariat.

I was a Depression baby, born March 6, 1932 in Wichita. Dad was a peanut roaster at Jett and Wood's. The place naturally went bankrupt. Then Dad packed the family from one town to another doing what factory work was to be done before each place folded.

This went on until 1938 when Dad sent Mama, Winnie, Billy and me to Grandma Dodson's farm somewhere in Darkest Arkansas. It was night when we got there and I remember I was yelling and screaming about something and generally out of sorts.

Grandma stoked up the wood stove and prepared us a quick meal of corn pancakes. They were made of eggs, real butter and whole corn meal. She soon had a pile of them so high I couldn't see over them. I couldn't remember seeing more food on the table than we could eat so this was amazing.

Those corn pancakes were as big as plates and covered with butter. I never tasted anything so delicious and was never so happy. I went to sleep somewhere in mid-bite and even dreamed of corn pancakes.

For breakfast there was a big plate at my place with biscuits opened and covered with good flour gravy. There were all the eggs I could eat and pounds and pounds of bacon and big glasses of churned buttermilk. There was also lots of oatmeal which I managed to not have room for, being quite used to plenty of that.

After breakfast I tore outside to be further amazed at all the food running loose. There were chickens in the yard, real ones with feathers on, not like those at the butcher's, hanging upside down and all naked.

Grandma went out with a hatchet and chopped the heads off two big ones for dinner. She served them Southern fried in a way that would have made the old Colonel hide his head. And with the chicken were big blocks of steaming hot corn bread. I would crumble it up and ladle out great dips of pinto beans in lots of rich bean soup on the corn bread and watch it soak in and the steam rise. Fantastic!

That afternoon I went out and killed six chickens. We had chicken in every way Grandma knew how to fix it for several meals. I was delighted.

A few days later we went down the road to visit Mama's brother, George. He had a lot of goats; an animal I didn't know existed.

My little cousin, Jenny, led one up a ramp and milked it into a tin cup. I tasted the milk and liked it. I asked her, "Jenny, what kind of dog is that?" She answered, "This here's a goat."

Later, I called my older brother aside; he was eight. I said, "Billy, these here goat dogs are great. Ain't nobody in Brooklyn ever heard of them. What we gotta do is take some back. We can corner the market in dog milk."

After Mama got finished visiting her people we went seven miles away to my Granddad Saxon's valley. He seemed to own the whole world. He had his own flour mill, saw mill, blacksmith shop, country store, post office, winery and even something brewing up the hill in the forest.

Naturally, he had his own farm with lots of every farm animal known to man. He raised every bit of his own food and only bought things like salt, sugar, spices, etc. And what he bought, he got wholesale from his own personal country store.

Grandma baked all the bread and canned all the food for winter. She still had time to mess with us kids. For awhile she couldn't understand Brooklyn and we couldn't handle much Southern. But we made out pretty well by pointing and grabbing.

The place that fascinated me most was the storm cellar. This was a great concrete bunker about ten feet by ten feet inside. It was lined all about from floor to ceiling with shelves of double rows of quart jars of food.

There were even bedrolls and a lamp so people could stay all night there. It was used mainly for storing food. As a storm cellar, it was naturally used for staying during heavy storms and was used also by the hired hands and my cousin Valerie.

I will never forget the oodles of quart jars of sausage patties on the shelves. There was every other kind of food down there but it was the sausage patties that really grabbed me.

They were half cooked and put in jars and covered with fat. That way they would keep for years and when fully cooked they tasted like they had been put up the day before.

Their aroma would really wake us up and get us out of bed. Their quality was so great that there is nothing on the market today that I would care to eat. Such a comparison is not just an exaggerated childhood memory, either.

Modern sausage is mostly fat and the lean is scraps and garbage. It is either tasteless or over-spiced because the pork is inferior. Even the best advertized is rubbery and over-spiced.

HOMEMADE SAUSAGE

Mrs. Curtis' Cookbook, first published in 1908, gives this recipe for sausage: "Take lean young pork 1½ pounds tenderloin, the rest any lean cut, 4 pounds, and fat, 2 pounds; put it through a sausage grinder — twice, perhaps three times, until of the desired fineness. Use for each pound of meat 1 teaspoonful powdered, dried leaf sage, 1 teaspoonful salt, 1/3 teaspoonful pepper and 1/3 nutmeg; nutmeg may be omitted if preferred. A quantity of sausage may be made at a time and preserved for regular use if one has a cold storeroom in which to keep it. It should be packed in jars and covered an inch thick with melted lard, which will preserve it."

Grandma used the same recipe as Mrs. Curtis and omitted the nutmeg.

To Mrs. Curtis and my grandma, young pork was from eight to ten months old, as opposed to a rutting boar or a farrowing sow. In 1960 the average age of a butchering hog was five months. Today the average age is only four months. This is simply not long enough for pork to acquire a decent flavor.

Economy prevents modern sausage makers from matching the cuts in the recipe. Even if one tried, the pork is too young to have good flavor. Hence, the spice pollution.

My grandma would have destroyed the best pork sausage you can buy. She wouldn't even have fed it to her own pigs. The pig in the modern sausage was injected with growth inducing hormones. The grain, while in the field, was sprayed with insecticides even while it was absorbing last year's insecticides from the soil. Chemicals from every angle. Yech!

While I'm on underaged, tasteless, polluted meat I'm going to level on chicken. American chicken is marketed at only eight weeks. No wonder the Colonel needs eleven herbs and spices! According to James Trager's "Foodbook", in France it is against the law to market chicken before twelve weeks. There, some poultrymen feed their flock for up to ten months. These, they advertise as top quality, *full flavored birds.*

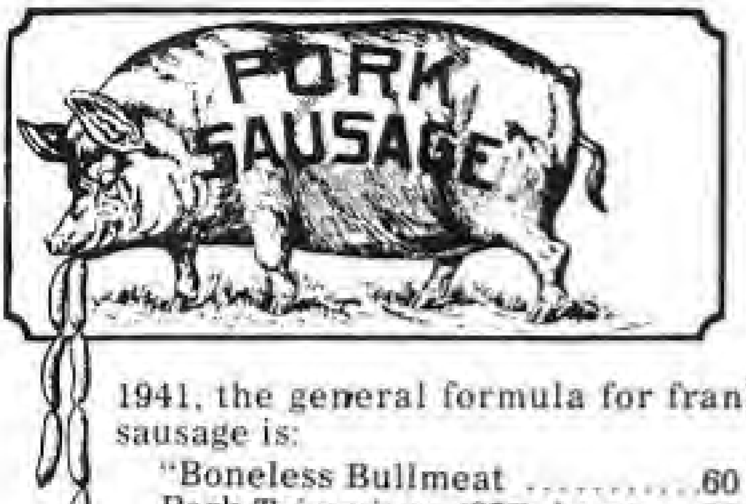
Our chickens get an even greater amount per pound of growth forcing hormones and chemicals than do our pigs. Until the growers shape up, you should boycott chicken in all its tasteless forms. You should especially keep your kids from eating it.

Another food that has been ruined is hot dogs. When I was a child in Brooklyn Mama would buy us each a nickel hot dog every Sunday after church. They were indescribably delicious. But real hot dogs, too, are a thing of the past.

The ones they make now are tasteless and nobody's idea of a treat anymore. They also average a ridiculous cost of 87¢ a pound. I can remember their taste declining even in the past five years.

Modern hot dogs are only 13% protein and they are 26% fat. Modern hamburger is only 19% protein and not much tastier.

In "The Chemical Formulary", copyright



1941, the general formula for frankfurter sausage is:

"Boneless Bullmeat .... 60 lb
Pork Trimmings (95% lean) ... 20 lb
Regular Pork Trimmings ...... 20 lb"

It is obvious that the Boneless Bullmeat and the Regular Pork Trimmings were also very lean when you compare it with the next recipe. This is for "Griddle Franks: Sausage manufacturers have a demand for 'frankfurts for the griddle' from lunch stands and restaraunts. The main difference between the formula for this product and any other frankfurt is that there must be sufficient fat to keep the sausage from sticking to the hot griddle. To make such a frankfurter, use about:

Boneless Bullmeat .... 60 lb.
Pork Cheek Meat .... 20 lb.
Pork Trimmings .... 20 lb.
(Not Too Lean)"

Can you imagine a modern frank maker having to be cautioned against using too much lean?

I'll bet their "Griddle Franks" didn't even have the 26% fat our regular franks have.

As you can see, again, my memory of childhood hot dogs being delicious was not an exaggerated childhood memory. The quality was definitely better.

A general cure for these real hot dogs was "2½ lbs. of fine salt, 2 oz. granulated sugar, 2 oz. dextrose (corn sugar), *2 oz. nitrate of soda, and ¼ oz. sodium nitrite* for each 100 lbs. of meat."

I'll bet there was as much as ¼ oz. of sodium nitrate in a 1½ pound can of beef stew I discuss further on.

On keeping the product germ free: "Sliming usually follows sweating, since the moist surface of the sausage provides a good field for bacterial growth. Careful handling after cooking and maintaince of sanitary conditions in sausage rooms and coolers will prevent bacterial infection of the product."

To avoid the trouble of proper sanitation, modern hot dog makers just fill their garbage with sodium nitrate and sodium nitrite. Some replace the sodium nitrite with sodium ascorbate.

Concerning the color of the real hot dog of my childhood: "Interior discoloration of the sausage is generally due to contamination of the meat, development of which may be traced to 'short' or under-cured materials, heating during processing, poor sausage room conditions and low interior temperatures during cooking and smoking."

In those days a good color was maintained by proper sanitation and careful processing methods. Today they maintain the color by filling the franks with sodium erythorbate, a red dye and preservative.

As you may have noted, the "*2 oz. nitrate of soda and ¼ oz. sodium nitrite* for **each 100 lbs.** of meat" was for curing. No chemicals were added either as preservatives or dyes.

Now let's get on to plant products. Before they leave the field or orchard, grains, vegetables and fruits are subjected to ever increasing dosages of insecticides.

The spraying kills most of the bugs on a given crop. A few of the bugs, however, are strong enough to tolerate this dosage. With their inferiors killed off, these stronger bugs multiply and fill the field next season.

Since last year's dosage is simply treats and goodies to this year's brood the dosage must be raised. This year's dosage will kill most of the stronger bugs but they too will have produced a few even hardier offspring. And on and on.

In a few short years, maybe two or three, the bugs will be so immune that the dose it takes to kill them will also kill the plants. Soon, if you don't thoroughly wash a head of lettuce, the residue on it may kill your whole family.

Even today, the tissues of this year's plants have absorbed last year's insecticides from the soil. Their outsides are coated with this

year's insecticides. The benefits are naturally passed on to the consumer.

Now for a quickie on the chemicals purposely put in food.

Foods are messed with and chemicalized mostly as a convenience to the processors. For instance, grinding grains by steel grinders is faster than by stone grinders. The furiously whirring steel grinder generates heat which destroys a lot of the nutrition.

If there is a choice between a saving in time-money and nutrition, nutrition is sacrificed. The processor believes you are stuck with his product anyway so it's no skin off his nose.

This book will show you how you are *not* stuck with his garbage.

After convenience processing comes cosmetic processing for appeal.

Flour is further damaged by bleaching. Bread in Britain and Germany is grayish - unbleached and better nutritionally. But American bread looks nicer.

To replace the vitamins destroyed by steel milling and bleaching, processors put in synthetic "vitamins", chemical compounds of little proven value and possibly harmful. They call this worthless stuff "enriched" bread.

Luncheon meats and many other foods are dyed to make them prettier. The dyes are often harmful and many are actually poison. But these poisons are not thought to be strong enough to be harmful in small quantities.

A third processing atrocity is the poisons they put in foods to retard spoilage. Bread, cookies, cakes, bagged and boxed snacks and again, luncheon meats.

These aren't poisoned for you. They are poisoned to increase their shelf life. This is done so they won't rot before your eyes in the store. Otherwise the store owner would have to send the garbage back to the processor and demand a refund.

A sick example is instant mashed potatoes, which, if properly packaged in moisture-proof plastic, should keep indefinitely. Yet, look what they put in them: "Ingredients: Idaho Potato Flakes, mono and di-glycersodium Sulphites, citric acid and BHA to preserve quality."

And what about the preservatives in canned foods? Canned foods are supposed to be heated to a certain temperature and maintained at that temperature until there is no possibility of any germ being left alive in there. The processor's responsibility ends when you open the can.

When the can is opened you normally use the contents in the present meal and put any leftovers in the refrigerator. Where is the need for preservatives at any point of this cycle? How come sodium nitrate, sodium nitrite, sodium erythorbate, etc.? Could it be that potentially harmful chemicals are cheaper than the amount of fuel it takes to guarantee a thorough job of sanitary canning?

I remember once using a 1½ pound can of beef stew. I put it in a frying pan and heated it up. I then ate half and put the other half in a jar for lunch.

When I came home that night I was shocked at what I saw in the unwashed pan. Across the bottom there was a thick crust of crystals. It was just like heavy frost patterns on a winter's window. I never ate any of that polluted swill again.

And then there are the canned foods, mostly beans, which have no preservatives. This is promising but then they say, "Disodium EDTA added to preserve color". But who needs it? I've seen a lot of home canning and I've yet to see any color change so drastic as to justify the addition of chemical fixatives or dyes.

Food processors have been using preservatives and dyes for a hundred years and more. The difference between the old days and now is that Grandma prepared most of her family's food and used very little processed foods.

She occasionally got the same, or worse, garbage when she opened a can but she opened so few cans that her family ate very little non-food matter.

Further on is a section from Mrs. Curtis' book which tells about preservatives in foods in 1908. It gives methods of testing for preservatives and dyes with the obvious intention of not buying any more of the polluted products. If homemakers rejected relatively mild preservatives in 1908, why should you tolerate the real poisons in today's foods?

Today, everything you eat is messed with. It is chemically treated while it is being grown and processed. Then it is preserved for shelf life and even when it is canned.

Any one chemical, by itself, in a serving, should be as safe as the processors claim. But coming at you all at once, in everything you eat, there can be no guarantee for your safety.

Since I am on chemicals I will include the sodium fluoride put in our drinking water. This stuff was used mainly for rat poison until better rat poisons were developed.

Sodium fluoride is a waste product from various chemical manufacturing processes.

Faced with the choice of polluting the streams with it or selling it to ignorant city councilmen, the manufacturers naturally chose to sell it. That's their idea of recycling waste matter.

They created an emotional issue concerning a planetary crisis caused by children's teeth cavities. They fed this to a lot of gullible types. These people sincerely believe that it is worth polluting everybody's drinking water in order to save the teeth of a tiny percentage of children too lazy to brush.

Sodium fluoride, even at one part per million, dulls the creative part of the mind. It has also been proven bad for older people. It is of no benefit to anyone over seven or eight whose teeth have stopped growing. And finally, it could be dispensed by pill to the children whose parents want them to have it. The cost would be only about $3.00 per year for each child.

But you pay for it, you drink it and you are getting sicker and sicker. This is a good example of the polluters using the loving types to further enrich themselves at the expense of our health.

The fact that you take in a few doses of these chemicals and don't drop dead doesn't mean they are harmless. They work on most people over a long period of time.

J.I. Rodale, in his book, "Food and Nutrition", says, "Diseases unknown a hundred, or even twenty-five years ago are now so prevalent that foundations have been established to study them".

These ailments have appeared and grown too rapidly to be blamed on heredity or even on living longer. The only explanation is the polluted garbage sold as food.

Possibly due to the growth hormones in most meats, kids grow faster these days but they are dumber and more neurotic than their parents were at the same age. Also, many kids are too shook up to take advantage of a college education.

To a large number of our youth, the college is only a platform for some idiotic protest of some issue over which they have absolutely no control. Hundreds of thousands have wasted whole semesters, dropped out, taken to drugs and become unemployable bums.

Another thing you might consider is the adults' heavy use of prescription drugs. Adults of twenty years ago didn't need them to the extent that they do now. These adults have been blamed for setting a bad example which has caused young people to turn to illegal drugs to help them face their own problems.

I'm convinced that the greater part of the drug problem, both for adults and our youth, is the food additives. They have induced a nationwide anxiety neurosis. It is anxiety which causes the adult to get a prescription for tranquilizers and his child to go to pot. If the kid still feels ooky and out of it he goes to the hard stuff. For the same reason, his parents become drunks.

Heredity is no answer to the epidemic of mental and emotional problems which have hit us. It is impossible for a whole generation to change that much through genetics.

This entire century has been one of war and social strife and my generation was naturally fearful of the biggy, atomic war and its fallout. But this present generation is the only one which has come apart.

All we can do about the food pollution is to boycott and yell. But by vigorous protesting we should be able to keep the processors from putting more chemicals in the finished food. Protest to store managers about the unnecessary dying, color preserving and preservatives in canned foods and chemicals put in for shelf life.

Let the food processors come out and advertize that they don't use chemicals to color or preserve their product and they will sweep their competition into the sewer. If they can't do it, boycott them.

Aside from complaining to your store manager, the only way to avoid most chemical

additives is to prepare all your food from the basic grains, legumes, vegetables and whatever cuts of meat you can afford.

I've stressed health first because you already want to save money or you wouldn't have bought this book. Now you have two good reasons for preparing your own food. Even so, I will now discuss your possible resistance to any change in your eating habits and how others, who would not change, died.

The Irish adopted the potato as their main food. It was to them, what rice is to the Oriental and what bread is to Americans. In the 1840's a blight struck the potatos and thousands actually starved to death. A lot migrated over here and some muddled through.

James Trager, in his "Foodbook" tells how the farmhands grew wheat, oats and barley for their landlords. Yet, they starved to death because they didn't know enough to grind those grains and make bread or even to boil and eat them whole.

During the First World War the French and Belgians were dying of malnutrition. They had only white flour and not enough of that.

The Americans sent them several shiploads of corn. There is nothing better, as you know. Anyway, they rejected the corn, calling it fit only for livestock. A lot more of them died. That's called natural selection and is the common fate of those who can't adapt.

In 1932-33 the Russians wanted the Ukranians to stop being peasants and become hired hands of the Russian government. The Ukranians wanted none of that so the Russians destroyed their crops. Then they starved up to ten million of them to death.

Again, even though their barns had plenty of millet and other grains, the stuff wasn't touched. It would not have saved them for long but the point is, they didn't know enough to eat it.

People today are faced with starvation due to impossible food prices and pollution. Buying grains and preparing your own foods will solve a big part of your problem.

Common sense in shopping is another way of attacking the problem. Before I get into preparation I'll cover shopping because I feel you are becoming frightened at the thought of doing something for yourself.

The first step in shopping begins before you leave the house. Never go shopping on an empty stomach. Everything looks good when you are hungry and you will buy the wildest garbage.

Next day you will regret many of your purchases. You will have paid too much for some and you won't even eat some others. Research studies have shown that a shopper spends from 9% to 17% more than he had planned to spend when he is hungry.

Another thing you should consider is bulk buying. Buy all your canned foods by the case. Any store will sell you food by the case and most will give you a 5% mark off.

Usually, even before you are half finished with the case the price has been raised. This makes buying by the case an even greater saving.

Also, the tuna in the case you buy today is sure to have less mercury and filth in it than the case you buy six months from now.

A good stock of food on hand, of everything you are used to eating, has several advantages. You have a greater sense of security, for one thing. You know exactly what you have and can plan a week's menus at one time. That alone will save hours each week, not to mention shopping time.

Buy everything in as big a package as they have. You may have to use a little more thought about getting the product eaten before it spoils but the saving is worth the effort.

FAMINE AHEAD

With the steady rise in prices, actual hunger will hit many people within a few years. More polluted foods will be taken on the shelves. Immune bugs will be wiping out whole crops. Blights will take out hybrid crops, identical field after field close together. To top it all, our government is selling our grain reserves to the Russians and the Chinese. Not only will this cause higher food prices but if we have a year of bad weather the famine is on.

Most people associate famine with India. Many nations send food to India. And even with all their aid from foreign countries the folks in India get hungrier every day.

When famine hits here we will get no help from the outside. The crops of Canada and Australia are committed to Britian, Russia and China for years to come. Besides, whatever hits us will hit Canada at the same time.

Since our famine will only last a few months, a closet stocked with several hundred pounds of grains will see you through the worst. A hundred pounds each of wheat, rice, assorted beans and corn and two hundred pounds of soybeans would do the trick. All but the rice could be sprouted, giving you several times their weight in fresh, tender greens. The grains could also be cooked whole or ground for bread.

Cases of tuna, cooking oil, baking powder and other staples would make living easy.

The idea is to buy and use grains and restock them continually so you will always have sproutable grains as long as they are available.

Grains treated with dry ice in five gallon cans may be stored for years. The cans are bought through any auto supply store. Look up dry ice in the business section of your phone book.

The cap is put on loosely so the gas can escape. When the smokey looking carbon dioxide stops pouring out around the cap, it is tightened so no kind of insect can get in.

It should go without saying that if you are timid and unarmed you had better keep your food supply a big secret. If your neighbors refuse to stock up they will demand a share when the famine comes. If you have a big mouth, unless you stock enough for everyone you tell, you will learn that starving neighbors are worse than no neighbors at all.

GROUP BUYING

Groups can also buy in bulk. Get a group of your neighbors together, read this book to them and plan some bulk sharing. You may not want to buy a hundred pounds of corn meal for your family. But if the group buys a hundred pounds for $13.75 and splits it into say, five shares, your share will cost only $2.75 for 20 pounds or 13¾¢ a pound for whole cornmeal.

If you mean to buy in bulk and then break it down and sell it for a profit you must get a retail number. This is like a state license. For this you go to your local State Board of Equalization. You give them an estimate of how much profit you expect to make and they will give you a retail number. They require a deposit of maybe a hundred dollars to make sure you pay whatever taxes you will owe. If you go out of business they will refund your deposit.

With your retail number the food wholesalers will give you many special deals, like credit and such which you couldn't get if you were a private co-op. Of course, credit comes with knowing you, so don't expect it right away.

Individuals and small groups all over the country are going in for cut-rate food stores. One man in this line is Louis Joseph Rapacilo. He owns the Sun Harvest Natural Foods store at 404 T St., in Eureka.

His business is in an old, two story, Addams Family type house. Visiting his store is like a trip into the past. It is fun from the minute you see its outside until you leave.

The main room is lined with barrels and bags of loose foods; grains, flours, etc. There are heaps of squash and other vegetables on tables and in boxes.

Behind the counter are jars of whole spices which give the place a terrific aroma. It has a lot of the atmosphere of my granddad's country store.

Louis promotes good quality foods at reasonable prices; organic and inorganic. Most natural food stores do not carry meat or meat products. This is the case at Sun Harvest in Eureka.

Being almost totally organic, a lot of his prices are higher than at the supermarket. But even so, if you should buy all your food from his store and from the health food store and prepare it all yourself, you would still cut your food bill in half.

Starting such a business as the Sun Harvest Natural Foods store takes effort but not business genius.The five elements you must deal with are space, licenses, sources of supply, profit and energy.

For space, any area where you can maintain proper sanitation for food handling is acceptable to most health departments. You will also have to conform to zoning laws concerning such a store.

As mentioned before, if you mean to operate at a profit you must get a permit from the State Board of Equalization. If you are selling only food you may not have to pay any taxes on it but you must register with them anyway.

If your store is to be outside the city limits you will have to get a county business license. If you set it up in town you must go to your City Hall for a business permit and a license. You must also go to the County Health Department for their permit.

If you expect to take Food Stamps, you will have to get a permit from the Federal Department of Agriculture in your area.

You can't accept Food stamps if you are a Co-op. That is, if you pay cash to the wholesaler and break down the bulk order for friends, you can't take Food Stamps in payment. Of course, Food Stamps are accepted at the Natural Foods and the health food store as well as at grocery stores. Only retail food stores can accept Food Stamps.

You can still have a dandy Co-op if you ar using Food Stamps and buying in bulk from your local stores. Your only restriction is that you can't pay wholesalers with Food Stamps as they will only accept cash. You won't make quite the savings buying retail but you won't need any licenses, either.

For a retail food business, your third consideration is sources of supply. Look up "Food Products" and "Grocers - Wholesale" in the business section of your phone book. Read all the listings and check off all those that interest you. Then call around and choose the ones best suited to your interests.

You might also look up "Grain Dealers" and "Feed Dealers". Some grain dealers sell mainly to bakeries but they should deal with you. Feed dealers carry grains for livestock.

Grains for stock feed are rock bottom cheap but there is no guarantee that they are free from insecticides. Washing is pretty effective but even so, I would rather pay a couple of dollars more for bulk grains raised for humans.

When you have space, licenses and supplies squared away you must consider profit. Without profit you won't stay in business.

Most such stores fail because of the owner's feeling guilty about making a profit. Whether you provide cheap food or pure food or both, merely introducing people to a better diet justifies a decent profit.

Louis follows some general rules for figuring a profit. If you order fifty pounds or more of any one product he has for sale there is only a 12% handling charge plus an approximate $2.00 freight charge for each fifty pounds, plus the wholesale price.

He will do a higher markup on foods that he has to ladle out and measure and especially those he has to package in small lots. He may have to figure as high as 30% profit on perishables and items that may stay around taking up space for months.

Louis has his own truck. He goes to the Bay Area and buys across the counter. With his retail number he gets the best prices going that day. Bringing the food back in his truck makes his shipping charges lower than eiher mail or freight.

To figure costs, take for instance 50 pounds of soy beans. If you live in Los Angeles County and drive to the El Molino Mill you can buy 50 pounds of soy beans for $9.60. But, if you order the same quantity from El Molino through Eureka's health food store you will have to pay the prevailing freight rate all the way from Alhambra, plus a higher handling charge since they are not geared for bulk orders. So from $9.60 the price shoots up to about $15.35.

If you order 50 pounds of soy beans from Louis, he will buy a 100 pound bag from Gieustos in San Francisco for $12.75. (Most likely, El Molino would sell for about the same price if they carried 100 pound bags of soy beans.) Instead of dropping the price down to $9.60 for 50 pounds, Louis cuts it exactly in half and charges only $2.00 for freight plus 75¢ for handling. This way you get 50 pounds of soy beans for $9.14 instead of $15.35.

$12.75	100 lbs.
1.53	12% handling
14.28	
4.00	freight
18.28	
-9.14	half
9.14	total for 50 pounds

This is not to compare the health food store unfavorably with the natural foods store. The health food store must carry the complete line of health foods, vitamins, supplements and books. Whereas they will order in bulk for you mainly out of courtesy, such orders are not their bread and butter as they are to the Natural Foods store.

Besides, Louis is more into staple foods than is the health food store so bulk orders are just a part of his service. He specifies bulk orders in his advertisements. If you are looking for such a service look under "Health Foods" in the business section of the phone book.

These two examples are just to show you how bulk foods are handled. Such stores in your area may use a different system. At any rate, you should have a better idea of how to get staples in bulk.

The main consideration when ordering food in bulk is how much it will have cost you when it is finally in your possession. For instance, the Whole Earth Catalogue lists Arrowhead Mills, Inc., P.O. Box 866, Hereford, Texas 79045, as selling by mail, 50 pounds of soy beans for $5.00. This is fine if you live in Texas, but the postage to Eureka would wipe out the savings in the base price. So even if they were giving it away free in, say, Florida, and I only had to pay the freight, it would still be cheaper for me to buy it out of San Francisco.

It almost goes without saying that convenience is a big factor. If I lived in Los Angeles County I would rather go to El Molino and pay $9.60 than have someone else get it for me slightly cheaper. The reason for this is that I will be buying other food items which are better buys than I would from the other firm. It all balances out.

To sum it up; go get it yourself if it is at all practical. Also, generally, the nearer the source, the lower the final price.

Just to give you an idea of the wonderful foods you can buy in bulk, I will reproduce part of El Molino's price list. Elsewhere, some of these items are cheaper and some are more expensive; but none are better. The prices here are general and will fluctuate.

Their list is longer but the following are the staples in their line with which I am familiar.

	25lbs	50 lbs	100 lbs
Carob Powder	$13.85	$24.05	$44.75
Corn (white)	4.08		11.00
Corn Meal (white)	4.60		13.75
Corn (yellow)	3.90		11.00
Corn Meal (yellow)	4.50	7.40	12.50
Pop Corn (yellow)	6.55	10.80	
Potato Meal	8.80		27.00
Rice, Brown (long)	6.60	11.10	18.70
Rice Polish	5.85	75 lbs.	15.10
Sesame Seed (hulled)	14.10		47.50
Soy Beans	5.85	9.60	
Soy Flour (raw)	6.55	75 lbs.	13.55
Sunflower Seed (Hulled)	17.25	31.30	
Wheat, Hard Red	3.56	5.65	9.95
Wheat Germ	7.39	12.50	

DESCRIPTION OF PRODUCTS OF EL MOLINO MILLS

CAROB POWDER — "St. John's Bread", "Honey Locust", "Locust Bean", etc. Finely ground select Carob pods from budded trees. Ideally suited for confections, hot or cold milk drinks, cakes, icing, cookies, fudge, high in natural sugars, low in starch, low fat (2% fat as compared to 52% fat in chocolate), and is delicious used with equal parts of powdered skim milk for all kinds of "Confections without Objections".

CORN (WHOLE) — White or Yellow — Midwestern selected corn for home grinding, sprouts, hominy or parching. Offered in various grinds for every use.

POP CORN, Yellow — Highest quality. Pops large and tender.

POTATO MEAL — A fine grind meal from whole Idaho potatoes. Excellent for breading and thickening of gravies, soups, etc., wherever the flavor of potato is desired.

NATURAL BROWN RICE — Finest quality, California Pearl rice. Hulled by a special technique to fully preserve all the germ. (The germ at the tip end of the kernel is often damaged in hulling by common methods used.) All the polish and bran as well as the rice germ remains for maximum natural goodness. Unsurpassed when properly cooked. Unpolished rice used in place of potatoes is a welcomed change. The protein is of high quality.

LONG GRAIN NATURAL BROWN RICE — Long, slim rice grains with a delicious flavor. Contains many times the nutrition of white rice.

SHORT GRAIN NATURAL BROWN RICE — Prized for its great vegetable protein, vitamin and mineral content. One of the most "complete" foods known to man.

RICE POLISH — Inner bran layers from brown rice. A by-product from polishing natural rice into white rice. Contains high concentration of minerals and vitamins often absent from refined foods. Add to practically all foods you would wheat germ. Particularly popular in "health cocktails". Extremely valuable in calcium in a form easily assimilated.

HULLED SESAME SEED — Untreated, freshly hulled white Seasame Seed. Add to oiled bread pans and muffin tins before adding dough or batter. Sprinkle on top of moist pancakes, waffles, breads, muffins, cookies when batter or dough is first put in container for baking. Also use in liquifiers for health drinks.

SOY BEANS — Easy cooking - Table variety. The Soy Bean combines more concentrated food elements than any other common food. Note these features: extreme high protein, 40 to 45%; low starch, less than 2%; easily digestible oils; rich in lecithin; "contains all essential Amino Acids" (Osborn & Mendel); has an alkaline ash and tends to balance the acid ash of acid forming cereals. The Soy Bean is concentrated, wholesome, nourishing and economical. It is rich in and is also a cheap source of protein of high quality, oil, minerals and practically all the known vitamins when prepared in various forms. Serve: cooked, baked, toasted, as milk, sprouted, in soups and a thousand taste tempting ways.

SOY BEAN FLOUR — (Raw) Select whole raw soy beans reduced to flour.

HULLED SUNFLOWER SEED — Large, tasty meats from giant size, select sunflowers, freshly hulled. Can't be beat as appetizers, just as it comes from the bag. May be toasted with oil or butter and salted, for appetizers. Add to cereals while cooking, cookies, salads, patties, etc. After pouring waffle batter on iron, sprinkle sunflower seeds on top before closing the lid. A rich food for as little as 62¢ a pound in bulk.

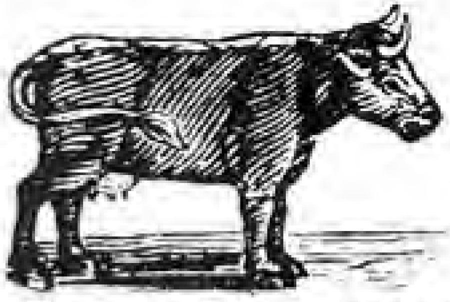
RED CEREAL WHEAT — Select quality, hard Montana and North Dakota Spring wheat. Grown in healthy soils of high mineral composition where the land is allowed to rebuild through a long range rotation plan. In discing under summer fallow, natural organic processes take place and humus is conserved. All El Molino hard wheat products are made with this wheat. The price of wheat is governed mostly by its protein content. Note the premium protein of El Molino wheat as compared with the high protein spring wheat listed by the U.S. Dept. of Agriculture in "Composition of Foods" chart. Its premium quality is evidenced by its Alkaline ash. (For chart, see El Molino Best Recipes)

WHEAT GERM — Untreated, natural embryo of select wheat - ready to eat. Especially delicious for breading fish and other meats; omelets, or in cookies. Add wheat germ to practically all foods for your best source of valuable natural vitamins. Refrigerate after opening bag.

Before you dash out and order 100 pounds of each of the above I suggest you buy a smaller quantity at the health food store so you know you like it.

Now I will get to some commonly eaten foods you should cut out of your diet. Not only are they bad for you but you can substitute other, cheaper foods for them.

MILK



First is milk. They ought to put that watered whitewash back in the cow, except that the chemicals in it might kill her.

Milk is for the babies of all mammal species. When the young are weaned nature no longer provides any kind of milk. Doesn't that tell you something?

Adults, especially, are harmed by milk. The mature body can't properly handle the calcium in milk. It goes to the joints, contributing to arthritis. If you have any arthritis, cut out all milk products for a week and see if you don't notice a decrease in pain. Milk also causes constipation and even anemia in many people, and also hardening of the arteries.

The consumption of milk in America has been declining. It is too expensive and too contaminated. That's why the milk industry is putting on all those TV ads. Dairying is the greatest single food industry and can afford the most advertising. They pollute the airwaves. Of course, those big industry types slip up once in a while and someone on our side slips in a zinger.

Notice lovely Vickie Carr and lovely Karen Valentine going on like as if they would be downright puny and weird looking without milk. Then comes Phyllis Diller going on about drinking the same slop and if that isn't a before and after goody I've never seen one. The ad man who brought Phyllis into the picture has to be honest and on our side. If you meet him on the street, buy a pencil from him.

Milk is certainly not a brain food. In one of his 30 second milk commercials, Mark Spitz says the meaningless and distracting "y'know" five times. In another, he says "y'know" eight times!

Milk is an expensive item which you have been led to believe is needed by everybody but which is not. However, there is a cheap substitute for milk for those with a subliminal mammary fixation.

Soya flour makes an excellent substitute for milk and only costs about 8¢ a quart. Soya flour costs as little as 22¢ a pound when bought in bulk at 25 pounds for $5.50.

Directions for making soy milk are found further on.

It is even good for infants. Rodale, in his book "Food and Nutrition" page 540, gives a comparison chart between cow's and soy milk. He writes of soy bean milk for infants and suggests adding bone meal and brewer's yeast to the soy milk and omitting the salt.

You might also drop breakfast drinks as they too have been brutalized. Read the label on a bottle of popular orange drink powder. Sodium Citrate, Tricalcium Phosphate, Artificial Color, BHA - Preservative.

Why? How come they can't just combine citric acid, flavoring and sugar, vacuum pack the product and then leave it alone?

Fresh orange juice and many frozen juice products are free of additives and are all right. There is no reason to buy the polluted kinds.

Better still, why not make your own soft drinks? The main element in orange juice, soft drinks, Kool-Aid, etc. is citric acid. Citric acid is bought at any drug store for about $2.50 a pound.

You can make your own soft drinks by using citric acid, sugar, syrup or honey and flavoring. The flavoring can be cake flavoring from the grocery store or spices like cinnamon, ginger, etc. The best drinks, however, are made by putting fruit, spices, honey and ice cubes in a blender.

You can't make substitutes for everything but if you are hooked on certain garbage you might as well forget the commercials and buy the cheapest. If you insist on using margarine buy the specials at five pounds for $1.00. It is no worse for you than the margarine that makes that TV clown feel like a king. He will more likely turn into a queen if he doesn't improve his diet.

Another economy is bacon ends. They sell generally for about $1.08 for three pounds. Although today's bacon isn't fit to eat, you may really want it but if you are poor you probably buy the cheapest brand.

Bacon ends are not only the cheapest bacon you can buy, but they are usually from better brands than the cheaper sliced bacon. You can slice the bigger hunks pretty well yourself. Also, you can chop up hunks of bacon ends for beans.

A worthless item of food, but one which I remember as being very tasty was bacon grease and green onions. Mama would heat up a batch of bacon grease and pour it into a bowl. The family would then sit around with green onions, dipping and salting. It was really good.

If there is a damaged freight — freight salvage store in your area you can pick up excellent bargains in dented cans, etc.

PET FOODS NOT FIT FOR A DOG

While on the subject of general shopping economy, let me warn you against pet foods. James Trager in his "Foodbook" tells of a speculation that 20% of the pet food sold is eaten by the buyers. This is backed up by an account of a Chicago supermarket which sells oodles of dog food to people living in a nearby public housing project where pets are not allowed.

Many older people with pets get the habit from accidental tastes of the pet foods they are handling. If they are also very poor it is convenient to rationalize that they wouldn't want to feed their darling pet anything they wouldn't eat themselves.

What they don't realize is that aside from aesthetic factors, pet food is often dangerous for humans. Dog food, especially, can have particles of bone which a dog can handle but is harmful to human stomachs and intestines.

Pet food is even more subject to higher concentrations of chemical additives. Since your pets can't tell you about taste, except by outright refusal, they can be eating great amounts of awful stuff. The only way you can tell if your pet's food is bad is if he dies young or becomes more neurotic. Even the average German shepherd has become a regular dingaling.

You have no doubt seen that stupid TV commercial for all meat dog food. They imply that cereal grains and soy products are inadaquate for your pet's diet.

Actually, the gristle, blood, bone and very low quality meat scraps used in most pet foods is far inferior in nutritional value to soy beans or even whole grains and cereals.

Also, an all meat diet is unnatural to your pet. The big cats and wolves constantly nibble grass and leaves for roughage and minerals they need. Or else, they get these from the intestines of the vegetarian animals they kill.

The nearest thing to an all meat diet I would see as fit for a pet would be the pet foods sold a generation ago. Then they used horse meat and good cuts of it. They also left the chemicals out.

I remember in the early fifties when I attended the yearly dog shows in Chicago. Pet food pushers would hand out opened cans of their product to be given to the pets in the show. When I got hungry I would just take a can of horse meat and go to it. It was chunks of pure meat and very tasty and nutritious. I never ate any outside the dog shows but when I heard of others buying and eating canned horsemeat it didn't bother me.

The horses that went into that dog food were wild Mustangs and just about extinct now. What you get for pets now are scraps of beef, pork, sheep and chicken which can't be sold for humans even in the cheapest cuts. This makes it pretty clear that what is left for pets is literally putrid garbage. That's why they must use all those chemicals.

If you have been alarmed about the chemicals in your food, think about what Karen feeds Buttons. Read the label on the can of "all meat" dog food. There is Potassium Chloride, Choline Chloride, D1 Alpha Tocopheryl Acetate, Pyridoxine Hydrochloride, BHT, Zinc Oxide, Cobalt Carbonate, Iron Sulphate, Copper Oxide, Ethyline Diamine Dihydroiodide, Magnesium Oxide, Manganous Oxide and Sodium Nitrite.

Would you want that fed to your little varmint? Or even your old mother?

You'll save money and your pet by sharing your own diet with him.

GRAY PANTHERS ALERT

Concerning poor diets for elderly people; I am aware of this, having lived around retired people for years. I know that most of them eat poorly.

"In the Midst of Plenty" is a book on poverty by Ben H. Bogdikian; copyright 1964. He tells of one 74 year old man who was limited to $11.50 per month for food and chewing tobacco. His complete daily diet was three hardboiled eggs, a small can of V-8 vegetable juice, three ounces of Spam and one ounce or a little over of dry cereal. With a little tobacco that finished off his $11.50.

Using my information, even at today's prices, he could have eaten much better for much less.

The book says he boiled the eggs so I guess he had at least a hotplate. He could have bought a secondhand hotplate for $1.00-$1.50 at a Salvation Army Store.

Being an old man, he couldn't eat much. So he could have put two ounces of wheat and a pint of boiling water in a thermos bottle each night and in the morning he would have a yummy, nine ounce, high vitamin-mineral-energy breakfast each morning for only 75¢ a month.

A pound of sprouted soy beans each day would cost 13¢ or $3.90 a month. This, his only green vegetable, would more than meet his minimum daily vegetable requirements.

Both the wheat and soy beans could be bought in five pound bags from the health or natural food store.

A ten pound bag of Cal-rose rice would give him all the rice he would want in a month.

Fifteen cans of Crown Prince brand Mackerel at 26¢ a 15 ounce can would cost $3.90. At half a can a day this would give him 6½ ounces of fish (less water and oil) each day. I eat this Mackerel all the time and have seven cans at this writing.

Daily Diet	Cost Monthly
nine ounces of wheat	$ .75
one pound soy bean sprouts	3.90
one and a half pounds rice	1.50
six and a half ounces fish	3.90

The above diet would cost him only $10.15 per month.

I challenge any dietician to prove that this diet would not provide all the nutritional needs of an elderly person. I wouldn't want to live on this but it is certainly better than the diet he had.

The setup for raising his bean sprouts (shown further on) wouldn't cost a penny. Crate wood from a few blocks of an alley would supply the frames and nails. His landlady could give him a couple of old sheets from the rag bag. Anyone can find a piece of plastic.

Any elderly person, mentally alert and not crippled, can build and maintain such a soy bean sprout setup.

Commercial candy is purely an item of pleasure and is not considered for its nutritional value. Children yell for it, though, because like all young animals they crave quick energy foods.

Commercial candy can't be sanitary. There is no way. After the melted sugar solidifies it is molded, layered, sprinkled and packaged. From its initial molding, it goes through several steps, none of which can be warm enough to melt the sugar or kill any of the germs which are naturally floating all over the place.

Either the machinery must be sprayed with deadly bacteriacides or the candy must be filled with enough preservatives to make it dangerous. But nothing can protect your child from the human filth most commercial candies are subjected to.

I worked in a candy factory in Melrose Park, Illinois. I will describe the manufacture of jelly beans, a favorite of Governor Ronald Reagan.

The lightly tinted cores of the jelly beans were sprinkled with starch and stored, by color, on trays. Since each tray was used for one color after another it was not labeled.

When searching for a certain color, the candy maker would take a jelly bean core from a tray, lick it to see its shade and then put it back. After licking and putting back several jelly bean cores he would finally find the shade he was licking for.

He would then take the tray of jelly bean cores and dump them into one of six large, revolving drums. Then he poured in sugar, flavoring and dye. The revolving drum would cause this to coat the jelly beans very prettily.

It was a very good feeling to put one's hand into a drum and feel the jelly beans flow through the fingers. I did this and although my hands were washed, they weren't all *that* clean.

Those drums were in the room leading to the men's toilet. Nearly every guy that came out of the john would dip a hand into one or more of the drums. Most of them came out buttoning their flys, indicating that they hadn't washed.

I noted this and other things and wrote a one page plea for worker sanitation. I showed it to one of the managers and suggested it be copied and posted around the factory. The manager thanked me for my concern and I was fired a half hour later.

Since sanitation is impossible, anyway, bringing up the subject at all is taboo.

I also worked at a bakery supply company in Melrose Park in 1952. They put out pastry fillings, flours, flavorings, etc. They had pretty much the same attitude about sanitation but they carried their practices over to fraud.

I remember this incident because it was the first time I had come up against a rejection of chemical food additives.

One or more states had banned a certain chemical in common use as a preservative. Where I worked, this chemical was put in just about everything. I was putting lables on some five gallon cans of jellyroll filling and was handed a different set of labels to put on about twenty-five cans going out of state. The labels I had been using listed this chemical. The new labels for the out-of-state cans omitted it. Even so, all the cans were from the same batch and the whole batch had that preservative.

I believe that if there were laws against such additives the manufacturers would simply fail to list the illegal stuff in the cans.

Our candies and bakery goods are polluted. You should train your children to avoid commercial candy.

Any complete cookbook has a section on making your own candy. All candy making amounts to is melting sugar and adding flavors, colors, nuts, sesame or sunflower seeds, etc. For five dollars and an afternoon's play, you can make a large variety of candies which should last the whole family a year.

Of course, I recommend honey instead of sugar and carob powder instead of chocolate.

You can put these candies in your child's lunch box and let him take them to the movies. You should even sell them to him. Why not?

You could sell them to him on the basis that at the end of each month you would give him half his money back. That would give you a profit on your raw materials and insure that he wouldn't spend any of his money on commercial candies.

The ideal thing would be to wean your child away from candy altogether. A super vitaminized candy substitute is sunflower seeds. You want the hulls left on or they are eaten too fast to be used like at movies, in school or while watching TV.

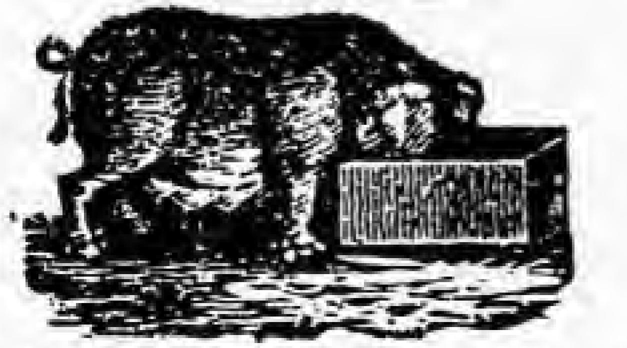
Keep the seeds in a side pocket. Pop one into your mouth, crack it with your teeth and when you have it hulled, transfer the hulls to another pocket or throw them on the floor if you are a slob.

Kids like them and once they get used to eating them they automatically fill a pocket before they leave the house.

Munching sunflower seeds all day keeps a child's or adult's hunger level down so he doesn't care to cram with useless and-or harmful snacks. Yet they leave lots of room for meals and also make up a constant vitamin and mineral intake.

Sunflower seeds with the hulls on can be bought cheaply from any pet store.

DEEP FAT FRIED FOODS



Another item you should drop from your diet is commercial foods fried in deep fat. These include French fries, potato chips, deep fat fried chicken, fish'n chips and peanut butter.

J.I. Rodale, in his book "Food and Nutrition" says "The continual heating and reheating of the fat in which salted peanuts are prepared make it *one of the most dangerous of all foods*, for it has been shown by competent authorities that reheated fats deteriorate into unhealthful and very probably cancer-causing substances. This is one of the reasons why we protest so sharply against French-fried foods. Judging from their rancid taste, most peanuts are cooked in oils that are never changed or replaced."

Aside from the health erosion from these commercial deep fat fried foods, their prices are outrageous. Check the price per ounce of potato chips, corn tasties and other lightweight bagged goodies.

Since Dad worked roasting peanuts in candy factories he could make anything. He would square away on a Saturday and make peanut brittle, donuts, potato chips, corn crunchies, etc. In one afternoon he would make enough kiddy garbage to last us for weeks.

Anyone can make potato chips like Dad did. First you peel some large potatoes with one of the floating potato peelers with a slit in it. Next you use the peeler to reduce the potato to thin slices. Then you swirl in a pan of water to remove the excess starch. Then put the slices on a towel and pat them dry with another towel.

A large frying pan is filled with cooking oil from a health food store. The oil is heated as hot as it will get, about 400 degrees F.

With a pair of tongs you drop the slices in one-by-one. As each turns the creamy tan you want you take it out with the tongs and lay it on a paper towel or even newspaper to absorb the excess oil.

In a few minutes you will be putting a slice in and taking a chip out, really quite fast. When you finish, salt the chips and you are ready for a party.

Chips cost from 10¢ an ounce in a 1½ ounce bag for 15¢ to .073¢ in a 10 ounce bag for 73¢. You can get large potatoes for as little as 5¢ a pound if you buy a 20 pound bag. Considering the oil they will absorb you can make just as good chips for about 20¢ a pound as compared to at least $1.15 a pound for commercial chips.

Deep fat frying is not as bad at home as by the commercial method. For one thing you are using up most of the oil. This is because you use a shallow frying or even sauce pan.

Thus, it is no economic strain to dispose of the leftover oil or if you add to it and use it a couple or three times that is all right, too.

This doesn't compare to the commercial methods of oil use. I was a fry cook in two all-night greasy spoons in San Francisco. The cookers in which we made French-fries and cooked breaded chicken and fish were changed every two or three weeks. The change was because of the darkness of the oil.

Oil was added as it was absorbed by the food. This wasn't much and also, the cooker was left on 24 hours a day.

In 1939 Dad got a pretty secure job and sent for us to live with him. He went to work overtime one Sunday afternoon and took me along.

A frantic seven year old loose in a candy factory isn't like in the movies. A candy factory is drab. Besides, candy was too common for us so we didn't like it much and so we ate less of it than other kids.

I was fascinated by the great vat of hot oil in which Dad roasted peanuts. I tried to skip cookies off its surface like I'd learned to do with rocks in the streams in Arkansas.

After a couple of dozen vanilla wafers sank to join the ages-old debris at the bottom of the vat, Dad sent me elsewhere. He gave me a pound carton of jawbreakers to play with; certainly not to eat. I spent the rest of the afternoon using the jawbreakers to clobber rats.

I remember that the vat's oil was pretty clear but that the bottom was covered with rubbish. Dad would lower in great baskets of peanuts which he would cook and either put aside for salted peanuts or grind up as peanut butter. It was obvious that they never changed the oil, only added to it. I don't think today's peanut butter is made any better.

COST OF COMMERCIALLY PREPARED FOOD

It's hard for a person to realize just how much he is wasting when he buys commercially prepared foods. I did a survey around town of what people pay for food in restaurants. Then I went to the supermarket and priced the makings. Some general comparisons follow.

Say you are a student or worker and eat breakfast and lunch out. For breakfast you have the usual two eggs, bacon, hash browns, toast and coffee. It will cost you from $1.15 to $1.35 unless you are eating at some fancy place. But if you had bought and prepared it yourself that same meal would have cost you only 25¢.

Large grade AA eggs are 50¢ a dozen. That's 4½¢ each or 9¢ for two. Good quality bacon is 80¢ a pound of 20 slices. That's 4¢ a slice or 8¢ for two. Bread is 40¢ a loaf of 20 slices. That makes 2¢ a slice and 4¢ for your breakfast toast. At 20 pounds for a dollar, potatoes are 5¢ a pound. Your breakfast serving is ¼ pound at 1¼¢. Ten ounces of instant coffee costs $1.50 and at eight strong cups per ounce, black coffee is only 1.8¢. Sugar and cream will bring it up to 2½¢ at the most. Total: 25¢; maybe less.

It wouldn't take you ten minutes to make your own breakfast. You are paying someone something like $6.00 an hour to do it for you.

A hot plate, frying pan, cooking pot and a second hand toaster would give you about a $5.00 a week pay raise just for cooking your own breakfast.

For lunch, say you buy a ¼ pound hamburger for 60¢, French fries, 25¢ and coffee, 15¢; total: $1.00. Hamburger is 66¢ a pound or 16½¢ for a ¼ pound patty. Buns cost 43¢ for eight or 5.3¢ each. Mustard, tomatoes, onions, etc., say 3¢ each burger. Total for burger: 25¢. Fries are still 1¼¢ for a ¼ pound serving, coffee still 2½¢; total for dollar lunch: 29¢.

You can figure this way with whatever you select to eat out. It will come out about the same. Of course, you wouldn't want to take cold fries for lunch or even a cold hamburger, but that's not the point. The point is that if you eat out you are paying at least two thirds of the price of the meal to have someone else prepare it for you.

Can't you see that it's downright stupid to eat out as a steady thing? If you are of modest means, you plain can't afford it. Take a lunch.

Other comparisons: Cheapie hamburgers at 20¢ each. They are made of ⅛ pound patties and smaller buns. If you could get the smaller buns the burger would cost 13¢ each. Even though they are a better buy than the bigger ones, they are mostly bread and still no bargain.

Hot dogs are from 25¢ to 40¢ generally for the regular size. Packages of ten for 68¢ are, say, 7¢ each. Buns are eight for 43¢ or 5.3¢ each and say 3¢ for mustard, onions, relish, etc., you can make your own, just as trashy, for 15¢ each.

Pizzas are made of white flour and a little baking powder and salt. You want to add an egg; fine. Then you put on some frills like cheese and pepperoni or sausage or hamburger and lots of pepper.

For a one person pizza at a pizza parlor you start at about $1.30. You can get something just as horrible at the supermarket for 77¢ for a 13½ ounce pizza or 98¢ for one weighing a pound.

To make one yourself, you mix 5¢ worth of white flour, a 4½¢ egg and ½¢ worth of baking powder and salt. Put on 2 ounces, or 12¢ worth of $1.00 a pound cheese. Add 2 ounces, or 32¢ worth of pepperoni, which costs 98¢ for 6 ounces. Then 2 ounces, or 6 2/3¢ worth of tomato paste at 40¢ for a 10 ounce can.

This way a pizza which would cost at least $1.30 in a pizza parlor or 98¢ in a supermarket costs 61¢ to make yourself. You can substitute four ounces of hamburger for the pepperoni and the pizza will cost you only 45¢.

Consider canned beans as opposed to dry beans. Beans of all kinds average 20¢ a can. Stores usually have a deal going at five cans for $1.00. This way you can usually buy five varieties of beans of the same brand in the $1.00 deal. They sound cheap but they are not.

Dry beans in 2 to 4 pound packages average 20¢ a pound. A pound of dry beans, cooked, equals four cans or 5¢ a can. The only difference in the canned beans is that they usually have Disodium EDTA added to preserve color. This way, instead of cooking your beans for 5¢ a can you are paying some slob 15¢ a can just to pollute them.

Another comparison is wholewheat bread (white bread isn't worth discussing). A popular brand of wholewheat bread sells for 52¢ for a pound and half loaf, or 35¢ a pound.

If you buy wheat in bulk and grind it in the cheap hand mill described further on, the flour will cost you 9¢ a pound or less. If you use the El Molino recipe for wholewheat bread you will need six ounces, or 30¢ worth of honey at 75¢ a pound. You can substitute six ounces, or 5¢ worth of sugar at $1.30 for a ten pound bag. Five and a half cups of your own wholewheat flour will cost you 13¢. Two packets of yeast will cost you 10¢. The three tablespoons of safflower oil will cost 4½¢. I use soy milk instead of cow's milk at a cost of 4¢.

The store bread costs 35¢ a pound. The El Molino recipe bread, with honey, will cost 21¢ a pound. With sugar it will cost only 13¢ a pound. Prices by the 1½ pound loaf are, respectively, 52¢, 31½¢ and 19½¢.

I never made bread before and it took me only 15 minutes of work to make 2.8 pounds of as good bread as I've ever eaten. I could have doubled the recipe for five minutes more labor.

What homemaker can't spare 20 minutes to save from 74¢ (honey) to $1.40 (sugar) on the bread bill? The savings through making your own bread amount to the same as earning $4.20 an hour (sugar) or $2.22 an hour (honey).

I don't consider the time on the grinder. A woman can turn the grinder while watching "As the World Turns". During one program she can grind a week's flour. If all the wives in America should grind flour while watching their soap operas, their families would be better fed and more cheaply, although those women would be no less addled.

BABY FOOD

One item you can save a fortune on is baby food. Baby food costs from 9¢ to 29¢ for a 3½ ounce jar. Any of the vegetables can be prepared in a blender or baby food grinder for less than 5¢ for 3½ ounces.

The turkey, veal, beef, chicken and their broths are a real gyp. I doubt if there is a full ounce of meat in any 3½ ounce jar. These sell for 29¢ for, at the most, 6¢ worth of meat.

Their combination meals are questionable at best. "Vegetables and Chicken" lists wheat flour, modified corn starch, salt, onion powder, garlic powder, sugar, celery extract, thyme and marjoram extracts. The flour and starch are for body. Why not use meat for body? They charge enough.

The other ingredients I have listed are flavorings. Maybe they aren't even *good* for babies. At any rate, a baby isn't much interested in taste until he is about six months old. The flavorings are put in to impress the mother.

You should feed your baby only what you are sure of. Prepare it all yourself and it will be cheaper and cleaner.

You should, by all means, get a Happy Baby Food Grinder, if you have a baby to feed. It is described in the Whole Earth Catalog: "When it comes to tools for child-rearing, this is second only to the human breast in solving feeding problems. Better than a blender, it can easily be carried wherever parents go, to grind up table foods to proper consistency for small infants through toddlers".

Its price is only $4.95. You can order it from Dolly Lundberg, 4036 Waterhouse Road, Oakland, Calif. 94602. Across the Rockies it is sold by Bowland-Jacobs Mfg. Co., 9 Oakdale Road, Spring Valley, Ill. 61362.

Already, you have seen the economy of preparing your own food even if you stick to your present diet. Preparing your own food is also the only way you can be sure it's free of other people's filth and of all the potentially dangerous chemicals.

You can further cut your food bill by adopting some cheaper items of food. Of course, you must also make sure that you keep proper nutrition in mind for every meal.

Americans get most of their protein from meat. Meat is getting too expensive for the average person to buy so Americans are starving.

Mexicans get most of their protein from corn and beans. They don't do so well on it, do they?

Orientals get most of their protein from soy beans. They also eat a lot of green vegetables. What meat and fish they eat is used as flavoring. An ounce or two of meat cut up on the rice or in the vegetables gives the meal the impression of having a lot more meat than there really is.

The thing to do is buy, say, a five pound pork or beef roast. Slice it up in strips and put it in your refrigerator's freeze box. It will go a long, long way as flavoring. Especially with Chinese gravy.

What you should do is go with your family to an Oriental restaurant and really pay attention to the dishes. Better to get the Sunset Oriental Cook book and take it with you. That way you can take notes before you go, about various foods you want to try, especially tofu and sprouts.

The atmosphere of the Oriental restaurant will charm the kids. This will make them more willing to accept new dishes than if you had introduced them yourself.

I'm not trying to get you to adopt an Oriental diet. Three elements of their diet, however, should be considered as regulars on your table. These three are polished rice, soy bean sprouts and tofu; sometimes called soy cheese.

A lot of people say that polished rice is not a good food. I agree; but neither are mashed potatoes or white bread.

Polished rice is simply rice that has had a lot of the vitamins and minerals removed from the outside. If you are worried by its nutritional lack you can buy rice polish, which is what they took off.

El Molino lists Rice Polish at 75 pounds for $15.10 and you can buy it from the health food store for 50¢ a pound. A couple of spoons full of it mixed in a health drink each day should kill any guilt feelings you have from eating polished rice.

I don't care what anyone says, I don't like brown rice. It takes much longer to cook, it is coarse, I don't like its taste and it costs at least 50% more than polished rice. Since it is hardly processed at all and only has the hull knocked off it should be much cheaper than polished rice.

You can buy 50 pounds of Townhouse, U.S. No. 1 Calrose rice for only $7.00 at any Safeway supermarket. This breaks down to only 14¢ a pound when you buy it in bulk. Rice starts at 22¢ for a one pound bag and decreases in price the more you buy.

I chose rice over bread or potatoes because rice is the cheapest of the three main carbohydrates and it tastes great with just about anything. It is easier to prepare than bread and is very easy to digest.

Below is a comparison chart between common carbohydrate foods, their food values and their costs per pound ready to eat. Of course, the nutritional units per slice and half cup are not to be confused with the prices per pound of cooked foods; or Cost P.P. The nutritional units would be several times more per pound.

	Calories	Protein	Fat	Carb.	Cost P.P.
		GRAMS			
1 slice white bread	63	2	.7	11.9	30¢
½ cup rice	100	2.1	.1	22	3¢
½ cup mashed potatoes	80	2.1	.9	16	5¢
½ cup cooked oatmeal	74	2.9	1.4	13	1¼¢
½ cup cooked wheat	55	2.1	.6	11.3	5½¢
½ cup cooked beans	107	6.6	.5	19.5	7¢
2½x2½x1½ inch cornbread	103	3.5	2.7	16.7	12¢

Another way of looking at the above is to figure that when you buy a pound of white bread you get one pound of food for 30¢. When you buy a pound of potatoes, at 20 pounds for $1.00, you get a pound of food for 5¢. But when you buy a pound of rice, at 50 pounds for $7.00 and cook it, you get five pounds of food for 3¢ a pound.

You would save a lot on white bread if you baked it yourself. Of course, I should think if you still want to eat bread you would bake wholewheat.

SOY BEANS

Soy beans are quickly losing their Oriental image. You should no more think of Chinese dishes when you think of soy beans than you think of St. Patrick's day when you eat (Irish) potatoes.

The following is from El Molino and they say it so well I got their permission to reproduce their views on soy beans.

"To stretch that food budget without stretching the waist line serve El Molino new 'Cook's Best' Vegetable Soy Beans each week. (Why not every day?)

"So much emphasis is on the importance of a high protein diet these days that soy bean products prepared dozens of different ways should head the list of required eating.

"Soy beans are the richest in protein, vitamins and minerals of practically all foods known to man, and yet costs but a fraction of other foods when considered in terms of nutrition per serving.

"Hundreds of varieties of soy beans are grown. However only recently the 'breakthrough' was accomplished in developing a new strain proclaimed to be the most delicious of all legumes. You'll agree when you serve your family the new 'Cook's Best' Vegetables Soy Bean by El Molino." (Most soy beans sold as human food are of high quality.)

Following is El Molino's comparison chart:

"MRS. SMITH PAID $5.40 EACH for 4½ lbs. BEEF and 25 lbs. SOY BEANS

'MRS. SMITH RECEIVED:

from BEEF		from SOY BEANS
6	SERVINGS	130
13	DAYS PROTEIN	180
356	TOTAL PROTEIN (grams)	4,540
5,659	CALORIES	37,569
204	CALCIUM (mg)	25,765
3,841	PHOSPHORUS (mg)	66,311
53	IRON (mg)	908
0	VITAMIN A (I.U.)	13,896
2	VITAMIN B1 (mg)	121
3	VITAMIN B2 (mg)	35

"THE SOY BEAN IS IN SO MANY RESPECTS THE MOST VALUABLE OF ALL PLANT FOODS." — (U.S. Office of Health Education)

The **EL MOLINO BEST RECIPE** book has a dozen fine recipes for soy bean use. The **SOYBEAN COOKBOOK** has over 350 and between them you should be able to fit soy beans in as a staple item of your family's diet.

SOY BEAN SPROUTS

One hundred grams, about a cup, of soy bean sprouts contain:

Calories	46
Protein	6.2%
Fat	1.4%
Carbohydrates	5.3%
Calcium	48 mg
Phosphorus	67 mg
Iron	1 mg
Vitamin A	180 Int. Units
Vitamin C	13 mg
B Vitamins:	
Thiamin	.23 mg
Riboflavin	.20 mg
Niacin	.8 mg

This makes soy bean sprouts the most nutritious of all the green vegetables used as staple foods. It is also unique in that its vitamin C content increases daily in the refrigerator until at least a week, when it begins to decline.

If you buy soy beans in bulk, say 50 pounds for $9.14, or 18¢ a pound, soy bean sprouts will cost you only 8¢ a pound. This makes them the lowest in price and highest in food value of any green vegetable you can buy.

Current vegetable prices per pound in the supermarket are: zucchini, 23¢; cabbage, 11¢; chard, 23¢; broccoli, 25¢; Brussels sprouts, 28¢; okra, 48¢; asparagus, 78¢; lettuce, 26¢; celery, 20¢; string beans, 38¢.

Soy bean sprouts are delicious alone, raw with oil, vinegar and salt and with other vegetables in salads. They are also a taste thrill cooked 10 or 20 minutes. The bean parts have a chewy texture and at first you may not think they are done but they are. Anyway, they have a peanut taste that makes them very yummy.

A couple of months ago I persuaded a student to try soy bean sprouts. He liked them so much he set up a perpetual sprouting system which gives him two and a half pounds of sprouts a day.

When I met him he had a pair of rabbits, a German shepherd and a vicious, ten year old, tom cat name of Lamarr-Jean. They were eating him out of house and home and my suggestions were a Great Pumkinsend.

He sprouts soy beans, corn and wheat. He eats them himself, gives nothing else to his growing herd of rabbits and cooks them for his dog and cat.

With oatmeal and table scraps, the new diet for the animals cost him 25¢ a day as opposed to the $1.50 a day he had been spending.

The animals thrive on the diet and Lamarr-Jean has become so virile he comes home chewed to pieces every morning. The student has gotten him sewed up by a vet twice. He says he is either going to cut out the cat's soy bean sprouts or have him altered.

There is some work to raising sprouts but it soon becomes a part of the daily routine. I'd say it's a fifteen minutes a day job, even if you grow a couple of pounds. It is not heavy work and no talent is involved so a six year old could take over the project.

SOY BUTTER

Soy beans are about 40% protein as compared to 26% in peanuts. Both seeds have oodles of the same vitamins but peanuts have a greater percentage of each vitamin. Even so, a diet rich in soy beans will most likely give you all those vitamins you need.

My recipe for soy butter has an added bonus for cholesterol concious types. This is safflower oil which contains about 80% linoleic acid. This is the most important of the unsaturated fatty acids.

Linoleic acid combines with cholesterol and makes a useful goody which aids in the formation of cell membranes and connective tissue. This way, if you eat a substantial amount of safflower oil you don't need to be afraid of foods with cholesterol. In short, safflower oil, in itself, is a thoroughly useful and good food.

Peanut butter sells for as much as 76¢ for a one pound two ounce jar, down to 47¢ a pound in a plastic jar of eight pounds. If you buy soy powder for $5.50 for 25 pounds and use safflower oil at 50¢ a pound from the health food store you can make soy butter for 35¢ a pound. You will be using the soy powder for many other things so the bulk order will be convenient.

Of course, you can cut the price even more by buying 50 pounds of soy beans and grinding them to powder and toasting them yourself.

Even if the soy powder has been toasted by the mill I put it on a tray and heat it for 20 minutes in the oven at 350 degrees. Then I mix safflower oil with it and add salt and poultry spice. You can put in any spice, bacon bits, or any flavoring you like, even sweetening such as honey.

To 9¼ ounces of soy powder I add 6¾ ounces of safflower oil. This makes one pound of possibly the most nutritious food you can eat for 35¢ a pound. Children love it and it even sticks to the roof of the mouth like peanut butter. After a couple of bites it even tastes remarkably like the best brand of peanut butter.

The first batch of the above I worked out was perfect. The next batch was a disaster. I used a different brand of soy flour and it had a different texture. It took longer in the oven and required a higher heat.

I used the same brand of safflower oil but it was rancid or something and tasted strong. The same amount of oil made the different textured soy flour runny.

I threw the mess out and made the next batch with a common vegetable oil. Delicious!

Work out your own heat and mix in enough of an oil of your choice until you get it right.

Don't try to stick too close to the figures in these recipes. Use your head and give them a little leeway.

BEAN PASTE

This is a wonderful rich food anybody can prepare for pennies a pound. I put cooked soy beans through my Squeezo strainer to separate the skins from the pulp. This makes a paste the consistency of peanut butter.

I put in garlic powder, bacon bits, and some Schilling Barbeque Spice. You could add onions, chopped hard boiled eggs, peppers, etc. Yummy and cheap!

This bean paste, spread thickly on crackers or sandwiches is delicious, rich and filling. It is great for lunches, picnics and parties.

I use soy beans but you can use any other bean although your product won't be so rich.

If you don't have a Squeezo you can use a food grinder, although you will still have the skins. You can even mash the beans with a spoon if you are just making small helpings.

SOY BEANS

Beans are well known to Americans but few know how to use them. Beans are high protein and hard to digest unless well cooked.

Beans are fine in salads, soups and mixed with rice or macaroni. Where the trouble comes in is when you eat beans mainly by themselves like in pork and beans or chili.

A lot of people have such ruined digestive tracts that they can't handle beans in any quantity. If you have trouble with beans, I recommend garlic capsules. With capsules you won't give off any odor and they will help you to use cheap foods you may have left out of your diet because of poor digestion. You can get them at the health food store for $4.00 for 250 with cash or food stamps. Six a day at two each meal should have you straightened out within a week or ten days.

A half cup of cooked beans at each meal would give you 20 grams of protein each day for only 5¢. If you mix them with your rice, salad, etc. you will get the most from them and they are tasty.

COOKED SOY BEAN FLOUR

This is a lot like bean paste but lighter and more fluffy. It can be cut into slabs and fried or mixed with garlic powder, bacon bits, poultry spice, salt, etc., and used for sandwiches. It is very filling and nutritious and you will think of lots of ways to use it. Like tofu, it only costs 9¢ a pound.

It is also moron simple to make. Put four cups of water into a mixing bowl. Then stir in three cups of soy bean flour. Let it soak a couple of hours and mix in your favorite flavorings, salt, etc. Grease the 1½ quart stainless steel bowl and pour the mess in.

Next, put the cooking rack and a couple of inches of water in the pressure cooker. Then cook the soy bean flour for one hour under pressure.

I chop up an eight ounce slab of this cooked soy bean flour and scramble an egg with it. I put salt and other flavors on it and it is my breakfast. I eat it because I like and it fills me up and keeps me going until lunch. It costs me under 10¢ for a high protein, very yummy breakfast.

I recommend a pressure cooker because it saves on fuel and makes up its cost in a short time. It also cooks things better, which would take forever and maybe even burn, otherwise.

I guess you could bake soyflour in a casserole but I never needed to bother with baking it. Don't let me limit you, however, in the ways you prepare these foods. I'm not a real cook and don't pretend to be. I just do what works best for me.

BREWER'S YEAST

Brewer's yeast is the richest known source of B vitamins and is 45% protein. It sells for from $1.19 to $1.65 a pound, making it the cheapest source of concentrated, instantly available protein.

For a guarantee that you are getting all you need of the B vitamins, most minerals and 18 grams of top grade protein, you should take 40 grams of brewer's yeast a day. This would be one tablespoon of yeast powder four times each day.

Since there are 448 grams in a pound, one pound should last you twelve days.

I like the taste of yeast in just plain water. You can mix it with juice or food if you like it that way.

Before you reject brewer's yeast as a regular part of your diet, you should read up on it in Rodale's **FOOD AND NUTRITION.**

A word of caution is in order about yeast. You should never eat the yeast cakes or dried yeast used for baking. This is alive. It will live inside you for days, taking the B vitamins from your system. Brewer's yeast has been treated and so is not alive. Therefore, it gives up its B vitamins instead of taking them.

OTHER FOODS

Throughout the book I've recommended several inexpensive foods you should adopt as staples. There is a bounty of other foods you can prepare to dress up your cheap staples and you can put out meals that look very classy.

Once you learn to prepare fresh, raw vegetables as side dishes and salads, you will not miss the garbage you ate before. You will also be fitter.

Surveys show that people eat less today than twenty years ago but they are fatter. This is due to less protein and more starches. There are also more fat people among the poor for the same reason.

Part of the poor nutrition is due to the 20% rise in the consumption of snack foods since 1950. Better to carry a sack of lunch you have prepared for pennies than to waste a buck at the franchise ptomaine parlor.

Instead of buying snack foods you should buy okra, asparagus, eggplant, Brussels sprouts, etc. and include some small portions of each in your lunch. Cheaper vegetables you can use in quantity are carrots, squash, cabbage and pumpkin. These are good raw for lunch.

Also eat plenty of eggs. If you use safflower oil in your diet it will take care of the cholesterol in the eggs. This way, you can take advantage of this cheap, high protein food.

One thing you should avoid with eggs is eating the whites raw. The type who likes his eggs sunny side up not only disgusts everyone watching but is in for a morning of indigestion.

Egg whites have to be cooked to be digestable. If you like eggs in drinks and eggnog, separate the yellows from the whites, put the raw yellows in the drink as they are fine, and use the whites for some cooked dish.

Healthful treat foods and still reasonably cheap are apples, bananas, cantaloupes, dates, figs and nuts. If you begin preparing all your own food you can afford all the treat foods you can eat.

COOKING TOOLS

You don't need to be set up like the French Chef to prepare your own foods. In my selection I have tried to pick the simplest, cheapest and most durable utensils.

One of the cleverest and handiest cooking tools is a one-quart thermos bottle, bought cheaply from any dime store. This is wonderful for a single person living in a sleeping room with no stove. It is still practical for one who has a good kitchen.

If you boil water and pour it into a thermos bottle and cap the thing tightly, the water will stay almost boiling for hours, cooling gradually. This will cook food just as surely as if you had it on a low fire all night. And it only takes about five minutes of fuel, as opposed to several hours stove cooking over low heat.

While attending Long Beach City College in 1960, I had a $6.00 a week sleeping room at the Wino Arms. I worked in the kitchen of the Seaside Hospital, part time. I got only $27.00 per week take-home but I still lived pretty high.

I got a meal a day at the hospital but mainly I did my cooking in a thermos bottle. At night I would put four ounces of wheat in a pan of water and heat it to boiling. Then I would pour it into the thermos bottle, cap it, and lay it on it's side. This is because the wheat swells and would clog up uncooked at the bottom. Laying the bottle down spreads out the contents so it cooks right and doesn't bunch up.

When I awoke in the morning the wheat would be all cooked and fluffy. From four ounces of wheat I would get one pound, two ounces of multi-vitaminized high energy food.

I would put margarine and salt on it and sometimes hot green peppers. It can be dressed up all kinds of ways.

I ate that for breakfast for two semesters. I would buy wheat in five-pound bags from the health food store and the breakdown price was 3¢ per breakfast. Inflation has driven the price up to 5¢.

I figured, rightly, that such a breakfast was more nutritious than anything I could buy in a restaurant. Besides, the money I saved went for partying and tearing around.

In another quart thermos I had beans or stew going. I would soak dry beans overnight and boil them up and put them in the thermos to be ready for me that night.

To sum up thermos cookery: It is the cheapest on fuel consumption. No food value lost through steam. Food can't burn. It is convenient because if you open it 24 hours later instead of eight, it is still warm. It is also tastier as the flavor has no place to go. It is great for camping as you can start it at home and eat it hot hours along the trail. It is great again for camping as it takes very little wood to start the process and after having a fire for five minutes you can proceed along the trail carrying your cooking foods as you march. Further for camping, a couple of thermos bottles on the trail would allow you to pack light grains for food instead of bulky cans and such.

Since I've been on wheat, let me suggest it for your children. Also oatmeal. These two breakfast foods are wonderful. They give quick and lasting energy. A big helping of either, or mixed together, will help your kid through the morning.

There are at least 2800 artificial fixatives and colors put in commercial processed foods. Breakfast cereals are loaded with them. If your child has turned into a neurotic little swine, it is most likely from the cereals Captain Monster advertises on the kids' Saturday morning stupids.

Give your child wheat and oatmeal and a dose of brewer's yeast with its B vitamins for breakfast. That will settle him down and build him up.

The garbage they sell to kids is bad for them. It is also very expensive if you figure how much an ounce you are paying for those over-processed and messed up cereals.

Electric Hotplates . . . so compact, portable and easy to clean

Both units have same heating element used in big ranges. Infinite-heat control to set temperature anywhere within range. Brushed chrome-plated steel body and black plastic trim 6-foot cord.

For 110-120-volt AC (regular household current)

Double Burner. One side heats to 500-watts; other side to 1100-watts. 10x10x3¾ in. high. Shipping weight 10 lbs. **$21.95**

Single Burner. Variable heating from 0 to 1100 watts. 9⅝x9⅝x4 inches high. Shipping weight 5 lbs. **$15.95**

HOTPLATES

If you live in a sleeping room a hotplate will give you a much wider range of foods and save a lot more money. Most landladies look the other way when they find you are cooking in your room. If yours doesn't, I have found that loud threats of physical violence makes most landladies go off and bother someone else.

Sears has single burner hotplates for $15.95 and doubles for $21.95. Unlike most hotplates, these have heat controls. This makes them so much easier to work with that I recommend them over the cheaper, one heat types.

You can get cheaper hotplates in most hardware and appliance stores the most common are the Liberty, single burner at $3.99 and a double for $14.69.

The biggest drawback for the non-control hotplates is that you can't turn them down for pressure cooking. This problem is solved by sliding the cooker over so that just a small edge rests on the hot burner. If you have only a single burner, use a brick or a book alongside the hotplate for the cooker to rest on.

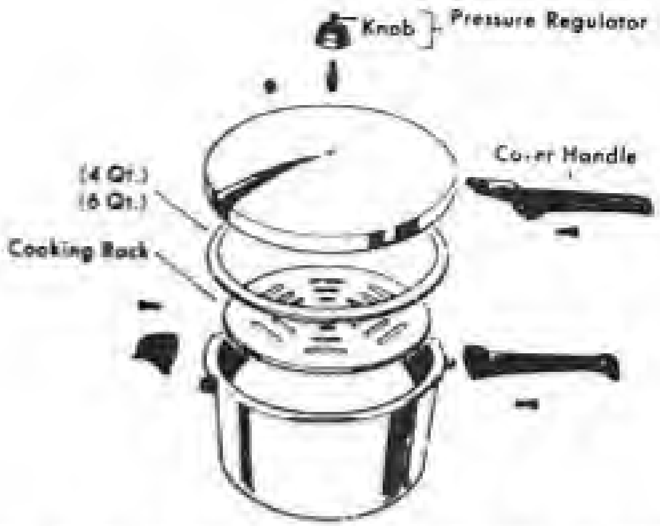
I taught a wino house painter a lot of this material. He has a sleeping room and he's to the thermos-hot-plate-steamer stage.

He has a frying pan and is crazy for corn pancakes. He also uses his frying pan to roast soy flour. He puts about a cupful into the clean frying pan and jiggles it and messes with it until it is a few shades darker. Then he mixes it with safflower oil and spices like chili and spreads it on his corn cakes. He takes these for lunch along with a jar of rice and beans and such.

He says he eats better now than he ever did before. Also, he has risen from cheap sweet wine to peach brandy because he can afford it now. Thanks to me has has graduated from a wino to an alcoholic.

PRESSURE COOKER

When heat can't escape, pressure builds up and forces the hot steam or liquid into the food from all sides at once. Also, since



the heat can't escape, little fuel is needed to maintain the super heated condition inside a pressure cooker.

A pressure cooker is a real necessity at high altitudes where water boils at lower temperatures. If you are in, say, Taos, New Mexico, (an awful place) which is 7000 feet up, water boils at about 180 degrees instead of 212. It won't get any hotter and you can boil meat all day before it finally gets done unless you use a pressure cooker.

At sea level the pressure cooker saves time and fuel. It is simple once you get used to it.

If you don't have a book for your pressure cooker, buy one from a hardware store or send 60¢ to National Presto Industries, Inc., Eau Claire, Wisc. 547701. Ask for their pressure cooker recipe book.

If you leave water in an aluminum pot for, say 24 hours, you will see crystals forming on the metal under the water. These aluminum salts are released in small quantities in everything cooked in aluminum where water is used. This also holds true for frying in aluminum pans as the salt in the food reacts with the aluminum.

Stainless Steel is so much easier to clean than aluminum, I think this alone would justify the switch away from aluminum.

Sears and Montgomery Ward have stainless steel pressure cookers for $21.59 for a 4-quart and $25.69 for a 6-quart. A pressure cooker will last a lifetime so you should get the best and so I recommend the 6-quart size.

I quote from their book: "Pressure cooking is the modern way to provide your family with nutritious flavorful meals in less time, with less work. Your cooker saves you time, cooks foods 3 to 10 times faster. It helps with your food budget, too, by turning inexpensive cuts of meat into tender, juicy meals. Pressure cooking retains the vitamins and minerals in food, gives you more nutritious meals than ordinary cooking methods. And the natural flavors of all foods are preserved in pressure cooking to provide rich, appetizing, interesting meals for your entire family.

"The modern pressure cooker is the ultimate in cooking convenience. By using the basic recipes in this book you soon devise your own recipes and complete Pressure Cooked menus. All of the recipes in this book were tested in a 4-quart Cooker."

Aluminum cookers are cheaper but they corrode and are probably unsafe. The local health food store people won't carry any aluminum cookware and their judgement on that is good enough for me.

STEAMING

Steaming is my favorite way of cooking. Next to the thermos bottle, steaming retains more vitamins and mineral than any other cooking method.

The best thing about steaming is that it makes the food tastier. When the heat comes mainly from the bottom, like in frying, the juices and flavor are forced out the top. In boiling, the food is agitated and broken down. The moving water goes into and out of the pores, carrying the flavors into surrounding liquid.

But in steaming, the heat hits the food evenly, from all sides. The food is not agitated or broken down. No juices or flavors are carried anywhere.

With steaming you can put two or more foods together without an exchange of flavors. Since there is no agitation, nothing gets mixed up.

For instance, I put into my bowl some rice. On top and at one side I put some soy bean sprouts. On the other side I put a slab of tofu. On top of the sprouts and tofu I put some strips of beef or pork. Atop that, I put some carrot slices.

I then put three cups of water in the bottom part of the steamer. I put the bowl of food in the top part and turn the fire down to just boiling and set the timer for 20 minutes. Then I go about messing and goofing until I hear the timer's ping.

Still another thing I like about steaming: you can't burn the food. With a timer, you just put everything in there and go on about your business. You don't have to watch it or fool with it. Even if you don't hear the timer and the water boils away, no harm is done.

When the timer pings I turn off the fire and take off the lid. Then I wait a couple of seconds for most of the steam to gush out and then I reach in with a pair of pliers and take out the hot enameled bowl.

It sometimes happens that drops form on the underside of the steamer's lid and fall into the bowl. To prevent this, bend something like an aluminum TV dinner tray so you can stand it over the bowl and the drops will be deflected from the bowl.

To cook rice in the steamer I put two cups, or one pound, of Calrose rice in a strainer. I move this under the water faucet until all the talc is washed from the rice. Rice without talc doesn't need washing.

I put 4¾ cups of water in the steamer pot and put in the steamer. This is just enough water to reach the steamer's bottom. Then I put in a large cloth to keep the rice from going through the streamer holes.

The cloth should be just big enough so the edges come out over the top, to be folded out and held down by the lid. When the cloth is in place I put in the rice and add four cups of water and set the timer for 35 minutes.

This gives me enough rice for several meals and I store it in the refrigerator. Recooking by steaming makes it just as moist and fluffy as any I've seen.

Steamers come in several varieties. The first I tried was the second to the largest size Mitsubishi rice cooker. This is a very handy electric steamer which goes off when the cooking time is over, yet keeps the food warm until it is unplugged.

CHINESE GRAVY, one serving

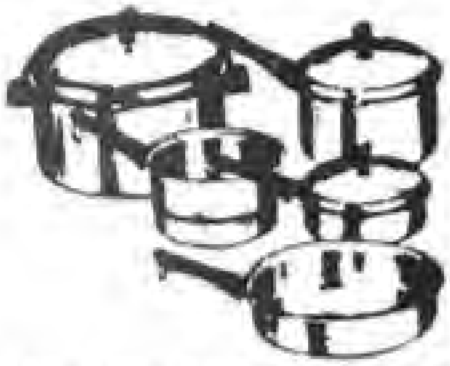
At this point I feel I must give you a recipe for Chinese gravy. This is the gravy put in and on just about everything in a Chinese meal. It's not very nutritious but it is tasty, cheap and only takes about three minutes to make. A serving of Chinese gravy put over my rice, tofu, sprouts and meat strips gives me as good a meal as I could buy and for only 25¢

Mix two tablespoons of soy sauce, one tablespoon of molasses and one teaspoonful of flour or starch. Heat ½ cup of water and add one beef boullion cube.

Mix in the soy sauce, flour and molasses and stir over the fire until the mixture clears to a brown syrup. Fantastic!

Its only drawback is that its pot is aluminum. I used it only a couple of months before the aluminum pot got so corroded I didn't want it any more. If the Mitsubishi company would change to stainless steel pots they would really have a winner in automatic steamers.

The steamer I use now is the Steam-Well 7-quart steamer put out by the Cookware Group. These sell for $4.49 at both Wards and Sears. Wards has a 20 quart family steamer for only $9.99.



STAINLESS STEEL COOKWARE

You might as well break down and get yourself a whole set of stainless steel cookware. It will last a lifetime, it is easy to clean and it doesn't corrode.

Sears and Wards offer a set of eight pieces for $20.00.

They have snug fitting lids and are perfect for waterless cooking. This is where you put just a little water in and cook a long time over low heat. This method is reputed to save more vitamins and minerals than pressure cooking.

The set includes a 1-quart covered saucepan; a 2-quart covered double boiler (includes insert saucepan); 5-quart covered dutch oven (cover fits skillet); 10½ inch open skillet.

Aside from this, you should also buy their three piece stainless steel bowl set for $3.49. These bowls range in sizes from ¾ to 1½ and 3-quart capacity. They are very useful and their price will go up and up so you should buy them now.

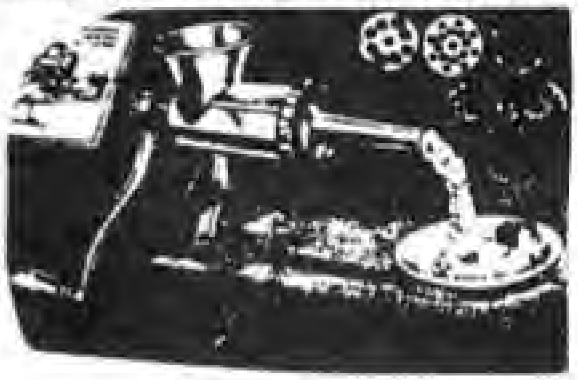
CANNER

Canning is fine if you can get a large supply of perishable food cheap. If you are into canning get a book on it. I bought my canner to make booze in.

It is porcelain covered and holds 36 quarts. It costs $7.50 from Wards and Sears.

Naturally, I dropped it right away and broke some porcelain loose from the bottom of the inside. I then lined the canner with a large plastic bag. Since contents were not to be heated I don't fear any deterioration of the plastic.

In the big pot line is a porcelain 16-quart kettle from Wards for only $2.79. This comes in handy for cooking large batches of food.



FOOD GRINDER

This is usually called a meat grinder or sausage maker. There are rinkydink, tinny toys on the market and advertised on TV around Christmas. This junk sounds great but they don't hold up or work well.

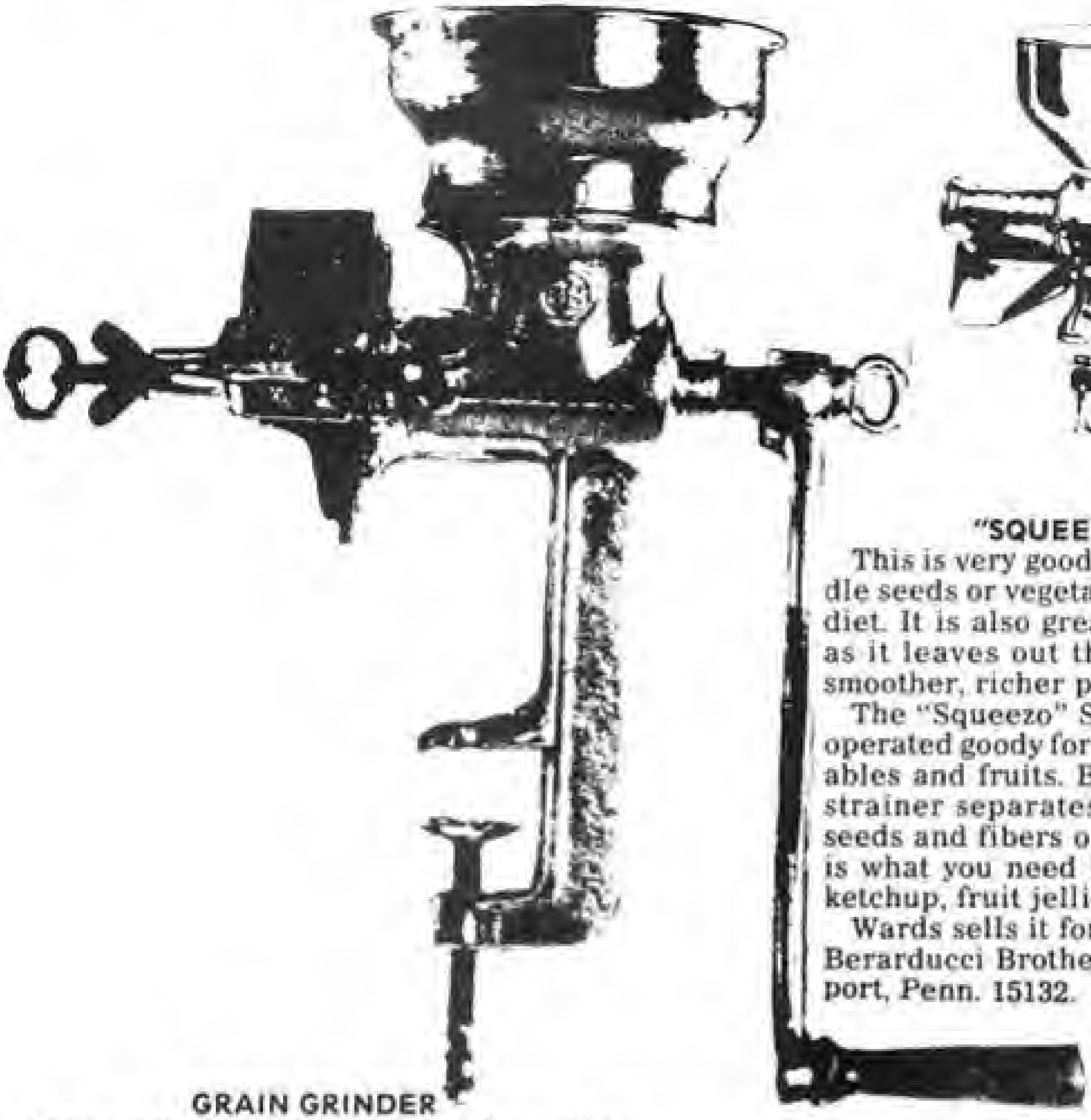
What you want is a strong grinder that will do a big job quickly and last forever.

A food grinder is for grinding meat. Also it is good as a pre-grinder to break down foods you mean to put in the blender. I burned a blender out once grinding coconut. If I had first put the coconut through the grinder the blender would still be alive today.

A grinder is also good for making bean paste.

I bought a meat grinder from Sears for $18.00. It is heavy duty and from Austria. It has five plates with different sized holes for the goody to be pushed through. It also has a nozzle to fit sausage casings on.

If you want the plainest one, you can get it from Wards for $5.80. It has three plates and no nozzle but if you are really hurting I'd say you can get by with this one.



"SQUEEZO" STRAINER

This is very good for people who can't handle seeds or vegetable skins or fiber in their diet. It is also great for making bean paste as it leaves out the bean skins, making a smoother, richer product.

The "Squeezo" Strainer is a simple, hand operated goody for making puree from vegetables and fruits. By turning the handle the strainer separates the pulp from the skin, seeds and fibers of vegetables and fruits. It is what you need for making tomato paste, ketchup, fruit jellies, applesauce, etc.

Wards sells it for $16.79. It is made by the Berarducci Brothers Mfg. Co., Inc., McKeesport, Penn. 15132.

GRAIN GRINDER

Grains are much cheaper than flour. Also, they keep longer than flour. Another important thing is that freshly ground flour has a lot more nutrition than that which has been ground for weeks or months.

With a grain grinder you can grind your flour fresh each day or make up a week's supply.

The Corona Grain Grinder is by far the best hand grinder made. Its burrs are steel and the unit is made to last a lifetime. It weighs 10 pounds. It's the most valuable tool in your survival program. $45.00 includes shipping. (The 1992 price). Send to Atlan Formularies, P.O. Box 95, Alpena, AR 72611.

Include your delivery address.

Your natural food store may have it. I use about three adjustments for fineness, depending on the grain I am grinding. Fiddle with the adjustments until you learn to get what you want. A little practice does it.

TIMER

A timer is needed by everybody. It saves standing and watching things cook. When you put your food in the steamer or pressure cooker you don't want to be fretting and watching the clock. With a timer you can go on about your business and wait for the ping.

You can get one from the dime store or Wards or Sears for about $4.00.

The Hygienic Cookbook 1876

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INTRODUCTORY.

Food and Diet

SINCE the most excellent culinary preparation cannot convert substances which are absolutely unwholesome and innutritious into good, wholesome food, it is obvious that the selection of *proper material* is a matter of the first importance in all matters pertaining to cookery. A few inquiries, then, respecting the nature of healthful food and some of the articles erroneously considered as such, may not be out of place as an introduction to that portion of this little work which treats more especially of the preparation of food for the table. We will first inquire,

What Is Food?

As relating to the diet of man, food may be defined as being any substance which is susceptible of being taken into the system and there assimilated, or made to take part in the formation of some of the tissues or structures. It is by this process of assimilation that the growth and maintenance of the body is effected. The best food, then, is that by means of which the desired end may be most readily and perfectly attained. Experience shows conclusively, actual experiment having again and again demonstrated the fact, that man can obtain nourishment from such substances only as are the product of the vegetable kingdom. The plant, through the agency of a mysterious force called vitality, so transforms the various elements of the mineral world as to prepare them for the sustenance of man and the animal kingdom in general. This change is an indispensable one, as all intelligent physiologists agree, and as the facts of every-day life abundantly attest.

Man's Natural Diet.*

While admitting that it is essential that the inorganic elements of the earth and air should undergo a process of organization through the medium of the vegetable kingdom before they can serve as food for man, it is claimed by many that food is still better prepared to meet the wants of the human system after it has undergone the further process of assimilation by the animal kingdom. On this ground it is claimed that flesh is the proper food for man, and that he cannot be deprived of it without suffering material injury thereby. As indicated, however, by his organs of mastication and digestion, the kind of food most suitable to his nature, and the best calculated to supply all the wants of his system, would seem to consist exclusively of fruits and grains.

So great, however, are the capabilities of the human system, in being able to accommodate itself to a wonderful variety of circumstances, it may derive nourishment from a large number of substances, many of which appear to be quite dif-
7 ferent in character from those designed by the Creator to be used for this purpose; consequently, we find that man may subsist upon several classes of roots and many other vegetable productions. So, also, life may be sustained by a diet almost exclusively composed of flesh. These facts do not conflict in the least, however, with the statements already made. As previously intimated, they only indicate the wonderful capability of adaptation to circumstances which man possesses. The character of his proper food must be determined from evidences of a more substantial nature than acquired habits and perverted appetences.

Perverted Appetites.

Possessing the power of cultivating the taste to an almost unlimited extent, men have unfortunately acquired many unwholesome and pernicious habits. Their appetites have thus become so depraved that they are enabled to relish articles which are the most obnoxious to a natural, unperverted taste. Among the various substances for which an unnatural taste has thus been acquired, we may mention as the most common, flesh food, butter and all kinds of animal fat, fine flour, spices, pungent roots, as radish, celery, etc., sugar, vinegar, pickles, preserves, tea, coffee, wine and all other stimulants, salt, soda, saleratus, and the various other mineral substances employed in cooking.

Animal Food.

As already remarked, there is the most conclusive evidence that meat is not the most natural
8 food of man. It is equally well shown that the use of flesh as food is detrimental to longevity, and prejudicial to the attainment of the highest degree of physical, mental, and moral development. More than this, it has many times been made evident to the most strenuous advocates of flesh diet that eating of the flesh of animals is an act attended with no inconsiderable amount of immediate danger to life. Cattle and sheep are well known to be subject to various diseases, just as is man. Hogs are notably liable to disease. How many people suffer all the agonies of death a hundred times from loathsome tape worms which originated in measly pork? And, if possible, how much keener suffering is endured by the poor victims of those horrid creatures, trichinæ, which are to be found in unnumbered multitudes, according to reliable authorities, in one out of every ten of those scrofulous scavengers which supply our cities with ham and sausage.

Fish are also subject to disease, epidemics resembling epizootic diseases often destroying them in vast multitudes. When *not* affected by disease, they are less nutritious than beef; and, upon the whole, they are quite as injurious when used as food as any other kind of flesh.

Notwithstanding the above facts, it cannot be denied that animal food contains the elements of nutrition, although in much smaller proportion than many vegetable productions. This is fully shown in the following table of comparative nutritive values of different articles of food, which is compiled from the most recent scientific works, and chiefly from Dr. Smith's excellent work on "Foods":—

9

ARTICLES OF FOOD.	Amount of Nutriment in 100 parts.	ARTICLES OF FOOD.	Amount of Nutriment in 100 parts.
Beef,	27.0	Lentils,	77.0
Sheep,	26.4	Potatoes,	26.0
Fowl,	26.3	Turnips,	9.0
Calf,	25.6	Carrots,	17.0
Fish,	22.0	Parsneps,	18.0
Wheat,	85.0	Beets,	16.5
Oats,	88.0	Cabbage,	5.6
Maize,	93.0	Apples,	16.0
Barley,	86.0	Pears,	14.0
Rye,	85.0	Peaches,	15.0
Rice,	87.0	Strawberries,	12.7
Millet,	87.0	Figs,	81.3
Beans,	86.0	Cherries,	23.7
Peas,	85.0	Dates,	76.0

Thus it will be observed that a pound of beef contains less than one-third as much nourishment as a pound of wheat or corn, while other kinds of flesh are still less nutritious. The popular notion that animal food is more nourishing than vegetable is thus shown to be wholly without foundation.

When animal food must be used, as its use is sometimes required as a temporary expedient, it should be carefully selected, so that it may be as free from disease as possible. Wild game is often the most wholesome. It must also be cooked in such a manner as to make it the least objectionable possible. To this end, the flesh should be thoroughly washed, so that the blood retained in it may be removed; fatty portions should be removed, and the flesh should be broiled, rather than fried.

10 **Eggs.**

Many vegetarians, so-called, make large use of eggs, apparently overlooking their animal character. They are exciting and stimulating in their nature at the best, and are usually made still worse by improper cooking. When boiled hard, or fried in grease and eaten with pepper and salt, they are very indigestible. For this reason the use of eggs in cakes and custards is very objectionable. The less they are used the better.

Milk.

Although somewhat less objectionable than flesh, milk is animal food, and is open to most of the objections urged against the use of meat. It is doubtless the best food for young animals, as each class of warm-blooded animals is provided with this kind of food, which is just adapted to the alimentary wants of the animal for which it is designed. In accordance with this principle, an error is made when we attempt to sustain one class or species of animals on food especially adapted to another. Cows' milk is excellent for calves, but cannot be so well adapted to the use of man, because the requirements of his system are of a different character from those of a calf. Even cows' milk is much better for the use of children than for adults, as certain changes take place in the digestive organs during the process of growth which render milk and all kinds of fluid nutriment objectionable, as they cease to be suited to the condition of the individual to be nourished.

Milk is quite liable to be freighted with the products of disease. Many cases have been reported in which there was the best of evidence
11 that typhoid fever was communicated through the medium of milk. In some instances the germs of disease were introduced into the milk through water which was fraudulently added to it, or which was used in cleansing the vessels containing it. In other cases, there were good grounds for believing that the typhoid poison was introduced into the circulation of the animals with their food, and thence transmitted to the milk. It is thought by some medical authorities of eminence that tubercular consumption, which is a very common disease in cows, is communicable to human beings through the medium of the milk. It is also a well established fact that when the period of lactation in animals is unnaturally prolonged, the lacteal secretion becomes largely of the character of an excretory product. If used at all, it should be with great moderation. The less the better for adults.

Cheese.

Old cheese is one of the most injurious of dietetic abominations. The notion that it aids digestion is a monstrous fallacy. It is itself very indigestible, and it impairs and retards the digestion of other food. In the process of ripening, or maturing, the cheese undergoes putrefactive changes which give rise to noxious acids and gases, to which the pungent taste of old cheese is due. Only when new, is it at all fit to be eaten; and then much risk is often incurred, as various poisons are frequently introduced as coloring material. Pot-cheese is less objectionable, when properly made, than old cheese made at the factories; yet this is by no means an entirely wholesome article of food.

12 **Butter.**

Butter is not materially different from other animal fats and oils, in its effects upon the system, at least; neither is its composition much different from tallow, lard, etc. Indeed, a very large proportion of the butter now used in large cities is manufactured directly from suet. Many who have partially adopted the hygienic mode of living have made a very grave mistake in their manner of using butter. Learning of its injurious character, they have ceased to place it upon the table in its solid form, to be used, as formerly, with bread, etc.; but they continue to put butter in their food as seasoning, and, possibly, increase the quantity a little to supply the deficiency felt from banishing it from the table as a separate dish. They doubtless go upon the principle that if the butter is only out of sight it can do no harm. The truth is that this is the very worst possible way of using butter or any other kind of fat. When cooked with the food, it thoroughly permeates the whole mass, and renders it next to impossible of digestion. When simply spread upon bread, it is much more easily disposed of. But there is no necessity whatever for the use of any kind of animal fat, any more than there is for the use of flesh. The various kinds of nuts, and the rich grains and seeds, as corn, beans, and peas, are wholly adequate to supply all that the system demands in the line of oil. When we remember, also, that in animals a large amount of fat is invariably the result of disease, this becomes a very undesirable article of food.

13 **Fine Flour.**

The invention of the process of "bolting" flour was a most unfortunate occurrence for humanity. It has been the direct cause of an incalculable amount of injury to health, fine flour being a most fruitful source of disease. It has also been productive of enormous waste, independent of the worse than useless labor bestowed upon the process itself; for by removing from the kernel of wheat the outer layers, called bran, coarse and fine middlings, etc., the grain is deprived of its most nutrient portions, which are fed to hogs or other domestic animals who thrive upon the best portion of the wheat while man contents himself with the impoverished residue.

Fine flour should never be used only in exceptional cases. It is barely possible that some invalids who have morbidly sensitive stomachs may find the coarsest portion of graham flour somewhat irritating. In such cases the coarse bran can be removed with a sieve, or a quantity of fine flour may sometimes be mixed with the graham for a time, until the system becomes accustomed to its use.

Spices.

All pungent, acrid substances should be wholly discarded by hygienists. They vitiate and destroy the delicacy of the sense of taste, and are active and potent agents in producing dyspepsia and all the attendant evils of that hydra-headed malady. Pepper, nutmeg, cinnamon, and the remainder of the list of savory, though pernicious, condiments, do not add anything of value to the food, but obscure its natural flavors, and destroy the relish for simple, unstimulating foods.

14 Salt, Soda, and Other Minerals.

Salt is said to be an indispensable article of *food* by many eminent physiologists. Nothing can be more untrue than this statement, notwithstanding the eminent character of its champions as men of learning and integrity. They doubtless have what appears to them to be evidence of the truth of their position. However this may be, the evidence that salt is an injurious article of diet in *any* quantities, either large or small, is of the most conclusive character. It contains no element essential to nutrition; in fact, it cannot be used by the system in any useful manner whatever. When taken into the body, it is hurried out by the most accessible channel; hence its stimulating character; for stimulation is simply the result of the defensive action of the system. It is inorganic in its nature, and, consequently, cannot be assimilated by the organs of nutrition, but is rejected like any other poison. The experience of hundreds—we may even say thousands—of individuals demonstrates, in spite of all the theories about hydrochloric acid, etc., that salt is not only useless, but harmful as an article of diet. It is an irritant, a caustic, an antiseptic; and it produces a feverish condition of the system, irritates the digestive organs, and, in any considerable quantity, greatly retards the digestion of the food.

All that has been said with reference to salt will apply with still greater force to soda, saleratus, cream tartar, and the other minerals with which modern cookery contrives to spoil our food and ruin our health. All are worse than useless. Discard them at once, if possible; if not, be sure

15 to cultivate a dislike for them as rapidly as may be, by gradually diminishing the quantity used.

Sugar.

Under this head, we shall include all the various forms of saccharine matter—sugar, sirup, molasses, maple sugar, honey, etc. It has been claimed by some that sugar was an inorganic substance like sand, salt, powdered glass, etc. This statement will not bear the scrutiny of science, however, and could not be honestly made by a person who understood all the scientific and chemical facts bearing on the subject. Sugar is, properly speaking, neither an inorganic nor an organized substance. It is an intermediate substance. It is one of those curious products which is formed in the laboratory of nature in the process of converting dead, inert, inorganic matter into living, active, organized structure. In other words, it is a partially organized substance. Its principal use in the economy of nature seems to be to render palatable, food which would otherwise be tasteless or unpleasant. For this purpose, it is, with rare exceptions, provided in just the right form and proportions in the substances designed for the dietetic use of man. In some articles, as very sour fruits, it seems to be deficient; but the want is supplied by a superabundance in such sweet fruits as dates, figs, and raisins.

The sweet element of these fruits is doubtless essentially the same as what is commonly termed sugar; at least, it becomes so by the processes of drying and cooking to which it is usually subjected. The question at once arises, Why may we not use sugar, then, as freely as we may use sweet fruit? The objections to the use of sugar are two:—

16 1. It is exceedingly liable to adulteration with very poisonous substances in the process of manufacture; sulphuric acid, nitric acid or aqua fortis, and bi-acetate of lead—a potent cause of lead paralysis—are frequently employed for various purposes.

2. On account of its condensed form, it is almost certain to be used in excess, when it becomes a very effective cause of dyspepsia, liver complaint, and a host of evils. With sweet fruits, this is much less liable to occur, although it is not at all impossible. On this account, sweet fruits are preferable to pure sugar, and hence we have usually recommended their use in place of the sugar of commerce.

When sweet fruits cannot be obtained, or when their use may be very objectionable for other reasons, a *very moderate* quantity of sugar may be used. Always buy the best white sugar. Brown sugar is seldom fit to use. Its dark color is due to the dirt it contains; and, worse than that, it is often filled with minute animals which are the cause of a disease known as grocer's itch. Maple sugar is no better than good coffee sugar. The sirups are hardly safe to use at all, as they are so largely adulterated. About one-half of that in market is spurious, being manufactured from cotton, old rags, sawdust, refuse starch, and sulphuric acid. About the only justifiable use of sugar is for rendering more palatable sour fruits.

Be careful to avoid excess in the use of sweetening; and, best of all, acquire, as soon as possible, a simple taste which will relish food best when nearest its natural condition, and without the addition of any condiment.

17 **Vinegar, Pickles, and Preserves.**

It would seem that nothing need be said to convince any candid, observing person that these articles are wholly unfit for food, as his own sensations must often have hinted to him their indigestible character. Vinegar is really more injurious than alcohol. This is not strange, since it is one more step advanced in the process of decomposition which ultimately converts sugar into carbonic acid and water. Vinegar is always formed by the fermentation of alcohol by means of yeast or something equivalent. Pickles are wholly intolerable, and are almost devoid of nourishment. Preserves are about equal with them in this respect. Converting good, wholesome vegetables and fruits into pickles and preserves is a very wasteful practice, to say nothing of its detrimental influence upon the health, which is simply enormous. They should never be eaten under any ordinary circumstances.

Tea and Coffee.

Although these cannot be called food in any sense, they are so often taken with the food that we will consider them here. The objections to the use of tea, coffee, cocoa, and chocolate, are the three following:—

1. They are stimulating. This implies that they contain elements which are recognized by the system as poisons, and are treated as such, being turned out of the body as quickly as possible after being introduced. Chemical analysis reveals the fact that each of the articles mentioned contains a poison which is very fatal to animal life when taken in any but the most mi-
18 nute quantities. Tea, coffee, chocolate, and cocoa differ somewhat in their poisonous qualities, but the difference is principally in degree, not in kind, since the element which gives to them their peculiar properties is essentially the same in each.

2. All drinks are objectionable when taken with the food, as they render digestion difficult, and impose a severe task upon the digestive organs before the work of digestion proper can begin, since all superabundant liquid must be absorbed from the food before the gastric juice can perform its proper function. Drinking with meals in a very pernicious habit, and makes thousands of dyspeptics. It encourages rapid eating, and, consequently, insufficient mastication and defective insalivation.

3. Tea and coffee are taken hot; and many people become so accustomed to the unnatural temperature that they are able to take into their mouths without pain that which would nearly scald their hands. Although no pain is felt, the injury is nevertheless accomplished. The fine sensibility of the nerves of taste is destroyed, and the whole mucous membrane of the mouth, throat, and stomach, becomes congested, debilitated, and subject to almost any disturbing influence.

Many people who call themselves hygienists use burned bran and molasses, burned bread, rye, barley, acorns, etc., in place of ordinary coffee; some use hot water only. Although the practice is not as objectionable as that of using worse articles, it is open to the full force of the last two objections, and when the roasting is carried beyond the point of simply browning the article
19 employed, be it bread, bran, or rye, it becomes somewhat poisonous and injurious. If it is thought that something warm must be taken to "warm up the stomach," a cup of warm water may be taken ten or fifteen minutes before the meal with no injury, as the fluid will then be absorbed before the food is taken.

Wine.

Without here entering into a discussion of the question which involves the medicinal use of wine, we can unhesitatingly state that its habitual use as a beverage is a habit worthy of the most unqualified condemnation. It is productive of an untold amount of suffering, sin, and crime. Nor is moderate drinking less deserving of censure than absolute drunkenness. Moderate drinkers are more dangerous enemies to temperance than drunkards. Stimulation means poisoning! and it is the gratification of the desire for artificial stimulus that constitutes the crime of using alcoholic liquors rather than the simple act of drinking wine, brandy, rum, whisky, or beer. All the virtue which wine is supposed to possess is due to the *alcohol which it contains*. Hence the only real difference between wine and rum, brandy, whisky, or other liquor is in the strength, and consequently the use of wine is open to the same objection as the use of those other liquors.

Time for Meals.

But two meals per day are far preferable to more than that number. The stomach needs rest as well as the other organs of the body. Meals should never be eaten with less than five hours' intermission, by adults. With small children, this rule may be varied somewhat ac-
20 cording to the age of the child. Probably the best hours for meals, considered from a physiological standpoint, are 8 A. M. and 2½ P. M. Those who find these hours inconvenient may take breakfast at 7 A. M. and dinner at 1½ P. M. Some

cannot make these hours convenient, and such may breakfast at 6½ A. M. and dine at 12 M. without suffering particular inconvenience from not taking the third meal, after having become accustomed to the change. For almost all persons, two meals are vastly better than three; but if the third meal is taken, it should be very light, and should not be eaten later than 5 P. M.

Change of Diet.

Perhaps the greatest obstacle in the way of a reform in diet is the difficulty which people find in breaking up old habits and establishing new ones. When this crisis is once safely passed, no further difficulty is experienced; and what was at first a hardship, is transformed into a pleasure such as was never before experienced. This is the uniform testimony of all who have persevered until new tastes and appetites were fully formed. But how to get over the unpleasant period during which changes are being made, is the problem. By observing the following suggestions, little difficulty will be experienced:—

1. *Make the change gradually.* Unless you can devote your time to the matter, suspending, in a measure, at least, your usual avocations, do not attempt to abandon everything not purely hygienic at once. When the change is made thus suddenly, the individual making it suffers more or less derangement of his system. He feels languid, weak, perhaps somewhat ill-tempered, and
21 may suffer somewhat from indigestion. These unpleasant sensations discourage him and weaken his will power, so that he is quite likely to abandon the attempt at reform; and it may be that he will lose confidence in the whole system. A gradual change will obviate all of these difficulties.

2. *Be sure to make constant progress.* The strongest argument which extreme and ultra hygienists are able to urge against this method of effecting a change from bad dietetic habits to good ones is the fact that many persons who make the attempt in this manner forget the importance of constant, prolonged, and persevering efforts, and allow themselves to rest contented after taking only the initiatory steps toward a reformation.

3. *Use common sense.* It is very frequently the case that people who attempt a reform in diet only exchange one bad habit for another; and sometimes, indeed, the second habit is far more injurious than the first. Exchanging light, sweet, fine-flour bread for heavy, perhaps sour, graham bread, is not reformation. Substituting large quantities of sugar, sirup, or molasses for meat is a terrible retrograde, rather than advancement. Banishing butter from the table, and then saturating the potatoes, gems, pie crust, and griddle cakes with suet, is no improvement! How many would-be health reformers have made themseves dyspeptics by attempting to reform in so unphilosophical, not to say absurd and ridiculous, a way!

4. *Do not attempt to live on an impoverished diet.* In other words, do not exclude from your dietary meat, butter, eggs, milk, sugar, and salt,
22 and then attempt to live on the residue of your former bill of fare. As each of the injurious articles mentioned is abandoned, supply its place with some new, palatable, and tasty hygienic dish. An impoverished diet is not one which excludes meat, butter, sugar, salt, spices, and other unhygienic articles; it is one which is lacking in the elements of nutrition, or which is not adapted to the particular conditions of the system. That which would be an impoverished diet for one might amply supply all the alimentary wants of another. Individual temperaments vary, and circumstances vary equally as much, so that set rules cannot be laid down which will be equally well adapted to all cases. Each individual must apply general principles to his own special case.

In commencing the change, discard the worst articles of diet first. Spices, vinegar, pickles, preserves, mustard, peppersauce, old cheese, and similar articles, may be discontinued at once and forever. Pork and all its products may be abandoned equally as promptly. Exchange fine flour for graham bread. Next attack the tea and coffee habit, reducing the quantity for a few weeks at first, if necessary, but being sure to rout the enemy. Curtail the butter and salt, and use only a moderate quantity of meat. By degrees these may be relinquished. Nuts may be freely used instead of butter. Sweet fruits may also be largely substituted for sugar. In the course of a few months, a person may thus easily become a thorough hygienist if he will constantly keep in view the ideal standard of a true reformer, which demands ultimate freedom from every habit which is the result of perverted taste, or departure of any kind from the strict observance of the
23 laws of nature. One important element which is usually necessary to success is a thorough appreciation of the fact that so intimate is the relation between moral and physical laws that the latter cannot be knowingly disregarded without doing violence to the former. "It is a sin to be sick;" and every law relating to health should be scrupulously and conscientiously observed.

It is quite possible that there may be found aged persons who have so long been accustomed to the use of flesh that an entire abstinence from that kind of food might be attended with more injury to them than the continuance of its moderate use. But this argues nothing in favor of animal food as the best diet for man. Young people and persons of middle age may make the change with impunity; and it is very doubtful if a return to the use of animal food can in such cases ever become necessary after the appetite for it has been once fully overcome.

24

COOKERY.

The Art of Cooking.

Good cookery may justly be classed among the fine arts; but in regard to that which is usually called good cookery, which consists in so compounding lard, butter, sugar, saleratus, cream, and spices, with the various fruits, grains, and vegetables as to not only completely conceal or destroy the natural and proper flavors of those articles, but to make them next to impossible of digestion and fit for nothing but the compost heap—such cookery might much more properly be called the black art. Indeed, if we except drug medication, we shall be perfectly safe in saying that modern cookery is the greatest bane of civilization at the present time. Men and women are subject to few diseases whose origin may not be traced to the kitchen. Closely following diseased physical natures come mental and moral inefficiency originating in the same prolific cause. This being the case, the importance of a thorough understanding of the principles of nutrition, and of the nature of alimentary substances by those who attend to this branch of the domestic economy, becomes very apparent. The position of cook, instead of being considered of a menial nature, should be looked upon as one of great importance and responsibility, and one which should be intrusted to none but intelligent and trustworthy persons. Especially is this true of hygienic cookery. Many have been discouraged and disheartened in attempting to make a reformation
25 in their dietetic habits by bad cooking alone. In the old methods of cooking it made little difference if the bread did sour in making; alum and saleratus would make it all right. If the meat became tainted by long standing, pungent and savory spices and condiments would effectually conceal the putrescent taste and odor. But in hygienic cookery, since nature's seasonings are the only ones allowed, the greatest care is necessary to preserve the delicate natural flavors of the articles used for food. In this direction there is a broad field open for skilful experiment.

One of the chief requisites for a good cook is perseverance. If the first attempt is not fully successful, do not denounce the recipe a failure, and the system a humbug, but try again and again until success, which is certain, is secured. Make the art of cookery a study, and utilize all your scientific knowledge, as well as your natural ingenuity, in your efforts to provide healthful and palatable food for those depending on you for those essentials of life.

BREAD.

This article of food, in various forms, constitutes a very large proportion of the diet of nearly all civilized nations. Yet it is a fact that a really good specimen of bread is seldom found, at least in this country. Very few cooks know how to make good bread, notwithstanding their acknowledged dexterity in compounding various mixtures to which they attach the name of that article. What, then, are the qualifications essential to

26 Perfect Bread?

1. It must contain as many as possible of the elements necessary to sustain life.

2. It must be light and porous, so that it may be thoroughly and easily insalivated and digested.

3. It must be palatable.

4. It must be of such consistency as to require sufficient mastication to enable it to become thoroughly permeated by the saliva.

5. It must not contain any ingredient which will be in any way injurious to the system if taken into it.

6. The material of which it is made must be preserved uninjured by the process of making.

Unwholesome Bread.

Let us briefly consider, in the light of the above principles, the real character of the bread which constitutes a staple article in the diet of the great majority of Americans, if we except the red-skinned natives of the West.

1. In ordinary bread, made from bolted flour, we have just the opposite of what is required for perfect bread, viz., "*as many as possible* of the elements necessary to sustain life." Instead, we have almost nothing but starch, which, alone, is no more competent to sustain the life of animals than pure water. It has been proved by actual experiment that dogs, when fed exclusively upon starch, or super-fine flour, will die almost as soon as when left wholly without food.

2. Although it is claimed by those who are prejudiced in favor of "raised" bread that in respect to the second requirement it has a decided preference over "unleavened" bread, which is
27 usually believed to be synonymous with heavy bread, yet if we may believe the testimony of most authors of popular cook books, as well as that of our own experience, it is not a thing at all uncommon for the good housewife, in the midst of her cares and burdens, to neglect her "sponge," which is undergoing the process of "raising," until putrefaction has so far advanced that heavy, sour, "soggy" bread is the result.

3. To be well assimilated, bread, as well as all other food, must be relished. To perfectly healthy tastes, the bread which is usually presented on our tables is far from palatable. It will bear no comparison with the sweetness and natural flavor of well-made unleavened bread. All are ready to grant the unrivalled superiority of the famous "hoe-cake," formerly so common in the South,

and yet its sole ingredients were corn-meal and water.

4. The eating of too large a proportion of soft food, which requires no mastication to allow it to be swallowed, is very injurious to the teeth. Like all other organs, they require exercise to preserve their integrity; hence, a large portion of the bread eaten should be in the form of crisps, crackers, or cracknels. Any one whose teeth are not in total ruins will find himself amply repaid for the trouble which he may experience in accustoming himself to the use of hard food. There is no better remedy for sore teeth and tender gums than eating food which requires vigorous and thorough mastication.

5. Not only is ordinary leavened bread, whether domestic or made at the baker's, almost totally deficient in some of the most important nutrient elements found in the grain and in unbolted flour,
28 but it contains many foreign elements which are decidedly injurious in their nature. These may be considered under the following heads:—

a. Elements which are used for the purpose of "raising." In ordinary home-made bread, no "raising" material is added to the dough. In this case, the putrefactive process, for such it is, is commenced by the introduction into the batter, from the air, of certain microscopic germs which are always the chief agents in originating the process of decay, and which are always present in putrefying matter. Hop yeast, besides containing the noxious elements just mentioned, contains an alkaloid which is peculiar to the hop plant, and which is a powerful narcotic poison when used in a concentrated form. It is due to the action of this poison that a hop poultice is often used to relieve local pain. Brewer's or baker's yeast is also a vile product of the process of putrefaction. It is simply the foul matter which rises to the surface of the vat as scum, or sinks to the bottom as sediment, in the fermentation of beer. Bad as are the articles already mentioned, there is a class still more injurious; viz., the soda, saleratus, cream of tartar, and the various compounds known as baking powders. They are all extremely pernicious, and have wrought much mischief upon human stomachs. It is useless to argue that a harmless salt is produced by the combination of these elements, for the salt itself is a caustic, irritating chemical, and a poison.

b. Changes which are the results of fermentation. The first, and that upon which the value of the process depends, is the production of carbonic acid. This well-known poison permeates the
29 whole loaf. The same is also the case when chemicals are used. Again, it has been proven by chemical analysis that a considerable portion of alcohol is formed in the "raising" of fermented bread, and that so much of this is retained in the bread that a person would take as much alcohol into his system by eating a few loaves of fermented bread, as by drinking a glass of beer. Lastly, if the process of fermentation is allowed to progress a little too long, true putrefaction begins, and acetic, butyric, and other unwholesome acids are formed, which often give to bread a very unpleasant taste and odor.

c. In addition to all these unwholesome elements, to which ordinary domestic bread is liable, baker's bread contains numerous other harmful ingredients, which are added either for the purpose of hiding the poor quality of his materials, increasing the weight of his loaves, or otherwise increasing his gains. Conspicuous in this list are blue vitriol, ammonia or sal ammoniac, alum, chalk, and magnesia. Sundry other chemicals, besides various filthy compounds sold as fruit essences, are also used in cakes and pies.

6. The production of carbonic acid and alcohol is at the expense of both starch and sugar, two of the chief nutrient elements of the grain, and also of the peculiarly grateful aroma which gives to each species of grain its characteristic flavor. This is one of the reasons why fermented bread can bear no comparison in sweetness with unleavened. The various chemicals which are employed in "raising" bread, through chemical action upon the ingredient of the grain, not only destroy some of them entirely, converting them
30 into harmful agents, but they render the whole less palatable and less nourishing.

Directions for Making Wholesome Bread.

Incredible as it may seem to one who has never seen the matter demonstrated, it is nevertheless a fact that bread possessing all the qualities of lightness and porosity may be produced without the introduction of any such deleterious substances as yeast, soda, saleratus, or cream of tartar. Neither will it be found necessary to allow the batter to stand until the process of decay is spontaneously induced. *Atmospheric air* and *soft water* are the only materials necessary to render bread as light as can be desired. These harmless agents are incorporated into the meal by proper mixing, and when heat is applied, the air expands, and the water is converted into steam, so that the bread is effectually raised without undergoing the process of decay, or being contaminated by any villainous chemical compounds.

Selection of Materials.—One of the most important requisites is the selection of the proper kind of material. Good bread cannot be produced from poor flour by the most expert manipulations of a professional cook. Especially is good material important in making hygienic bread, since its excellence depends so largely upon the natural properties of the grain, and deficiencies and unpleasant properties cannot be obscured by the addition of foreign materials so frequently employed in the old methods of bread-making. First-class flour must possess each of the following qualities:—

1. It must be prepared from grain which has been fully matured, and which has not suffered
31 deterioration from rust or mold, or from being exposed to moisture and heat.

2. The grain should be thoroughly purified from all foreign substances before grinding.

3. The flour must not be deprived of any of the nutritious elements of the grain by the process of "bolting" which is so generally resorted to, and which results in ruining the teeth and constitutions of thousands of persons every year, and involves the reckless waste of by far the most nutritious portions of our nutrient grains. In other words, fine flour should never be used. Wheat meal or graham flour, corn meal, oatmeal, barley meal, and rye meal can now be readily obtained in nearly all localities; and they should always be used instead of bolted flour.

4. The meal should be properly ground—neither too coarse nor too fine. If too coarse, the hulls of the grain will be irritating to the delicate digestive organs, especially to those whose stomachs are rendered morbidly sensitive by disease. If too fine, the bread made from it will be less likely to be as light as desirable.

5. Lastly, when water is used for making the batter, pure soft water only should be selected. Hard water toughens the dough and greatly diminishes the tenderness of the bread. No salt should ever be added to the water. Neither should any chemical be added for the purpose of "softening" the water, as the evil will only be increased.

Directions for Making.—After having selected the proper materials, much care and even dexterity is needed to produce good bread. The following general directions must be carefully attended to:—

32 1. Care must be exercised to select just the right proportion of the ingredients for the particular article to be produced. Whenever convenient, accurate measurement should be resorted to. But it must be borne in mind that different kinds of grain possess different absorbing qualities, and different qualities or grades of the same kind of grain will also vary in this respect. Hence the amount of water or other fluid to be incorporated with a certain quantity of flour must be subject to certain variations. But a little careful experimenting will readily fix the proper amount in all cases.

2. Since the lightness of unleavened bread depends so largely upon the expansion of atmospheric air, it is, evidently, quite important that care should be taken to incorporate into the batter as much of this harmless "raising" agent as possible.

3. Much also depends upon the condition of the oven, which must receive a due share of attention. The terms *quick* oven and *slow* oven are of frequent occurrence in the technology of cookery, but are often quite loosely employed. A *quick* oven is one which is so hot that the hand can be held in it but a very few seconds. An oven in which the hand can be held for a full half minute is termed a *slow* oven. These definitions are obviously not quite satisfactory, but perhaps they are as precise as can well be given without resorting to the thermometer which is not always at hand.

4. All utensils employed must of course be kept scrupulously clean in order to preserve unimpaired the natural sweetness of the grain.

5. Do not be discouraged even after repeated
33 failures. Still persevere, and final success is certain. The making of good, wholesome, hygienic bread is the very highest triumph of the culinary art; and when accomplished, one of the most efficient means of restoring and preserving health has been acquired. Bad bread is probably responsible for more despondent feelings, more ill-tempers, more crimes, perhaps more suicides, than any other article of food. And good bread is equally efficient in promoting health, cheerfulness, amiability, and even piety; for we fully credit the statement that there is "religion in a loaf of bread." Is not such a triumph, then, worth working for?

6. If it is desired that the bread should be tender and moist, it should be made with hot water. If dryness and brittleness are the qualities desired, cold water should be used, and the colder the better.

It is important that the meal should always be perfectly fresh, as all kinds of flour deteriorate very rapidly after grinding, especially when exposed to warmth and moisture. The best and cleanest grain should be selected.

Soft Biscuit, or Gems.

We give this first as being the simplest and most quickly made of any form of bread. It is, consequently, a very convenient article for breakfast. Although but a short time has elapsed since this kind of bread was introduced into cookery, it has become a very general favorite among all classes, even those who are not hygienists. It is to be lamented, however, that too often the delicate natural flavor and sweetness of
34 the grain is destroyed by the caustic action of such questionable articles as soda, saleratus, baking powders, etc. Nothing but pure water and meal are needed in its composition.

Into one part of cold soft water stir two parts of rather coarsely ground graham flour made from the best white wheat. Sift slowly in with one hand while stirring with the other, thus endeavoring to get in as much air as possible. If the flour is made from red wheat, a little more than two parts of meal will be required. The batter should always be thick enough so that it will not settle flat. If it is too thin, the biscuit will be likely to be flat and blistered; if too thick, they will be tough and heavy. In the first case, the batter is not of sufficient firmness to retain the air, and in the second, it is too stiff and unyielding. Beating the batter after mixing does not materially increase its lightness. No salt should be used.

BAKING.—The loaves must be small, like biscuit. Cast-iron gem pans or patty pans are most convenient for baking in. The pans should be heated very hot before dropping the batter in. A very hot oven is required, and the gems should be baked on the top first, to prevent the escape of the air and steam. The heat should not be sufficient to brown them in less than fifteen minutes, and they are better to bake twenty-five or thirty minutes; a longer time toughens the crust.

In order to prevent sticking, many people are in the habit of placing in the pans so large an amount of grease that the biscuits are rather fried than baked. This is a most pernicious practice, and is wholly useless. To prevent sticking,
35 smear the baking iron with sweet oil or fresh butter. Heat it thoroughly, and then carefully wipe away as much as possible of the oil. This will leave the iron smooth; and if it is carefully wiped after each baking, and then laid away in a dry place without washing, no difficulty will be experienced from sticking, and it will require oiling only at long intervals. The pan must always be very hot when the batter is placed in it.

By combining other grains in various proportions, a great many different kinds of gems may be made. A mixture of equal parts of graham flour and corn meal makes a very nice article. Boiled rice may also be used. Take one part boiled rice to three parts of water, and stir in graham flour sufficient to make a batter a little thicker than when the meal is used alone. Hominy and pearl-barley may be used in the same manner. This will be found a very convenient method of utilizing portions of food which might otherwise be wasted.

Corn-Meal Gems.

Upon one part of fine corn-meal, pour two parts of boiling water, and mix well. Bake in gem pans, in a quick oven. This makes the simplest and sweetest corn cake that can be made.

A favorite method with some is to allow the batter to stand over night after mixing; but it is liable to injury from souring.

ANOTHER METHOD.—Pour boiling water upon a pint of sweet, evenly-ground corn meal, stirring briskly until all is scalded. Then thin the batter with cold water, and add half a pint of fine or graham flour. Bake until slightly brown. Hot stewed pumpkin may be used instead of hot water.

36 Oatmeal Gems.

Make a thin batter of nice oatmeal and cold water. Let it stand over night, and in the morning add a little graham flour if too thin. Bake as wheat-meal gems.

Rye-Meal Gems.

Use rye meal instead of wheat meal, and mix and bake as directed for soft biscuit. The batter should be a little thicker.

Rye-and-Indian Gems.

Take one pint corn meal and twice as much rye meal. Scald the corn meal with boiling water, stirring it well. Then add the rye meal with sufficient warm (not hot) water to make a thick batter. Beat, or stir with a spoon, a few minutes, and bake in a moderate oven.

Graham-and-Indian Gems.

Scald one-half pint of corn meal. Add one-half pint cold water. Beat out all the lumps. Add another half pint of cold water, and sift and stir in about a quart of graham flour. Bake on the top for forty or fifty minutes. If the crust is too hard, cover in a dish for a few minutes after baking.

Green-Corn Gems.

Take one part grated green corn and two parts of water. Thicken with graham flour, a little thicker than for soft biscuit. This makes very tender and palatable gems.

Drop Cake.

Mix wheat or rye meal with cold water to a stiff dough, stirring until well mixed, and drop
37 with a spoon upon a hot baking tin in a hot oven. Bake until well cooked and brown. Eat while warm.

Johnny Cake.

Prepare the batter as for corn-meal gems, and bake in a common baking tin. This is known in the South and West as "hoe-cake," "corn-dodger," etc. In the days of open ranges and fireplaces, the batter was commonly baked upon a board before the fire.

Mixed Johnny Cake.

Take equal parts of wheat meal and coarse corn meal. Scald the latter, and add the wheat meal with only sufficient water to leave the batter stiff enough to need smoothing with a spoon. Make one or two inches thick, and bake an hour. Let it stand covered a few minutes after baking.

Snow Cake.

Take one part of corn meal and two parts dry snow. If the snow is moist, use less. Mix well in a cold room. Bake in gem pans, filling the pans rounding full. Place quickly in a very hot oven. If the cakes are raw, or too dry, more snow was required. If they are heavy, too much snow was used.

Oatmeal Breakfast Cake.

Saturate oatmeal of medium fineness with water. Pour the batter into a shallow baking dish, and shake down level. It should be wet enough so that when this is done a little water will stand on the top. Bake twenty minutes in a quick oven. It may also be baked in fifteen minutes on the top of the stove in a covered dish.

38 **Rice Cake.**

Thin well-boiled rice, while hot, with water. After cooling, work in wheat meal until a pretty stiff dough is formed. Bake in any desired form.

Pudding Biscuit.

Any kind of cold mush may be made into excellent biscuit by working into it graham flour, and kneading well. Bake with moderate heat.

Griddle Cakes.

No. 1. Make a thin batter by slowly stirring buckwheat flour into cold water. Bake upon a smooth iron or soapstone griddle. Rub the griddle well as soon as each cake is removed, and it will require no greasing. Eat as soon as baked.

No. 2. A mixture of corn meal and graham flour makes very excellent griddle cakes. The griddle may be placed in the oven, and the cakes baked crisp, if desired.

No. 3. Very nice cakes can also be made by mixing graham flour with grated sweet corn to a proper consistency.

Hard Biscuit.

Pour upon the flour to be used, boiling water enough to wet it. About one part water to two of flour is the quantity usually required. Stir with a spoon just enough to mix it well without much working. Then roll or press it with the hand upon a bread board, with plenty of flour, to the thickness of one-half or three-fourths of an inch. Cut into convenient shape, and bake in a moderate oven for twenty minutes. They are very tender if not baked too long.

39 **Rolls.**

Make a stiff batter with cold water, work in as much flour as will knead well, and then knead for twenty minutes or half an hour. Make into rolls one-half inch to two inches in thickness, and bake in a hot oven on a grate or baking pan dusted with flour, laying them a little distance apart. Excellent rolls may be made by kneading flour into cold graham, corn-meal, or oatmeal pudding.

Scalded Rolls.

These are made like the preceding with the exception that the batter is first made with hot, instead of cold, water. They do not require so much heat as the soft biscuit.

Corn Rolls.

Take corn meal, rather fine, scald with boiling water, stirring well. Add a little cold water and beat out all lumps; then add more water and stir in graham flour sufficient to make a batter somewhat thicker than for soft biscuit. Bake in rolls.

LOAF BREAD

Graham Bread.

Make a stiff dough with rather coarse wheat meal. Knead a long time, and bake in quart dishes.

Potato Bread.

Boil and thoroughly mash mealy potatoes. Add the desired quantity of graham flour, and mix with water, making a batter sufficiently
40 thick to knead on the board. Bake in any form preferred. May use equal quantities of potatoes and meal, or two parts of the meal to one of potatoes.

Sweet Potato Bread.

Steam or boil without peeling, a sufficient number of sweet potatoes. Peel and mash fine. Add a sufficient quantity of graham flour to give the desired consistency. Mix and knead quickly, and bake in small loaves or rolls.

Cocoanut Bread.

To each quart of graham flour add three tablespoonfuls of grated cocoanut. Mix either with water or the milk of the nut, knead until the dough is spongy, and bake as directed for other bread.

Snow Bread.

Mix one part of corn meal with two parts of dry snow, stirring well. Pour into a pan, rounding in the middle to a thickness of about two inches. Bake in a *hot* oven twenty or thirty minutes. When properly made, this bread is very light and sweet.

Oatmeal Bread.

1. Stir oatmeal slowly into boiling water, making quite a thick batter. Pour into a deep dish and bake in a hot oven till brown.

2. Knead dry oatmeal into oatmeal mush. Form the dough into a small loaf and bake with a moderate heat. The dough may be rolled thin —one-fourth inch—and cut with a cake cutter. Makes very nice cakes.

41 **Mixed Bread.**

Take three parts of corn meal, and one part each of wheat meal, oatmeal, and rye meal. Scald with boiling water after mixing thoroughly. Steam six hours, and bake half an hour.

Rye-and-Indian Loaf.

No. 1. Take equal parts of rye and corn meal. Scald the latter with enough boiling water to wet it thoroughly. Add the rye meal and sufficient water to admit of stirring with a large iron spoon. The loaf should be about three or four inches thick. Smooth it over with the wet hand, and place on the top of the stove where the heat is not quite sufficient to burn it, and let it simmer an hour or two until cracks appear on the surface. Then bake with a moderate heat for three or four hours. To prevent too thick a crust, it may be steamed three hours and then baked one. If the bread proves sticky and heavy, the batter was too thin, or the meal was too fine; if it is hard, it was not wet enough.

No. 2. Take one part rye meal, or coarse wheat meal, and two parts corn meal; pour boiling water over the corn meal, and stir it till the whole is sufficiently wet to work in the meal without adding any more water, and then, when about milk warm, work in the meal. Should the dough be too stiff, add as much warm, *but not hot*, water as may be necessary; bake in a round iron dish from three to five hours. This bread, when new, or a day or two old, may be sliced and toasted; it is very sweet and wholesome. The crust is apt to fall off; this may be wet in water and put in a stone jar with some
42 moderately tart apples, peeled and sliced, nicely covering the apples with the crust; then add a little water, and cover the dish with a tightly-fitting cover; set it on the stove till the apples are cooked, and then take the crust off into plates; sweeten the apples to suit the taste, and spread over the crust. Or, the crust may be broken and stirred into the apples, thus making a very excellent dish.

Brown Bread.

Several good recipes for making this excellent New England bread are recommended by successful cooks. We give a number to suit various tastes.

No. 1. Take four cups corn meal, four cups rye meal, and one cup wheat bran or middlings. Mix with warm water, making a pretty stiff batter. Bake in covered dishes in a moderate oven three hours.

No. 2. Take equal quantities of rye and corn meal, and mix with water, making a dough that can be kneaded. Work with the hands until it loses its stickiness, and will readily cleave from the fingers. Let it stand several hours, or over night, and bake in loaves, in covered dishes, in a moderate oven, from three to five hours. Or, it may be steamed three hours, and baked one. Coarsely-ground meal is better than fine for this kind of bread.

No. 3. Take such proportions of corn and rye meal as desirable, and one-eighth to one-fourth of wheat bran or shorts. Mix with either warm or cold water, and not too thick to be easily stirred with a spoon. Bake slowly at first. Wheat meal may be used in place of the rye
43 meal; in which case the batter should be somewhat thinner.

Pumpkin Brown Bread.

Equal parts of sifted pumpkin and rye and corn meal may be made into very excellent bread by treating according to almost any of the above recipes.

Apple Brown Bread.

Pare and core a few juicy apples, either sweet or mildly sour, stew and thoroughly mash. Then work in equal parts of corn and rye meal until the batter is of proper consistency, and the whole is thoroughly mixed. Bake as directed for other kinds of brown bread.

Rusk.

Bread or crackers of any kind may be made into rusk by first drying till brown and then grinding in a coffee or hand mill. This is a very serviceable article for thickening puddings, soups, etc.

Graham Crackers.

Mix graham flour and cold water into a very stiff dough. Knead, and roll a quarter of an inch or less thick. Cut into any desired form, prick with a fork to prevent blistering, and bake in a hot oven fifteen or twenty minutes.

Graham Crisps.

No. 1. Mix same as above. Roll very thin, and bake quickly in a hot oven. Excellent food for dyspeptics.

No. 2. Make a thin batter of any kind of meal,
44 pour into any convenient baking dish, one-eighth of an inch deep. Bake until crisp. Very tender when warm, but become tough by standing.

Oatmeal Crackers.

Mix finely-ground oatmeal with water sufficient to wet it thoroughly, usually one part of water to two of meal. Roll about one-fourth of an inch thick. Bake carefully, as they will be liable to burn. These are excellent crackers to eat with mushes of all kinds. They have a peculiar nutty flavor which makes them very palatable.

Oatmeal Crisps.

Into oatmeal mush, or scalded oatmeal, knead a small quantity of graham flour. Roll very thin, prick with a fork, and bake upon a grate. Be careful that they do not burn. They are very tender and crisp when warm. If they are kept several days, place in the oven a few minutes just before they are to be eaten.

Corn-Meal Crackers.

Scald corn meal with boiling water, and with the hand wet in cold water form the dough into small cakes one-fourth of an inch in thickness. Bake until somewhat brown.

Graham and Oatmeal Crackers.

No. 1. Equal parts of graham flour and oatmeal made as directed for graham crackers are very tender.

No. 2. Work graham flour into oatmeal pudding, forming a pretty stiff dough, and kneading well. Bake until nicely brown in a moderate oven.

45 **Graham and Corn-Meal Crackers.**

No. 1. Excellent crackers may be made by using one-third corn meal and two-thirds graham flour. The corn meal should be scalded before adding the graham flour.

No. 2. Work graham flour into cold corn-meal pudding. Knead thoroughly, roll thin, and cut into square cakes. Are very tender when warm.

A large variety of crackers may be made by combining graham flour, oatmeal, corn meal, and rye meal, in various proportions.

Those who have not become fully weaned from fermented bread and soda biscuit will find the following recipes an improvement upon many of the old methods; we do not recommend them, however, and advise all, especially invalids, to use only the more strictly hygienic kinds of bread already described:—

Leavened Graham Bread.

No. 1. Into three pints of warm water, stir graham flour sufficient to make a batter about as thick as can be well stirred with a spoon. To this, add two large spoonfuls of hop yeast. Cover, and set in a warm place to rise. When light, stir again, and let it rise the second time. This will make two ordinary loaves of bread. Put into tins, and set in a warm place about ten minutes, or till it begins to rise the third time. Bake about one hour.

NOTE.—If mixed too thick, the bread will be dry and hard; or if it gets too light before baking, it is not so good; but made just right, it will be nearly as fine grained and spongy as the best fine-flour bread.

46 No. 2. Make a thin batter of flour and warm water (some prefer fine flour to graham). The water should be about 100° temperature. The batter should be just thick enough so that it will not separate by standing. Place the batter in a warm place for about six hours, at the end of which time it will be found to be light. It should not be allowed to stand long enough to acquire any unpleasant smell. Thin with warm water and stir in enough graham flour to make a dough thick enough to mold. Mold thoroughly, and place in baking tins, allowing it to stand an hour or two until it becomes light. Some use milk.

Sweet Brown Bread.

Take one quart of rye flour, two quarts of coarse corn meal, one pint wheat meal, half a teacupful of molasses or good sugar, and one gill of potato yeast. Mingle the ingredients into as stiff a dough as can be stirred with a spoon, using warm water for wetting. Let it rise several hours, or over night; then put it in a large, deep pan, and bake five or six hours.

Gems.

The addition of milk and eggs to gems made from the various grains as previously directed, is thought by some to make them more palatable. They are less healthful, for reasons already explained; still they are much better than soda or saleratus biscuit, and if either *must* be used, by all means employ eggs and milk instead of soda, saleratus, cream tartar, or sour milk.

Buckwheat Griddle Cakes.

Make one quart of flour into a thin batter with lukewarm water. Add a handful of Indian meal
47 and half a teacupful of yeast. Keep in a warm place over night, and bake in the morning.

Rice Griddle Cakes.

Soak over night one quart of cold, boiled head rice, in a pint of milk or water; the next morning add one quart of milk and stir in nearly as much flour and two well-beaten eggs. Bake on a soapstone griddle. Fine bread crumbs or rusked bread, mixed with rice, improve this cake.

Pumpkin Griddle Cakes.

Take equal quantities of strained pumpkin and sweet milk. Thicken with corn meal. Allow it to stand over night, and bake slowly on a soapstone griddle.

TOAST.

Fruit Toast.

Slice thin and toast cold soft biscuit. Place in a proper dish and pour over the slices hot canned whortleberries, raspberries, or similar fruit, with much juice. Eat with oatmeal cracknels. Some cooks soften the toast with hot water before adding the fruit.

Peach Toast.

Cut into halves soft biscuit, and brown nicely. Pour some of the juice of canned peaches into an earthen baking dish. Lay in the slices, and place upon each a piece of peach. Place in an oven, and bake twenty minutes.

Tomato Toast.

Nicely brown tender bread, and place in the dish in which the toast is to be served. Pour
48 over it a proper quantity of tomatoes stewed as directed elsewhere.

Dry Toast.

Any kind of graham bread when toasted is an excellent article for dyspeptics. It has several advantages; the most important are, 1. It requires sufficient mastication to thoroughly insalivate it; 2. It undergoes a change during the process of toasting which renders it more easy of digestion. Simply drying is not sufficient. The bread must be browned; but care should be exercised not to burn it.

Milk Toast.

Scald sweet milk, and thicken it with a very little flour or wheat meal. Carefully toast both sides of either brown or white bread (stale bread is best), cracker, or biscuit, till its color becomes yellowish brown; then put it in the dish for the table, just covered with the thickened milk gravy. Add no butter.

This recipe is not strictly hygienic; but we can heartily recommend it in preference to butter toast, which is one of the very worst articles of food, notwithstanding the fact that it is so frequently provided for sick people.

Fruit-Bread and Cake

The contrivances usually designated by these names are the most prolific sources of dyspepsia and "biliousness" of which so many people complain. Even those who are the most careless
49 with reference to everything that pertains to hygiene seem to learn this fact after having ruined their health by indulgence in every savory compound of fine flour, sugar or molasses, lard, sour milk and saleratus, which ingenious but ignorant cooks could invent. For this reason, most chronic dyspeptics stand in mortal fear of anything that looks like a cake; but we would assure them that the cakes we recommend are such that even the dyspeptic may partake without fear of harm; at least, unless he is so badly diseased that "nothing agrees with him."

Fruit Gems.

Make a batter as for gems. Add a few whortleberries, chopped apples, dates, raisins, or any other fruit desired. Bake in gem pans as directed for gems.

Fruit Cake.

Stew and mash any kind of fruit desired, either fresh or dried; as apples, pears, or berries. Have plenty of juice. While boiling hot, pour it upon wheat meal with which a few cut raisins have been previously mixed. Form into loaves with slight kneading on a board with plenty of flour. Bake in rather small cake dishes, one to two hours. The oven should not be excessively hot, and should be quite moderate toward the last.

Sweet Potato Fruit Cake.

Make a dough as directed for sweet potato bread. Add a sufficient quantity of grated cocoanut and chopped fruit, as dates, raisins, and figs. Roll thin, cut with a cake cutter, and bake in a quick oven.

50

Apple Biscuit.

Form a thick batter by mixing graham flour with cold sweet apple sauce. Form into biscuits without kneading, and bake.

Fruit Crackers.

Make a dough as for fruit cake, mixing in chopped dates. Roll thin, form into crackers, and bake.

Strawberry Short Cake.

Make a thin batter of fine oatmeal. Let it stand over night. In the morning, add an equal quantity of graham flour, and grated cocoanut in proportion of a teacupful to each quart of flour. Bake in gem-pans in a quick oven. When cold, cut in halves, and cover each half with ripe strawberries. Raspberries, whortleberries, blackberries, or stewed cranberries, may be served in the same way. If the fruit is quite sour, date sauce may be added.

Rice Cake.

To two parts of well boiled rice, add one part each of corn meal and stoned dates or seedless raisins chopped fine. Make into a soft dough with water, roll one-third of an inch thick, cut into small cakes, and bake in a moderate oven. Dust the pan with meal to prevent sticking.

Cocoanut Cake.

No. 1. With a pint of boiled cracked wheat mix a grated cocoanut, a half pint of cocoanut milk, half a pint of dried currants or other dried berries, a quart of stewed sweet apples or boiled figs, and sufficient wheat meal to make a moder-
51 ately stiff dough. Bake, in loaves, an hour and a half to two hours.

No. 2. Make a batter of about the thickness required for gems, by mixing graham flour with equal parts of water and cocoanut milk. Add grated cocoanut in any desired quantity.

Corn-Meal Fruit Gems.

Make batter as usual for corn gems. Add one-third berries or chopped apples. Bake in gem pans.

Whortleberry Johnny Cake.

Make a stiff dough of corn meal and boiling water. Add one-half ripe whortleberries. Form an inch thick upon a flat baking tin with the hand wet in cold water. Bake until brown.

Popped-Corn Fruit Cake.

Grind and brown in the oven a quantity of popped corn. Reduce to a pulp some kind of fruit, and mix with the popped corn to a moderately stiff dough. Form into molds and allow to stand for a half hour.

By combining the various fruits in different proportions with the several grains, a great variety of fruit cakes can be made.

The following recipes for cakes we cannot recommend, and would advise invalids to avoid using; but they are comparatively harmless beside the cakes too often used:—

Currant Bread.

Take three pounds of flour; one pound of raisins; two pounds of currants; one pint and a
52 half of new milk; and one gill of yeast. Warm the milk and mix it with the flour and yeast; cover with a cloth, and set it by the fire. When risen sufficiently, add the fruit, and mold it; then put it into a baking tin, or deep dish, rubbed with sweet oil, or dusted with flour; after it has risen for half an hour longer, bake in a moderately hot oven.

Fruit Loaf.

One and a half cups of bread crumbs—or soaked batter bread—one cup of wheat meal, one cup of sugar, two cups of chopped apple, and two-thirds of a cup of currants. Mix intimately, and bake till the apples are tender. This may be eaten with or without a dressing.

Whortleberry Journey Cake.

Take one pint of whortleberries, one small teacupful sugar, one pint corn meal, one tablespoonful of flour. Wet the whole with *boiling* water, and bake in small, round cakes in a *hot* oven twenty minutes.

Cocoanut Cookies.

One cup good wheat meal, one-half cup grated cocoanut, and one-half cup sugar. Rub these thoroughly together, then wet with a scant half cup of water—just enough to make a dough as soft as can be readily worked. Roll out to one-third of an inch, cut into shapes, and bake in a pretty quick oven about fifteen minutes. Some care is required not to bake them too hard.

Currant Cookies.

Substitute Zante currants for the cocoanut in the above, and proceed in the same manner. Or
53 if preferred, chopped raisins or dried whortleberries may be used.

Cream Cake.

One pint sweet cream, one cup white sugar, one cup raisins or currants, one egg if desired; graham flour for rather a thin batter. Bake in bread pans. Or the same may be made into a dough, molded and cut into cakes or formed into rolls. Bake in a quick oven.

PUDDINGS.

Puddings are among the staple articles of diet with hygienists; but they become the cause of much mischief to the digestive apparatus. This is due to the improper manner in which they are eaten. Many people eat pudding very much as they would soup, without the slightest attempt at mastication. Of course mastication is not necessary to soften this kind of food, as is the case with many other articles; but simply breaking up or comminuting the food is not the sole object of mastication. One most important object is to secure the thorough admixture of the saliva with every particle of food taken into the stomach. This is especially necessary with farinaceous foods, of which puddings are usually made. When this does not occur, digestion is rendered much more difficult, and is likely to become impaired. To obviate this difficulty, some kind of dry food should always be eaten with puddings and soups of all kinds. Crackers made according to the recipes already given are the best for this purpose.
54 This will insure thorough chewing. Puddings will be relished better if eaten with bread or crackers made from some other kind of grain. They are almost always made too thin.

General Directions.

1. Too violent heat is a thing to be carefully avoided at all times. Gentle heat will cook all kinds of grains and vegetables much more efficiently than violent heat.

2. Soft water should always be employed. No salt is needed after a person has learned to appreciate the delicate flavors of the natural grains.

3. Much stirring is also damaging to puddings, as it makes them less light than they would otherwise be, and many times makes them more likely to burn. This is particularly true of samp.

4. When fruit of any kind is added to puddings while they are cooking, it should be previously cooked, and then added just before the pudding is done. Otherwise it will be likely to settle to the bottom and burn. Oatmeal, corn meal, graham, and farina puddings, are rendered much more palatable by the addition of some kind of fruit, or grated cocoanut.

Graham Pudding.

Sift the meal slowly into boiling water, stirring constantly until it is a little too thick to settle flat. If made from coarse meal, it will be as thick when done as when first mixed; but if the meal is fine, it will become somewhat thinner. Allowance can easily be made for this when fine meal is used, by making a little thicker at first. After stirring in the proper amount of meal, set the kettle upon a part of the stove where it will
55 simmer without burning. Let it remain thirty or forty minutes without stirring. By this method the pudding is made light, and is thoroughly cooked. It may be molded in cups dipped in cold water, and allowed to cool, if desired.

Oatmeal Pudding.

Sift one part of coarsely ground oatmeal into three or four parts of boiling water, stirring five minutes or until it sets. Cover closely and put it where it will only simmer for a half hour. Do not stir after it sets, and take up carefully. It is somewhat improved by cooking three quarters of an hour.

Corn-Meal or Hasty Pudding.

The meal should be sifted, when wanted for use, with an oat seive, thus removing the coarsest of the bran. Stir into boiling water rapidly enough to be able to beat out the lumps which may form before they are cooked hard. If the meal is fine, make it as thick as desired to be when done. If it is rather coarse, use one part meal to about two and one-half parts of water. Stir frequently until it sets; then cook gently without stirring for one or two hours. To prevent burning, remove the kettle to a part of the stove where the heat is barely sufficient to keep it simmering.

Cracked Wheat.

Take one part of the wheat to four or five parts of water. In making, follow the directions given for oatmeal pudding, allowing it to simmer four or five hours. It will cook quite as fast when only simmering as when boiling hard, and
56 will be much less likely to burn. It is a very healthful dish.

Crushed Wheat.

This is an article recently introduced into the market. It is commonly sold in small packages by grocers. Use two parts of water to one of the wheat. Make as directed for graham pudding, and allow it to simmer an hour or an hour and a quarter.

Farina.

The proportions required are the same as for oatmeal pudding. Boil the water in a kettle. Into one-eighth as much cold water stir two-thirds of the farina to be used. Pour the mixture into the boiling water, stirring well, and then stir in the remaining third of dry farina. Cook as directed for oatmeal pudding.

Boiled Rice.

No. 1. Select good, plump, unbroken grains; after washing, pour into about eight parts of water. Let it boil rapidly until the kernels are thoroughly softened. Then strain off the water through a colander. This is the method commonly employed in India, where this article of food is called *bhat*. The water may be saved, and used for all purposes for which rice water is serviceable.

No. 2. Some recommend soaking the rice an hour or two in cold water before boiling. Then boil twenty minutes, stirring very little; and afterward place it where it will simmer for a half hour longer. When this method is followed, as little water as possible should be employed, so that the rice may merely steam at the last.

57 Raisins previously soaked in cold water for several hours, are a great addition to boiled rice.

Graham and Rice Pudding.

No. 1. Boil a gill of rice in three or four pints of water for twenty or thirty minutes. Stir in sufficient wheat meal to make as thick as desired, and allow it to cook slowly for half or three quarters of an hour longer.

No. 2. Cold boiled rice may also be used in the same way. Take one part rice to three of water. Carefully beat out the lumps, add the meal, and cook as directed for No. 1.

Boiled Samp.

Sift with an oat seive to remove the hulls; or if this useful utensil is not at hand, wash two or three times in water. Pour one part into three or four parts of boiling water and stir until it sets, but no longer. Cook slowly, as directed for other kinds of pudding, for two or three hours. Is sweetest when made from new corn meal.

Small Hominy.

Pour one part hominy into three parts of water and stir for about five minutes, or until it sets. Then allow it to simmer for three-fourths of an hour. When cold, it may be sliced and browned upon a soapstone griddle.

Hulled Corn.

Hulled corn or "great hominy" makes a very palatable article of food when cooked until tender. It requires cooking for several hours, and care should be exercised that it does not burn. The addition of a little green corn cream after it is cooked is beneficial.

58 Hominy and Beans.

A good dish is made by adding one part beans to three parts of hominy when the latter is about half cooked. Cook until both are tender. Serve warm.

Millet Pudding.

Look carefully over and wash the desired quantity of millet kernels. Scald in two successive waters and then boil in three times its measure of water. Cover close and cook slowly for an hour or more.

Boiled Wheat.

Select clean, plump, white wheat. Pick over and wash carefully. Soak over night and boil five or six hours.

Pearl Barley.

Prepare in the same manner as wheat, and boil six hours.

Tapioca.

Soak in a small quantity of warm water an hour or so. Add a little water and bake slowly, stirring frequently. Add fruit after removing from the oven. Manioca may be cooked in the same way.

Rice and Apple Pudding.

No. 1. Pare nice apples and remove the core without dividing them. Cover the bottom of a dish with moist boiled rice, and place upon it the apples with their centers filled with chopped dates and raisins. Cover with the rice and bake in a closed dish until well done.

No. 2. Prepare the apples in the same way.
59 Spread the rice upon a thick piece of cloth previously wet in cold water. In the center of the cloth place an apple which has been filled with dates, and carefully bring the edges of the cloth together, enveloping the apple. Tie with a string. The apple should be wholly covered with rice. Boil or steam an hour. Immerse in cold water as soon as taken from the kettle, and remove the cloth.

No. 3. Select the best ripe cooking apples. Pare, core, and cut into small pieces. Put into a saucepan and mix in a sufficient quantity of sweet fruit to sweeten. Scatter in about one part of uncooked rice to four parts apple. Fill with water, cover close, and bake two hours in a moderate oven.

Christmas Pudding.

No. 1. Place a layer of partially boiled rice in a deep basin or nappy. Place upon it a layer of sliced apples, raisins, and chopped dates. Add another layer of rice, and so alternate until the dish is full. Cover and bake half an hour.

Berries or fruit of any other kind may be served in the same way.

No. 2. Boil one pint of pearl barley in five times as much water, for five or six hours, until the kernels are soft. To three cups of the barley add two cups of chopped apple, one cup of raisins previously boiled until tender, a few currants, and a cup of chopped dates. The juice of a lemon may be added if desired. Mix, and bake one hour and a half. Serve warm or cold.

Corn-Meal Fruit Pudding.

Mix corn meal to a stiff dough with boiling water. Add one half as much fruit as dough,
60 stir well together, and bake one to two hours in a pudding dish.

Bread Pudding.

No. 1. Stew either green or dried apples until very soft. Thoroughly mash and strain if necessary. Sweeten by adding a sufficient quantity of dates prepared in the same way. Slice good graham bread or gems and soak until soft in a hot mixture of three parts water with one of lemon, orange, grape, pie-plant, or other fruit, juice. Place in the bottom of the baking dish a layer of the apple, and then of the bread, alternating until the dish is full, placing fruit on the top. Bake half or three quarters of an hour.

No. 2. Soak rusk, bread crumbs, or broken bread of any kind, until soft. Stew dried apples in as little water as possible, leaving the pieces unbroken. Mix with the bread and bake moderately two hours. Dates may be added if desired.

Steamed Bread and Fruit Pudding.

Cut into small pieces bread or crackers. Add one third each of sour apples and raisins or dates chopped fine. Mix well, and add a little water. Steam for four hours.

Tapioca Apple Pudding.

Soak a sufficient quantity of tapioca in a proper amount of water until soft. Prepare nice ripe apples, either sweet or sub-acid, and pare and core without dividing. Place a portion of the tapioca in a proper dish. Place upon it the apples with the centers filled with chopped raisins and dates, if sour; cover with the remainder
61 of the tapioca and bake until the apples are well done. The dish should be covered closely, and the heat should be moderate.

Sweet Potato Pudding.

Grate six medium-sized, raw sweet potatoes. Add two quarts of cold sweet cider, one cup of grated cocoanut, and an equal quantity of raisins. Thicken with graham flour, beat the batter well, and bake in a moderate oven.

Bird's Nest Pudding.

Prepare apples as directed in the preceding recipe. If the apples are sweet, place in the center of each a few dried currants; if sour, chopped dates or raisins should be used. Take a few spoonfuls of graham or white flour, wet with cold water until smooth, and add boiling water sufficient to reduce it to the thickness of cream. Fill the dish and bake until done.

Apple Pudding.

Mix one part of ripe currants with eight or ten parts of graham flour. Mix with boiling water sufficient to make as moist a dough as can be easily handled. Roll out three-fourths of an inch thick and place on a baking tin. Pare, core, and quarter ripe, sub-acid apples. Divide the quarters lengthwise and press the pieces into the dough. Bake three quarters of an hour, and serve warm with some sweet sauce.

Gooseberry Pudding.

Boil one cup of rice in six of water for half an hour. Prepare two cups of gooseberries and mix with an equal quantity of graham flour. Add the boiling rice, mix quickly, and steam three
62 quarters of an hour. Serve with some sweet sauce.

Chestnut Pudding.

Boil, peel, and pound chestnuts, and rub them through a seive. Pare and grate ripe, sub-acid apples. To one part of the chestnut add two parts of apples, a little lemon juice, and sufficient date sauce to sweeten. Bake slightly.

Fig Pudding.

Soak a half pound of figs until soft. Scald a quart of graham flour, and make it into a stiff dough. Fill full of the soft figs, and bake or steam an hour and a half. Serve with lemon, plum, or pie-plant sauce, as preferred. A few tart apples, chopped fine, may be added to the pudding in place of the sauce.

Tomato Pudding.

No. 1. Slice thin good graham bread or gems. Place in a baking dish with an abundance of sliced tomatoes, arranging in alternate layers. Cover close and bake an hour. Serve with sweet sauce.

No. 2. Peel and slice thin fine, ripe tomatoes. Place in a baking dish in layers, strewing between the layers equal parts of rice and chopped dates. Cover closely and bake in a moderate oven for two or three hours. Serve as preferred.

Green Corn Custard.

No. 1. Peel and shred sweet, mellow peaches. Add an equal quantity of grated sweet corn, and the same quantity of water. Mix well, and bake in an earthen or porcelain baking dish for twenty minutes or half an hour. A little corn starch
63 may be added for thickening, if necessary. Excellent without dressing of any kind.

No. 2. Another custard can be made by using one part corn to two parts juicy tomatoes, peeled and sliced.

Grated apples, sliced plums, or almost any kind of fruit may be thus used with green corn.

Apple Custard.

Grate sweet, or pleasant sour, apples, or both together. Mix a small quantity of dry flour, allowing a spoonful for each pie. Cover a deep pie dish with crust. Spread in a half cup of chopped raisins or dates, fill with the apple, and bake. Must not be allowed to stand before baking.

Oatmeal Jelly.

Soak two parts of oatmeal in three parts water over night. In the morning, drain off the water and add to it an equal quantity of hot water. Boil over a quick fire. Stir until it boils, then moderate the heat and let it simmer ten minutes and turn into molds. It will set in a short time and may be served warm, in saucers, with fruit juice of some kind.

No sugar or milk has been recommended in any of the foregoing recipes for puddings, for reasons fully explained in the introductory portion of the book. The use of a small quantity of sugar, however, is not wholly condemned, if the best is selected, and if it is mainly confined to such purposes as sweetening sour fruits. If the milk is obtained from healthy animals, it may be
64 even less objectionable than sugar; yet it can be almost wholly dispensed with by using sweet corn milk and cream, which is much more healthful. Sugar or milk can be added to such of the above recipes as seem to require them by those whose tastes refuse to be satisfied without. Such persons may also make use of the following recipes, though doubtless with some detriment to health:—

Bread Pudding.

Pour a quart of boiling milk on as much bread, biscuit, or crackers, broken or cut into small pieces, as will absorb it; cover it, and let it remain till quite cool; then sweeten, and bake an hour and a half.

Rusk Pudding.

One and one-third cups rusk, half a cup sugar, two cups sweet apples, sliced, two quarts milk. Stir together and bake two hours and a half.

Baked Apple Pudding.

Pare, core, and slice about two quarts nice tart apples. Add to them one teacupful of Indian meal, one cup graham flour, and stir together. Pour over them three-fourths of a cup of sugar dissolved in one cup cold water, or sweet milk, stirring till all the flour is wet. Butter or flour a deep basin or pan to prevent sticking, and turn the mixture into it, smoothing it evenly over the top. Then spread smoothly over it a batter made by stirring together half a cup of cold water, or sweet milk, three tablespoonfuls of Indian meal, three ditto of graham flour, and one tablespoonful sugar. Bake about two hours and a half.

65 NOTE.—This is to be eaten with sweetened cream or a sauce made by stirring into one quart boiling milk, two heaping tablespoonfuls of corn starch, moistened with cold milk, letting it boil for five or ten minutes afterward. Sweeten according to taste.

Green Corn Pudding.

To one quart of grated ears of sweet corn, add a teacupful of cream, one gill of milk, a tablespoonful of flour, and two ounces of sugar; mix all together, and bake an hour and a half.

Cracked Wheat Pudding.

Boil wheaten grits till quite soft, then dilute with milk to the proper consistency. It should be rather thin; sweeten, and bake one hour.

Baked Rice Pudding.

A small teacup of rice carefully washed, half a teacup of sugar, two quarts of new milk. Stir well together, and let it bake two hours or more in a moderate oven. It is well to stir it once or twice at first, that it may mix well with the milk when swelled.

Tapioca Pudding.

Soak the tapioca in warm water or milk an hour or two. Then add milk, or milk and water, and a little sugar. Bake slowly, stirring frequently. When done, add fruit. About one cupful of tapioca is required to make four quarts of pudding.

Corn-Starch Pudding.

Beat together one egg, two spoonfuls of corn starch, and two spoonfuls of sugar, with a little milk. Set on to boil, one pint each of milk and water. When boiling, add the beaten mixture,
66 and cook one minute. Dish up, and ornament with drops of jelly.

American Plum Pudding.

Take one pint each of graham flour and corn meal. Scald the corn meal, then add the wheat meal, with two thirds of a pint of Malaga raisins—more or less to suit the taste—with water sufficient to make a batter just firm enough to hold a stout spoon upright. Mix thoroughly, and put it into a pudding boiler, or any suitable covered dish, and boil or steam three and a half or four hours. If the corn meal is coarse, and the mixture of the right consistency, the pudding will be perfectly light. The long cooking makes the raisins rarely delicious. Other fruits may be used in their place, as prunes, prunellas, dried cherries, dried pears, etc.; but the fresh and the more tender fruits will not endure the long cooking. Serve warm with fruit sauce.

Pastry.

Pie is a word which to the dyspeptic is a synonym for every pang and torment of indigestion. This fearful significance, however, is not due to any inherent evil in the article itself, but rather to its various usual concomitants which are added by the cook under the name of shortening, flavoring, etc. But pies made according to the methods we shall recommend are wholly harmless, even to the poor victims of weak stomachs and impaired digestion. The chief mischief-making element of the ordinary pie is the crust,
67 which is usually a conglomerate mixture of a very small quantity of superfine flour with lard in abundance, and sometimes with the addition of sour milk, soda, saleratus, etc. Such a compound might very justly inspire dread in the stoutest stomach, to say nothing of a diseased one.

But the contents of pies are usually by no means free from objection. The spices and various condiments, together with the large quantities of sugar employed, are entirely inimical to health. All of these may be wisely discarded, and that without any loss of palatable qualities, and a great increase of nutritive value. The natural flavor of our native fruits is quite sufficient when presented in shape to be appreciated; and for sweetening, we have the various kinds of sweet fruits, as sweet apples, dates, raisins, figs, etc. By combination of various foreign and domestic fruits, as great a variety of healthful and palatable pies may be made as could be desired.

No one need entertain the slightest apprehensions regarding the healthfulness of pies made according to the following recipes.

Oatmeal Pie Crust.

Scald two parts of oatmeal with one part of hot water. Roll thin. It bakes very quickly, so that fruit which requires much cooking must be cooked before making into the pie. This remark, however, applies only to pies which are baked with an upper crust. This crust is very tender, and possesses all the desirable qualities of shortened pie crusts, with none of their deleterious properties.

Potato Pie Crust.

68 Boil one quart dry, mealy potatoes. The moment they are done, mash them, and sift through a colander. Rub them evenly through two cups of graham flour in the same manner as the shortening in common pie crust. Have ready one cup corn meal; pour over it one and one-third cups boiling water, stirring it till all the meal is wet, then add it to the potatoes and flour, mixing only until thoroughly incorporated together. No more flour should be added. The molding board should be well covered with dry flour, however, r[illegible] is slightly difficult to roll out. It should be roll[illegible]d very thin, and bake in a moderate oven.

[illegible]OTE.—It is very essential that the above conditions s[illegible]ould all be complied with. Bear in mind that the potatoes must be *hot*, and mixed immediately with the flour; the water be poured, while *boiling*, upon the corn meal, and the whole mixed together very quickly, and baked immediately. Inattention to any of these requisites will be quite apt to insure a failure.

Graham Pie Crust.

Make a stiff dough by pouring boiling water upon graham flour. Roll thin with plenty of flour upon the roller and board, and without kneading.

Bean Pie Crust.

Boil white beans until soft with plenty of water. Rub through a colander or sieve, and add sufficient graham flour or corn meal to make a pretty stiff dough. Roll out thin.

Mixed Pie Crust.

No. 1. Equal parts of graham flour and corn meal or oatmeal, or two-thirds graham flour to
69 one-third of either of the others, mixed with cold water to a stiff dough, make very excellent and

perfectly hygienic pie crusts. The dough should be rolled thin, and the pie should be covered closely with a thick napkin immediately upon taking from the oven.

No. 2. To oatmeal, corn meal, or graham pudding, add a little graham flour. Knead well, and roll thin. Oatmeal with graham flour is perhaps the best combination. It is very tender when warm.

Cocoanut Pie Crust.

Two cups graham flour, one cup grated cocoanut. Make into a stiff dough with cold water and knead well. Add one cupful of well boiled rice. Mix well and roll thin. This crust is very excellent.

Corn-Meal Pie Crust.

A very tender crust for squash, pumpkin, and custard pies may be made by simply placing in the bottom of the baking tin dry corn meal to the depth of about one-third of an inch, and then placing carefully upon it the hot squash or custard, as the case may be. The greatest objection to this crust is that it is so tender that it is somewhat difficult to remove it from the baking tin without considerable breaking.

If pie crust made according to any of the above methods cannot be tolerated, and if pies must be used, notwithstanding, a little cream or milk may be added to the crust, but butter should never be used under any consideration.
70 Neither should soda or sour milk be employed. The following recipes may be used:—

Cream Pie Crust.

No. 1. Take equal quantities of graham flour, white flour, and Indian meal; rub evenly together, and wet with very thin sweet cream. It should be rolled thin and baked in an oven as hot as for common pie crust.

No. 2. Mix graham flour with sweet cream, and proceed as above. Fine middlings may be used in the place of graham flour if preferred.

Apple Pie.

Pare, core, and slice nice ripe apples of pleasant flavor. Prepare the crust by any of the methods described. Fill the under crust with the prepared apples, adding a little flour, and sprinkling on the whole a little water. Cut a few holes in the upper crust for the escape of steam, and place it upon the pie, wetting the edge to make it adhere closely to the lower crust and so prevent the escape of the juice. Bake until thoroughly done. It is well to moderate the heat a little for a few minutes before taking out, so that the exuded juices may be re-absorbed.

If the apples are very hard, they should be stewed before making into the pie. Sour apples may be rendered more palatable by mixing with an equal quantity of sweet apples or by the addition of raisins or dates. When raisins are used, they should first be stewed a short time.

Apple Custard Pie.

Grate sweet apples, or a mixture of sweet and sour, if preferred. Add and mix one spoonful of
71 dry flour for each pie. Cover a deep pie plate with crust, and add the apples. Cover the top with chopped raisins, dates, or figs.

Berry Pies.

Whortleberries, blackberries, raspberries, strawberries, cranberries, and, in fact, all the edible wild and cultivated berries, make excellent pies, either when fresh or after having been canned or dried. The sour berries may be improved by adding sweet fruits of various kinds, as dates, figs, raisins, etc.

Cranberry Pie.

With stewed cranberries, mix an equal quantity of chopped dates. Bake between two crusts. The upper crust may be made by laying strips of thin pie crust across in two directions, leaving open spaces between.

Currant, rhubarb, gooseberry, and cherry pies may be made in the same manner; or, if preferred, sweet apples may be substitued for dates.

Raspberry and Strawberry Pies.

These berries are of such delicate structure and flavor that baking greatly injures them, almost destroying their finest qualities. On this account, it is better to prepare the crust of just the right size, and bake it separately. Bake the bottom crust in the pie plate or tin, and the upper crust upon a flat surface, pricking it to prevent blistering. After baking, place the ripe berries in the dish containing the bottom crust while still hot. Cover with the upper crust, and return to the oven for a very few minutes. A very short time is sufficient to steam the fruit.

72
Dried Fruit Pies.

Prepare the dried fruit by first washing very quickly, and then allowing it to soak over night in cold water, cooking in the morning until tender in the same water in which it has been soaked. Each kind may be used alone, or several kinds may be mixed, as preferred. Dried apples and whortleberries are very good mixed. Berries require little more than scalding after thoroughly soaking, and should be placed in crusts while hot.

Raisin Pie.

No 1. Soak good raisins over night in cold water. Stew slowly until tender. Dredge well with flour, adding a few slices of tart apples or lemon if desired. Bake with two crusts.

No. 2. Chop a sufficient quantity of nice, large raisins. Mix a spoonful of flour or corn starch with a cup of water, and add to each pie. Bake with two crusts.

Lemon Pie.

Two cups sweet apple sauce; two sliced lemons; one teacup of chopped raisins; one raw potato, grated; a very little corn starch and flour. Bake with two crusts after properly mixing.

Tomato Pie.

Scald smooth, ripe tomatoes, peel and slice, and make as directed for apple pie.

Peach Pie.

Pare, and cut into thin pieces, nice, ripe peaches; sprinkle with water if not sufficiently juicy, and dredge with flour.

73 Sweet apples and pears may be made into excellent pies in the same manner.

Batter Pie.

Stir wheat meal, or a mixture of wheat and corn meal, into water, making a batter a little too thick to settle flat. With this, cover a pie tin or nappy, and place upon it a layer of small fruit, unbroken. Then place batter on the sides of the dish, and add another layer of fruit, covering the whole with a thin layer of batter. If the fruits are very juicy, a little flour should be sprinkled upon each layer to absorb the superfluous juice. Bake from forty to sixty minutes. Care must be taken that the juices do not boil over and escape into the oven.

Pumpkin Pie.

Pare, cut, and stew a ripe, sweet pumpkin, using as little water as possible, and preserving all of the juice. Rub through a colander or sieve, and mix with it a little flour, about one gill to a quart of the stewed pumpkin. If too stiff, add a little water. Bake in one crust. A few chopped dates may be added for sweetening.

Custard Pie.

No. 1. A very good substitute for custard pie may be made even without the use of either milk or eggs. Boil Iceland moss in water until it will make a nice jelly. Flavor it with any kind of berry juice, lemon, or grated cocoanut. Do not use the flavoring extracts to be obtained at the stores, however, as most of them are spurious articles, and are sometimes absolutely poisonous.

74 No. 2. Prepare crust as usual for custard pie. Prepare filling as elsewhere directed for green corn custard.

Apple Dumplings.

No. 1. Make a crust of graham flour and corn meal, two parts of the former to one of the latter. Roll one-fourth of an inch thick. Select, and pare and core without dividing, a number of nice, ripe, sub-acid apples. Fill the center with chopped dates or raisins, and envelop in the crust. Bake until both fruit and crust are well cooked. They require a quick oven at first, but the heat should be moderated after the crust is browned.

No. 2. Make a batter as for gems, and with it cover the bottom of a patty pan to a depth of a quarter of an inch or a little more. Lay in half of a ripe, sub-acid apple which has been previously pared and cored. Cover with batter, and bake as directed in the preceding recipe.

Cranberry Dumpling.

Thoroughly mix two parts of cranberries and one of chopped dates. Spread in an even layer upon a crust previously prepared. Commence at one side and carefully form the whole into a roll. Cut the roll into pieces about two inches long; cover the cut ends of each piece with crust, after wetting it to make it stick, and bake. If the dumplings require any further sweetening, they may be eaten with sweet apple sauce. May be either baked or steamed.

Cherry Dumpling.

Cover the bottom and sides of a basin or deep baking dish with batter made as for gems. Cover
75 the bottom with a layer of cherries and chopped dates or raisins in abundance. Sprinkle on a little flour, and form another layer in the same way. Two or three layers should be thus made, with no batter between them. Cover the whole with a crust and bake in a moderate oven, first on the top until brown, and then on the bottom. May be eaten either warm or cold. In order to save the juice, do not fill the dish quite full.

Raspberries, blackberries, grapes, and nearly all kinds of berries, may be served in a similar manner.

Snitz and Dumplings.

Boil a quantity of dried sweet apples in four or five times as much water, until tender. Then make a small quantity of batter as for gems, and drop into the boiling fruit with a small spoon. Boil a few minutes longer to cook the batter.

Tarts.

No. 1. Cover gem pans with cocoanut pie crust. Place in a quick oven. When nearly done, add a few ripe sweet berries of any kind. Let them remain in the oven a few minutes longer to soften the berries.

No. 2. Make a stiff dough of equal quantities of graham flour and grated cocoanut, with cold water. Roll very thin and cut into cakes two and one-half inches in diameter. Make rings of most of the cakes by removing the centers. Then place three or four of these rings upon each one of the remaining pieces, wetting them to cause

them to stick together. Prick the center piece with a fork, and bake in a hot oven. Be careful
76 not to brown them. Add any kind of sauce when they are desired for use.

Grape Tarts.

Strain canned grapes to remove seeds and skins. Add bread crumbs and thoroughly mix. Make a dough of oatmeal as directed for cracknels; roll thin, and bake in gem pans. After removing from the oven, add to each a spoonful of the prepared grape sauce.

No sugar has been employed in the above recipes; but if it is considered indispensable, or if sweet fruits cannot be readily obtained, it may be used when considered desirable, always in moderation, however. None but the best coffee or maple sugar should ever be employed. The following recipes are not so injurious as less hygienic ones, but they are far inferior to the preceding, and cannot be employed without a certain amount of detriment to the system. Their principal use should be to assist in making the change from bad habits to better ones.

Custard Pie.

One pint and a half of milk, three eggs well beaten, and a large tablespoonful of sugar. Bake only slightly, as hard baked eggs are hard of digestion.

Rice Pie.

To one pint boiled Carolina rice, add one pint and a half of milk, and half a cup of sugar. Flavor with extract of lemon, and bake in an under crust. Raisins may be added if preferred.
77 An egg adds to its attractiveness with some, but detracts from its healthfulness.

Pumpkin Pie without Eggs.

Those who have never tried it will be astonished to see how palatable a pumpkin pie may be made without eggs or spices. Select for the purpose a pumpkin of firm texture, deep color, and perfectly ripe. Stew and sift in the ordinary manner, and add boiling milk to make it somewhat thicker than when eggs are used. Sweeten to suit, with equal parts of sugar and molasses. Some add pounded cracker or a spoonful of flour. Bake in a hot oven, on a single crust.

FRUITS.

To an unperverted taste, nothing is more palatable and delicious than the natural flavors of the various domestic and foreign fruits which constitute so important a portion of a genuine hygienist's bill of fare. They are certainly toothsome enough, and much more wholesome, without the irritating condiments too often mingled with them by fashionable cooks. Even sugar, which in moderate quantities is the most harmless of all the condiments, may be wholly dispensed with by the exercise of a little ingenuity of mingling sweet with sour and sub-acid fruits. By this method, the many evils which arise from the use of large quantities of sugar, to which so many people are strongly inclined, will be wholly avoided, and yet all the requirements of taste and nutrition be fully met.

78 Unripe fruit should never be eaten when ripe can be obtained, and then only when well cooked. Most ripe fruits require no cooking. In cooking fruits, none but stone or porcelain-lined vessels should ever be used. Brass and copper are dangerous. The same is often true of tin on account of its adulteration with lead.

Baked Apples.

Moderately tart apples, or very juicy sweet apples, are best for baking. Select good ripe apples, free from imperfections, and of nearly equal size. Wipe carefully to remove all dirt, and bake an hour in a dish containing a little water. Sweet apples require a little longer baking.

Baked Apples and Dates.

No. 1. Select fine, large, sour apples. Pare and core them without dividing. Fill the center with dates. Place them in the baking dish, adding a little water, and bake until well done.

No 2. Pare, core, and cut into small pieces a sufficient number of sour apples. Chop fine one-third the quantity of stoned dates or raisins. Place a layer of the apples in a deep baking dish. Add a layer of the dates. Alternate thus until the dish is full. Add a little water if much juice is desired. Bake slowly.

Steamed Apples.

Apples may be steamed either whole or when pared and divided. More time is required than for baking, and the latter method is usually preferable.

Green Apple Sauce.

By green apples is not meant unripe ones, but
79 undried ones. Select ripe, juicy, well-flavored apples, either sweet or sour, or both. Pare, quarter, and core quickly, not allowing them to stand after preparing them, to prevent their becoming dark. Boil with a little water until tender. They may be flavored, if desired, with lemon or with other fruit or juices. Sour apple sauce is very well sweetened with dates and raisins. The sauce is richer if the apples are cooked with the skins on.

Dried Apple Sauce.

Wash good dried apples and boil slowly in sufficient water to cover them. If preferred, the sauce may be flavored with lemon, dried quince, peach, dates, or any other fruit.

Baked Pears.

Pears should be baked as directed for baked apples. They are very excellent.

Pear Sauce.

Pears may be pared and cored as apples, or they may be boiled whole. They are delicious either way. Being quite sweet, pear sauce is an excellent article to serve with dishes which would seem to require sugar. Figs may be added if desired.

Peach Sauce.

Peaches hardly ripe enough to eat uncooked, make very good sauce when pared and boiled. The stones should not be removed. When ripe, or nearly so, the skins can be conveniently removed by immersing the peaches in boiling water for about two minutes, and then rubbing them with a coarse towel. Moderate heat only
80 should be employed in cooking peaches as they do not stand but very little heat. Figs make the best seasoning.

Dried Peach Sauce.

Dried peaches should be stewed in the same manner as dried apples.

Apricots.

This is not a very abundant fruit. It should be cooked according to the directions given for cooking peaches.

Pineapple.

This is a tropical fruit, and is seldom seen here in its perfection. Its chief value is as a flavor for other fruit. It may be preserved for use in this way by canning.

Quinces.

These are of little value of themselves, but give an excellent flavor to many other kinds of fruit. They may be preserved for this purpose by canning.

Grape Sauce.

Stew ripe grapes in as little water as possible. Some sweet fruit will be required with them by most people.

Cranberry Sauce.

Cranberries make very excellent sauce when mixed with a considerable quantity of sweet apples or dates.

Stewed Raspberries.

Nice, ripe raspberries are quite as good fresh as when stewed; but if they are cooked, care must
81 be used to avoid cooking too long, as they are very delicate, and lose some of their best qualities when subjected to long cooking. Simply scalding is all that is required. A few dates may be added if sweetening is desired.

Strawberries.

These berries are so delicate that, for the taste of many people, they are greatly injured by cooking. When ripe, they need no addition to their own natural, delicious flavors.

Currants, blackberries, gooseberries, whortleberries, and cherries make excellent sauce, and may be prepared much the same as other small fruits.

English Currants.

This is a very useful fruit as an addition to other fruits and to puddings of various kinds. It also makes an excellent dish when stewed alone like other dried fruit.

Plums.

Of the many varieties of plums, some are edible raw, being sweet and wholesome, while others require cooking and the addition of sweet fruit of some kind to render them palatable.

Dates.

Dates are mostly employed to sweeten sour fruits. They may be eaten alone, however, either raw or cooked; but only small quantities should be eaten, as they are too sweet to be very wholesome.

Bananas.

This is a very nourishing tropical fruit. It is best eaten raw. It should be peeled and sliced,
82 and may be eaten with bread or puddings. Some prefer to add orange or lemon juice. It may be baked with the skin on, or may be made into pies or puddings. It may be canned like other fruit, and makes an excellent addition to puddings.

Rhubarb.

Peel the stalks and cut them into thin slices. Stew in a small quantity of water with a sufficient quantity of dates to sweeten to the taste.

Oranges and Lemons.

These are mostly used to flavor other food. Oranges may be eaten alone. They are seldom obtained here in perfection.

Steamed Figs.

These make a very delicate and showy dish for dessert. They should be placed in a steamer and steamed until tender.

Raisins and prunes may be cooked in the same way.

Stewed Prunes.

Prunes make excellent sauce. They should be first hastily washed and then cooked gently until tender.

Sugar has purposely been wholly omitted from the above recipes for the benefit of those who may wish to exclude that article from their bill of fare, which is really a very desirable thing when it can be done without any disadvantage.

Those who find the use of a certain amount of sugar desirable, have only to omit the sweet fruits and substitute sugar in moderate quantities. Excess is very injurious. A little cannot be considered harmful.

83 **Steamed Squash.**

Steamed squash is much nicer and sweeter than boiled. The squash should be cut into several pieces, freed from seeds, and placed in a steamer. The heat should be moderate. Mash if desired.

If boiling is more convenient, use only sufficient water to prevent burning, and reduce the juice to a sirup by the time the squash is sufficiently cooked.

Baked Squash.

Baking is a still better method of cooking squash. It retains all the original sweetness of the vegetable. Select a good, ripe squash, wipe thoroughly, and free from seeds. Cut into pieces of convenient size, and bake without removing the shell.

Pumpkin.

Pumpkin may be cooked in the same way as squash, but requires a little longer time. Long cooking improves it.

Stewed Tomatoes.

Scald until the skins wrinkle, and then peel. Slice thin, and stew with a moderate heat for half an hour. Thicken with rusk, graham bread crumbs, pounded crackers, or oatmeal. Grated green corn is another excellent material for thickening. Cook a few minutes longer after adding thickening. Tomatoes are richer if cooked two hours.

Apple and Tomato Sauce.

Cook tomatoes as directed above, and add sliced apples when half done. Cook until the apples are tender.

84 Stewed tomatoes may be mixed with various other fruits and vegetables, forming a great variety of palatable dishes.

Nuts.

Many kinds of nuts are both wholesome and palatable. When eaten in moderation, they are objectionable for very few. Among the better varieties are almonds, chestnuts, filberts, hickory nuts, walnuts, Brazil nuts, pecans, peanuts, and cocoanuts. Chestnuts and peanuts are improved by roasting. Chestnuts are excellent when boiled or steamed.

Nuts are often a very pleasant addition to cake and some puddings. They should always be eaten at the regular meal, constituting a part of it.

Melons.

These are wholesome when ripe. They should never be gathered until they are fully matured; are best when fresh. Cooking cannot improve them.

Sauces

Date Sauce.

Chop nice, clean dates and boil with a small quantity of water until very soft. Rub through a sieve to remove the stones. Thin slightly with hot water, add a little lemon juice, and boil a moment longer. This is an excellent dressing for dishes which require sweetening.

Grape and Apple Sauce.

Stew together equal parts of grapes and sweet apples. Strain through a thin cloth, and thicken
85 with a little flour. Use for puddings. Sour apples and dates may be used, if preferred, instead of sweet apples.

Pear Sauce.

Flavor the juice of stewed pears with lemon or lime juice, or place in it, while hot, a few slices of lemon.

Orange Sauce.

Add grated orange peel and orange juice to date sauce prepared without the addition of lemon, unless the orange is very sweet.

Sweet Apple Sirup.

A very nice dressing for puddings may be made by boiling new sweet-apple cider to the consistency of thin sirup. If sufficiently concentrated, it will keep without canning. It may be simply scalded and then canned for use in pies and sauces. The cider should be made of selected apples, and should be boiled the same day that it is made, so that fermentation may not begin.

Other sauces can be prepared from the juices of almost any kind of fruit. Some will be improved by thickening a little with flour or corn starch.

Vegetables.

The usual methods of cooking vegetables render some of the most nutritious of them almost wholly worthless as food, and, in fact, next to impossible of digestion. But if the following directions are carefully observed, many excellent and whole-
86 some dishes may be prepared from the large class of roots, seeds, etc., known as vegetables.

General Directions.

1. The remark with reference to the cooking of grains by gentle heat is equally true with vegetables, as a general rule. The cook should bear in mind that when water is boiling, it cannot be rendered any hotter, no matter how much the fire may be increased, without closely confining the steam.

2. With only one or two exceptions, all vegetables are much richer and more nutritious when

served in their own juices. A great amount of nutriment is wasted by cooks who throw away the water in which vegetables have been boiled. To avoid such waste, and render the food as nutritious as possible, always cook vegetables with just sufficient water to keep them from burning until done, so that there will be little left unevaporated by the time the food is sufficiently cooked.

3. Do not add any condiment of any kind. Grease of all kinds is especially objectionable, as the process of cooking produces certain changes which render tenfold worse an article which is very objectionable at the best. The reason why many dyspeptics cannot eat vegetables without intense suffering, is that these otherwise harmless articles of food have been poisoned by the admixture of such irritating and indigestible things as butter, pepper, salt, mustard, etc.

4. Vegetables should be well cooked, but overcooking is very damaging.

5. All vessels used in cooking vegetables should be kept scrupulously clean. When brightly pol-
87 ished, they will not only corrode less rapidly, but will impart less of their substance to the articles cooked in them. Brass and copper vessels should receive especial attention, as they become sources of poisoning, when mingled with the food.

Boiled Potatoes.

Select potatoes of nearly equal size, wash thoroughly, cutting them as little as possible. Put them into boiling water nearly sufficient in quantity to cover them. Boil with a gentle heat until soft, being careful to keep them boiling; then turn off the water and let them stand partially covered for five minutes in a moderate heat. They should not be covered close after being cooked either by boiling or in any other way. If it is desirable to retain the heat, they may be covered by a napkin folded once or twice, or the dish containing them may be set, uncovered, in the oven.

If the potatoes are old and withered, they may be soaked in cold water for a few hours before cooking.

Some excellent cooks place the potatoes upon the stove to cook in cold water instead of placing them immediately in boiling water.

Potatoes may also be steamed, or cut in slices and cooked in just sufficient water to keep them from burning. The latter method is a very expeditious one.

Steamed Potatoes.

Prepare the potatoes as for boiling. Place them in the steamer after the water is boiling well. When done, allow them to stand in the steamer uncovered for a few minutes, or remove them to the oven, to render them dry and mealy.

88 ### Mashed Potatoes.

Potatoes may be cooked as directed in either of the preceding recipes and then quickly peeled and mashed. By this method very little of the most valuable portion of the potato, which lies close to the skin, is removed. If more convenient, the potatoes may be pared before cooking, care being taken to pare as thinly as possible. The same precautions to prevent their becoming watery should be observed as already directed. Season with green corn cream.

Baked Potatoes.

Baking or roasting potatoes are by far the best methods of cooking them. They should be carefully washed and buried in hot ashes or placed in a hot oven. Remove as soon as done, and break open the skin to allow the steam to escape, so that they may not be watery. Potatoes of nearly equal size should always be selected.

Browned Potatoes.

Slice cold potatoes. Place the slices upon a soapstone griddle, or upon a baking tin in a hot oven. Remove when nicely browned. Eat while warm. Mashed potatoes may be browned by making into small cakes and placing in the oven on tins.

Sweet Potatoes.

These may be cooked in the same manner as the common potato. Baking after partial boiling is an excellent method of preparing them. They are excellent sliced and browned.

89 ### Baked Beets.

Like potatoes, and, in fact, almost all roots and tubers, beets are much sweeter baked than when prepared in any other way, as by this method of cooking all of the rich juices are retained. The baking should be performed slowly and carefully. Several hours are usually required.

Boiled Beets.

Wash carefully without cutting or breaking the roots so that the juice may not escape. Boil until sufficiently soft to yield to pressure, but do not puncture them. Place in cold water for a few minutes after removal from the kettle, and the skin can be easily rubbed off with the hand. If any seasoning is required, lemon juice may be used.

Beets and Tomatoes.

Mix equal quantities of cooked tomatoes and well boiled beets chopped fine. Boil a few minutes, and serve warm.

Boiled Parsnips.

Parsnips should be boiled as directed for beets, except that there is no objection to puncturing them with a fork to ascertain when they are done. Small ones may be cooked whole, but large ones should usually be divided. They may be cut in slices and stewed when haste is necessary. The water should all be evaporated when they are done, and they are much improved by being allowed to brown slightly in the kettle. Parsnips may be steamed as well as potatoes.

90 **Mashed Parsnips.**

Wash and scrape, carefully removing the skin. Boil until tender and mash as directed for potatoes.

Browned Parsnips.

Slice cold parsnips into rather thick pieces and brown as directed for browned potatoes.

Carrots.

Cook as directed for parsnips and beets.

Stewed Turnips.

After washing and paring the requisite number of turnips, slice them thin, and place them in sufficient water to cook them. Cover close and boil until the water is all evaporated.

Boiled Turnips.

Wash clean, wipe, and peel. Considerable of their sweetness is lost if they are allowed to remain in water after peeling. Boil whole in a closely covered kettle and serve in the water which remains when they are done. Only sufficient water should be used to keep them from burning, and this should be reduced to the consistency of sirup by the time the turnips are done. Be careful to remove as soon as done.

Mashed Turnips.

Cook turnips as directed in the last recipe. Mash until entirely free from lumps, and stir a few minutes before removing from the fire.

Boiled Cabbage.

Select a well-developed head of cabbage, remove the coarser outside leaves, and if there are signs of insects, lay in water to which a little salt
91 has been added for an hour or two to drive them out. Rinse away the salt water and place the cabbage in just enough water so that when it is done there will be only sufficient to keep it from burning. Do not drain off the water once or twice as many recommend, but preserve the juice. Cover close and boil vigorously until tender, and then let it simmer for awhile. If it is likely to burn before sufficiently cooked, add water. If there is too much water, remove the cover so that evaporation may go on more rapidly. The condensed juice will be very sweet, and should be served with the cabbage. An excellent sauce to be eaten with cabbage may be made from stewed tomatoes by adding rusk, bread crumbs, or thickening with a little graham flour. Some consider it a good plan to inclose the cabbage in a napkin while boiling. This prevents falling in pieces.

Cabbage and Tomatoes.

Boil in a very little water a finely chopped cabbage. When nearly done, add half the quantity of cooked tomatoes. Cook well, but be careful to avoid burning.

Steamed Cauliflower.

Select a large cauliflower and place it in salt water to drive away the bugs which may be hidden in it, and which it is undesirable to cook. Carefully wash to free from the salt, and wrap carefully in a napkin. Place in a steamer and cook until the stalk is soft and yielding to gentle pressure. Twenty or thirty minutes are usually required. Serve with green corn white sauce.

92 If steaming is not convenient, the cauliflower may be boiled the same as cabbage.

An excellent dish may be prepared by removing the cauliflower from the steamer when it is about half done, picking to pieces, and placing it in a sauce pan with the juice of cranberry or plum sauce. Cover close and stew until tender. Serve cold.

Boiled Green Corn.

No. 1. Remove the husks and silk from green corn, in its prime. Place in a kettle containing a small quantity of boiling water, taking care to lay the large ears at the bottom so as to keep as much out of the water as possible. Cook from ten to twenty minutes according to the age of the corn. Too much cooking hardens it. All it requires is thorough scalding. Cover with a napkin upon removing from the kettle. Corn cooked in this way and eaten without butter and salt is more palatable if eaten from the cob. Steaming requires a little more time than boiling.

No. 2. Shave half of the corn to be cooked, and grate and scrape the remainder. Boil the shaved corn for five minutes in just enough water to cover it. Then add the grated corn and cook ten minutes longer.

Roasted Green Corn.

No. 1. Remove the husk and silk and place before an open grate until the kernels burst open.

No. 2. Bury in hot ashes without removing the husks. Sweet corn prepared in this way is very palatable.

Succotash.

Cook green beans until nearly done; add an
93 equal quantity of shaved corn and cook fifteen or twenty minutes longer. The juice will be richer if some of the corn is grated. Corn cooked in this way sours very readily.

Green Corn Cream.

Equal parts of grated green corn and water, strained through a sieve or cloth, make a fluid which very much resembles cream, and which may be used for many of the purposes for which cream is usually employed. It makes a very excellent dressing for puddings, vegetables of various sorts, and even for peaches, and similar fruits. Two parts of water to one of corn make a thinner fluid which might be called green corn milk.

Green Corn White Sauce.

Place the milk, prepared as directed in the preceding recipe, in a saucepan, and stir until it boils. Add sufficient graham flour to make it of the desired thickness and boil five minutes longer. This is an excellent dressing for cabbage, cauliflower, potatoes, and other vegetables.

Boiled Beans.

Pick the beans over carefully, wash them perfectly clean, cover them about three inches deep with cold water, and let them soak all night. Early in the morning place them over the fire, leaving upon them all the water that may remain unabsorbed, and adding enough more to cook them in. Let them *simmer* slowly all the forenoon, but do not allow them to *boil*. Some cooks consider the addition of raisins to boiled beans an excellent plan. Try it. Sliced cabbage may be added when the beans are half done.

Baked Beans.

94 No. 1. Prepare and cook as directed in the preceding recipe; but remove them from the fire as soon as they are soft, and bake for an hour in a very hot oven. They may be mashed fine before baking.

No. 2. After carefully preparing the proper quantity of beans, soak them over night and in the morning parboil until they crack, and then place in the oven and bake in the same water. The addition of a little water may be necessary. Bake all day, adding water when required, but allowing it to become nearly evaporated just before removing the beans from the oven unless much juice is desired.

String Beans.

Select tender bean pods and string, wash, and cut or break them into short pieces. Boil with gentle heat in a small quantity of water until tender. Add a sufficient quantity of green corn cream to make a good soup, and immediately remove from the fire. Cooked tomatoes are considered an addition by some.

Dry Peas.

Cook according to the methods already described for dry beans; less time is required.

Peas Cake.

Boil one part of dry peas in four parts of water until reduced to the condition of a paste. Then rub through a sieve and mold. When cold, cut in slices and eat with some kind of sour sauce. The slices may be browned if preferred.

95 Green Peas.

Pick and shell green peas, being careful to avoid dirt as the peas are injured by washing. Put into water enough to cover them. Cover close and cook gently fifteen to twenty minutes. Some boil the pods about twenty minutes and then skim them out and boil the peas in the same water. A few young potatoes or beets may be cooked with the peas if desired.

Green Beans.

These may be cooked as directed for green peas. A good seasoning is found in green corn milk or cream if it has been prepared.

Asparagus.

No. 1. Place the young and tender shoots in a napkin, or tie them in bundles, and cook as directed for cauliflower, and serve as greens.

No. 2. Cut the tender portion of the stems into small pieces and cook as peas. Season with green corn milk or cream.

Greens.

This kind of food contains little nourishment, but is well relished by some people. Spinach, cabbage sprouts, and beet tops, make very good greens. They should be thoroughly washed. Cowslips, dandelions, mustard leaves, turnip leaves, and radish leaves, are also used; but they should be first scalded. Boil in just enough water to cover. The addition of young beets or potatoes improves the flavor.

Boiled Onions.

For healthy stomachs, boiled onions are not very objectionable unless the odor is offensive. To prevent smarting of the eyes in preparation, they may be peeled under water. Boil in a small quantity of water. They may also be roasted.

Cucumbers.

Cucumbers, if eaten when fresh, and without any condiments, are not particularly objectionable as food, although they contain little nutriment. Soaking in water hardens them, and renders them less easily digestible.

Those who are making the change of diet, and have not yet become accustomed to food seasoned with nothing but its own natural flavors, as in the above recipes, may add moderate quantities of salt, milk, or sugar, but never more than just sufficient to make the food palatable.

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96 Soups, Stews, and Gruels.

These articles of food, although much used, and usually considered the most easily digested of all kinds of food, are really quite objectionable when viewed from a physiological standpoint. As a general thing, they are not very nourishing on account of the large proportion of water which

they contain. The large amount of water also makes them more difficult of digestion than more solid kinds of food, since it must be absorbed before the process of digestion can be carried on, as previously explained. Crackers should always be eaten with soups and gruels so as to insure thorough insalivation. Gruels are often proper
97 food for sick people, because they have considerable bulk, with little aliment, it being usually the case that very little nutriment can be appropriated by the system when a person is suffering from acute disease.

No butter, milk, cream, salt, or other condiments, have been recommended in the following recipes. Those who do not find them palatable can add a little milk and salt at first, gradually learning to do without them entirely.

Potato Soup.

Pare and slice potatoes, put them in cold water, and boil until soft. Add a small quantity of soft-boiled rice, barley, or millet. Thicken with a little graham flour first mixed with water and beaten smooth. Crackers or soft biscuit may be added to the soup if desired.

Vegetable Soup.

Five quarts of water; one teacup of rice or pearl barley (soaked over night); one teacup of dried beans or two of fresh; six potatoes sliced; one teacup each of turnip, parsnip, and onions, chopped fine. The barley and dried beans require two hours for cooking; the other vegetables, half an hour.

Bean Soup.

Take half a pint of cooked beans for a quart of soup. Mash them, and boil until they are very soft and well mixed with the water, and then, if preferred, strain to remove the skins. Thicken with a little graham flour, and boil a few minutes longer.

98

Green Bean Soup.

Take one quart of garden or kidney beans, one ounce of spinach, and one ounce of parsley. Boil the beans; skin, and bruise them in a bowl till quite smooth; put them in a pan with two quarts of vegetable broth; dredge in a little flour; stir it on the fire till it boils, and put in the spinach and parsley (previously boiled and rubbed through a sieve).

Split-Pea Soup.

Take one-eighth as many peas as the quantity of soup required. Boil gently in a small quantity of water until soft enough to be rubbed through a coarse sieve or colander, or until they fall to pieces. Strain, add sufficient water to make the requisite amount of soup, and boil again. Thicken with graham flour and boil again a few minutes. Either split or whole peas may be used if they are strained. The white marrowfat is the best, but the blue pea is also excellent. Some scald the latter and turn off the water before cooking.

Dry beans may be made into a soup in the same manner, but double the quantity is required for the same amount of soup.

Tomato Soup.

Scald and peel good, ripe tomatoes, add a little water, stew them one hour, and strain through a coarse sieve; stir in a little flour, or crumb in toasted biscuit, and then boil five minutes.

Vegetable Oyster Soup.

Slice and boil until tender; thicken with graham flour and pour over toasted bread or crackers.

99

Parsnip Stew.

Wash, pare, and slice parsnips and an equal quantity of pared potatoes, and cook gently with a small quantity of water, and closely covered. Add a few bits of dough made from graham flour and boiling water. Thicken with boiled pearl barley.

Vegetable Stew.

In a large saucepan with a tightly fitting cover, place a pint of water. Add a half pint of sliced onions, one pint of shred cabbage, and a pint of sliced turnip. Cover closely and stew with moderate heat for forty-five minutes. Then add a quart of potatoes of medium size, and cook until the potatoes are done. Mash and thoroughly mix. If there is too much juice when done, drain it off and boil down to a sufficient quantity to make the whole of proper consistency. This dish with the addition of pork, is a very favorite one with the Irish, but needs no such addition for hygienists.

Onion Stew.

Cook one pint of onions three-fourths of an hour (or more, if large), then put in one quart of potatoes, and, when boiling, cover the surface with scalded wheat-meal dough. Lift when the potatoes are done, and add to the liquid one-half pint of cooked rice, and cook ten minutes. Then pour it over the other ingredients, mix slightly together, and serve hot.

Vegetable Broth.

To equal quantities of turnips and carrots, add an onion. Chop fine, and add a little lentil flour.
100 Boil until well cooked in water sufficient to make a thin soup.

Graham Gruel.

Mix two tablespoonfuls of wheat meal smoothly with a gill of cold water; stir the mixture into a quart of boiling water; boil about fifteen minutes, taking off whatever scum forms on the top.

Oatmeal Gruel.

Mix a tablespoonful of oatmeal with a little cold water; pour on the mixture a quart of boiling water, stirring it well; let it settle two or three minutes; then pour it into the pan carefully, leaving the coarser part of the meal at the bottom of the vessel; set it on the fire and stir it till it boils; then let it boil about five minutes, and skim.

Corn-Meal Gruel.

Slowly stir into a quart of boiling water two tablespoonfuls of corn meal. Boil gently twenty minutes or half an hour.

Farina Gruel.

Mix two tablespoonfuls of farina in a cup of water, and pour slowly upon the mixture about a quart of boiling water, stirring briskly. Boil ten minutes.

Milk Porridge.

Place over the fire equal parts of milk and water. Just before it boils, add a small quantity of graham flour, oatmeal, or corn meal, previously rubbed with water, and boil a minute longer. This recipe is not recommended as hygienic.

101 **Bill of Fare for Each Month.**

The appetite craves variety of food. Especially is this the case with those whose tastes have once been perverted and depraved; and frequent change in the kind of food, or in the manner of its preparation, is a very important auxiliary in effecting a reform in diet. Long-continued sameness begets disgust for articles of food which may have been well relished at first. Perfectly healthy tastes do not manifest this desire for change in nearly so marked a degree, and yet there can be no doubt that there is in nature a demand for variety of food which should be gratified. We desire, however, to impress with distinctness the fact that, contrary to the supposition of many, it is not at all necessary to depart in any degree from the strictest rules of dietetics in order to obtain all the needful variety in articles of diet.

By variety is not meant a great number of dishes at one meal, but a change in the dishes prepared from day to day. Three or four kinds are usually enough for a single meal. Dyspeptic stomachs tolerate better but one or two kinds. Persons whose digestive organs are impaired should avoid the use of fruits and vegetables at the same meal. Fruit should be eaten very freely with meals, but not between meals.

The following bill of fare may be found useful to those housekeepers who are anxious to provide their families with a variety of healthful food, but are often sorely troubled to know "what to get next."

JANUARY.

SUNDAY.—*Breakfast:* Baked potatoes, browned parsnips, snow bread, oatmeal gruel, dried apple sauce, with ripe apples.

102 *Dinner:* Rice and apple pudding, canned tomatoes, mashed potatoes, graham rolls, and oatmeal crisps, fresh grapes, steamed figs, apples.

MONDAY.—*Breakfast:* Browned potato cakes, tomato toast, graham pudding with dates, graham and Indian gems, ripe sour apples.

Dinner: Boiled potatoes, baked beans, cranberry sauce, pudding biscuit, parched corn, apple pie.

TUESDAY.—*Breakfast:* Baked potatoes, baked squash, bean soup (made with cold beans), oatmeal breakfast cake, canned fruit.

Dinner: Vegetable stew, baked apples and dates, rice cake, graham crackers, berry sauce.

WEDNESDAY.—*Breakfast:* Baked sweet potatoes, dried sweet corn (stewed), crushed wheat or farina, stewed prunes, Johnny cake, apples.

Dinner: Boiled dry peas, steamed potatoes, sweet-potato bread, canned peaches, boiled samp, custard pie.

THURSDAY.—*Breakfast:* Pea soup, browned potatoes, graham and oatmeal crackers, corn-meal gems, canned peaches.

Dinner: Boiled rice, apple dumpling, hard biscuit, apple brown bread, canned whortleberries, apples.

FRIDAY.—*Breakfast:* Baked potatoes, graham pudding, rice cake, corn-meal crackers, dried apple sauce, dates.

Dinner: Boiled sweet potatoes, stewed turnips, baked squash, small hominy, English currants, apples.

SATURDAY.—*Breakfast:* Browned sweet potatoes and turnips, fruit toast, graham or corn-meal gruel, oatmeal crackers, brown bread, raisins, apples.

Dinner: Rice and apple pudding, small hominy—cold, sliced and browned, graham rolls, fruit gems, cranberry sauce or canned fruit, dates, apples.

FEBRUARY.

For this and the succeeding months we have not made out the complete bill of fare for a week, as for January, but leave the reader to use his discretion in selecting for each day such as he may choose of the articles suggested.

BREAKFAST.—Baked Irish potatoes, baked sweet potatoes, browned potatoes, peas cake, browned turnip; graham pudding, oatmeal pudding, crushed wheat, farina, graham, corn-meal, or oatmeal gruel; tomato toast, fruit toast, dry toast; breakfast cake, rolls, gems, crackers,
103 crisps; canned fruit, cranberry, dried apples, peach, whortleberry, or cherry sauce, dates, prunes, raisins, apples.

DINNER.—Boiled or steamed Irish and sweet potatoes, mashed potatoes, boiled turnips, baked squash, boiled or baked beans or peas, hominy and beans, hominy, tapioca, rice, corn-meal pudding, bread pudding, rice and apple pudding, sweet potato pudding, steamed bread and fruit pudding; potato soup, split-pea soup, bean soup, dried sweet corn; brown bread, gems, rolls, snow cake, crackers, apple bread, fruit cake, fruit crackers, sweet potato fruit cake, popped corn fruit cake; dried fruit sauce, canned fruit, baked apples, dates, figs, raisins, apples, grapes, nuts.

MARCH.

BREAKFAST.—Baked or browned potatoes, browned parsnips or turnip, baked squash, baked beets, cold boiled beets—sliced, cabbage and tomatoes, beets and tomatoes; gruels; puddings; griddle cakes, rolls, gems, crackers, toast; canned and dried fruit, apples, dates.

DINNER.—Boiled potatoes, turnips, beets, parsnips, cabbage; mashed potatoes, turnips, parsnips; boiled and baked peas and beans, parsnip stew, vegetable stew, small hominy, farina, rice, fig pudding, tapioca apple pudding, bird's nest pudding, apple custard; bean, pea, and potato soup; oatmeal bread, scalded rolls, mixed loaf, graham and corn-meal crackers, cocoanut bread, cocoanut cake, corn-meal fruit gems, dried fruit pies, tarts, raisin pie; dried and canned fruit, dates, figs, apples.

APRIL.

BREAKFAST.—Peach toast, canned cherries, rhubarb and plums.

DINNER.—Vegetable oyster stew, greens, pearl barley, boiled wheat, tapioca pudding, baked rice pudding, corn-starch pudding, American plum pudding; lemon pie, rhubarb and other sour fruits.

Add to the above the bill of fare for March.

MAY.

BREAKFAST.—Same as for April; in some sections, rhubarb and green currants may be added.

DINNER.—About the same as for March and April.

104 JUNE.

NEW DISHES.—Rhubarb, green currants, young beets, asparagus. Beans and the various preparations from Indian corn should be exchanged for such grains as rice and oatmeal during the warm months.

JULY.

NEW DISHES.—Summer squashes, beets, onions, green pea soup, string bean soup, early potatoes, cucumbers, strawberries, strawberry shortcake, cherries, cherry dumpling, currants, raspberries, bananas, pineapples, whortleberries, whortleberry Johnny cake, oranges, lemons, lemon pie, orange sauce. Use chiefly fruits and grains during the summer months.

AUGUST.

NEW DISHES.—New potatoes, green corn, green corn cream, green corn custard, green beans, succotash, tomatoes, tomato soup, early apples, apples and tomatoes, tomato pudding, water melons, musk melons, blackberries.

SEPTEMBER.

NEW DISHES.—Peaches, green corn custard, pears, plums, baked apples and pears, green apple sauce and stewed pears, stewed peaches, apple and peach pies, green corn gems, roasted green corn.

OCTOBER.

NEW DISHES.—Boiled beets, beets and tomatoes, early cabbage, vegetable stew, grapes, grape sauce, grape and apple sauce, steamed cauliflower, grape tarts, gooseberries, gooseberry pudding.

NOVEMBER.

NEW DISHES.—Steamed pumpkin and squash, pumpkin pie, pumpkin bread, baked squash, chestnuts, chestnut pudding, carrots, boiled turnips, sweet potatoes.

DECEMBER.

NEW DISHES.—Hulled corn, boiled samp, popped corn, custard pie, boiled, steamed, and browned parsnips, cranberry sauce, cranberry dumpling, cranberry pie, custard pie, Christmas pudding, hickory nuts, walnuts, peanuts, and the various foreign nuts.

105
BEVERAGES.

Summer Drinks.

Many people indulge in the very pernicious habit of drinking iced water during the hot summer months, no matter what may be the condition of the system. This practice often leads to serious results, and should be regarded as decidedly unhealthful. Soda water is another summer beverage of very suspicious character. It is not injurious on account of containing soda, for there is no soda in it, notwithstanding its name. Its effervescence is caused by the escape of carbonic acid which has been mechanically pressed into it. Its injurious properties are due to the sirup employed, which is very rarely pure. Pine-apple sirup seldom contains the slightest trace of pine-apple juice. It is made from coal tar and various other similar commodities. The same is true of the other sirups employed, and the more thoroughly they are let alone, the less damage will be done the health.

Excellent and wholesome drinks may be prepared from lemons, oranges, currants, and almost all the different kinds of berries, by diluting their juices with water and adding a very little sugar when required.

A very pleasant drink can be made from rhubarb. Prepare the stems as for stewing. As soon as the water boils, drain off the juice and dilute it with an equal quantity of cold water. Add a little sugar, and pineapple if desired.

106 A beverage can be made from apples in a manner similar to the above.

The juices of fruits are harmless and wholesome if used in moderation. They are by some considered superior to water only, it being thought that they quench thirst more readily. At all events, they are infinitely superior to tea, coffee, wine, beer, and the various other mixtures which are generally so largely employed during the hot months.

To Keep Water Cool.

Ice is almost universally depended upon as a means of cooling drinking water in summer. The free use of iced water is harmful for several reasons. 1. It is so intensely cold that it often works serious mischief by too suddenly reducing the temperature of the internal organs; 2. The ice often contains organic impurities—the scum and slime from stagnant water, which render the water to which it is added very unwholesome. If taken at all, it should only be in very small sips.

The better way is to drink none at all; and by making use of the following means, the water may be kept sufficiently cool to answer all the real demands of nature; in fact, it may be kept nearly at freezing temperature:—

Place between two sheets of thick brown paper, a layer of cotton half an inch thick. Fasten the ends of the sheets together so as to form a roll. Sew in a bottom made of similar material, making it nearly air-tight, if possible. Fill a pitcher with cool water, and cover it with the cylindrical box by inverting it over the pitcher. If the box is kept constantly wet with water,
107 evaporation will go on so rapidly that the water in the pitcher will be kept very cool for a long time.

Water may also be kept cool by placing it in jugs and wrapping them with wet cloths.

Filtered Water.

The best of all drinks is pure soft water. But absolutely pure water is very difficult to obtain. In fact, it never occurs in nature. Filtered rain water is the nearest approximation to it which people generally can obtain, and a good filter is necessary to procure this. People living in districts where hard water only can be obtained from wells and springs cannot afford to live without a filter. In using hard water, they are constantly imposing upon their systems a task which must sooner or later, result in serious damage to their health. Unfiltered rain water is not fit to drink, at least after it has been standing a day or two.

How to Make a Filter.

An excellent filter can be obtained at reasonable rates at this Office. See advertisement on last page. Those who think they cannot afford to purchase this valuable article, can construct a very good one at a very small expense, in the following manner:—

Take a large flower pot or earthen vessel, make a hole one-half inch in diameter in the bottom, and insert in it a sponge. Place in the bottom of the vessel a number of clean stones of sizes varying from that of an egg to an apple. Place upon this a layer of much smaller stones and coarse gravel. Then fill the jar within two inches
108 of the top, with equal parts of pulverized charcoal and sharp sand, well mixed. Place loosely over the top of the jar white flannel cloth, allowing it to form a hollow in the middle of the jar, into which the water can be poured. Secure the edges by tying a stout cord around the outside of the jar. By keeping a suitable vessel under the filter thus made, and supplying rain water when needed, very pure water can be obtained. It can be kept in a cool place in the summer time. It will require to be renewed occasionally by exchanging the old sand and charcoal for fresh. The flannel and sponge must be frequently cleansed.

How to Make a Cistern.

In many localities, soft water can only be obtained by preserving, in some way, that which nature distills from the clouds. Cisterns built in the ground are commonly employed for this purpose; and every family should be provided with this convenience when necessary. But it often happens that, through some defect in construction, a cistern becomes a source of disease rather than a means of health; hence the necessity for proper care in construction. The main thing is to make it perfectly impervious to the entrance of worms or vermin of any kind. It should be covered above, as well as upon the sides, with water-lime cement.

But for drinking and cooking purposes, rain water is wholly unfit, even when it is kept in as good condition as when it falls from the clouds. In its passage through the air, it gathers dust, and becomes colored with smoke and tainted with foul gases. Before it enters the cistern,
109 also, it washes from the roof a great quantity of impurity—decayed wood, accumulated dust, and the offal of birds. A cistern should be so constructed that, if possible, these impurities may be entirely excluded from it.

This may be readily accomplished by constructing a filter in such connection with the cistern that all the water from the roof must pass through it before entering the cistern. A large, water-tight cask should be selected for the purpose. Sink this into the ground close to the cistern, establishing connection between the latter and the bottom of the cask. Place in the bottom of the cask a few clean, smooth, hard stones of the size of a man's fist, to serve as a support. Place upon these a perforated sheet of zinc made so as to nearly fit the cask. Upon this, place a layer of two or three inches of coarse gravel, thoroughly cleansed; then a thin layer of fine gravel. Upon this, place about a foot of fine, sharp, clean sand, thoroughly mixed with an equal quantity of freshly-burned and pulverized charcoal. Cover this with clean gravel to a depth of two or three inches, and the whole with another sheet of perforated zinc, and the filter is complete. There will be sufficient room left in the upper part of the cask to allow the accumulation of water when it is running in rapidly, as during a rain storm. The cask should be large enough to allow this.

Another method of purifying the water of cisterns, which is in some respects superior to the above, is the following: Build the cistern as already directed, and then divide it into two portions by means of a partition made of porous brick, laid in water-lime. Allow the water to
110 enter the cistern upon one side of this partition, and withdraw it by means of a pump from the opposite side. It will be found that very complete purification will be effected by its filtration through the brick. Of course, the partition should be so tight that water can pass through only by soaking through the porous brick. Hard-burned or glazed brick must not be employed.

Still another means is to inclose the end of the pipe through which the water is withdrawn from the cistern, in a tight chamber of porous brick. The water will become nearly pure in passing into this chamber through the brick.

Those who have tried the two latter methods described, pronounce them to be very efficient means of purifying water, if properly employed. The first method has one advantage, however, in that the gravel and charcoal can be removed and renewed as frequently as desirable with but little trouble or expense.

Lead Pipes.

WATER intended for drinking purposes should never be allowed to pass through lead pipes, as in so doing it becomes impregnated with the metal, and thus often becomes a source of dangerous, even fatal, poisoning. Paralysis and colic are among the most prominent effects of poisoning by lead. Water pipes should be of galvanized iron, zinc, or block tin.

111 PRESERVING FRUITS AND VEGETABLES.

Canning and drying are the only ready methods of preserving fruits and vegetables which are at all hygienic. Pickling in salt, alcohol, or vinegar, and saturating with sugar, are eminently unhygienic methods, as they render the article preserved wholly unfit for food. Refrigeration is an excellent method, but it cannot well be practiced on a small scale.

Canning Fruit.

Canning fruit is a very efficient means of preserving it in a wholesome condition, but it is a process which demands careful management to make it a success. Tin cans are sometimes used, but glass cans are now so cheap and are so much better that they should always be preferred. In the end they are cheaper, as they last much longer than tin cans. Tin cans are liable to injure the flavor also. There are several excellent kinds of fruit cans in the market.

In canning fruit two things must be most carefully attended to or failure is certain:—

1. The fruit must be sufficiently cooked.

2. The air must be excluded and the can hermetically sealed.

The best fruit should be selected, and that which is not overripe. It should be kept as clean as possible so that little or no washing will be required, as this is injurious to many fruits. Pick over carefully, and wash quickly if washing is necessary. Either steam or stew, adding as little water as possible, and as little sugar as will suffice to make the sauce palatable. Sweet fruits
112 require none at all, and none is necessary to the preservation of the fruit. Steaming is rather preferable to stewing or boiling as the fruit is less broken and its natural flavors are better preserved. A porcelain-lined kettle should be used, as all kinds of metal kettles are likely to be corroded by the acids of the fruit.

The fruit need not be cooked so much that it will fall to pieces, but it should be so thoroughly scalded that every part of it will be subjected to a high degree of heat, in order that all of the germs from which fermentation originates may be destroyed. Simply heating is not sufficient.

Some kinds of fruit require longer cooking than others. The length of time varies about as follows: Boil whortleberries and cherries, five minutes; raspberries, blackberries, and ripe currants, six to eight minutes; halved peaches, gooseberries, and grapes, eight to ten minutes; sliced pineapple and quince, and halved pears, fifteen to twenty minutes. Tomatoes, thirty minutes to two hours.

While the fruit is cooking, prepare the cans in which it is to be placed. Thoroughly scald them so that there may be in them nothing which will induce decay. To prevent breaking when the hot fruit is placed in the can, it may be heated by pouring into it hot water and quickly shaking it so that all parts may be heated equally, or the can may be placed in cool water and gradually heated to the requisite degree. Dry heat is equally efficient, and may be applied by keeping the cans in a moderately hot oven while the fruit is cooking. Some place the cold can upon a folded towel wet in cold water, which cools the
113 bottom and so prevents cracking. This method is very convenient.

When the fruit is properly cooked and the cans are in readiness, first place in the can a quantity of juice, so that as the fruit is put in, no vacant places will be left for air, which is sometimes quite troublesome when this precaution is not taken. Then add the fruit itself. If any bubbles of air chance to be left still, work them out with a fork, spoon handle, or straw. Fill the can full, and immediately put on the cover and screw tightly on. If the can is unpleasantly hot, it may be securely held by passing a towel around it and twisting the ends together. As the fruit cools, the cover can be tightened, and this should be promptly done, so that no air may be allowed to enter. Sometimes the fruit will settle so that a little space will appear at the top. If you are sure the can is tight, do not open to refill, as you will be unable to make the can quite as tight again unless you reheat the fruit, in which case you would be liable to have the same thing occur again.

Some allow the fruit to cool about ten minutes before adjusting the cover. This gives time for the fruit to cool and settle some. The can is then filled with hot sirup and the can tightly sealed.

After filling and tightly sealing, place the cans in a cool place and watch them closely for two or three weeks, when they may be set away if there are no signs of fermentation. Should any such signs appear, open the can immediately, scald the fruit thoroughly, and seal as before, being very careful to examine the cover and see if
114 there is not some imperfection which prevents the perfect exclusion of air.

Small fruits and tomatoes may be preserved in bottles or jugs by sealing with wax. Thoroughly heat the bottle or jug, and put in the fruit, first putting in juice as when using cans. Shake down well, and refill. Then place two thicknesses of cloth over the mouth, insert a tightly-fitting cork, and thoroughly cover the whole with melted wax made according to the following or some equally good recipe: One pound resin, two ounces bees-wax, and one and one-half ounces of tallow; melt and mix.

When canning in glass vessels, care must be used to protect the vessels from draughts of cold air, or they will be liable to break.

Apples, pears, quinces, and peaches, should be pared and cut into pieces small enough to can conveniently. In canning, they may be arranged in the can with a fork, if desired, the juice being afterward added, but care must be exercised to get out all air bubbles which are very liable to occur when this method is adopted. The skins may be very expeditiously removed from peaches by immersing them in boiling water for a minute or two, and then rubbing with a coarse towel. This is best done when they have just reached maturity, but have not become very mellow. Strawberries require boiling thirty minutes.

Canning Vegetables.

In canning pumpkin or squash, the same general rules should be followed as in canning fruits. They may often be placed in the same cans in which fruit has been kept, after the canned fruit
115 has been used, as they will keep without canning until January, or even later, with care.

Many people fail in their attempts to can green corn. The principal cause of failure is too slight cooking. Merely scalding is not sufficient for green corn. It must be thoroughly cooked, and then there is no greater difficulty in keeping it than in keeping any kind of fruit. With thorough cooking, glass cans are just as good as tin, although the latter may be used for vegetables, and are preferred by some. Tomatoes are also improved by long cooking. Drying is usually considered a better method of preserving green corn, peas, and similar articles, than canning.

Drying Fruits and Vegetables.

The great secret in drying fruits and vegetables is to dry as quickly as possible without subjecting them to so violent a heat as to burn them or injure their flavor. A little ingenuity will enable a person to devise many convenient and inexpensive methods by which artificial heat can be applied at once to a large quantity of fruit or prepared vegetables, such as peas, beans, or sweet corn. Drying under glass in the sun is a very good method. Juicy fruit, like cherries and small fruit, can be more quickly dried after being scalded. Green corn should be scalded so as to "set the milk," after which it should be cut from the cob. A very excellent way of removing it from the cob is to shave off the tops of the kernels with a sharp knife, and then scrape the ear with the back of the knife; the kernels will thus be pressed out, leaving the hull behind, adhering to the cob.

"The most expeditious mode of drying is by
116 means of the oven; but the drawbacks are interference with cooking operations, and danger of scorching; a little forgetfulness, or lack of close attention, and the whole is spoiled. Perhaps the best arrangement for drying on a small scale, is by means of a rack, made for the purpose, and placed by or over the kitchen stove. Any one of a little ingenuity can make it, and the shape and size will be governed by the place where it is to be used. A light frame constructed so as to hold a series of trays, from six to twenty in number, is a very convenient arrangement. The trays may be made of strips of wood, a sufficient distance apart to allow the circulation of air between them.

"For the quick drying of small fruits, green corn, etc., a frame may be made to stand directly over the stove, and constructed in the following manner: Nail together a square or oblong frame, and attach to it four legs or supports, long enough when standing on the floor to raise it about a foot from the top of the stove. Across this, stretch mosquito netting, supporting it in the center by cross-bars, running each way. If the frame is large, several supports will be required, or the netting will 'bag,' and the drying will be uneven.

"Fruit dries very quickly upon this, and will need watching to prevent scorching. It may be partially dried upon this, and finished in the sun, if desired, to make room for more.

"Another method of drying, and one which is often practicable among fruit growers and gardeners, is by the employment of the hot-bed, which is generally unused for other purposes in the season of fruit drying. All the change necessary in its structure, is the laying of a floor on
117 which to spread the fruit. The sash should be raised two or three inches to prevent the fruit from becoming scorched under the rays of the sun."

To preserve dried fruits and vegetables, heat them thoroughly just before putting away, and then hang up in paper bags in a dry place.

Preserving Fresh Grapes.

Pick carefully the later kinds of grapes. Select such bunches as are perfect, rejecting all upon which there are any bruised grapes, or from which a grape has fallen. Spread them upon shelves in a cool place for a week or two. Then pack them in boxes in saw dust which has recently been thoroughly dried in an oven. Bran which has been well dried may also be used. Dry cotton is employed by some. Keep in a cool place. In this way, grapes may be kept until long after New Year's with ease.

Another method still more efficient is to select perfect bunches, as already directed, and dip the broken end of the stem of each bunch in melted sealing wax. The bunches may then be wrapped in tissue paper and placed in layers, or hung in a cool place, or they may be packed in saw dust.

How to Keep Apples and Pears.

Of the numerous varieties of fruits which are grown in this country, apples and pears are about the only ones that can be kept for more than a few days after they are ripe without the employ-

ment of artificial means. And, fortunately, these fruits are the very ones which, upon the whole, are in all other respects the best adapted to meet the wants of man. But even these fruits may
118 be preserved in better condition, and for a much longer time by the employment of certain means, and by attention to a few practical points. The best methods of preserving fruit are always those which change its natural condition as little as possible.

Preserving fruit in ice-houses has been practiced quite extensively, and with very satisfactory results. But many people have not the means to invest in an expensive fruit house. They can derive great advantage from observing the following rules:—

1. If the fruit is of a late variety, allow it to remain upon the trees as long as possible without freezing.

2. Always pick the fruit by hand and handle with the greatest care.

3. Gather the fruit on a dry, cool day, and place it in heaps or bins for two or three weeks.

4. Then carefully pack in barrels, after assorting, head them up, and place them in a cool place.

Upon the approach of freezing weather, the fruit should be removed to the cellar or winter fruit house. The best temperature for keeping fruit well is about 34° F., or 2° above freezing. The cellar in which ordinary vegetables are kept is too warm and damp for apples. Thorough ventilation is also essential, especially in the autumn and early spring.

Before packing away for the winter, fruit should be carefully assorted. That which has nearly reached maturity should be placed where it will be easy of access. The different kinds ripen at different times. They should, on this account, be carefully watched, that they may be used
119 when in their prime, as they rapidly deteriorate in quality after reaching that period.

Apples of good quality may be canned in the latter part of the season if they ripen faster than they can be used.

Many find it advantageous to keep their apples in thin layers upon broad shelves in a cool place. This plan allows frequent and thorough inspection without disturbance of the fruit. It also permits the removal of affected fruit as soon as it shows symptoms of decay.

Warmth and moisture are the two things which favor decay, and should be especially guarded against.

Keeping Lemons and Oranges.

It is often desirable to preserve these fruits which are of excellent service as flavors for other fruits. During the summer there are always times when they can be bought very cheaply in small lots. Then is the time to buy. Place them at once in a vessel of cool water, which should be kept in the cellar, or ice-house. Change the water every day, and they may be kept perfectly fresh for weeks.

These fruits will dry without decaying if they are kept in a perfectly dry place.

Cranberries can also be preserved in water for a long time if the water is often changed.

To Keep Sweet Potatoes.

Little difficulty is usually experienced in keeping the common Irish potato as long as desirable; but the sweet potato requires much more careful treatment for its preservation. The best plan is the following: Select fine, clean sand. Dry it
120 thoroughly in the oven, and bury the potatoes in it, packing them so that the sand will surround each one. Keep them in a place which will be very dry and moderately warm, and they will keep a long time. Irish potatoes require a cool place.

The same plan is an excellent one for keeping parsnips, except that the earth used need not be dried, and a cool place is better than a warm one.

HOUSEHOLD HINTS.

By the exercise of a little ingenuity and care, in many of the affairs of domestic life, much may be saved which would otherwise be wasted. Broken lamps and dishes may be mended by the employment of a little cement; a little glue will repair a broken piece of furniture when the breakage first occurs; here a nail or tack, and there a little putty, paint, or varnish, will save many dollars in the course of a year which may be used in the circulation of reform literature. Some of the following hints and recipes may be found useful:—

How to Remove Rust from Clothing.—Oxalic acid will take rust or any other stain out of white goods. Dissolve a small quantity in boiling water and dip the spots in. The acid can be got at any drug store. Another way is to saturate the spots with lemon juice and spread the cloth in the sun; if it don't take out all the rust the first time, repeat the application. Another method is to wet the cloth with yellow sulphide
121 of ammonia, by which it will be immediately blackened. After allowing it a minute or two to penetrate, the excess of sulphide is to be washed out and the black spot treated with diluted chlorohydric acid, by which it is at once removed. Finally, wash well with water.

Scouring Silver.—Never put a particle of soap about your silver if you would have it retain its original luster. When it wants polish take a piece of soft leather and whiting and rub hard. The proprietor of one of the oldest silver establishments in the city of Philadelphia says that housekeepers ruin their silver by washing it in soap-suds, as it makes it look like pewter.

CEMENT FOR STONEWARE.—To a cold solution of alum add plaster of Paris sufficient to make a rather thick paste. Use at once. It sets rather slowly, but is an excellent cement for mending broken crockery, eventually becoming as hard as stone.

CEMENT FOR IRON.—Take equal parts of sulphur and white lead, with about a sixth of borax, mixing them so as to form a homogeneous mass. When about to apply it, wet it with sulphuric acid and place a thin layer of it between the two pieces of iron, which should then be pressed together. In a week it will be perfectly solid, and no traces of the cement will be apparent. This cement is said to be so strong that it will resist the blows of a sledge hammer.

PASTE.—The adhesiveness of paste may be greatly increased by adding to it a small proportion of powdered alum. The alum also greatly delays its souring.

122 CEMENT FOR GLASS.—Take an ounce of pure white lead in oil, and ten grains of finely powdered acetate of lead, mixing thoroughly. Apply immediately, and allow the mended article to dry for two weeks before using.

CEMENT FOR WOOD AND METALS.—To common glue add powdered chalk. A little borax, added, will preserve the glue for some time.

CEMENT FOR LABELS.—Take equal parts of gum tragacanth mucilage, and one part flour. This cement is especially good for attaching labels to metals, and resists damp very well.

DURABLE WHITEWASH.—Slack, with abundance of hot water, half a bushel of lime, stirring briskly meanwhile. When completely slacked, add sufficient water to dissolve. To this add two pounds of sulphate of zinc (white vitriol) and one pound of common salt. The last-named ingredients cause the wash to harden, and prevent cracking. If a cream color is desired, add yellow ochre. For stone color, add raw umber and lampblack.

KALSOMINING FLUID.—The following is well recommended for walls: White glue, 1 lb.; white zinc, 10 lbs.; Paris white, 5 lbs. Soak the glue over night in 3 qts. of water. Add an equal quantity of water, and heat on a water bath until the glue is dissolved. Put the two powders into another vessel. Pour on hot water while stirring, until of the consistency of thick milk. Mix the two liquids thoroughly, and apply to the wall with a whitewash brush.

HINTS FOR HOUSE CLEANING.—Remember the closets and garret as well as the sitting room and parlor.

123 Mix with the whitewash a considerable proportion of pulverized copperas. It will disinfect the moldy walls, and destroy the eggs of various kinds of vermin.

Never put new paper upon the walls without removing the old. Much harm has often resulted from a neglect of this precaution.

Be careful to avoid arsenical colors in selecting wall paper. Green is the most likely to be dangerous.

A little whiting and a few old newspapers are almost indispensable for polishing the windows and mirrors.

A hot iron applied to old putty will soften it almost instantly.

Matting can be cleaned easily by thorough sweeping after sprinkling salt or moist corn meal or sawdust upon it.

To cleanse the drain pipe, pour down a strong solution of copperas.

Disinfect the cellar by ventilation, whitewashing, and scattering chloride of lime or copperas about.

The cistern should also be noticed. Draw out the water and cleanse it thoroughly, if possible, twice a year. If there is only a slight taint to the water, it may be removed by letting down into the cistern a coarse sack containing one or two bushels of powdered charcoal.

Rats and mice may be driven away by placing in their holes or runways caustic potash or unslacked lime (powdered).

A solution of corrosive sublimate will kill bed bugs and cockroaches instanter.

Paint can be removed by applying a strong solution of oxalic acid.

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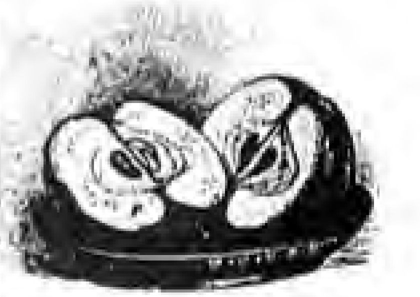


An Herbal Tranquilizer

BY Kurt Saxon

Depression, anxiety, anger and hostility are natural emotions under varying situations of stress. Where such emotions are felt, but are unwarranted by any stressful situation, the body's mechanism for processing the B vitamins is probably not working properly.

This may be temporary, due to a run-down condition. Just in case, go to a health food store and ask for a complete selection of B vitamins and eat them like candy for a few days. At least, take the recommended dosage three times a day instead of once.

If you smoke, and-or drink, try to stop for awhile. Alcohol and tobacco is notorious for robbing the body of B vitamins.

If you symptoms disappear, you have found their cause. But instead of cramming down the vitamins, try to organize a more healthful diet. This may be all you need.

Long term stress may have damaged your body's ability to process the nutrients in food. In this case, you may be on vitamins from now on.

Worse, the shocks and stresses of a harried lifestyle may have caused permanent damage to your nervous system, especially if they led to a nervous breakdown. If this is the case, you may need tranquilizers from now on.

Such tranquilizers as Valium, Thorazine, Librium, etc. are narcotic and habit forming. Like all narcotic use, the body gradually builds up a tolerance so that more must be used to achieve the needed relief from the condition for which they were prescribed.

Literally millions of people, especially women have become habituated to these narcotics. This has often happened because they simply lacked the self control to cope with everyday annoyances. Rowdy children, a surly mate or job difficulties have often turned otherwise stable people into addicts. Regardless of the reasons, whether failure to simply cope, or actual damage to the nervous system, addiction is a one way street leading to eventual insanity.

There is also the real probability that with worsening economic conditions, leading to the collapse of our social system, your medications might become unavailable. Or else, they might be withdrawn from the market as the dangerous narcotics they are.

Soybeans for Survival

by Kurt Saxon

Pound for pound, soybeans are the least expensive, most nutritious and most versatile food you can buy. For instance any homemaker can make soy milk for 22 cents per gallon as compared to cow's milk for $2.29. Soy cheese, or Tofu, can be made for 19 cents a pound as compared to $1.29 per pound in the supermarket. Then there are soybean sprouts at 19 cents per pound. You pay about three times as much for any green vegetable and with much less nutritional value.

Although soybean products may be new to you, they have been the mainstay of oriental families for hundreds of years. Good foods, like good music, prove themselves by being accepted by succeeding generations. Soybean products have become a staple all over the orient and are fast becoming accepted here.

I don't much like to promote soybeans as a survival food. That might make you think that buying a hundred pounds or more was admitting that your family was on the verge of bankruptcy or something.

People who think like that keep buying $6.00 a pound steak to prove they're well off until they go to sign up for welfare. But if they had the survivalist attitude that the better they could live at the least expense, the further away from bankruptcy they'd be.

Food is the biggest part of the average family budget. The adoption of soybeans and other foods I'll write about in succeeding editions of VICTORIA will cut your food bill by half or more.

Soybeans can be ordered through your local health food store at about $22.00 for 50 pounds, or 44 cents per pound. They keep for years, like any other dried seeds. You don't have to buy in bulk at the start. A purchase of five pounds would give you enough to prove out all the products in this article. Of course, you get them cheaper by buying 50 pound bags.

Let's start with soy milk. It tastes different from cow's milk, like lamb tastes different from beef. It has a slightly nutty taste and some say it tastes sort of chalky, although it has less calcium than cow's milk. Even so, the chalky taste doesn't make it unpleasant. If a milk drinker remarks that it tastes different, just tell him it's another brand.

As the table below shows, soy milk has less calcium phoshorous and riboflavin than cow's milk. If milk is your only source of calcium buy a big bottle of calcium tablets at the health food store. They sell for very little so get a year's supply for a few dollars and take as directed.

	Soy Milk	Cow's Milk
Protein	3.4%	3.5%
Fat	1.5%	3.9%
Carbohydrates	2.1%	4.9%
Calcium	21 mg.	118 mg.
Phosphorus	47 mg.	93 mg.
Iron	.7 mg.	.1 mg.
Thiamin	.09 mg.	.04 mg.
Riboflavin	.04 mg.	.17 mg.
Niacin	3. mg.	.1 mg.

Aside from milk for drinking, soy milk can be used for cooking just like cow's milk.

I don't know of anyone nowadays who isn't already set up to make soy milk. All you need is a blender or fine grinder. Then you'll need two cooking pots of a gallon or more capcity, a collander and two foot square of cotton

Either way, you ought to kick the habit. Of course, if they are really needed, kicking the habit would only put you back in the same condition for which they were prescribed. So later on I'll describe the substitute.

Quitting cold turkey, or simply stopping, if you've been on them for a long while may bring on withdrawal symptoms. The most common symptoms are the uncomfortable desire to draw yourself up into a round ball. This is inconvenient, however, unless your mate is a fanatic bowler.

Even in mild cases you'll want to ball your fists and scrunch in your toes, constantly. You may even get the sniffles, making you think you have a cold. The latter symptom can last for months, even after the more common symptoms have left.

For the first symptoms described, the best relief is simply to keep busy, or at least, distracted by your favorite TV shows. It's hardest at night, however, when you're trying to relax and go to sleep. These symptoms should leave in a couple of weeks.

In case you get what seems like terminal sniffles, don't take a lot of cold remedies, like Contac or the green goody you drink from the plastic shot glass. These are narcotics, also, so they will simply prolong the first symptoms. Instead, buy straight antihistamine from the drug store and take as much as you need.

If you can't face any withdrawal symptoms, you might try cutting the dosage of your medication in half for the first week. Meanwhile you are taking the substitute so although you should experience little, if any withdrawal symptoms, your nervous condition should be under control. Next week, cut your dosage in half again and so on week by week. This should get you past the worst of the withdrawal symptoms by the time you are off the original medication. You may still develop sniffles, but those are the breaks.

The substitute is simply one oz. Chamomile, one oz. Scullcap, one oz. Hops and one oz. Valerian. These are all common herbs bought at or ordered through any health food store.

You can buy in bulk much cheaper from the San Francisco Herb Co., 367 Ninth St., San Francisco, Ca. 94103. I suggest you call TOLL FREE in the U.S. 800-227-4530 and order five pounds of each.

5 lb. Chamomile, $18.75; 5 lb. Hops, $13.05; 5 lb. Scullcap, $24.95, and 5 lbs. Valerian root (powdered) $17.80 which adds up to $74.45, plus U.P.S. fee. Just call them and pay on delivery.

When you get the herbs, put the cloth to strain the milk through so none of the soy meat gets in.

First soak eight ounces of soybeans over night in a quart of water. Then pour away the water. If you have a Vita Mix blender, put all the beans in, plus one quart of water. Turn it on and let it run for maybe three minutes or until the beans are pulverized.

If you have a regular blender, put in three cups of water and one and one half cups of presoaked beans, which should be half. Then push the slowest button on up to the fastest. When liquified, pour the contents into one of the pans. Then repeat with the other one and one half cups of beans and three more cups of water.

Rinse the blender out with two more cups of water and pour it into the pan. Now you will have two quarts of water plus the liquified beans. To make for faster straining, pour two more quarts of water in the beans and milk. Now you strain the milk out. Put the two square foot piece of cotton cloth in the collander and place the collander over the other pan. The collander must be higher than the liquid will be. Otherwise it won't strain quickly. If your collander sinks down into the pan, just take a wire coat hanger and bend it out slightly, put it across the pan and rest the collander in it.

Pour in the gallon-plus of liquid and soy dregs. When the dripping stops, take a spoon and scrape the dregs down toward the middle. Then gather the edges and twist into a ball and twist out the remainder of the milk.

Now you have soy milk, but it needs to be cooked. Set the pan on the stove at medium heat. When the milk gets hot put the heat on high and watch until it starts to boil. You must be quick and take the pan off or it will foam up and spill all over the stove.

Anyway, when you have it really hot, put the heat down and put the pan back and let it get to a simmer or rolling boil. Keep it there for 10 minutes. Don't scrape the bottom. It shouldn't burn, but if it does, scraping will only let burned milk flavor the rest. Some will stick to the bottom anyway but not enough to bother.

Save the dregs to cook up in stew or soup. You can also mix it with pet food as it is very nutritious and pets accept it readily. It makes pet food go twice as far.

If your family simply won't accept the slightly different taste, mix in some carob powder, bought from the health food store. It will then taste like chocolate milk and will be enjoyed by the most finicky child.

If you are trying to lose weight, soy milk will do it effortlessly. It's very filling. One glass full will really dull your appetite. Better give the kiddies a smaller glass full or they won't finish their other food.

TOFU

Tofu has the appearance of cream cheese and the consistency of jello. It has a very bland flavor but absorbs the flavor of whatever food it's mixed with.

It has as much or more protein as most meats. It is not only highly nutritious but is easily digested and very filling. To test the acceptability you might make some scrambled eggs. But only use half the eggs and half tofu. I don't think your family would notice any difference.

Still, there's no need to sneak around. Let the family know what they're eating and I'm sure they'll take to it right away. It's not as if it tastes bad. Actually it has too little taste of its own to be a problem even if the taste of it plain was not enjoyable.

Tofu is commonly cut up into small squares and added to soups, stews, casseroles, salads, etc. It lends itself equally to deserts as well as to meat dishes. It is also an excellent diet food, being filling, nutritious and taking on the flavor of the more fattening foods it's mixed with. If you are dieting, just mix half tofu with a normal portion of any food and you'll cut down on the

Chamomile, Hops and Scullcap in the blender and turn it into a powder separately. Mix as needed.

There are two ways of taking this combination of herbs. One way is by making a tea. An ounce of each herb is stirred into two quarts of boiling water. As the water resumes boiling after the herbs are stirred in, the pot is taken off the heat, covered and allowed to set for an hour to steep.

Have another pot ready with a collander. Put a muslin cloth in the collander and pour the tea in. After the straining has stopped, twist the cloth so the herbs are in a ball and most of the liquid is out.

The spent herbs can be combined with the next spent batch and re-boiled and steeped. Twice as much of the tea is needed, but it makes the herbs go 50 percent further.

The first dose should be eight ounces. After that, four ounces every few hours will keep you tranquil, with no side effects.

In the day time the nerves are smoothed so you are very alert. At night, the nerves are soothed so you'll sleep soundly. If you take sleeping pills, substitute the herbs.

If you are really down, the first dose will give you an actual high. After that you'll level off and from then on, if you take it regularly, you'll just be normal. On the other hand, four ounces given to a person who doesn't need it will have no effect at all.

(A pregnant woman must omit the Chamomile and substitute Black Cohosh).

The hops gives the tea a rather bitter taste, which some people can't stand. Others learn to like it.

If you hate the taste you can take it as a powder. Actually, in the powder form the herb goes much, much further. The only difference is that the tea takes effect in from three to five minutes, whereas the powder takes effect in about twenty minutes. The tea is better for getting back to sleep if you awaken in the middle of the night.

To use the powder, use a rounded teaspoon and dump it on the tongue behind the teeth. (Don't breath in or you'll get a coughing fit). As soon as you get it in, wash it down with water or juice.

Aside from going further, the powder is also more portable so you can easily take a packet to work or on trips.

This combination of herbs also cures alcoholism. People are always saying that alcoholism is a disease. Not so. The alcoholic is a depressive.

Alcohol relieves the depression. It takes more B vitamins from the system, causing greater depression. Drinking, even in the daytime is preferable to the awful carbohydrates and feel just as full and cozy as if you'd gone off your diet completely.

Nearly every recipe I've read on making tofu has not only been complicated, but wrong. I think most of the writers just took some recipe, didn't understand it, rewrote it so as not to violate copyright laws and presented it as fact without even trying to make it. Isn't that tacky?

Anyway, I kept on trying and improvising until I can make it just as well as anyone and so can you. Once you've got it right you can make it in just a few minutes and your 19 cents a pound tofu will be even better than the $1.29 a pound tofu bought at the supermarket.

Since you've read this far, you've got most of the process mastered. All you do to make tofu from soy milk is curdle it. Some people curdle soy milk with lemon juice or vinegar. Lemon juice is quite expensive and like vinegar, leaves a taste. You don't want any taste, except that of the pure tofu. I use epsom salts. You can buy five pounds of it for about $1.50 in any supermarket. At one heaping teaspoon for each batch, five pounds will last for months and months.

While your gallon of soy milk is cooking, take one cup of hot tap water and stir in one heaping teaspoonful of epsom salts. Stir until it dissolves. When the soy milk is done, turn off the heat and stir in the cup of water and epsom salts. It will begin to curdle immediately. Epsom salts is a laxative. To avoid any laxative remaining in the tofu, pour an additional two quarts of water in the now curdled milk. This will dilute the epsom salts.

Next, put the cloth in a sieve over the sink and slowly pour in the six quarts of water and bean curds. When the dripping stops, turn the finished tofu in the cloth and sieve into a container of the same size. One batch gives at least one and one quarter pound of tofu.

To maintain its original form and consistency, fill the container with fresh cold water. Otherwise the weight of the tofu would only press more water out, causing it to become leathery. It will keep this way in the refrigerator for at least a week. You need only cut and lift out slices with a spatula as needed.

SOYBEAN SPROUTS

Soybean sprouts are not to be confused with the commonly known bean sprouts sold at supermarkets and used in oriental dishes. These are from mung beans and are far more expensive.

As the table below shows, cooked soybeans are very nutritious. Their sprouts, although not as rich as cooked soybeans, are still the most nutritious and inexpensive green vegetable available.

	Soybeans	Sprouted Soybeans
Calories	331	46
Protein	34.9%	6.2%
Fat (vegetable fat) good food for you	18.1%	1.4%
Carbohydrate	334.8%	5.3%
Calcium	227 mg.	48 mg.
Phosphorus	586 mg.	67 mg.
Iron	8 mg.	1 mg.
Potassium	1900 mg.	
Sodium	4 mg.	
Vitamin A	110 International Units	
Vitamin C	trace	13 mg.
B Vitamins		
Thiamin	1.07 mg.	.23 mg.
Riboflavin	.31 mg.	.20 mg.

depression.

The herbs take away the depression and even nullify the effects of the alcohol. One can drink socially after a shot of herb tea or spoonful of powder.

To prove this, take four ounces of your favorite liquor mixed with four ounces of the tea. Sip it along as you do normally. You might get a little mellow, but you won't stagger, even after twelve ounces of whisky mixed half and half. It works, but it's a waste of good booze.

If you want to test the formula, but your health food store doesn't stock all the herbs send $10.00 to Allan Formilaries for four ounces of the powder.

Niacin	2.3 mg.	.8 mg.
Choline	300-340 mg.	
Pantothenic Acid	1800 mcg.	
Vitamin K	190 mcg.	
Mixed Tocopherols	140 mg.	
(Vitamin E included in this)		

Everyone needs vegetables for roughage and crunchiness and vitamins and the like. Since you get at least a pound and a quarter of sprouts from eight ounces of soybeans it amounts to about 19 cents a pound. You can't get any green vegetable in the market place as nutritious or so inexpensive.

Most instructions for making soybean sprouts are almost as complicated as those for making tofu. My system is easy and sure even for the beginner. All you do is pour eight ounces of dried soybeans in a one gallon glass jar with it's metal lid punched with about a dozen nail holes. There is no need to pick over the beans for broken ones as many are broken just under the hull and many are infertile anyway. They are easily left behind when the sprouts are grown.

Pour about a quart of fresh water over the beans and let them set over night. Next morning drain off the water, remove the lid and gently wash the beans in the jar.

Drain the beans again through the lid and stand the jar upside down in a bowl with a bottle cap or something under it to help any excess water to drain and also to permit air to get in.

After about four hours remove the lid and again gently flood the beans with fresh water. I say gently because after the beans begin to sprout their little sproutlets are very brittle and if handled roughly they will break off and the beans will die. Flood and drain at least three times each day, for four to six days, depending on the temperature. The sprouts are done when the bean parts are green and before the white tails are coverd with little rootlets. If you let them grow much longer they'll become woody and tough.

When the sprouts are about three inches long pour the whole bunch out into the sink. Fill it with warm water and swirl the sprouts around, breaking loose any hulls that remain attached. Then spread your fingers and scoop out all the good green beans with sprouts attached. This just takes a couple of minutes and it's no trouble to leave the hulls and dead beans behind.

Now wash your sprouts and store them in the refrigerator. They are good raw, as snacks or in salads. They are also delicious cooked lightly and served like any other green vegetable.

Once you see how easy they are to grow and serve, you'll really appreciate them for their goodness and economy. They could serve as your only green vegetable, although we hope you'll always have a good variety.

Ozark Biscuits And Gravy

You'll get a big "At-A-Girl" every morning with these. At first it takes a few extra minutes, but you'll soon begin to have them ready for the oven in no time, with a little practice. Serve up a generous bowl of sausage gravy to spoon over individual biscuits, and this warm, filling breakfast supplement is worth those extra few minutes a day! Inexpensive, too.

3 cups unbleached flour
4 teaspoons baking powder
1 tablespoon sugar
a good dash or two of salt
½ cup shortening
2 eggs slightly beaten
two-thirds cup milk

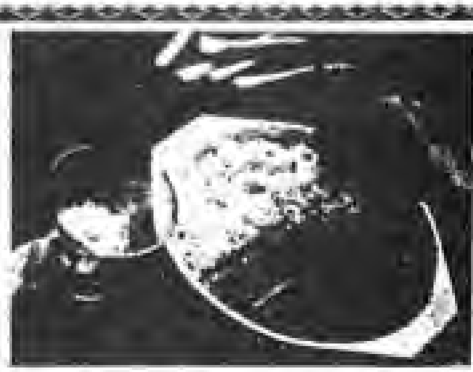
Cut shortening into dry ingredients. Combine egg and milk, then add to mixture. Stir quickly. Turn dough onto floured surface. Knead a few strokes with enough flour that the dough does not feel sticky. Cut out biscuits with biscuit cutter or drinking glass turned up-side-down. Bake at 450 degrees til lightly browned 10 to 15 minutes. Makes about 18.

Potato Chips

Pare the potatoes and slice into thin shavings with a vegetable cutter. Let them soak in ice water for an hour, drain and dry in a towel. Have ready your heated deep fat and fry until they curl and are lightly brown. Put them in a wire frying basket to immerse in the fat and shake them as free of fat as possible before lifting from the kettle, then put to drain on absorbent paper. Dust with salt. Keeps a week or more.

Quick casserole

Sunset — 1962



For a quickly prepared supper try this main dish that you just heat and serve. It is a casserole of canned refried beans, frankfurters, and cheese topped with chopped green onions. A green salad, hot French bread, and fresh fruit might complete the meal.

Grease a 1½-quart casserole and spread 1 can (1 lb.) refried beans evenly in the bottom. Arrange 8 frankfurters, split lengthwise, on top of beans and sprinkle with 1½ cups shredded American or jack cheese. Bake in a moderate oven (350°) for 10 to 15 minutes or until the cheese melts and beans are hot. Slice green onions (with tops) and pass them in a small bowl for each person to sprinkle on his serving. Makes about 4 servings.

Bake Your Own Staff of Life

By next year you will probably not be able to buy any brand of bread for under one dollar a loaf. Yet, the ingredients will still remain comparatively cheap, especially if you have your own grain grinder. But even if you have to buy the flour from the grocery, the total outlay will be less than one quarter of the price of store bread.

Bread baking is a chore only if you think of baking it a loaf at a time. However; those who bake their own bread usually do a week's supply at one baking. This is usually from three to six loaves at a time. Six loaves can all be baked at once in the average oven.

To the beginner, a large baking project can seem like a lot of work. But like any new effort, you can expect a routine to set in quickly as you become familiar with the various steps. After two or three bakings you'll find the time and any mess cut in half. If you establish a weekly time to do your baking you'll soon come to accept baking as an easily manageable part of your weekly routine which you might even come to look forward to.

The plusses of doing your own baking are many. The savings are obvious. Learning a new skill is fulfilling. Don't discount your added prestige among your friends. The smell of new baked bread throughout your home will be a joy to the whole family. If you've never tasted hot buttered bread fresh from the oven you may come to think that alone is worth the effort.

From baking loaves of bread you may wish to go on to rolls and pastries, not to mention pies and so many other items you can sell or use as gifts. Also, once you've gotten used to baking, you can bake breakfast biscuits, cornbread and such and never buy commercial breads again.

Guest Editorial

Nancy Tappan has written the finest editorial I have ever read on relocating. She takes out all the wishful thinking which clutters publications such as The Mother Earth News and various other publications catering to urban clerical types fantasizing about being gentlemen and lady farmers.

However, while pointing out the hardships encountered in relocating, she also describes the possibilities of success in breaking loose from the establishment. For all too many the choice will be between relocating now, with all it's hardships, and the real possibility of relocation later as a refugee.

SOME THOUGHTS ON RELOCATING

by Nancy Tappan

Making a Living in a Small Town

The concept most fundamental to Mel's view of long-term survival was that of relocating to a small rural community (see P.S. LETTERS 3 and 6). As those of you who have picked up and moved know, that experience is traumatic indeed. Not only must you endure the severe emotional stress that such a move engenders, but you must also face the problem of earning a living. And that is not an easy task in a small town.

Without exception everyone that I know who has moved to the country (ourselves included) has been plagued by three troublesome misconceptions: an unrealistic idea of what living in the country or a small town is like, an even more unrealistic idea of the financial cost involved and a gross miscalculation of the amount of time that it takes to get settled and established in the community.

Unfortunately, most of us who have never lived in the country have a romantic vision of the bucolic life, one spawned by reading Mother Earth News and back-to-the-land books. We see ourselves living off of our five acres and still having enough produce and livestock left over to barter or sell enough to buy a few necessary staples. The hard truth is that farming, especially on small acreage, is difficult, even if you have experience and know-how, and impossible if you have neither, so forget the idea that your little patch of Eden can furnish you with any appreciable amount of food right away. During our first year here, for example, my garden was demolished by grasshoppers, two of our pigs were run over because our fences weren't secure and we got stuck with two of the poorest excuses for cattle that you have ever seen. Moreover, unless you are very lucky, your expenses will be staggering — your place will need repairs, you will need tools and equipment, you will find livestock expensive and goods no cheaper than they are in the city.

Disillusioning as it may be to discover that your refuge is not paradise, it is even more disillusioning to examine the job market in the town you are in or near. Most small communities have little, if any, industry and what does exist is sensitive to the state of the country's economy. We are in a lumber area and because of the slump in the housing industry, many of the mills are shut down; consequently, we have widespread unemployment among the unskilled. In addition, there are many retired in the area who are willing to work part-time for low wages. In short, we have an employer's market.

Many service businesses do not exist in rural areas because of the low population density — people must travel to the nearest medium-sized town (20,000 or more) or do without. Professional services are at a minimum and even the medium-sized towns do not have the highly specialized professional such as a copyright attorney or nephrologist. What you do find are an abundance of people with basic skills (those most valuable in a post-holocaust world) — plumbing, carpentry, welding, etc. — and a few businesses such as hardware stores, markets, and drug stores that answer a need and do very well. Unlike the suburbs or an area with a 20,000 plus population you do not

The article on bread baking, here, recommends all purpose flour. Unbleached flour should be substituted. If you want to make wholewheat bread you'll have to use more water. You should make white bread until you learn how. Then you will be knowledgeable enough to experiment without any total disasters.

BREAD BAKING

SUNSET JANUARY 1942

In this busy world, home-made bread has become largely a subject for fond recollection. Which is sad, we say, because bread making is easy, and fun. In fact, few tasks give so much satisfaction in return for so little effort.

We know of no happier season to revive this gentle art. Some of the old-fashioned spirit which Christmas brings still lingers; the time is ripe for New Year's resolutions, of which regular "baking days" might well be one. But, let the fragrance of the freshly baked loaves speak for itself!

WHITE BREAD

- 4 cups (1 quart) milk
- ¼ cup sugar
- 4 teaspoons salt
- 2 tablespoons shortening
- 1 package dry granular yeast, or 1 cake compressed yeast
- ¼ cup lukewarm water
- 12 cups sifted all-purpose flour (about)

Scald milk; add sugar, salt and shortening. Cool to lukewarm. Add yeast, which has been softened in lukewarm water. Add flour gradually, mixing it in thoroughly. When just enough flour has been added so that dough is stiff enough to be handled easily, turn out onto *lightly* floured board and knead until smooth and satiny. (Fig. 1.) Kneading consists of folding the dough over on itself, pushing it lightly with a sort of rocking motion, folding it over, pushing it,—and repeating this process rhythmically for about 8 to 10 minutes or until dough looks satiny and feels smooth.

Shape kneaded dough into a smooth ball, and place in a lightly greased bowl. Brush surface lightly with melted fat, cover, and let rise in a warm place (80° to 85° F.) until doubled in bulk or light.

find specialty shops of any kind. So you can see that if you want to work in an existing business in your immediate area, your choices are severely limited.

Further, you are an outsider and, as such, are regarded with suspicion. Contrary to popular myth, neither country people nor small town residents are the salt-of-the-earth, friendly sort who will drop everything to help a neighbor. Of course, there are exceptions, but many are benighted souls who distrust anyone and anything that they have not known all their lives and many take great delight in seeing city slickers fall flat on their faces. You must also be wary of those who have recently moved to the area — with a convert's zeal they want to keep others from following them and overpopulating their sylvan haven. And if you not only come from the city but from another part of the country or are different in any way — because of color, physical handicap, religion or whatever — you have another strike against you. Prejudice against the unfamiliar is far greater than in a metropolitan area. And gossiping and rumormongering are favorite pastimes.

Just how do you go about earning a living in such an environment? In short, by being adaptable — willing to accommodate to the eccentricities of small town life and willing to change your ideas about work. First, look around you and try to blend in — the locals are sensitive and will spot anyone who "puts on airs" immediately. The fact that you belonged to the L.A. Country Club or have a Ph.D. or were president of your Kiwanis chapter in Hoboken cuts no ice and your bruiting your past about simply serves to make you more of an outsider. If you enjoy people — warts and all — and have a sense of humor, I can assure you that living in a small town can be an enlightening — and enjoyable — experience since you meet and become friends with a cross-section that you would never encounter in a large city. As Mel used to say, "It increases your existential amplitude."

For many, especially men, changing their ideas about work is even more difficult than adjusting to small town life. First you must jettison all your preconceived notions about the kind of work you will do, the way you will work and the pay you will accept. When you first relocate, you will probably have to take whatever jobs come your way at the wages offered and if you open your own business, charge much less than you could in a city.

The willingness to change attitudes toward work is but one aspect of a revolution occurring in this country today — the move from what Alvin Toffler calls Second Wave production modes to Third Wave ones. It is interesting that the changes this shift is affecting in people's work patterns parallel those that the survivalist must make when he decides to relocate. Working in a conventional office, keeping standard hours and receiving company benefits may soon be the exception rather than the rule not just for the survivalist but for the majority of this country. More and more people are opting for flextime, they are taking part-time jobs so that they can produce rather than purchase more of what they consume, and rigid family roles are softening as husbands, wives and children work together and traditional jobs are interchanged. The self-help movement, do-it-yourselfing and bartering are also a part of this revolution — and an integral part of survivalism. But working in this way — either at home or in a small office near your house, performing two or more jobs at once, taking lower wages, trying to get your refuge set up, working long and strange hours — is extremely difficult at first because of the mental juggling that it requires. In a traditional office environment or sales job you gear yourself to cope with one related set of problems during a given time period, but this new approach to work precludes such tidy compartmentalizing. Unless you are flexible, you may well lose your mind. I know, because many a P.S. LETTER paste-up has been interrupted by the birth of a calf, a beef customer, or Robin's mooing to inform me that she wishes to be milked. And everyone around here must be willing to do every kind of job. One minute Mel would be writing a column and the next giving a heifer a selenium shot. Candy, who is responsible for the new efficiency that you see in P.S. LETTER, has scrubbed the kitchen floor on more than one occasion, and I am by now a pro

Lightness can be determined by pressing the dough gently with the finger. If the impression remains, the dough is light. (Fig. 2.) Punch down by plunging the hand into the dough and folding the edges toward the center. (Fig. 3.) Turn ball of dough smooth side up, cover, let rise again, and when light, punch down a second time. Divide dough into 4 equal portions with a sharp knife. Round each portion into a smooth ball. Cover well and let rest 10 to 15 minutes. Mold into loaves. (Fig. 4 through Fig. 9.) Place in greased bread pans. (Fig. 10.) Brush tops with melted fat, and let rise in a warm place until doubled in bulk. (Fig. 11.) Bake in a moderately hot oven (400° to 425° F.) for 40 to 45 minutes.

Remove loaves from pans to cool (Fig. 12.) Yield: 4 (1-pound) loaves.

1. Knead the dough until smooth and satiny

2. Test dough for lightness with the finger

3. Punch the dough down after it has risen

at scooping manure.

Although you may think that I've over-emphasized the importance of making these attitude changes, they are the key to your being successful in making a living after relocating. Specifically, your best opportunity by far is to start your own business (preferably one that will be needed in a post-crunch society), but before you do, you must be realistic about the amount of time that it will take to get it going and, if possible, set enough money aside to cushion you through the lean startup period (about two years). If you can't do this, be prepared to moonlight in order to make ends meet and consider renting rather than buying a home until you get established.

If you decide to start your own business, be aware that most of the people with brains and initiative leave to seek their fortune in the city or are currently operating the few successful businesses in town; therefore, do not try and compete with the local hardware store, for example, if it is providing good service and merchandise. On the other hand, if you want to practice a trade such as plumbing, are good at what you do, and above all, will show up when you say you will and work during odd hours, you will do better in time than the other four plumbers listed in the phone book. Why? Although their skill may be commensurate to yours, chances are they will have caught the infectious "nobody's going to tell me when, what or how to do it" attitude that permeates the local chat and chew parlors and ruins many a good man.

Poke around your immediate community and also around the nearest city with a 15-20,000 population, where you will find more opportunities, talk to the locals and determine what services are needed. Those who have been successful in this area have done exactly that. In fact, most of the new businesses in the Grants Pass area during the past few years have been started by newcomers. A good friend of Mel's moved here five years ago not knowing what he would do. He swept chimneys, raised bees, and somehow kept his wife and two children fed while he studied for his real estate license. Today he has his own office, which is the most successful in a town full of real estate firms, because he had the foresight to specialize in refuge property. Another man left the trucking business and opened a gun shop and I've lost track of the number who have started mail-order businesses. I know of a lawyer who is now running a restaurant and loving it and a couple who had just enough capital to buy a roto-rooter but saw as they went around cleaning drains that there was a need for a business maintenance service. They now operate the roto-rooter business by day and the maintenance service at night. A former engineer is now designing solar greenhouses and fleshing out his income by building fences. Although this area has many printers, the man who prints P.S. LETTERS has more business than he can handle because he doe: careful work. A survivalist, he also has a manual printing press in his basement. Last week I talked to a couple who with $1000 started producing high technology clocks in a remote area of Southern Washington. Contrary to popular thinking, they say that manufacturing in a small town is feasible — if you can use unskilled labor, and are willing to work until you drop at night.

These are the successes — unfortunately, the failures are many but they all stem from the same root — an unrealistic estimate of both the time and the capital it takes to begin a business. Many who didn't make it got carried away buying their refuge property and didn't have any capital left to fall back on; some lunged into businesses without realizing how much hard work and responsibility being your own boss entails and how difficult it can be to discipline yourself.

Without some capital, there is no easy answer. You will certainly not earn anything comparable to what you can in a city nor do you have the variety of job markets open to you; however, living costs are lower and if you are persevering, you can make out by taking whatever work comes along and by taking advantage of opportunities to learn. Three years ago friends of ours, a heavy equipment salesman and his wife, moved here, knowing that he would have to make a career change. By cutting out every frill and doing odd jobs, they managed to scrape by and, during that time, acquire two very marketable

4. *Flatten the ball of dough with the hand*

5. *Then fold the flattened dough lengthwise*

6. *Stretch dough to three times length of pan*

skills: he has learned cabinet making from a superb craftsman and she will soon be proficient on both an IBM composer and a phototypesetting machine.

If you are a professional, such as an engineer, doctor, lawyer or architect, you should investigate with great care the demographics of an area before moving there. In many cases, these findings will be the deciding factor in your choice of location if you want to continue a career in the same field. If, for example, you are a doctor and want to move to Oregon, you would be well advised to pick another state, for we have a surfeit of physicians, so much so that the State Board is discouraging doctors from taking the exams qualifying them to practice in the state and, in addition, making those exams very difficult. The Rogue Valley also has a glut of attorneys; on the other hand, this area is only now reaching the saturation point for architects and engineers.

As a professional practicing in a small to medium-sized community, neither your pay scale, the equipment available to you, nor in many cases, the caliber of your peers will be equal to that in a city. You will find a dichotomy existing between the old timers who have been practicing in the area for years and have more or less stopped learning and the newcomers who are attuned to the latest research and developments in your field. Finally, your ego will suffer severe damage for the idea prevails in rural areas that working with your hands is somehow nobler than working with your brains and book learning is definitely suspect.

The professional can at least relocate and continue in his same field but if you are currently working at some level in corporate management or if your job involves the use of expensive scientific equipment, your only answer is to change careers. There are few companies large enough to afford management personnel in small towns and there are certainly no Johnson Space Centers around. But then one of the tenets of the survivalist is to become as independent of the system as possible, to be his own boss.

When thinking about where, and how you want to earn a living, do not overlook the whole new array of work possibilities that the home computer makes feasible to those in white collar, technical and professional fields. More and more salesmen, designers, consultants, psychologists, investment counselors, insurance agents, certain kinds of researchers and office workers can now work at home, communicating and receiving information by plugging into computer terminals. Toffler sees "a return to cottage industry on a new, higher electronic basis (which is very energy efficient, by the way), and with it a new emphasis on the home as the center of society."

You can relocate from the city to a small town and make a living. Those who have made the transition gracefully have had vision, flexibility, patience, and a good sense of humor. Not that it isn't a difficult and trying task. I know, I've never worked so hard, cried so much — or laughed so often.

7. *Overlap the ends; press the edges to seal*

8. *Fold lengthwise; seal the edges. Repeat*

9. *Roll the loaf under the hand to round it*

10. Place loaf in pan with seam underneath

11. Let loaves rise in pans before baking

12. Cool the baked loaves before storing them

1. Fan Tans are strips layered and sliced

HOT ROLLS

The simplest of meals takes on a festive air with the addition of a pan of piping hot home-made rolls.

DINNER ROLLS

- 1 package dry granular yeast, or 1 cake compressed yeast
- ¼ cup lukewarm water
- 1¾ cups milk
- 6 tablespoons sugar
- 1½ teaspoons salt
- 6 tablespoons shortening
- 1 egg
- 6 cups sifted flour (about)

Soften yeast in lukewarm water. Scald milk; add sugar, salt, and shortening. When lukewarm, add one cup flour and beat thoroughly. Add egg and yeast; beat well. Add enough more flour to make a soft dough. Turn out on a lightly floured board and knead until smooth and satiny (about 10 minutes). Place in a greased bowl, cover, and let rise in a warm place (80° to 85° F.) until doubled in bulk. Punch down, mold (see below), and put in greased muffin pans or on a greased baking sheet. Let rise until doubled. Bake in a moderately hot oven (425° F.) 15 to 20 minutes. Yield: 2½ dozen small rolls.

Rolls can be molded in a number of intriguing ways, including:

1) Fan Tans: Roll dough into a very thin rectangular sheet. Brush with melted butter. Cut in strips about 1 inch wide. Pile 6 or 7 strips together. Cut into pieces 1½ inches long and place on end in greased muffin pans.

2) Cloverleaf Rolls: Form dough into small balls. Dip balls into melted butter and place 3 balls in each section of a greased muffin pan.

2. Cloverleaf Rolls are three little balls

3. Crescents are rolled, curved triangles

3) Crescents: Roll ball of dough into a ¼-inch thick circle. Cut in pie-shaped pieces. Brush with melted butter and roll up, beginning at the wide end. Curve into crescents on a greased baking sheet.

4) Bowknots: Roll dough with the hand to ½-inch thickness. Cut in pieces about 6 inches long. Tie in knots. Place on greased baking sheet.

You may prefer to bake a few rolls at a time and store the remaining dough in the refrigerator. The following procedure will guarantee you a fresh batch of light rolls even four or five days after the dough is mixed:

First, increase the amount of yeast in the above recipe to 2 packages of dry, granular yeast, or 2 cakes of compressed yeast. Then mix the ingredients as directed above, knead until smooth and satiny, cover, and let rise until doubled in bulk. Punch down, break off as much as will be needed for that day, and form the remainder into a smooth ball. Grease the surface of the ball lightly, cover, and put in the refrigerator. When you are ready for the next batch of rolls, remove the dough from the refrigerator and punch down. Break off as much as will be needed and replace remainder in refrigerator. Mold at once into any desired shape. Place in greased pans and let rise until doubled. Bake as above.

4. Bowknots are tied from 6-inch lengths

White breads today are more nutritious than ever, thanks to enriched flour. This is the same fine white flour we have always known and used, but to it have been added some of the B-vitamins and iron. Enriched flour looks, tastes, and bakes exactly like any other white flour, but breads made with it contain important added food values.

SPROUTING SEEDS

For Health Enjoyment, & Economy

By D. R. Hiatt

Long ago we discovered that there is no necessity of importing citrus fruit from hundreds of miles away in order to maintain optimum health during winter months when acceptable fresh green vegetables are difficult or impossible to come by. Neither did we feel that the Lord intended us poor vegetarians to take fish liver oil, nor us poor all-natural fooders to bolster our diets with expensive laboratory products.

For years however, we were without much actual proof of the validity of that notion until after we discovered the high food potency of fresh sprouts. Not until then did we understand how to secure an abundance of superior quality vitamins, including the much sought D and other even more shy or fugitive vitamins, all at a fantastically low cost well within scope of the most restricted income. The practice of sprouting has since become so habitual and commonplace with us we marvel that we failed to institute it in our home many years sooner than we did. We knew of it all along, but didn't do anything about it, much to our present shame.

Scarcely any productive endeavor could possibly be more simple than the sprouting of seeds. There are but two basic requirements, namely: warmth and moisture: supply these to viable seeds and it is found to be impossible to keep them *from* sprouting. On the other hand of course, improper or capricious control of these fundamentals would inhibit germination or kill the embryos outright.

Indeed if you wished to do so you could, after thoroughly mastering all the details and installing convenient facilities, earn a handsome profit right in your own home by growing sprouts for sale to those who can easily be taught to want them but who shirk the very negligible labor involved. A lady we know made an increasingly fat income in this way, and finally wound up with a prospering business establishment "down town."

For sprouting vessels, 'most anything will do at the outset. There are a number of different manufactured units offered for sale, fashioned of various materials, and some of them featuring handy and quite attractive cabinets and receptacles.

Some folk however, and we were of this class at first, feel reluctant to lay out the price for such a device. Nevertheless, the lack of a factory-made job need not deter anyone from making a start; and we do mean *anyone*, absolutely.

For instance, it is easier if you have trays with drainage through the bottoms; but actually *any* dish, plate or platter may be utilized for the purpose, providing the unit is always thoroughly drained of excess water after each flushing. Any seeds remaining immersed in water will sour. The idea therefore is to keep the seeds *moist* but *not wet*.

Now let's get going. About a tablespoonful of alfalfa seeds are required to "plant" 25 or 30 square inches of space, and will produce nearly a quart of succulent 2 or 3 inch sprouts in about the same time that Jonah stayed in the whale,—three days and three nights. Two or three times that amount of beans or peas will be required to cover the same space and produce a comparable crop, and these larger seeds should first be soaked overnight in cool water. The tiny seeds such as alfalfa may be put to sprout without preliminary soaking.

Place two thicknesses of clean cloth to cover the bottom of the vessel you have chosen. Scatter your readied seeds on this cloth, not over two seeds deep. Cover snugly with two more thicknesses of cloth, and flood gently with pure water, allow excess water to drain off and set aside in a warm, dark spot. They seem to germinate more readily in the dark, and the vitamin C develops more briskly. Be sure to rinse and drain at intervals, three or four times each 24 hours, never allowing them either to stand in water or to become too thirsty. The more comfortably warm and cozy they are, the faster they will grow, and the more water they will drink.

Generally speaking, most sprouts are at peak palatability and highest vitamin potency at between 60 and 80 hours after planting. Soybeans, peas, and alfalfa are about right when the sprouts are two to three inches in length.

In sprouting grains, the foregoing procedure is followed, but these are more palatable when the sprouts are much shorter, scarcely longer than the original seed itself. If combined in salads, soups or with fruits, however, they are quite acceptable up to one or two inches in length.

Sunflower seeds also develop a rather unpleasant tangy taste when the sprout exceeds the length of the seed.

Whenever a tray of sprouts have come to the stage of growth most acceptable to your taste, they may be popped into the hydrator compartment under refrigeration, where they will remain about as is for a few days.

Some people pluck the seed wreckage off the sprouts before serving, but we have never bothered to do so, as we can detect no difference in taste,—only in appearance.

Chlorophyll content may be induced in the sprouts by exposing them to light,preferably indirect sunlight, during the final several hours before harvesting. This chlorophyll constitutes another miracle of nature, and is apparently closely linked with the secret of life itself. Marvelous are the qualities and virtues attributed to this substance and what a blesing that we may produce it near any sunny window. Many people maintain a sizable flower pot or soil box at such a window, in which they plant a variety of seeds and harvest the leaves regularly as a tasty addition to the salad bowl. But that is another story, altogether.

Now just by way of illustration, here are two or three of the literally hundreds of ways in which you can serve the daily harvest from your kitchen sprout garden.

A delicious and nourishing "quick-pick-up" beverage may be made in a jiffy by liquefying a cup of alfalfa sprouts along with two cups of unsweetened pineapple or orange juice, two or three tablespoons raw almond or nut butter, and with a bit of honey to taste.

A healthful "you name it" dessert tidbit is made by grinding together a cup of sprouted wheat or other cereal, one cup of almonds or cashews and a cup of seeded raisins. Add a pinch of salt and mix well. Form into inch "marbles" and roll in unsweetened or fresh grated cocoanut.

A "sudden salad" of very high merit is made with a pint or more of chopped fresh alfalfa sprouts, a diced avocado, a diced cucumber, and three diced tomatoes. Toss and serve with your favorite dressing.

Add finely chopped soy, mung bean or other sprouted seeds when making potato patties, for a tantalizing aroma and unusually zestful taste thrill.

Delicious savory sprouts are achieved by combining with various herbs, sweet basil, summer savory or your favorite herb seasoning. Any of the legume sprouts fit into this recipe. Add seasoning and a pinch of health salt, then steam or vapor cook to desired tenderness.

Inexhaustible variety may be introduced by the use of sauted onions and peppers, and/or tomato pulp or juice.

In fact, you can add sprouts to just about any other vegetable item with a genuine boost to both taste and nutrition The jaded appetite responds to sprouted seeds with a new interest in nourishing food.

Over and above the nutritional and gastronomical advantages of sprouts, the housewife and mother who takes delight in her cooking ingenuity, and even you menfolk who like to don the high chef's cap at times, can derive a lot of rich enjoyment in experimenting with the culture of the various seeds, and their many scores of potential uses in the round of family meals. It is said that sprouts may be served every day in a calendar year without once duplicating a recipe. The family of this writer very soon fell into a general rut of habit and preference, and we just jog along, not having the time to think up and execute surprises. Anyone anywhere can do better than we have done with our sprouties, but we cannot see how anyone can afford to exclude the practice from their home. We think also that it would afford a most interesting and educational "nature demonstration" for any classroom.

Remember, there are hundreds of kinds and varieties of seeds to experiment with; and the sprout of any food plant is edible with the possible exception of tomato and potato. Each sort of seed has its own characteristic flavor; certain ones will appeal to the taste of one person or family, while others will not. Work out the combinations you like best. Any sprouted seed can whip its weight in wildcats so far as food energy and cell-building material are concerned.

Now, don't wait another minute!

WHAT TO SPROUT

The question will rise as to what seeds may be sprouted for food. The answer is that almost any grain or legume will lend its merits to this age-old technique.

Among the best for the purpose are alfalfa, soybeans, mung beans, lentils, garden peas, garbanzos, and the cereal grasses, wheat, oats, barley and rye.

At just the right stage of development the legumes are palatable both raw or steamed. While some families relish the cereal sprouts raw, most prefer to grind them for incorporation into their breads along with the usual ingredients. Even here, too large a proportion of sprouts tends toward a slight bitter taste.

KING ALFALFA

Since we have already confessed that to our way of thinking, alfalfa seed is the Number One choice for sprouting, we may as well point out also that it is tops in nutrition. We gleaned the following points from a Paul Bragg Newsletter.

Alfalfa is another herb which has been found to contain valuable nutritive elements. This has been known to cattle breeders for a long time. And in South Africa the ostriches produced more beautiful feathers and stronger young when fed alfalfa.

The Arabs too, centuries ago, fed it to their horses to make them strong and swift. They tried it out on themselves and found that it worked. It made them so lithe that they could spring to a distance of 29 feet. Before that Alfalfa was simply grass. But they gave it a new name: AL-FAL-FA, meaning Father of all Foods.

Now scientists are discovering that alfalfa contains all the known vitamins, including Vitamin K, the blood-clotting vitamin, and Vitamin B8, the valuable addition to the B complex which is common in all green leaves. Also it is rich in potassium, which some dietitians call the Elixir of Life; phosphorus which speeds up the brain vibrations; calcium, the bone and teeth building material.

The most valuable nutrient that Alfalfa has to give us is chlorophyll. Chlorophyll is the life blood of alfalfa. It is very similar to human blood, as only a few atoms of chemicals keep it from being biological perfect blood. Chlorophyll in plants not only is important because of its photosynthetic value but because it is a most powerful oxidation catalyst.

* * *

EASY AND CHEAP

Do you know that you can produce palatable and highly nutritious food more quickly, easily, and economically by germinating seeds for the edible sprouts than in any other way in this world?

Nowhere else under the sun is such productive power stored and available as in seeds. And in no other form can so much nourishment be purchased for so little money. A dime's worth of seeds sprouted will feed an entire family to satiety with live, protective, cell-building food.

A one minute flushing with water, three or four times daily for three to four days constitutes the total time and "labor" involved in raising a crop ready to harvest, and serve.

Sprouted seeds are food fit for a king, yet they are within the means of the veriest pauper. We have never seen anyone too poor to have them in abundance every day. To the rich and poor alike, you could give no better gift than the knowledge of sprouting seeds for food.—D.R.H.

SPROUTS AND EDUCATION

We'd dearly love to see some progressive school teacher try a brand new approach to education on her roomful of wriggling, posing, shirking, aggravating little animals.

What we have in mind is that the harried shepherd might not only provide better grazing for her little "lambs" but also give them a start on the very most fundamental piece of knowledge available to the human race.

And how? Very simply indeed. By inciting them to start and maintain an increasing number of little sprouting trays as a practical "nature project" or demonstration. That's half of it. The other half is to encourage the unruly little rascals to eat the sprouts along with their lunch.

The three to four day production period makes a strong appeal to the juvenile mind which demands quick action and spectacular results. The introduction of a bouquet of live sprouts to the daily dietary of an average or sub-average child may well transform him or her to a downright intellectual. It may also make a magnificent change for the better in the personality traits and behavior. The chores of starting, flushing, and harvesting may be assgined as special awards of merit.

The surplus sprouts may be sold to raise funds for school projects of various kinds. Amazing indeed would be the long and beneficial line of chain reaction developments under the guidance and encouragement of an alert and enterprising teacher. And a daily salad of sprouts will do the teacher good too!—D.R.H.

GERIATRICS

We are reminded of one Ma Huang of whom we made mention in one of the earlier issues of our *Journal of Natural Living*. He was a remarkable Chinese chap who closed his history several centuries before the western world began to show signs of life. He is said to have possessed documentary evidence to the effect that he attained the ripe age of 257 years and to have retained to the last the use of his faculties and zest for living.

In that connection, it may be worth noting that his frugal diet consisted almost entirely of whole grains, fresh or dried oriental fruits, and sprouted seeds together with a few green herbs. Any diet which is capable of sustaining life to *any* degree for so long a span would surely be apt to aid us now to maintain a state of vitality sufficient to make our days enjoyable and productive. Ma Huang was a famous educator who enjoyed the good life for a long time!—D.R.H.

Sprouts and Food Economy

An Anonymous Contribution

(Reprinted from JOURNAL OF NATURAL LIVING)

Hear ye! Hear ye! Hear ye! Are you of the millions of Americans dependent wholly upon outside sources of supply for your food? Are you of those who raise small gardens but who do not begin to raise enough food to last you throughout the year? Are you of those who spend much time and more effort in the "sweatshop", canning this, preserving that and freezing the other until you don't care much whether you eat the following winter or not? Well listen! Here is good news for you:

When sprouts are mentioned as food, grains and legumes are usually referred to; although, nutritionally speaking, all sprouts are "loaded" with life. Some, however, are not palatable, and therefore not practical as foods. Others are very palatable, can be used in a variety of ways, are low in cost and high in nutritional value. Sprouted legumes and grains contain "complete" proteins. They are also a good source of quick energy, much of the starch having been converted to simple sugars during germination.

Immediately, they begin to swell. Very soon, tiny sprouts appear and will grow to a length of two and one-half to four inches by the end of 72 hours. At this point, from one pound of beans thus treated, four to six pounds of fresh produce is ready for consumption. Moneywise, that reduces our cost per pound to somewhere around three to five cents!

Now here is the "payoff": these sprouts are fantastically high in Vitamin C and the B complex vitamins. One-half cup of soy sprouts is equal in Vitamin C to six glasses of orange juice!

See what I mean about food economy? It takes much less of this type of food to supply the needs of our bodies. This is fresh food. This is live food—indeed, it is growing food until the moment it is consumed, providing you use the sprouts raw as in a salad or a sandwich

They can also be quick-cooked or lightly steamed and made into a delicious vegetable dish in just five minutes, without losing too much of that increased vitamin content. Sprouts can be used in bread, soups, pancakes—almost anywhere!

Delicious bread can be made from sprouted wheat and rye. By "de-sprouting" the soy beans, and using the sprouts as a raw or cooked vegetable, one can then use the bean (ground up) with the whole wheat flour to make a nourishing bread. Generally speaking, the more kinds of grains employed, the more delicious the bread.

All sprouts produce about the same general rate of increase: foodwise, they are most practical to use after sixty to eighty hours of growth. Beyond that, most tend to become unpalatable because of root-hairs, leaves, and changes in flavor. During the germinating period, the Vitamins C and B complex are reaching very high points. In the dry soy bean, there is no Vitamin C. Volume for volume at 72 hours, the sprout is just about the most concentrated source of Vitamin C known. The record for peas, oats, corn, wheat, etc., is equally impressive.

Scientific Testimony

Catharyn Ellwood, famous nutritionist, lecturer, and author of the popular book "Feel Like a Million," states that in her opinion sprouted seeds easily head the dietary list as one of the most perfect foods. One may be sure that they are the *most living* food known to man. She points out that it is in seeds that Mother Nature has tucked away the precious procreative power necessary for continuation of life on this planet.

She further states on page 252 of her book that "One of the chief advantages lies in the fact that sprouting seeds can give us a new crop of delicious food every two to four days—a crop that needs no thought to soil conditions, composting techniques, blight, bugs, weeds, storms, sprays. One that can be grown at any season and in any climate and is simple to harvest and store for future use . . . and no wastes."

Sprouted seeds, she goes on to say possess miracle nutritive factors not imparted when consumed otherwise without first germinating them. The earliest known historical mention of these virtues appears in a book said to have been written by the reigning emperor of China nearly 3000 years B. C.

Somewhat more recently, World War I in fact, a wise army doctor fed sprouted legumes to both white and East Indian troops in the Near East in order to clear up scurvy among them. About the same time, another army officer divided his troops into two groups having about the usual symptoms of scurvy. Of one group each man received his ration of 4 ounces of lemon juice, while those of the other group got four ounces of sprouted beans. The latter, at the end of the experiment, were 20 per cent more free from spongy and bleeding gums, etc., than the former.

There is practically no vitamin C whatsoever in the dry seeds. Dr. Pauline Berry Mack, at U. of Pa. found that when the sprouts first peeped out of soybeans the tested 108 milligrams of Vitamin C. By the end of 72 hours they had stepped up to 706 milligrams. After that, though better for eating purposes, the C drops off some—being used to nourish the growing plants. So, the trick is to stop them at the high point, refrigerating if necessary until eaten.

With respect to the B-Complex, Dr. Bailey of Minnesota University found that B-1, niacin and pantothenic acid doubled in the sprouting process. Pyridoxine and biotin increased about 150 per cent, but B-2 and folic acid hit the jack pot at near 500 and 450 per cent respectively.

Two doctors at President College at Calcutta, Bombay, found the important constituent choline of black eyed peas and wheat climbed 20 and 30 per cent respectively during four days of sprouting.

While admittedly not the most potent source of Vitamin E, the mung bean was found to increase by one-third in this respect during the same length of time. At the U. S. Ag. Experiment station in Beltsville, Maryland, and elsewhere, the feeding of as little as five pounds daily of five-day sprouted oats, spectacularly increased the fertility of breeding animals of both sexes, even restoring confirmed failures to usefulness.

Now here is a word of hope for those who like a mess of beans but dislike the abundant gas they generate. By sprouting beforehand their nourishment is increased and their explosive nature is quieted at the same operation. And that's nothing to sneeze at, for us folk who enjoy beans.

And for those who "need a little something to pick them up," here's a word from Dr. Loa of Yenching U. at Peiping, who states that in sprouting much of the original starch content is converted into simple sugars. This means quick energy, as the monosaccarides enter the blood stream almost at once without requiring any digestive alteration, and no subsequent let-down.

It all seems to add up to a whale of a lot of stick-to-the-ribs nutrition, along with minerals, vitamins unsaturated fatty acids, etc., commonly held in high esteem and at uncommonly high prices in the corner drug store, all practically "for free" from now on, fresh and succulent from your own kitchen garden. The orientals have had nearly 5000 years start on us in this significant knowledge, and it's time we climbed onto the gravy train here in the Western Hemisphere.

Expert Approval For Sprouts

D. R. Hiatt

Scientific researchers have finally got around to placing their official stamp of approval upon a dietetic practice which has at least three thousand years of successful history to support it.

Better late than never, however, and the experts are now affirming that the sprouts of various food seeds contain a spectacular assortment of the vitamins required in human nutrition.

They tell us that by the simple process of sprouting seeds, one may produce at will an abundance of A, B, and C vitamins. It is said indeed that one salad serving of sprouted soybeans or other similar legume can furnish half the daily requirement of C. It seems moreover that alfalfa sprouts are an excellent source of D, E, G, K and U. While the seeds themselves may provide little or in some cases none at all of certain vitamins, yet these are developed or generated amazingly during the sprouting period.

In our humble opinion, alfalfa is the king of sprouting seeds. Scarcely any day is allowed to pass in which these do not appear on our family table in some form, but usually raw—as in tossed salad. We are told that they contain those indispensable cell-building amino acids such as arginine, lysene, theronine, tryptophane. (Isn't it too bad that these benign substances must make their way under the handicap of such outlandish and forbidding names?)

In addition to the aminos are found such organic mineral essentials as calcium, magnesium, phosphorus, chlorine, potassium, sodium, silicon and others, all in a form which the body can readily assimilate for health and vigor. We wish that space here would permit us to make mention of the definite contribution these organic minerals are able to make toward healthy bodies, healthy minds and stable emotions.

Laboratory research indicates that up to 150 per cent more protein constituents are found in alfalfa sprouts than in such grains as wheat, oats and corn. The high chlorophyll content, induced when the sprouts are exposed to sunlight for a few hours, exerts a sweetening effect on the foul breath which is so common nowadays, and leaves a clean, fresh taste in the mouth. The chlorophyll contributes also to the remarkable and well known healing qualities of this versatile legume. If you are looking for a perfect food, you may consider alfalfa sprouts as one of the strong contenders for that title. Nutritionist Catharyn Ellwood refers to them as "the most living food on earth."

The late Frank W. Bower, renowned nutritionist, spoke of alfalfa as a "wonderful plant with unlimited possibilities for good." Among his most significant discoveries is the fact that alfalfa contains at least eight essential enzymes required in the digestion and assimilation of foods. It is thus a nutritional "gold mine" for health prospectors. The sprouted seeds are a natural, readily supplied food supplement of great potency.

But after all these assurances that sprouted seeds are good for you, still some may inquire suspiciously "What do they *taste* like?" And the answer to that is a welcome surprise, for they are succulent and luscious, used in any wise you would employ lettuce, parsley, etc., in salad making. They are an unsurpassed addition for your favorite green salad. In sandwiches, they remain fresh and crisp for many hours. They may be finely chopped and stirred into soups and sauces just before serving. You may liquefy them in vegetable or fruit juices. They even add rare beauty as well as unusual flavor to fruit salads.

Why Starve?

Overwhelming evidence is available to the effect that there is little excuse for anyone to be either hungry or malnourished, even on the tiniest income.

Whole grains, and other seeds, with all their life and goodness in them may be purchased almost anywhere for a few cents per pound. When properly prepared, a very few ounces of such will satisfy the lustiest appetite.

People who currently pay from twenty-five to seventy-five cents or more per pound for robbed, devitalized, lifeless foods have no right to complain of hard times, for it is possible to enjoy the blessing of a stomach well filled with top quality nutrition on less than five cents per day per person!

"What utter nonsense," you exclaim. But the fact remains, proven, established, demonstrated. And the secret may be compressed into very few words, thus:

Viable seeds may be grown into palatable and nourishing sprouts of high vitamin and mineral potency in 3 or 4 days, wherever warmth and moisture are available. The same seeds may be crushed or soaked whole overnight to be eaten raw or cooked into a porridge. By making full use of seeds thus prepared to form the staple, filling portion of the diet, with such minor additions as one is able to obtain for variety and taste, hunger may be banished and a good state of health maintained indefinitely at astonishingly low cost.

If you know of anyone to whom it is a problem to satisfy food requirements on a meager income, what greater boon could you bestow than that of imparting such information?—*D. R. Hiatt, Journal of Natural Living.*

Safe Food In A Dangerous World

In her excellent article appearing in the February issue of *Natural Food and Farming*, our old time friend Lottie R. Stewart, R.N., remarks as follows:

"The part played by food in the maintenance of good health and in the prevention of epidemics has long been known to the public, but we have relied—for the protection of this food—too much upon the Federal Food and Drug laws and upon the Medical and Dental professions, who have failed to oppose the wholesale adulteration of our food supply and have permitted the insidious extension into our food culture of processed foods, whose nutritional value is not questioned until after the damage is done.

"For years, many substances have been added routinely to foods in the interest of flavor and the postponement of spoilage, which were later discovered to be harmful to the human system. . . . Each of these additatives or adulterants may contribute 'just a little bit of poison', but the sum total may spell disaster for our bodies."

Our late friend Anton Jensen, in his book *How To Live Safely In a Poisoned World*, points out the fact that there is presently very little food to be purchased in the super market or the roadside stand which has not been treated to a generous lacing with one or more of the thousand and one life-destroying substances employed on the growing, handling and processing phases of the food industry.

With more than thirty million people of this nation chronically ill, and with debilitating epidemics frequently sweeping like waves over large or small sections of this population, this problem of obtaining unrobbed and unpoisoned foodstuffs has become alarmingly acute.

Against such a somber background, the simple practice of sprouting seeds for food shines forth with peculiar importance and lustrous magnificence.

It is true that brash men and government bureaus are now recklessly tampering with the virgin status of certain groups of seeds, but the fact remains that if anything on earth has escaped or survived the recklessness and greed of the age it would be the embryo in the seeds of our edible plants. Indeed, if God had not by special providence contrived to spare the seeds from the general contamination, there might be left to us not one viable seed today.

In any case, those alert individuals and families who recognize the forces of race extermination at work among us will do well to turn a bit of attention to the art of growing sprouts in order to maintain a constant supply of fresh, succulent, appetizing and nutritious food. It would seem the better part of wisdom to introduce the practice now, rather than wait to be forced by uncompromising circumstances into a crash program for which we shall be ill prepared.—D.R.H.

* * *

YOU CAN SURVIVE THE NUCLEAR WINTER

OR

HOW TO BUILD A FOOD FACTORY

by Kurt Saxon

Four years ago I sent to a Hollywood producer friend a collection of all my editorials in the five volume set of THE SURVIVOR. His idea was that they could serve as a scenario for a motion picture about WW III and its survivors.

He worked very hard promoting it to studio heads but with no results. The common response was that the subject was too frightening and would only depress the viewers.

Then came "The Day After", followed shortly by "Testament". Were these not frightening and depressing? There was even much fanfare before the showing of "The Day After" that it might traumatize children. Many stations even announced warnings against letting children watch before they aired the picture.

All this made for great publicity and the ratings were high. More people watched "The Day After" than would have watched otherwise. Also, the viewers were far more attentive to the picture's message.

And the message was simple. Every viewer was convinced that every character in the picture soon died.

"Testament" was shown without much fanfare. But its message, although subdued, was just as hopeless and final; everybody will die in the event of a nuclear war.

In the meantime, long documentaries on "defense" systems were aired continuously. As each system was described by the hopeful, wiser heads, according to the media, debunked them. Nothing could stave off the inevitable, nor could any measures save the populace.

For the past year, "Star Wars" has been debated, for and against, often enough to insure its exposure to everyone. The idea is that it is purely defensive and only to shoot down incoming missles. Its detractors say, even so, at least ten percent of the enemy missles would get through and destroy the major population centers.

Wholly defensive as it may be, its threat lies in its supposed ability to shoot down incoming missles while the Pentagon lobs missles at the Kremlin with impunity. Reagan stupidly offered to share the technology with Gorbachev. Not only would the knowledge of how America's defense systems work enable the Russians to override our systems, but it would also free their superior conventional war machine to take over Europe. America would then override the Russian defenses and nuclear war would rage full scale.

As if this often-aired scenario wasn't enough to kill all hope of individual survival, Carl Sagan and other scientists have gone public with their theories of a nuclear winter. It seems that all that radioactive dust thrown up by thousands of ground-zeros will blot out the sun. So for years there will be only darkness over the face of the Earth.

Then Gwynne Dyer's series on War was played at least two times on PBS so no one need miss it. It was a dramatic work, indeed. It reinforced the barrage of propaganda which, in effect, has made the American public accept the idea of nuclear doom.

So the media has been enthusiastically airing every kind of doomsday scenario that anyone can come up with. But Survivalism, which holds out hope for those who would prepare, has been discredited as somehow evil. Whomever would save himself and his loved ones has been branded antisocial at best and a camouflaged, armed predator at worst.

I don't think the media people got around a table and deliberately planned to convince the average person that he was doomed. But it all fits a pattern of resignation and apathy.

Urbanites realize that in the event of a nuclear war they would be doomed. Most of them are too establishment-linked to move to rural areas. Also, a sizeable portion of them moving out of the cities has already caused the erosion of many urban tax bases.

So the unspoken plan is to indoctrinate the public with the idea that their only salvation lies in disarmament. This will eventually come about, they hope, and possibly genuinely believe. The alternative, the Establishment preaches, is a devastating nuclear war, followed by an unsurvivable ice age. In the meantime, the urban populace is to continue at their jobs, thus keeping the system going.

It should be obvious to all that nuclear war is indeed inevitable. There is also the great possibility that several thousand nuclear warheads would cause a change in the planet's weather. But there aren't enough nuclear warheads, and won't be, to make the sky black.

Most of the debris would hit the ground in from a few hours to a few weeks, depending on the weight of the particles. A certain amount of fine dust would indeed go up into the stratosphere. It could hang there for months or even years, before the sky was back to full clarity.

Of course, there would be some blockage of sunlight. That might cause, at worst, a ten percent drop in the temperature worldwide. This would mean winter would last a month longer and begin a month earlier.

A natural consequence would be that normal agriculture would be over for some time. But on the plus side, there would be no large urban populations to feed and so there would be little market for agribusiness, anyway.

The radioactivity in the rural areas would die down in a few weeks as the urban slagheaps smouldered on. Also, weather under the hazy skies may not even permit full-season vegetable gardens for a couple of years.

Even so, there is no reason to believe that every nuclear warhead will be fired. Nor will every urban area be hit. Nor will fallout kill every person with the sense to stay inside for a couple of weeks after the war ends.

So what if twenty years after the war a lot of people may develop cancer? Hiroshima and Nagasaki have proved that the threat of every survivor's contracting radiation poisoning and giving birth to mutants is a myth spread by those who would have us surrender to the Russians.

So, taking all things into consideration, if you don't live at ground-zero you will have a good chance to survive. Of course, you will have to prepare. But this doesn't mean you will have to spend the rest of your life in a hole in the ground or face an altogether sunless future.

Surviving a nuclear holocaust brings to mind Max Shulman's opening line in his book, "Sleep "Til Noon". "Bang! Bang! Bang! Bang! Four shots ripped into my groin and I was off on the greatest adventure of my life". And it will be an adventure. But a rather horrible adventure which will select out of our species all the genetic corruption which should not have been nurtured in the first place. Maybe what is to come is simply Nature's way of doing for us what our species was too immature to do for itself.

If you can't face up to the adventure, you have the option of stocking up on cyanide capsules, as a group of university students requested of their faculty. They were turned down. But I have them for sale at two for $1.00.

But let's say you are the dynamic type who intends to make it through come hell or high water. You want to be a part of the future and also want your line to survive and prosper.

Unless you live in a definite high risk area, a simple greenhouse will insure you and several neighbors all the fresh food you need. This greenhouse need be only 20 by 20 feet square and will accommodate hydrophonic tanks, a ground level intensive gardening space, rabbits, chickens and earthworms.

You may think that 400 square feet would not produce much food and you'd be right if you are limited by conventional ideas of typical outdoor gardens. But 67 square feet of hydroponic garden can supply all the vegetables needed by a family of five, all year 'round, as described in "Hydroponic Gardening". And with my methods, the yield of such a small space can be more than doubled.

Hydroponics is simply a method of growing plants in plastic-lined wooden tanks, partially filled with peanut-sized gravel. The nutrients are simple, easily available chemicals added to water poured into the tanks.

The organic garden area at ground level would be worked by the French intensive method as described in "Success With Small Food Gardens". Your yield would be over twice as much as with a conventional garden.

Moreover, with my methods you can get up to twelve crops per year! This is accomplished by planting the seeds in ordinary No. 15 tin cans with the bottoms cut out. These are lined up on paper on the cinder blocks bordering the garden area. When each plant has been growing for a month or six weeks and needs more room as it matures, its can is set in a hole in the garden or hydroponic tank to complete its growth.

In this way you can get twelve crops per year from most plants. Especially since the controlled environment of a greenhouse knocks off an average of fifteen growing days.

On one side of the greenhouse, under the hydroponic tanks, would be 20 rabbit cages with simple trays under each to catch their droppings and urine. Two bucks and eight does would supply at least 800 pounds of meat and 200 warm rabbit skins per year.

On the other side would be 20 cages of chickens, with three layers per four square foot cage. At least three happy roosters would be put in with the hens periodically for fertile eggs to hatch. Overall, the 57 hens should lay about 10,000 eggs per year, at four each per week, or about 833 dozen. As you hatched the eggs to renew your flock you could get about 800 pounds of chicken meat per year.

Both chickens and rabbits could be fed from the greenhouse produce.

The droppings and urine from the rabbits and the chicken droppings would go into simple methane generators from which would come gas for light and heat. After the gas stopped coming from a 55 gallon drum methane generator, the sludge would go to feed earthworms in plastic lined boxes under the cages on both sides of the greenhouse.

Earthworms double their populations every three months so there would be plenty of worms to supplement the chickens' feed and also to put in the organic garden area. The worms' castings could also be sold for up to a dollar a pound for indoor plants.

Concerning energy from methane; gasoline generators to provide electricity can be adapted to work on methane. In this way, you could have an inexhaustible supply of electricity for lighting the greenhouse through the darker days.

Such a home food factory (less commercial generator and frills) would cost under $1,000. It would consist of a simple frame of bent metal tubing covered with inexpensive plastic. Such plastic only lasts about two years. The corrugated fiberglass sheets used on many commercial greenhouses costs considerably more but is permanent.

The greenhouse could be built onto that side of your house which permits the most sun. Even if a new door had to be cut into the house, it would be well worth the cost.

Your home food factory would pay for itself in the first few months through savings at the supermarket and sale to neighbors. Moreover, neighbor ladies would be glad to work in it for food alone. You could get all the comparatively free labor you wanted. Say you offered the neighbor ladies $5.00 per hour. But instead of money, they would be paid in produce as priced in the supermarket.

Another plus to this system would come during the chaos of war and its aftermath. Your neighbors would not only not loot you, but they would protect your family and greenhouse with their lives.

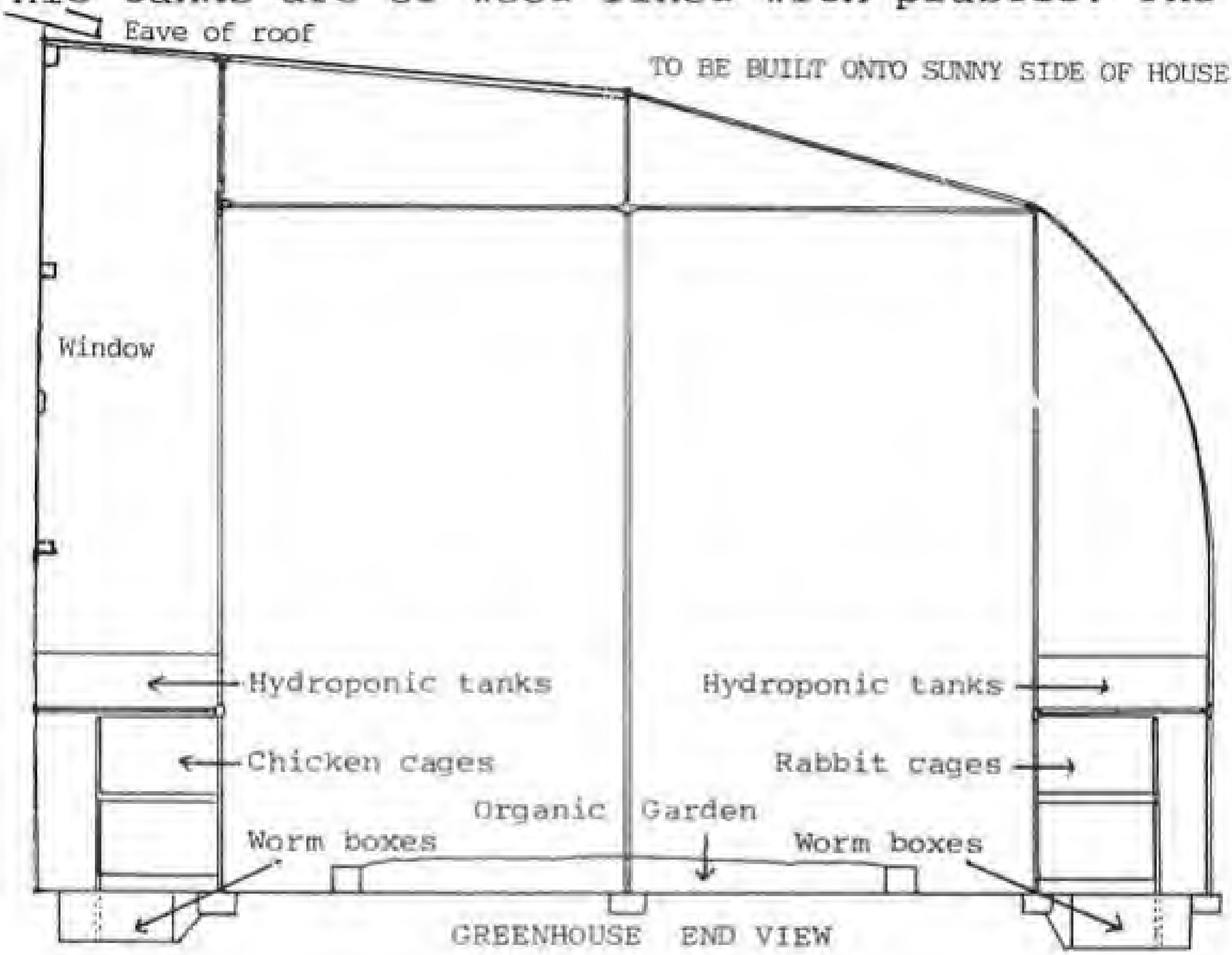
Aside from the diagrams of the greenhouse, I will explain the step-by-step operations of its various functions in following issues. In the meantime, I advise you to buy all the books I've listed on food and food raising and processing so you can study the subjects in greater detail.

Incidentally, putting up such food factories would make a profitable business for someone with investment capital. I would be glad to form a corporation for selling such prefabricated greenhouses nationwide. Contact me if you are interested.

In the meantime, write for the most complete seed catalogue, free. You can get it from Gurney's Seed & Nursery Co., Yankton, SD 57079

GREENHOUSE

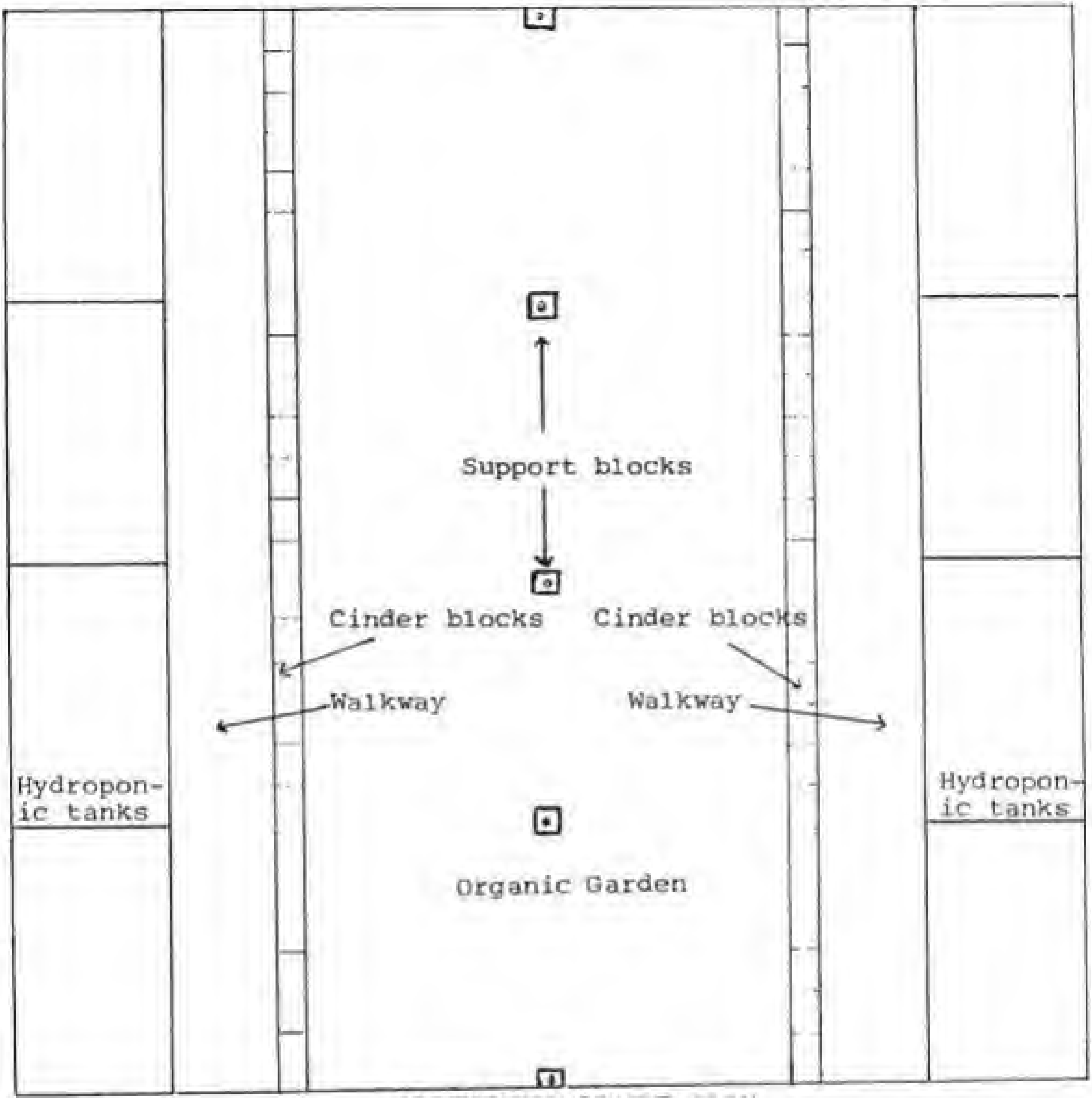
The greenhouse on the facing page is simple, inexpensive and can be assembled by any builder who is handy. It is entirely composed of metal tubing, plastic and cinder blocks. The hydroponic tanks are of wood lined with plastic. The



GREENHOUSE END VIEW

cages can be bought cheaply from most farm supply stores or you can make them yourself from materials bought through any hardware store.

In later issues I'll give diagrams and instructions for each item. Even so, depending on your space requirements, you could have a larger or smaller setup built from the illustration of the ground plan and end view.



GREENHOUSE GROUND PLAN

FROM THE GROUND UP

by Kurt Saxon

In a further clarification of my food factory in a greenhouse, I will start from the ground up, which will be the raising of the earthworms.

Earthworms are a very valuable asset to any greenhouse. They not only reduce the organic waste into the best compost available but they can be fed to chickens or sold to fishermen.

It's true that those who get rich from selling worms are selling them to people who want to get rich selling worms. So forget about big profits for now.

You should start out with only a few thousand and keep your operation small. This is only a basic course teaching you the principles of raising worms. When you know more about them and gain the proper perspective, you can expand to whatever volume you can handle with ease.

Even before you build your greenhouse, you can learn the art of raising worms and maybe sell enough of their castings to pay for your investment. Worm castings are sold mainly for house plants and bring up to $1.00 per pound. You might find a local greenhouse owner who would buy all you can produce for resale to their customers. Even if you don't market the castings, you can dry and save it for potting your own greenhouse plants.

Your surplus worms can be sold to pet shops to feed the fish and birds. They can also be put up in easily available plactic cartons with covers in batches of a dozen big worms and a handful of their growing media. These can be placed with any business catering to fishermen.

The main thing is getting started. This involves collecting the worms, boxes and worm food.

First, write the sources below for information on prices of worms and the sellers' own ideas on raising and selling them.

Next, make four wooden boxes from 3/4 to one inch thick lumber, scrap or from a building supply store. The boxes should be two by two foot square and five inches high. If you are not at all handy, anyone working in a lumber yard can make them for you for a few dollars.

Then you will need two more of the same size boxes but with 1/4 and 1/8 mesh screens nailed to the bottoms of the boxes instead of wood. These are shaker boxes used in separating the bedding, castings and worms.

To start, buy a bag of black Michigan peat moss at a garden store. With the 1/4 inch screen shaker box, fill two of the boxes to within 1/2 inch from the top. Any peat which won't go through should be discarded unless you can shred it finer.

Then put 1,000 worms on top of the peat in each box. When they have burrowed under, fill the boxes with dried cattle manure which has not been chemically treated. You can buy this at any garden store, also. Then, using a garden sprinkling can, sprinkle one gallon of water evenly in each box.

Next, store the boxes in a cool place, not below 50 degrees, and not touching the ground if it is wet. Put the two extra boxes bottom side down on the full boxes as covers. Then let everything alone for ten days.

After 10 days fill one of the extra boxes to within a half inch of its top with more black Michigan peat sifted through the 1/4 inch screen. The worms will pretty well digested the contents of the two boxes as well as reproducing quite a few more worms. Aside from the worms, all that will be left will be little pellets of worm castings and some uneaten black Michigan peat.

To separate the castings from the worms and peat you'll need the 1/8 inch screen box and a table to shake the castings onto. Take a few handfulls of worms, peat and castings at a time and put them in the screen box. Shake over the table until most of the castings have fallen through. Dump the worms and peat into a dishpan or other large container.

When you've emptied both boxes give the worms time to burrow down to the bottom of whatever peat is left. Then scrape the peat off the worms and put it in the empty box. Next, put more peat into that box until it, too, is refilled to within a half inch of the top. Then separate the worms into two piles and divide them between the two boxes as before. Again cover them with cattle manure and sprinkle a gallon of water on each.

After the next ten days you may have enough extra worms to start another box. Even so, your first ten days should give you from 24 to 28 quarts of castings.

As you perfect your techniques and gain a complete understanding of the process, you can branch out to a profit-making enterprise.

By the time you have your greenhouse established, you will be ready with plenty of worms. Then, instead of commercial black Michigan peat moss for bedding, you can use plant waste shredded by a mechanical shredder you will soon be able to afford.

Bedding can also be supplemented by finely shredded newspaper, corrugated cardboard, grass, leaves or any other organic waste matter. Just so it's fine enough to go through a 1/4 inch screen, helping it to hold moisture more uniformly, is easier for the worms to move through and eat and also because it's easier to work with.

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THE HOME WORKSHOP MANUAL 1930

SMALL WOODWORKING MACHINERY

MACHINERY is remaking all our home workshops. More than anything else, the introduction of compact, efficient, and reasonably priced woodworking machines has helped to popularize the hobby of making things with tools. Why? Because machines lend new zest to the work, they take away the drudgery, and they make it possible for the beginner as well as the trained craftsman to turn out satisfactory projects.

It is the purpose of this chapter to show the amateur how to make beautiful, useful, and substantial pieces of furniture almost entirely with these motorized home workshops, and do it more easily and accurately than by hand.

COLONIAL FOOTSTOOL

The first project, a footstool of Colonial design (Figs. 1, 2, and 3), allows a variety of machine operations to be learned. Obviously, any similar small piece of furniture will involve the same methods.

Mexican mahogany is an excellent material to use for the visible parts, although other woods such as birch or maple may be substituted and stained to imitate mahogany, if desired.

Step No. 1—Getting Out the Stock for the Rails. On the circular saw cut the four rails (two side and two end pieces) to the approximate sizes to make it easier to handle them on the planer. Pine or whitewood will serve for them if they are to be covered with upholstery. Plane one surface smooth and true and mark it with an X on all pieces to indicate the working face. Hold this face against the planer fence and joint (plane) one edge smooth and true. This edge on each piece should be marked with an X in order to identify it as the working edge.

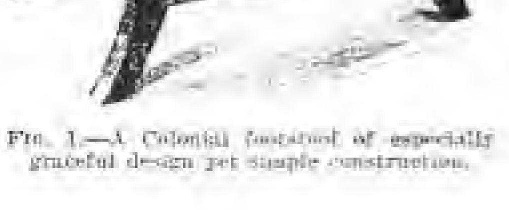


Fig. 1.—A Colonial footstool of especially graceful design yet simple construction.

Fig. 2—Original pencil sketch of the footstool, which was made as a preliminary to illustrating the various steps in machining the parts. For details, see the drawings in Fig. 3.

A few suggestions may well be offered parenthetically in regard to jointers (Fig. 6). The 4-in. jointer is about as small as is practical and works very well on all general work. The best type jointers are made with three knives or cutters, which are securely fastened in a cylindrical head. The cutters must face the operator, since the machine revolves towards him. There need be no fear about working at this machine as jointers are carefully guarded; however, a few safety rules must be observed in order to avoid the likelihood of any accidents.

Before starting any machine, try all adjustments to make sure that no parts are loose. Revolve the machine by hand to see that the knives swing clear of the throat. All three knives must be set exactly the same distance out so as to make a smooth cut, free from ridges. Never run any wood over the jointer smaller than ½ by 1 by 10 in. For all thin pieces use a block set on top of your work to push the material across the cutters. Never rest the hand or a finger on the extreme rear end of the wood.

When stock is pushed across the jointer, the pressure is placed on the part of the planer furthest away from the operator. It is good practice to skip over the throat portion of the machine with the hands, moving forward as you go along. Do not take too coarse a cut; it is better to make several finer ones, as it will lessen the chance of the wood's getting away from you. When making any adjustments, always be sure to turn the power off.

To return to the operations in making the footstool, continue as follows after the working face and the working edge

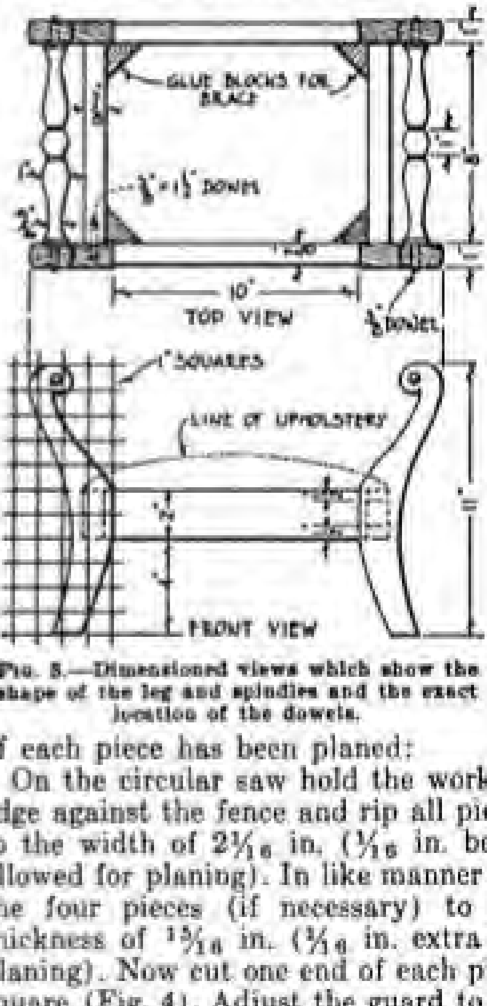


Fig. 3.—Dimensioned views which show the shape of the leg and spindles and the exact location of the dowels.

of each piece has been planed:

On the circular saw hold the working edge against the fence and rip all pieces to the width of 2$\frac{1}{16}$ in. ($\frac{1}{16}$ in. being allowed for planing). In like manner cut the four pieces (if necessary) to the thickness of $\frac{13}{16}$ in. ($\frac{1}{16}$ in. extra for planing). Now cut one end of each piece square (Fig. 4). Adjust the guard to get each pair of pieces exactly the same length, and cut the other end of each. Plane the remaining surfaces and edges smooth and true on the planer (Fig. 6).

Step No. 2—Legs. Draw and cut out an accurate cardboard pattern. Use it to mark the wood. To avoid splitting, bore ⅜-in. holes for the handles or cross spindles before sawing the curves. On the jig saw (Fig. 5) cut the design out carefully, keeping just outside the lines. Be sure to make "safety" cuts in the

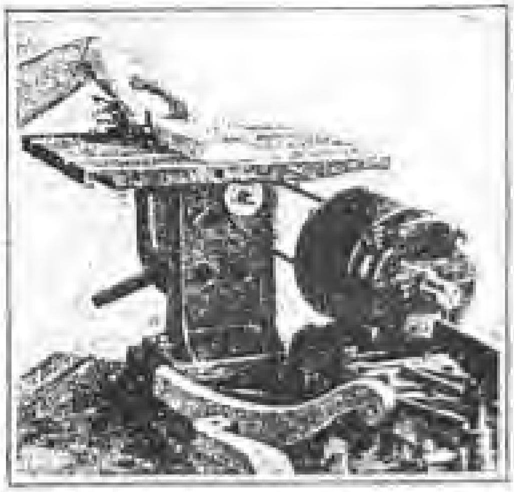


Fig. 4—How to hold the rails (sidepieces) when cutting them to exact length on the circular saw.

waste stock where necessary to avoid having to back out the saw at acute corner curves and perhaps cause the blade to break.

Step No. 3—Spindles. The stock should be 1⅛ by 1⅛ in.; this allows ⅛ in. for truing up on the lathe. Locate the center of each end by drawing diagonal lines. Bore small holes to receive the points of the lathe centers. Rough the corners off with a gouge and then turn to the largest diameter. Next cut down a short distance to give the exact length from shoulder to shoulder—8 in. Turn the spindle to the design (Fig. 8) and sandpaper it in the lathe. Turn the dowels at the ends to exactly ⅜ in. in diameter and 1⅛ in. long, and as you cut the work free, round up the ends with a small skew chisel.

Step No. 4—Sandpapering. On the disk sander true up and smooth all flat surfaces and convex curves. For concave curves use a drum sander, if available (Fig. 7); otherwise turn a cylinder to 3 in. in diameter and fasten a sheet of No. 1½ sandpaper to it.

Step No. 5—Joints. Locate accurately all centers for the dowel holes—two in each end of each of the four rails and corresponding holes in the legs. By means of the lathe and a chuck, bore all the holes. If you use a short auger dowel bit, which is advisable, first file off the threads on the point (leave the point itself) to prevent the bit from pulling too fast.

Step No. 6—Assembling. Make a trial fitting of all parts between clamps but without glue. Mark the joints of mating members No. 1 and No. 1, No. 2 and No. 2, and so on. Two separate gluing operations are necessary. First glue the long rails and legs together. Place a scrap of wood under the clamp to avoid bruising the legs. Put plenty of glue into the holes and on the dowel pins; then clamp the work together lightly. Use only a liquid glue of the best quality or a tested brand of flake hide glue. Sight across the legs for any twist. Allow at least five hours for the glue to dry.

Next assemble the project completely, being sure that all four legs rest on a true surface, that the frame is square, and that the tops of all rails are in line. It is a good idea to have some fine sawdust on hand when gluing to sprinkle over the glue that oozes out; this will absorb it sufficiently to allow it to be peeled off like gum immediately afterwards with a chisel. When the glue has set, glue the corner blocks in place.

Fig. 5 (above).—Cutting out of the footed legs on the jig saw. Note the rod and adjustable foot which holds down the stock on the table. Fig. 6 (at left).—One face of each piece is planed; then this face is held against the fence or guide of the planer and one edge is jointed (made true) as shown. The position of the hands is important. A swinging guard presses against the wood.

Step No. 7—Cleaning Up. Remove all excess glue with a sharp chisel, cutting, wherever possible, across the grain. Sandpaper thoroughly all parts with No. ½, 0, and 00 paper, rubbing with the grain. Round the corners slightly.

Step No. 8—Finishing. There are many ways of finishing mahogany. One of my favorite methods is as follows: Buy a high grade mahogany water stain powder and dissolve according to directions, or obtain a prepared wood stain or dye of first-class quality. Use liberally and let it dry. Brush on very thin white shellac and sandpaper when dry with No. 00 paper. Apply two coats of paste wood filler, following the directions on the can. Allow at least two full days for the filler to harden. Apply three thin coats of white shellac, rubbing each coat when dry with No. 00 sandpaper, and the last coat with crude oil (or light machine oil) and fine pumice stone powder. If you have a spraying outfit, spray clear lacquer on instead of shellac.

PRISCILLA SEWING CABINET

Roomy as is the Priscilla sewing cabinet shown in Figs. 9, 10, and 11, it has the advantage of being easy to carry about the house from place to place. As is customary, it contains a sliding tray, divided into four compartments, for buttons, needles, and small accessories.

Fig. 9—Of all sewing cabinets the Priscilla is perhaps the favorite because of its Colonial grace.

Mexican mahogany is perhaps the best material for this project, although you may substitute cheaper woods and stain them to imitate mahogany.

Step No. 1—Getting Out the Stock. On the planer dress one surface of each piece smooth and true and mark it with an X; this is known as the working face. Hold the marked surface against the fence of the planer and plane one edge at right angles to the working face. Mark this edge with an X; this is called the working edge. There are only two surfaces to mark.

Now go to the circular saw and, holding the working edge against the fence, rip the stock to the correct width, allowing $\frac{1}{16}$ in. extra for the final planing (Fig. 12). In like manner, obtain the

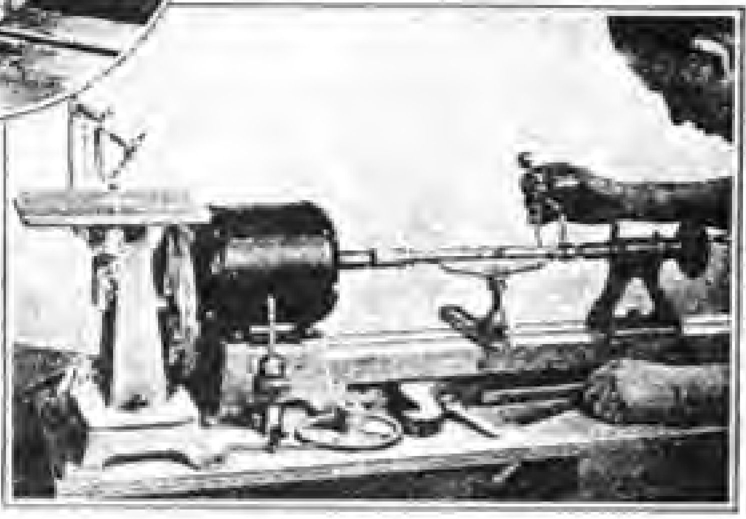


Fig. 7 (above).—Cleaning up the convex curves of the legs on a drum sander. If this type of sander is not available, a sanding cylinder can be turned from wood for use in the lathe. The edges of the sandpaper should be wedged into a longitudinal groove by means of a small strip of wood. Fig. 8 (at right).—The spindles or handles in the lathe. Calipers are used to make measurements.

thickness, if not already correct. Return to the planer and dress all surfaces smooth and true.

Follow this method for getting out all stock. At this point it is advisable to cut out cardboard patterns of all curved parts to insure the required accuracy of size and shape.

Step No. 2—Turned Legs. The stock should be at least ½ in. longer than needed to allow for turning the bottom end without striking the point of the dead center. Draw diagonal lines on both ends of the stock to locate the centers. Drill small holes at these points to receive the center pins of the centers. Square lines around the stock, locating the portions that are to remain square. Rough the stock with a gouge and turn to the design (Fig. 14). Sandpaper thoroughly while in the lathe.

Step No. 3—Curved Feet. On the jig saw cut out the curved outline. On the drum sander smooth the edges just sawed. Use the disk sander for the flat edges at the top and bottom (Fig. 13). If you are not already accustomed to these machines, you will be agreeably surprised at their speed and accuracy.

Step No. 4—Hopper Part. The end dado or box joints (see the detail drawing of the corner joints) can be made easily on the circular saw as follows: Set the circular saw a little over ⅛ in. above the saw table, and set the ripping gage at the proper distance from the saw blade, so as to make the four grooves on the end pieces. If your blade is thick enough, one cut will be sufficient. Now take the sidepieces and cut the tongues or tenons to fit these grooves just made. The cut should be made in two operations to insure a perfect fit. Use the cardboard pattern for laying out the curves at the bottom of the end pieces and cut the curves on the power jig saw.

Step No. 5—The Handle. The jig saw is a real help in the construction of the handle. Bore a ½-in. hole in each corner of the cut-out portion, insert a saw blade in one hole, and saw out the grip part (Fig. 16). Next cut out the outside curve. Return to the drum sander and smooth all curved edges. A smooth finish is important.

Step No. 6—Assembly. The handle is fastened to the top strip by screws from beneath, as indicated. Glue the hopper with high grade liquid glue or flake hide glue. The work should be allowed to set between clamps until the glue is hard.

Step No. 7—Dowel Joints. Put the chuck in the lathe, use the correct size auger bit for the dowels (in the case ¼ in.) and, while the power is on, very carefully file the threads off the screw end to prevent the bit from pulling into the wood too fast; do not, however, remove the point. Locate accurately all centers of all

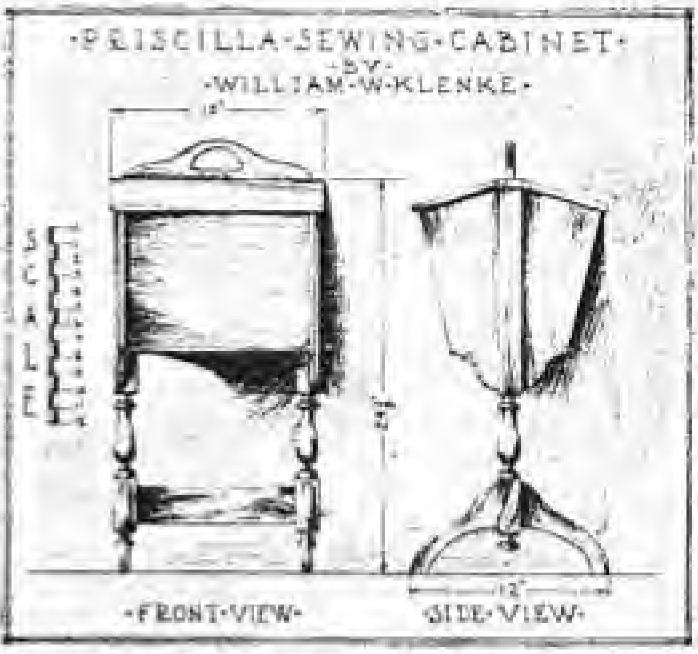


Fig. 10.—The cabinet sketched in pencil. See Fig. 11 for the completely dimensioned working drawings.

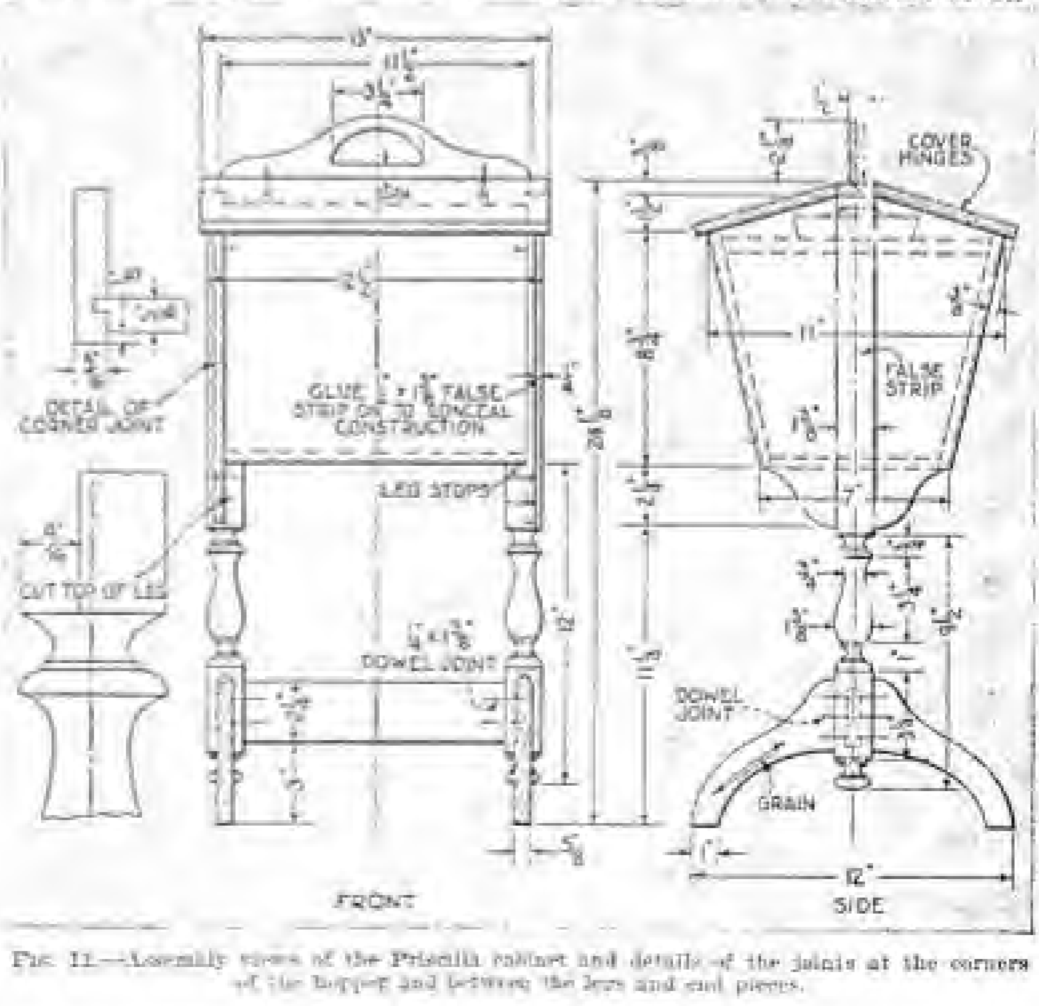


Fig. 11.—Assembly views of the Priscilla cabinet and details of the joints at the corners of the hopper and between the legs and end pieces.

holes and bore the holes in the lathe as illustrated in Fig. 15. Make sure by careful test that the ½ by 2¼ in. cross brace is exactly the right length to suit the length of the hopper.

Step No. 8—Assembly. Glue the legs and curved feet first; then glue the cross brace. When dry, this entire bottom unit is fastened to the hopper with screws. Glue a false strip over the center of the hopper to make the leg appear as if it continued all the way up. Next screw the bottom in place and fit the covers and hinges.

Step No. 9 — Tray. On the various machines, work out the tray in the same way as the other parts.

Step No. 10 — Cleaning up. Remove all excess glue with a sharp chisel, cutting where possible across the grain. Sandpaper thoroughly all parts with Nos. ½, 0, and 00 paper, always rubbing with the grain if practicable. Round the corners slightly.

Step No. 11—Finishing.

There are many ways of finishing mahogany. One requires the use of bichromate of potash, which can be purchased at any drug store. Make a saturated solution of the crystals and water and apply a coat of one part saturated solution and four parts of water. When dry, sandpaper lightly with No. 00 sandpaper; then give an even coat of ready-mixed penetrating mahogany wood stain. Follow with paste wood filler and finish with several coats of shellac, varnish, or clear lacquer.

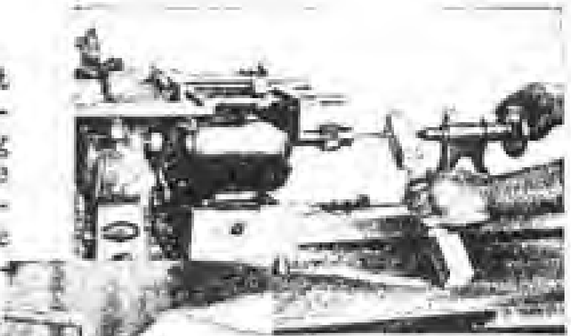


Fig. 15 (above).—Boring the dowel holes. Should holes have to be bored all the way through the stock, a block is bored and fitted over the tail-stock spindle to save the bit from damage.

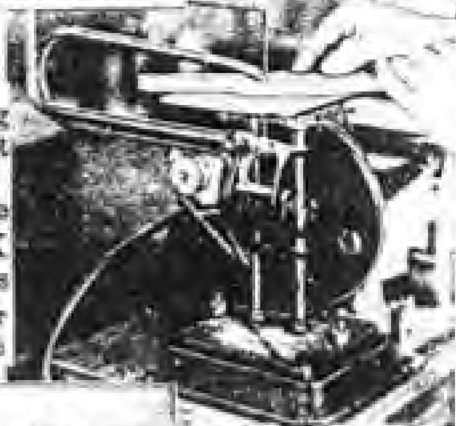


Fig. 16 (at left).—Cutting the inside of the handle on the jig saw is as simple as guiding a sewing machine.

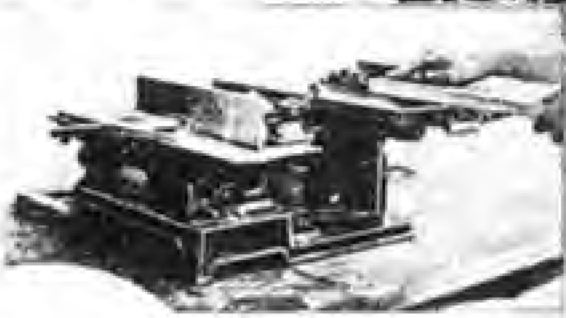


Fig. 12 (above).—Ripping stock to width, the guard being removed for clearness.

Fig. 11 (below).—Calipering a leg in the lathe.

Fig. 13 (in circle).—Sanding the pad edge of the feet.

MARYLAND END TABLE

In learning to use small woodworking machinery or a motorized home workshop, you will find the Maryland end table shown in Figs. 17, 18, and 19 is a particularly instructive and desirable piece of furniture to build. Because of its delicate proportions and graceful lines, it is a little gem; at the same time it is simple in construction.

Mexican mahogany is one of the best materials for this table, unless you intend to finish it with colored brushing lacquer, perhaps in some brilliant tone to make the piece individual and outstanding, in which case birch or maple is suitable. Because of the delicate proportions, a hard wood must be used.

Step No. 1—Getting Out Stock. Using the planer and circular saw, get out all the stock in the following manner:

On the planer, dress one surface smooth and true; mark this with an X to indicate the working face. Hold this face against the fence of the planer and plane one edge at right angles to the working face. Mark this edge also with an X to identify it.

Hold the working edge against the fence of the circular saw and rip the stock to the correct width, allowing 1/16 in. for planing. In like manner obtain the thickness. Return to the planer (Fig. 19) and dress all sawed surfaces smooth and true. Follow this method for preparing all the pieces. Cut out cardboard patterns of all curved parts.

Step No. 2—Turned Legs. The stock for the legs should be at least ½ in. longer than the finished measurement, to allow for turning the bottom end without striking the point of the dead center.

Draw diagonal lines on both ends of the stock to locate the centers. Bore small holes at these points to receive the center pins. Square lines around the stock to locate the portions that are to remain square.

Rough the stock with a gouge and turn to the design. Sandpaper thor-

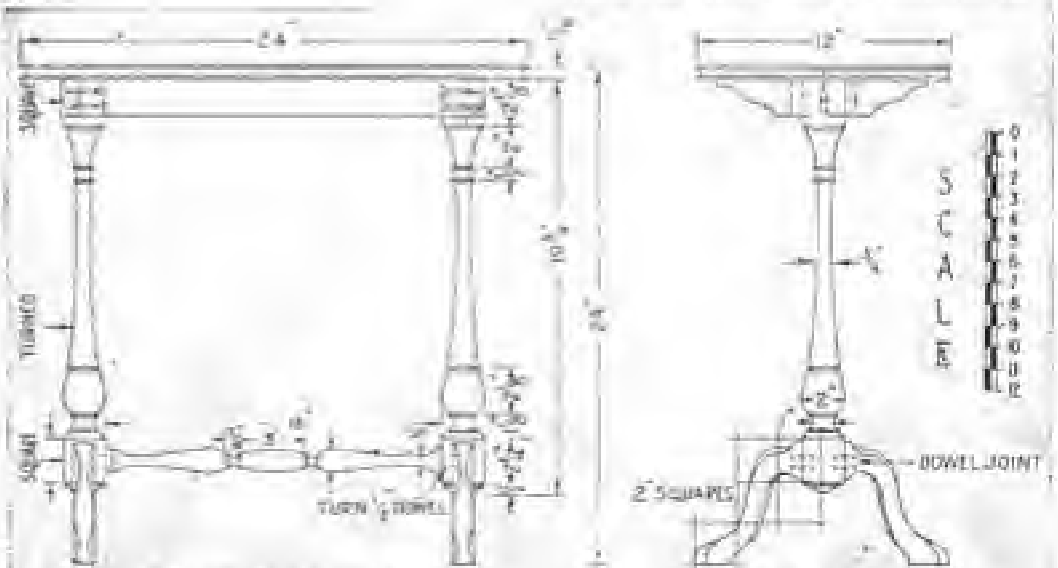


Fig. 17.—A table slightly simpler in design than the one shown in Fig. 18. The edges of the top can be left unornamented.

oughly while in the lathe.

Step No. 3—Curved Feet. Cut out the curved outline on the jig saw and smooth the edges on the drum sander. Use the disk sander for the flat bottom and top edges as in step No. 5.

Step No. 4—Top Brace. On the jig saw cut out the outlines of the braces; on the drum sander, true and smooth the outline.

Step No. 5—Joints. True the top and bottom flat edges of the curved feet on the disk sander. Carefully locate all the dowel holes. Place the chuck and dowel bit in the lathe and bore all the holes the correct depth.

Step No. 6—Sandpapering. Before assembling the table, thoroughly sandpaper all parts with No. 1 followed by No. ½ and 0 paper.

Step No. 7—Assembly. Make a trial fitting between clamps without glue. First, glue the curved feet to the legs; then assemble the entire project, using plenty of first-class liquid glue or hide flake glue of good quality. The tops of the legs are held together by gluing a strip on each side of the leg. After this is done fasten the top to the braces with screws.

Step No. 8—Cleaning Up. Remove all excess glue with a sharp chisel, working across the grain where possible. Thoroughly sandpaper all parts with No. ½, 0, and 00 paper, always rubbing with the grain where possible, and rounding the corners slightly.

Step No. 9—Finishing. If a lacquer finish is to be used, first apply two coats of white shellac, rubbing each coat when dry with 00 sandpaper. Apply the lacquer according to directions on the can.

If you have used mahogany or walnut or a wood which is to imitate them, brush on water stain or a prepared wood stain or dye of the desired color, and after it is thoroughly dry apply a very thin coat of shellac. Water stain has a tendency to raise the grain, and the shellac will stiffen these fibers and make them brittle. Sandpapering lightly with No. 00 or finer paper will cut them down clean and smooth.

Apply two coats of good quality paste wood filler (unless you have used some close-grained wood) according to directions you will usually find on the can containing the paste. Allow at least two full days—a longer time is even more desirable—for the filler to harden. Then brush on three coats of white shellac, rubbing each coat when dry with No. 00 or finer sandpaper and the last coat with rubbing oil, light machine oil, or crude oil and fine pumice stone powder.

With a spraying outfit, you can spray on clear lacquer instead of using shellac.

CHIPPENDALE MIRROR

The motor-driven saw is the greatest aid a woodworker has. Skillfully handled, it will perform wonders in cutting up stock quickly and accurately, in making joints of many different varieties, and in doing with ease and speed the preliminary operations which are most common in building furniture and most tedious to do by hand.

As an object lesson for demonstrating in greater detail than heretofore the use of the circular saw, the Chippendale mirror illustrated in Figs. 20 and 21 is excellent. Aside from the handwork needed in assembling and finishing, the frame of this graceful piece can be made almost entirely with the saw and its attachments. The operations are simple and the finished product is useful; so, in making the mirror, not only will a good-looking piece of work result, but excellent practice will be given in machine sawing.

As to stock, mahogany and maple are two appropriate woods to use. Extreme care should be taken in selecting the pieces for the top and bottom to see that the grain forms an attractive figure.

Step No. 1—Making the Patterns. From the working drawing (Fig. 21) lay out full size squares on heavy paper, such as wrapping paper or cardboard; then plot the curves. Cut these patterns out in template form. It will be necessary to make only half patterns of the top and bottom, as the half can be used for both sides. For the top and bottom it is advisable to use five-ply laminated stock to avoid possible splitting.

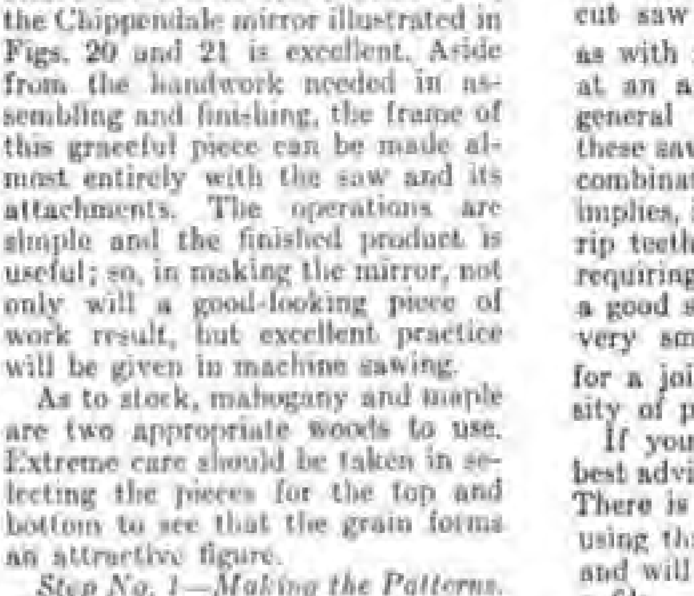


Fig. 18.—A graceful Maryland end table constructed with the aid of small woodworking machines.

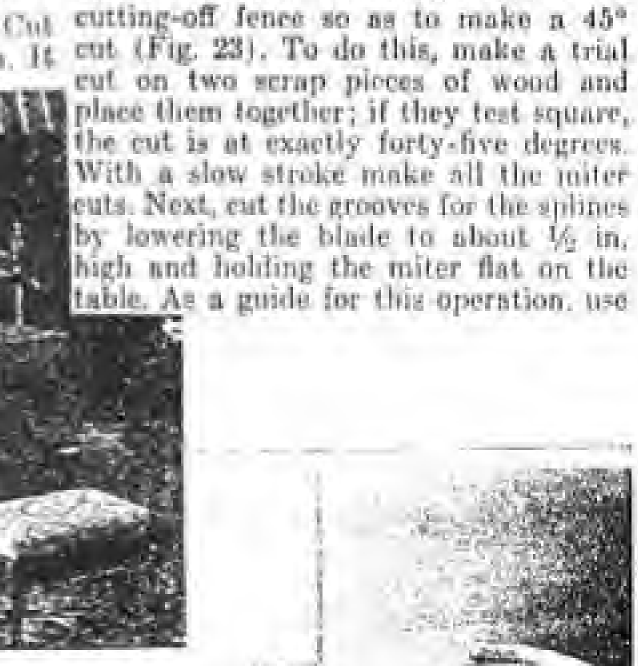
Fig. 19 (at right).—Planing the edges of the table top on a bench jointer. It is essential to hold the wood very firmly against the fence.

Step No. 2—The Frame. Although the design as it is given for the molding is a good one to follow, you can substitute any suitable stock picture molding of about the same size.

Circular saws are made in three different types—rip, crosscut, and combination or miter. The rip saw is used to cut with the grain. The teeth are rather large and, as with a hand saw, are filed at right angles to the blade. The cut is like that made with a chisel. The crosscut saw has much smaller teeth and, as with a hand saw, the teeth are filed at an angle. This saw is used on all general work except ripping. Both of these saws are set to give clearance. The combination or miter saw, as the name implies, is made up of both crosscut and rip teeth and is usually hollow ground, requiring no setting. The cut made with a good sharp blade of this type will be very smooth, oftentimes good enough for a joint without the slightest necessity of planing.

If you purchase only one blade, the best advice is to buy a combination saw. There is one disadvantage, however, in using this type of blade, it often binds and will need frequent pointing up with a file.

For this work we shall use the combination or miter saw (Fig. 22). Set the cutting-off fence so as to make a 45° cut (Fig. 23). To do this, make a trial cut on two scrap pieces of wood and place them together; if they test square, the cut is at exactly forty-five degrees. With a slow stroke make all the miter cuts. Next, cut the grooves for the splines by lowering the blade to about ½ in. high and holding the miter flat on the table. As a guide for this operation, use



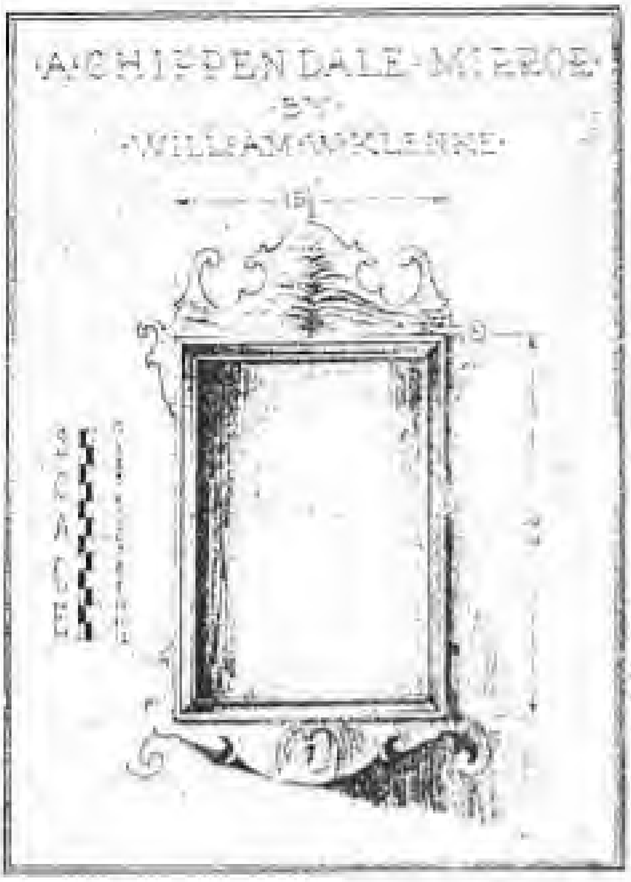


Fig. 20.—Pencil drawing of a Chippendale mirror showing dimensions and scale. Details of construction are given in Fig. 21.

the ripping fence. The upper sketch of Fig. 25 should be consulted for the form and application of the spline.

Step No. 3—Assembly of Frame. Glue temporary ears (triangular blocks of wood) on all the corners, so as to have something on which to get a grip when

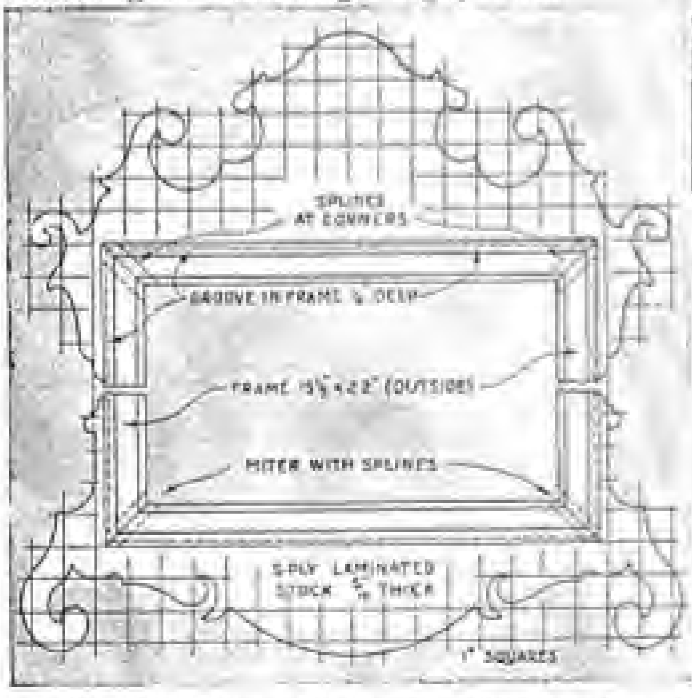


Fig. 21.—Half-patterns of the curved outlines can be made by plotting them on heavy wrapping paper ruled with 1-in. squares.

clamping up the frame. By temporary ears, in cabinetwork, we mean pieces of soft wood that are cut so that the grain in them runs the long way and are glued in place. The ears should have two angles of 45° each and one of 90° as shown in the sketch.

Allow the glue at least four or five hours to set. Next, assemble the entire frame, using plenty of the best glue. Test the corners to be sure that they are square and that there is no twist to the frame. Be certain that the grain in the splines runs the short way, as shown; this adds much to the strength of the frame. Make the splines a little wide at first and cut them to shape after the glue has hardened.

Step No. 4—Cleaning Up the Frame. By means of the sanding disk, clean up the corners, especially where the ears were fastened and where the splines projected. Having thus obtained the best result, you are now ready to turn to the next step.

Step No. 5—Cutting the Grooves. Cut the groove on the top and bottom edges and part way on both sides, to receive the head and bottom pieces (Fig. 26).

Fig. 24.—Cutting miters by tilting the table at 45 degrees and placing the molding on its edge.

Step No. 6—Cutting Out the Curved Designs. With the template, transfer your curved design to the wood. Next, cut just outside the lines with a jig or band saw. If you are working with a small machine, it will be necessary to place the design on both sides of the wood, to be able to work from each side.

Step No. 7—Truing Up the Edges. Use a drum sander on all of the curved edges possible; the inaccessible curves will

23.—The saw blade is mounted so that the top teeth point toward the operator.

Fig. 22.—The common method of cutting miters with the cut-off fence at 45 degrees and the table level.

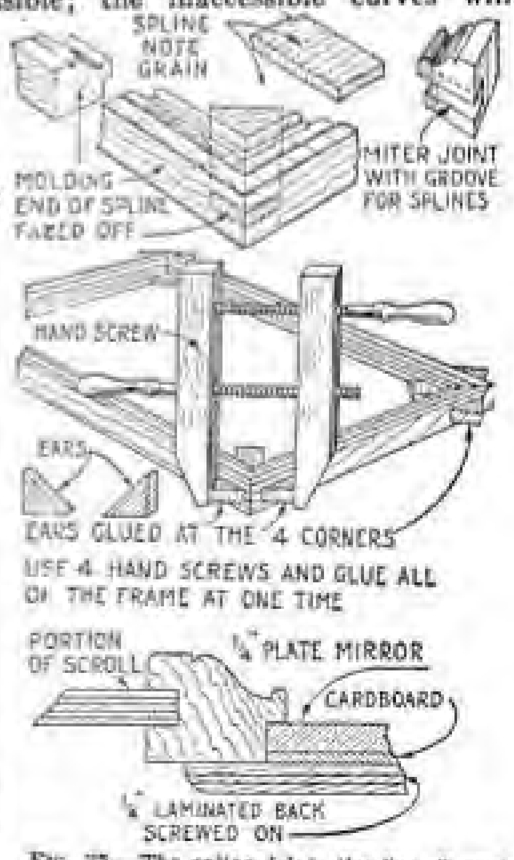


Fig. 25.—The spline joint, the "ears" used to facilitate clamping, and a cross section of the frame.

have to be cleaned up with a file and sandpaper. If you have done the sawing carefully, there will be very little sanding to do.

Step No. 8—Assembly of Scrolls. First, put plenty of glue in the groove and on the edges to be glued; then, force the various parts together. Be careful to wipe away all of the excess glue after the parts are assembled.

Step No. 9—Cleaning Up the Work. If there is any excess glue on the work, remove it with a sharp chisel. Sandpaper all of the parts thoroughly first with No. 0, then with No. 00 sandpaper. Round off all of the edges slightly.

Step No. 10—Finishing. For mahogany: Apply either a mahogany water stain powder or a prepared dye or wood stain of first-class quality. Brush on a very thin coat of white shellac. When it is dry, sand with No. 00 sandpaper. In order to fill the grain in the wood, a paste wood filler must be applied. Shellacking is the next process. Apply then three thin coats of shellac. After the first and second are dry, rub each with No. 00 sandpaper, but for the last coat use a mixture of powdered pumice stone and crude or machine oil. If you have a spraying outfit available, spray on a clear lacquer instead of the application of shellac.

For an antique finish on maple: There are two good methods. One is quite similar to the method stated above for mahogany except that an amber stain is

Fig. 26—The grooves for the head and bottom pieces are cut after the frame is assembled and clamped.

used. Since maple is a close-grained wood, no filler need be applied; the shellac will fill any small pores that may be present. The other method is to use an oil walnut stain, and after it dries rub the high-lights almost through to the bare wood with No. 00 sandpaper in order to give the effect of a worn surface. The finish then is applied as in the other cases.

HANGING BOOKSHELVES

The curved outlines of the attractive hanging bookshelves shown in Figs. 27 and 28 make an ideal problem for a more detailed study of the use of the motor-driven jig saw. The bookshelves will prove an addition to the living room

Fig. 27.—These bookshelves form an ideal object lesson in the use of the jig saw.

or den, or, indeed, may be placed in the breakfast room to hold artistic pieces of china or pottery.

In choosing the type of wood to be used, much depends on the finish. One

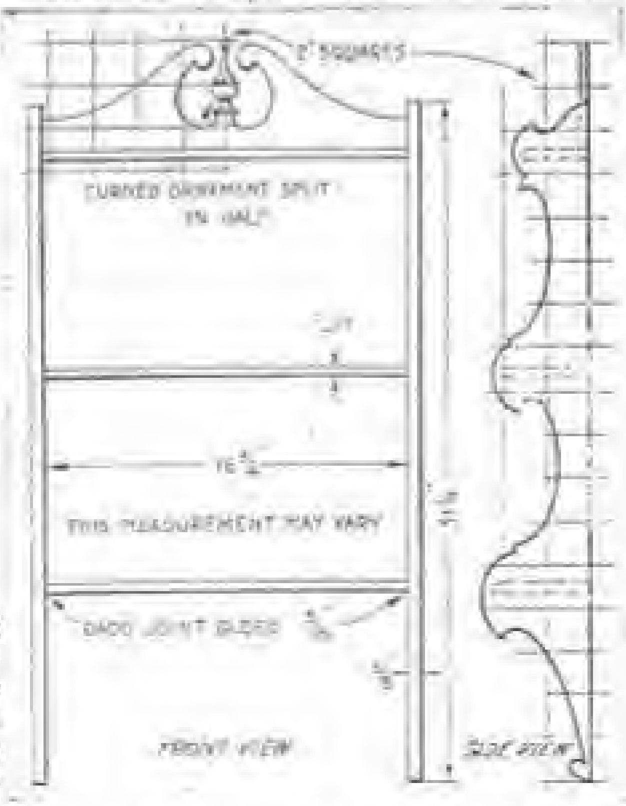
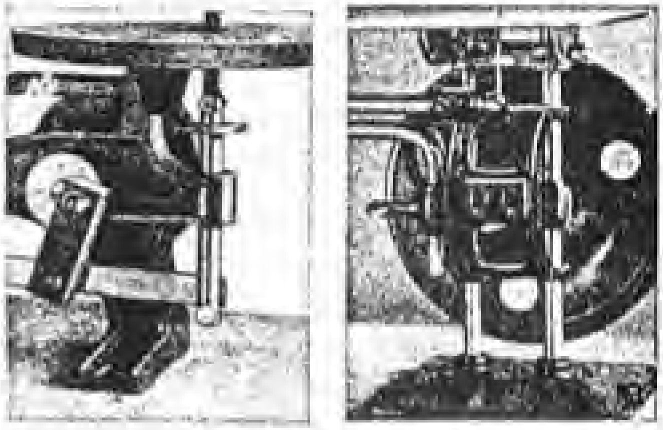


Fig. 28.—Assembly drawing of the shelves with the curved outlines which are to be enlarged by laying them out in 2-in. squares.

good choice would be a cheerful color of lacquer, agreeing with the color scheme of the room in which the shelves are to hang. Whitewood, or even wood taken from packing cases, may be used, if close grain.

Step No. 1—Making the Patterns. On a sheet of heavy cardboard 5 by 31 ¼ in., lay off 2-in. squares, and from the working drawing (Fig. 28) plot the curves. Cut along the outline with scissors. In like manner lay out and cut the headpiece on a sheet of cardboard 5 by 16 ¾ in.

Step No. 2—Getting Out the Stock. On the jointer, join all edges of the various pieces—the two sides, the headpiece, and the three shelves.



Figs. 29 and 30.—Two types of jig saw mechanisms. At the left is the crank motion and at the right the horizontal motion mechanism.

Step No. 3—Using the Circular Saw. On the circular saw, rip the pieces to the correct width and again join these edges on the jointer. Cut the ends off square, making all the shelves the same length. If you have a shaper (shaping machine), use it for putting any desired molded edge on the front of all shelves. Of course, you can easily round these edges, as shown, with a hand plane.

Step No. 4—Using the Jig Saw. Jig saws are constructed on two different principles. The one type works on a cam or eccentric, with a little handle or crank on the side of the wheel connected with the saw; and as this wheel revolves, the handle pushes the saw frame up and down (Fig. 29). The second type (Fig. 30) is constructed with a horizontal sliding block or crosshead, which moves the saw frame up and down by means of a crank mechanism.

The table of the jig saw is set to an angle of 90 degrees in order to make a square cut. Insert a rather coarse blade in the frame, seeing that the teeth point down. Now adjust the finger for holding down the work to the proper thickness.

You will have to work in from both ends on account of the length of the sides; it may even be necessary to do a little handwork if your machine will not reach to the center from both ends. It will pay you to do the jig-sawing with the greatest possible care, as it will eliminate a great deal of handwork.

Step No. 5—Smoothing Up the Edges. Use a drum sander on all possible curves. Curves that are too abrupt for the sander must be smoothed with a cabinet file, followed with sandpaper. For some of the curves, a small spokeshave will help a great deal; and on the convex curves and flat pieces, a sharp chisel is the best tool to use. A good, careful cabinetmaker tries to use the file as little as possible.

Step No. 6—Cutting the Dado Joints. Place the two sides together, being sure to have a right and ' [illegible]t side. With a try-square, mark the [illegible]ation of the three shelves. Use a groo[illegible] of the proper size and fasten this in [illegible] circular saw, 3/16 in. above the saw [illegible]le. Groove out both sides. Note that [illegible] grooves do not run to the front edg[illegible] this means that you must raise the [illegible]k up so as to start cutting at the [illegible] mark. A little handwork will be [illegible]essary at this point. The end can be [illegible]e cleaned out by boring a 1/2-in. [illegible] with a Forstner type bit [illegible]ake the holes 3/16 in. [illegible] The rounded front ed[illegible] of the shelf will fit the [illegible] perfectly. A simpler [illegible]hod, though not so good, [illegible]fastening the sides t[illegible] he shelves, is to make joints and screw the job [illegible]gether with round-headed screws.

Step No. 7—Turning the Ornament. Glue two pieces of stock together with a sheet of paper between, making a piece 1 1/2 in. square, and turn the ornament in the lathe. The purpose of the paper is to allow the splitting apart of the two pieces after the turning operation is completed.

Step No. 8—Sandpapering. Using No. 1/2 sandpaper, thoroughly sand all parts. Repeat with No. 0 sandpaper.

Step No. 9—Assembling. Make a trial fitting between clamps to make sure that all joints fit. Mark the companion pieces as they are to go together. Use plenty of the best glue and clamp the work tightly. Clean off all of the excess glue by throwing fine sawdust over the glue that oozes out of the joints and then scraping it off at once with your chisel.

Step No. 10—Cleaning Up. After allowing the glue to harden for at least five hours, carefully remove any excess glue that may still remain. Then sandpaper with No. 0 sandpaper, rounding all sharp edges. The piece will then be ready for the finishing operation.

Step No. 11—Finishing. Apply one coat of thin white shellac to all parts. When this is hard and dry, sandpaper thoroughly with No. 0 sandpaper. Now apply the desired color of lacquer, using a sprayer if available.

FIG. 31 [illegible].—The table of the jig saw can be tilted to any angle, making it easy to cut an accurate bevel.

FIG. 32 [illegible].—The tension of the blade in this machine is [illegible] by working a lever at the top.

SMALL BAND SAWS

Another useful machine, although not illustrated, is a small band saw. It is especially helpful for curved cutting like that required in making a graceful chair. After a little practicing has been done, the back legs of a chair can be sawed out almost as easily as a woman sews a seam on a sewing machine.

Many woodworkers who have had some experience in the use of band saws do not know how to twist the saw blade into three loops, which is the usual way of storing or shipping them. Hold the saw in the palms of your hands, teeth pointing outward, and allow a portion of it to rest on the floor. Let the saw form an ellipse. Place your feet on the blade and give the hands a twist inward so as to make the teeth above the feet point inward; drop the saw blade and you will find it in the three loops.

In putting the blade in place, lower the top wheel as far as it will go or sufficiently to allow the blade to be slipped over the wheels. Place the saw on the top wheel first and see that the teeth point forward and down. Then work it on the bottom wheel, revolving the wheels by hand. Next adjust the upper wheel, working the handwheel with the left hand and feeling for the tension with the right hand.

Revolve the wheel a dozen times to see if the saw blade is running in the center of the wheel rims. If it does not run true, it is an easy matter to tilt the top wheel in either direction by turning the adjusting knob in the center of the top wheel. When the blade runs true, see that the guides are supporting the blade.

The table on most band saws can be tilted at an angle when necessary by a few turns on the machine screw under the table in the back part of the machine. See that the table is firmly fastened before starting work. Set the saw guide to the proper height to allow the wood to pass under.

There are only a few safety precautions to observe in running a band saw. First of all, have a good guard on the machine. Always spin the saw around a few times by hand to make certain that everything is as it should be. Do not allow anyone to stand at the side of the

FIG. 33.—Some types of portable jig saw motors can be easily dismantled and used as electric hand drills for drilling screw holes, making holes for inserting a jig saw, and other light work.

machine while it is running. Be sure to keep the machine well oiled at all times.

The actual sawing on this machine requires little practice. No matter what happens, never back out of a cut; to do so may pull the saw blade off. If you get off the line, do not twist the wood but pull it towards you and start that portion of the cut over again.

The amateur woodworker will soon master the use of the band saw if he follows the directions carefully and practices on some of the furniture designs.

CATCHING SAWDUST

With some types of small combination woodworking machines it is possible to use a bag for catching the sawdust from the circular saw and prevent it from being scattered about the room and over the clothes of the operator. Figure 34 shows a saw with a sawdust chute which serves a double purpose—to guard the blade under the saw table

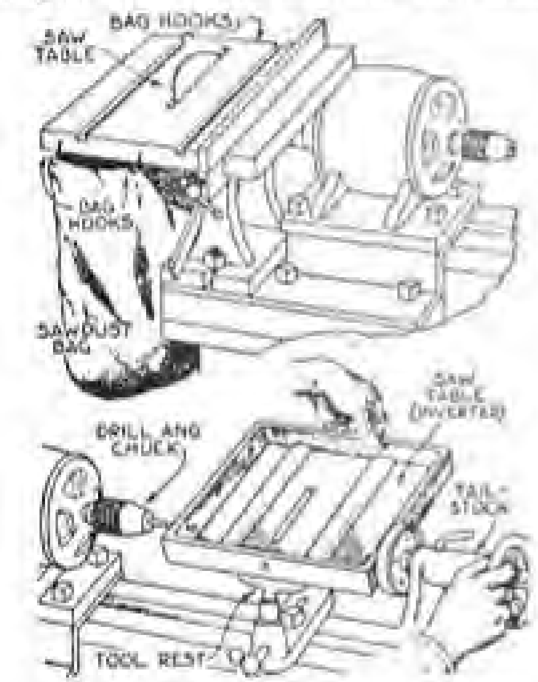


FIG. 34.—The sawdust bag in place (upper view); and how the holes for the hooks are drilled.

and to catch and discharge the sawdust in one direction. A sugar bag lining is slipped under this chute and fastened to the sides of the saw table with four S-hooks.

The S-hooks hang in holes drilled in the sides of the saw table. How these holes may be drilled is also illustrated. The tool rest is adjusted to support the saw table at the right height and the work is then fed to the drill by means of the faceplate mounted on the threaded spindle of the tailstock.

A revolving circular saw causes considerable wind, and it is this air in motion which whirls the sawdust about the room. A sugar bag lining acts like a vacuum cleaner bag, for it allows the air to escape but catches the dust. In arranging a bag about a saw that is not shielded under the table, there may be some danger of the bag's becoming entangled in the whirling saw. This should be carefully guarded against.

HOW TO REPAIR FURNITURE

THE patching of wood is an art. Every handy man has frequent occasion to practice it. When done artistically, it is a credit to the mechanic; but done slovenly and crudely, it may be worse than the original defects which it replaces.

Patching, as described here, is for the purpose of preserving parts of valuable antique furniture, and, as the patches add to the percentage of new material in the piece, they should be as small as possible. The same principles, of course, apply to the patching of modern furniture and interior woodwork or trim of the better kind.

If a defect is caused by windshake, insert dowels across the grain, if possible, and patch the surface; if doweling is not possible, a dado (groove) may be cut across the back of the board and a spline or slip of wood inserted and glued.

If the blemish is a nail or screw hole, patch it. Don't use plugs, as they show end grain, which is undesirable in face work. Don't use bungs or face-grain plugs put into holes bored with an auger bit; this is all right in rough work, which can be planed after the plugs are set, but in furniture repairing the spur of the bit will tear the wood enough to show an ugly circle in the finished work.

In nearly all old handmade pieces that have drawers, the parting rails between the drawers are from two to five times as wide as is really necessary. Enough material usually can be obtained from this extra width to do all the patching required; this wood will always match better than new wood. In patching fine furniture, obviously we should make the inserts of material which matches the wood and not be content with fillers, putties or waxes such as are satisfactory on less important work that is to be painted and not left in the natural color of the wood.

PATCHING OR "GRAVING"

Patching wood is commonly called "graving"; the name comes from the fact that a grave is cut out for the patch. The edges for the patch and the side of the grave should be slightly beveled as illustrated in Fig. 1. The patch should be slightly thicker than the grave is deep so that when the clamps are removed the patch will be higher than the face of the work. It can then be dressed down flush.

To lay out patch and grave, a template should be made from cardboard. Lay the template in place and mark the grave with a sharp pointed knife, not a scribe, which will tear the wood. To lay out the patch, use the same template, but mark with a pencil. In cutting out the grave, work to the knife line; in cutting the patch, leave the pencil mark on.

In doing graving, chisels with extra long bevels should be used. Bevel edged chisels are the best, for they can be used in closer corners than square edged ones.

Graving should never be done at right angles to the grain of the wood. Several forms for patches are suggested in Fig. 1. *A* is wrong, as it crosses the grain at right angles; the others are satisfactory. There is no limit to the number of designs possible. After some proficiency is acquired, patches may be made in the

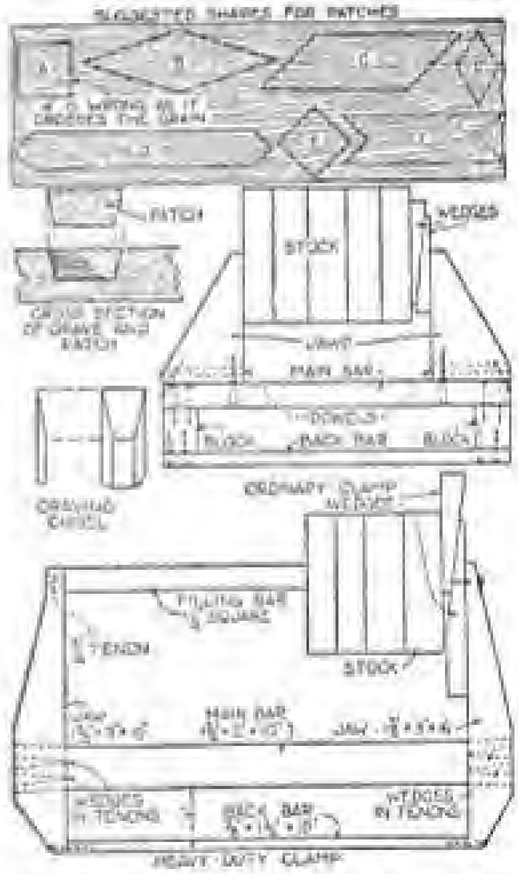


FIG. 1.—How to make patches, a chisel for cutting recesses, and two homemade clamps.

shape of hearts, shamrocks, the leaves of different trees and almost anything the imagination may suggest—in effect, fine inlay work. The more complicated designs should be made of veneer about 1/28 in. thick.

An aid in graving is boring out the center of the grave with wood bit and bit gage set to the proper depth; this gives the grave a flat floor. If a commercial bit gage is not obtainable, one can be improvised as shown in Fig. 2. It is a block of hardwood 7/8 by 7/8 by 1 1/2 in., with a 5/16-in. hole bored about 5/8 in. from one end and a 1/4-in. hole in the center at right angles to the 5/16-in hole The block is split through the first hole and across the second. Hold the two pieces over the bit shank with a 1/4-in. stove bolt, nut and two washers. Insert a piece of wire, bent back at the lower end to prevent scratching, between the two blocks and tighten the stove bolt with a screw driver.

Use a good grade of glue for patching. Apply it to both grave and patch. Insert the patch and clamp it in place with considerable pressure.

A block of wood should be placed between the clamp head and the patch to distribute the pressure evenly. Allow at least three hours for the glue to set before removing the clamp.

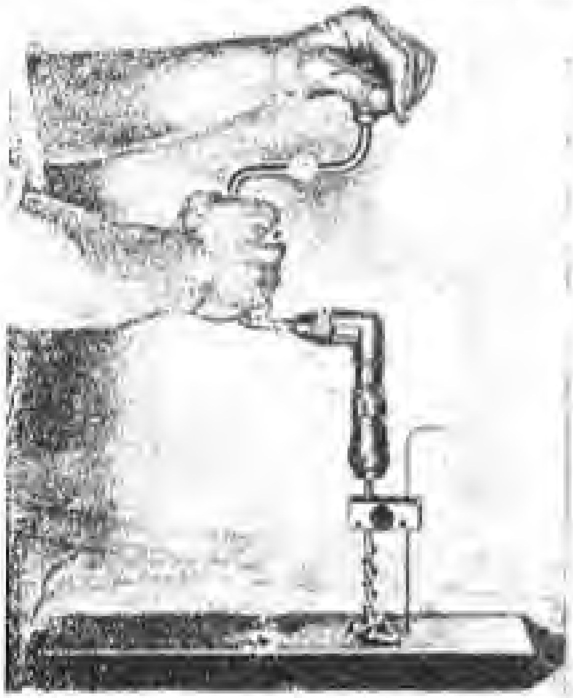


Fig. 2.—Using a homemade bit gage for boring out the recess or "grave" for a large patch

Although band screws or iron C-clamps are ordinarily used for applying pressure, it is a simple matter to make clamps in various sizes as shown in Fig. 1. The dowels through the head and tail blocks in the smaller clamp should be near enough to the end for the screws to pierce them; the screws will hold better than if driven only into the end grain of the jaws. The filling piece used in the larger clamp may be removed by drawing the pin through the tenon. Several filling bars of different lengths may be made so that the clamp can quickly be adjusted to the size of the work in hand, as illustrated in Fig. 3.

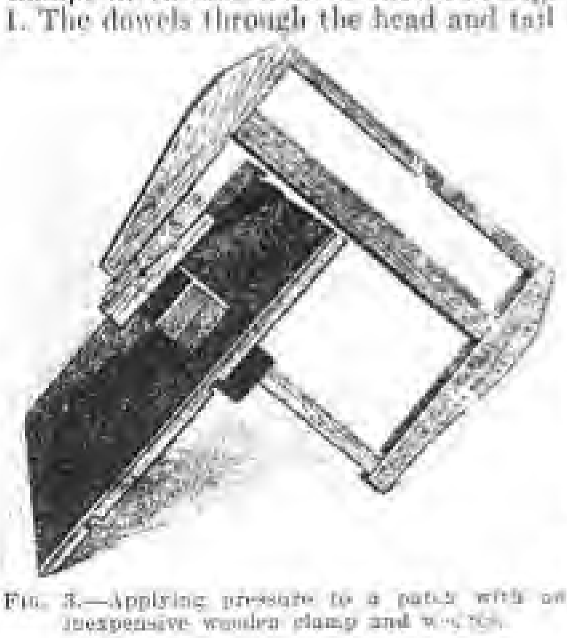


Fig. 3.—Applying pressure to a patch with an inexpensive wooden clamp and wedges

PATCHING VENEER

Many have the mistaken idea that all veneered furniture is modern. Veneering was done by Chippendale, one of the first of the famous old furniture masters. He did not veneer his furniture to deceive the purchaser and make him believe it to be made of solid wood, but because it was possible to obtain more beautiful grain and a wider range of figures in veneer.

Most veneer, it should be borne in mind, is not sawed, but cut from the log with knives as the log revolves in a huge lathe. The veneer comes from the log like ribbon from a roll and reveals the full beauty of the wood figure. A visit to any well appointed museum will make it clear that many valuable pieces of old furniture are veneered.

This being true, we are justified in going to great lengths to preserve all the original veneer of antique furniture, especially as it is more difficult to give veneer an artificial appearance of age than it is to antique solid boards.

In veneered furniture the veneer is the original surface, so any veneer which is renewed is considered just that much new material, in spite of the fact that the wood beneath it is old. If a veneered board should be replaced by a solid board, that much of the original construction is regarded as having been altered and the value of the antique is accordingly reduced.

You may find pieces in which the material was mahogany but which are also veneered in mahogany to obtain the advantage of a more decorative grain. In some cases the veneer may look hopeless, but to retain the originality of the piece you can almost always devise ways and means of preserving at least ninety percent of the veneer.

The veneer frequently will be found in small splinters, narrow strips, wide strips, small and large pieces. For the piece to retain its value, this must all be put back. A piece in this condition, provided it is worth restoring, should be sent to an expert; the repairing is so difficult that the beginner, without experience or equipment, cannot hope to do more than make bad matters worse. Ordinary work of this kind, however, is no more difficult than other common repairs.

To replace pieces of veneer, lay them flat, glue side up, and scrape off all the old glue. Do not wet the veneer, as it will expand to a greater size and be too big for its original place. Remove all old glue from the surface on which the veneer is to be replaced and make all preparations for clamping. Use cold glue, that is, liquid glue; this work requires speed, but it calls for more speed with hot glue than with cold, as the veneer, being very thin, will expand much faster when hot glue is used. Apply a coating of glue to the board only, not to the veneer. Put the veneer in place and clamp quickly.

Every gluing job is worth exactly what the clamping makes it worth. The amount of glue used has not as much to do with the quality of the joint, as a very thin coating of glue in a properly clamped joint is better than many times the amount of glue in a joint that is improperly clamped. A positive glue joint, made with a good grade of glue, may have the fibers of the wood broken all around it, but the joint itself will not part or break, unless subjected to dampness or conditions such as glue, from its very nature, cannot withstand.

Fig. 4.—When furniture veneer is damaged or has become loose, careful patching or regluing will usually repair it.

Blisters in veneer are caused when the glue gives way in places and air pockets form under the veneer. To heal a blister is a simple operation. With the point of a very sharp knife, make an incision at or near the side of the blister where the glue still holds, and lift the edge of the blistered veneer. Be careful not to make the incision too far from the side where the glue still holds, or the edges will lap when clamped, and

I would much rather have the blister to contend with than the lap. Pour enough vinegar in the blister to fill it up, replace the blistered veneer in its position, place the work in such a position that the vinegar will not leak out, leave for about eight hours, and remove any vinegar that has not been absorbed by the wood. Although this treatment will not actually remove the old glue, it will insure the adhesion of new glue.

Thoroughly dry (by heat) the blister and adjacent wood and make all preparations for clamping. Again lift the edge of the veneer, introduce enough glue to cover well but not too heavily the core side of the joint, and spread the glue with a thin, flat tool such as a long-bladed putty knife, spatula, steel kitchen knife, or an old corset rib, which is best of all. Replace the lifted edge of veneer, cover with several layers of paper, and set the clamps with uniform pressure. When the clamps are removed and the paper scraped off, there will be no blister; and if the incision followed the grain exactly, it will be invisible.

When patching small defects in veneer, the templet method should be used, as explained previously, but both the "grave" and the patch should be marked out with a sharp-pointed knife and worked exactly to the line. Cut the patch with shears as if cutting paper (Fig. 4).

WARPED AND DAMAGED TABLES

Antique drop-leaf and gate-leg tables are so popular and good ones are so hard to get these days, that it pays to do all the patching and repairing necessary in order to save any promising old table. With care and patience one can restore nearly any piece to its original condition.

Let us assume that the table we are working on is a gate-leg table with "rule joints"; it has rectangular leaves and three hinges to a side. The hinges were put on with blunt-point screws, which have been rusty for so many years that the wood around them has rotted away and made ugly black spots clear through to the face side. The hinges have broken loose, carrying away a part of the rule joint; the leaves are badly warped; the top has been nailed and renailed to the frame; the frame is loose and "rickety," and nails have been driven through the mortise and tenon joints; half of one leg has been split off and is missing.

Hopeless? Well, it is about ready to be consigned to the basement for kindling wood, but it is an antique and belonged to our great-grandmother. If possible, it must be restored to usefulness.

First we must get that warp out of the leaves and top. Take them off the frame, remove the hinges, draw all nails and screws, and remove the old finish, if any, so the wood will absorb moisture. Use whatever facilities you have for getting the boards well soaked with water; if you can steam them, or get them steamed, that is best. Another method is to wet thoroughly a quantity of sawdust or shavings, or a mixture of both, and spread it some two inches deep on the first board. Lay on the second board, cover it similarly, and do the same for the third and any others. Place convenient weights, such as bricks, on the top board and keep the sawdust or shavings wet (Fig. 5). It will take several days at least to get the boards well soaked and probably two weeks in cold weather.

Meanwhile we must prepare a clamp with which to draw the top and leaves straight. One can be made of rough

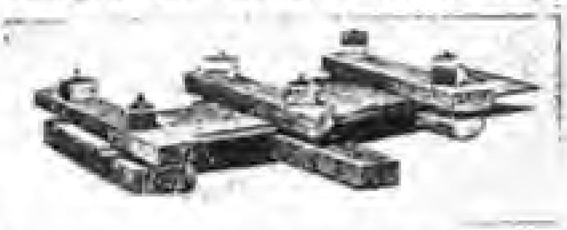


FIG. 6.—Clamps made of rough "two-by-fours" for drawing water-soaked table tops or leaves.

"two-by-fours" and half-inch bolts, with a nut and two washers to each bolt. (Fig. 6). Bore the wooden pieces in pairs.

Now let's get to work on the frame. Take out all nails. If the frame is pinned with wood pins, back them out with a punch. Splice the broken leg with a piece of wood that matches as well as possible. Make a long, slanting splice. Clean all dirt and glue out of and off the old joints. Reassemble the frame with glue in all joints. Insert shims or wedges where necessary to make close fits. After the glue has set, remove the old finish with paint and varnish remover, and apply a coat of boiled linseed oil and turpentine, equal parts. Set the frame aside until the oil is dry.

When satisfied that top and leaves are soaked sufficiently to prevent their splitting when clamped up, put them in the clamps and run all nuts down hand-tight; then start at one corner and go all the way around, giving each nut a couple of turns. Continue until all the work is clamped straight. Use enough clamps so that they will not be more than 12 in. apart, center to center. Place the clamped-up work in a warm, dry place and allow it to dry thoroughly.

In drying, the boards will shrink considerably. The clamps exert most of their pressure on the edges, and when the boards shrink, the shrinkage will occur at the point where there is least pressure, or the center of the boards. To prevent this shrinkage from splitting the boards down their centers it is neces-

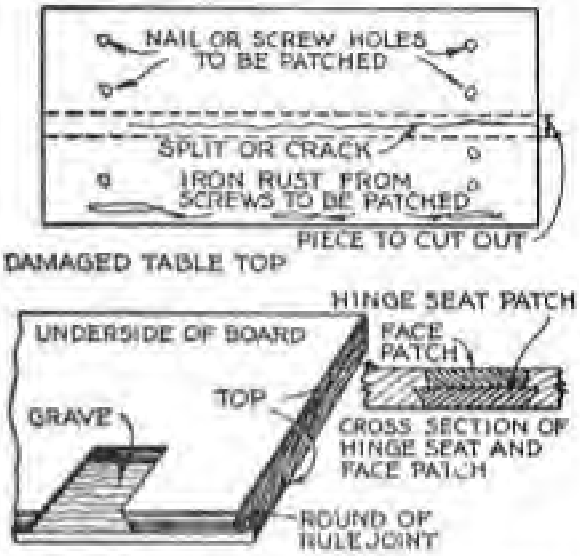


FIG. 7.—Typical table top defects, and an expert's method of patching the old hinge seats.

sary, in a moderately warm room, to loosen the clamps about twice a day. This allows the boards to shrink naturally. When more than one board is clamped up at a time, narrow strips of

FIG. 5.—Repairing antique furniture is one of the most interesting and profitable of hobbies. Even badly warped boards can be restraightened in time by the application of moisture and pressure as shown at the left.

wood should be placed between the boards at each clamp; the air space allows them to dry more quickly.

When the top and leaves are thoroughly dry, take them from the clamps. They will have flat surfaces once more, but if there are any cracks or splits that cannot be glued up successfully, remove them by ripping out a piece wide enough to include the defects, as above. Joint (plane) the new edges, rip and joint a piece of new material wide enough to replace the part removed, and glue up the boards into the original shape and size.

Leaves and top are now ready for patching. Patch all nail and screw holes as suggested before. The old hinge seats, however, must be patched all the way through, and, as a good job cannot be done where the grave for the patch is cut all the way through the board, these must be patched from both sides. The patch on the underside must come all the way to the edge of the board so as to renew the damaged part of the rule joint. In Fig. 7 is shown a satisfactory method, the grave for the face patch being cut through to the hinge seat patch. The hinge seat patch is allowed to project out past the edge of the leaf or top. After the glue has set, trim the patch to conform to shape of the rule joint of which it is a part.

All patching completed, you now have new wood in which to cut new hinge seats. Apply new hinges and resurface the face of the work with sandpaper and fine steel wool. Oil the wood as you oiled the frame. The final finish is discussed in Chapter XIII.

A word of warning: Be sure that the top is not narrower than its original width or the leaves will stand out at an angle, giving the table a hoop-skirt appearance. This always can be avoided by inserting a strip of suitable width in the top before gluing the boards together, or, if this is not desired, by cutting back slightly the shoulders of the tenons on the end pieces of the apron.

WHAT IS AN ANTIQUE?

Before continuing the repair of old furniture; it might be well to explain what constitutes an original antique. It is, in a general way, anything at least 100 years old and ninety percent original. Our Government recognizes as antique, and allows to enter the country free of duty, anything shipped from abroad that can be proved, to the satisfaction of the customs officials, to be more than 100 years old.

Collectors of antiques who are particular in regard to their purchases are very careful to buy nothing that is more than ten percent restored; this rule applies to American antiques as well as foreign. So, according to this standard, a piece of furniture 150 or even 200 years old, if more than ten percent renewed with material not in it originally, is not entitled to be called antique.

The original size and shape must be also considered. One may have, for example, a corner cupboard or a secretary with a straight molding at the top and plain feet under it and replace the straight molding with a broken arch top, and the plain feet with more elaborate ones. The piece in its original form may have been centuries old, and probably the changes and replacements made do not affect more than two or three percent of the whole. But the design has been changed, so in its new form the age dates from the time the changes were made, and to all intent and purposes it is a secondhand piece of furniture.

Anything in which the design or size has been changed is not an antique, not even 100 years or more after the changes are made, for it can never again be original. To substitute wood panels for glass, or glass for wood; drawer handles for knobs, or knobs for handles; to change the number of panes of glass in a door, say from eight or ten to thirteen—any of these slight changes destroy the originality of an antique and prevent its ever becoming valuable as an antique.

One supposed connoisseur bought a very fine old snake-foot round table (commonly called candlestands by those who don't know the difference). Two of the feet were split, but could be glued back and the piece would have been 100 percent original. It was undoubtedly many years past the 100 mark, but the lady insisted that the repair man make two new feet and discard the damaged ones.

He went ahead according to instructions, but before he had progressed far the lady returned to say that she did not like the design of the turned post. Couldn't he make her a new post, turned to her own design? Sure! So a new post was turned, but then she decided the top was not large enough for the spread of the feet. Couldn't she have a new top a little larger? She got it! The table can't be regarded as a year old yet, but the lady boasts of her "antique" candlestand she "bought up in the mountains."

The repair man had more than ninety percent of the table left on his hands. He made one new foot, repaired the two damaged ones, reassembled the table, and sold it as an original antique table, which it was, without question.

All this is to warn against changes which destroy originality. You can't possibly have antiques made to order. Of course, where several are missing and can't be duplicated, wood knobs may be changed for glass knobs and vice versa, or one design of handles may be changed for another, but wherever possible to do so, every part of the piece that is original should be preserved, although to preserve it may take much more time and work than to replace it with new material. The size and every detail of design should be preserved, regardless of the desire to change it.

REPAIRING DRAWERS

In repairing a piece with drawers, where the drawer slides have worn beyond their usefulness, they may often be used by turning them end for end and putting the bottom side up, or shifting them from one end of the drawer to the other.

FIG. 8.—How a badly worn drawer may be built up by gluing a strip to the bottom.

The end of the drawer being worn down so that the bottom of the drawer chafes on the parting rail, the drawer end should be built up by gluing a strip to it, and then refitted to the opening. Figure 8 shows a drawer repaired in this manner.

Figure 9 is a clamp made from 1 by 3 in. oak (crating lumber). It may be made for a few cents, but is worth many dollars. It can be of any size to suit the particular needs of the maker, so no dimensions are given. This was used to clamp up the drawer end in Fig. 8, but several other ends were clamped at the same time.

In Fig. 10 is shown the same clamp with the work glued up in it. Note that irregular work may be glued up, and that pressure is exerted by driving pairs

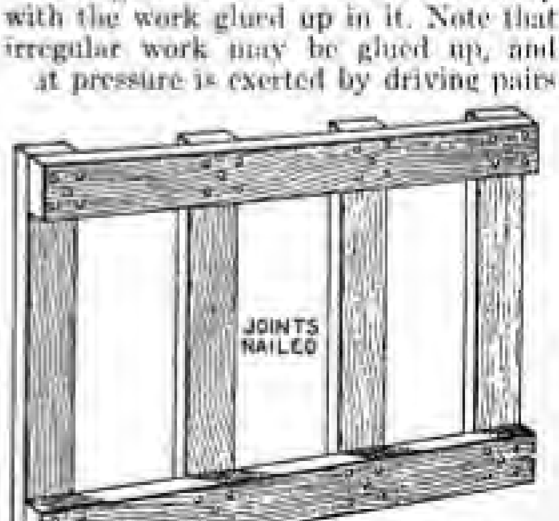


FIG. 9.—A frame for clamping such as those illustrated in Figs. 10 and 11. It is made of crating lumber.

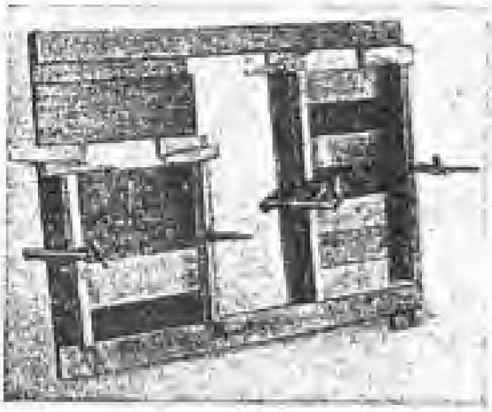


FIG. 10.—A framework of rough lumber used for clamping furniture parts. Note the cross members which keep the work flat. They are held in place with C-clamps.

of wooden wedges between one side rail and the work. For narrow work, part of the clamp is filled in with pieces of board. The wedge away from the work is set in place and nailed to a crosspiece

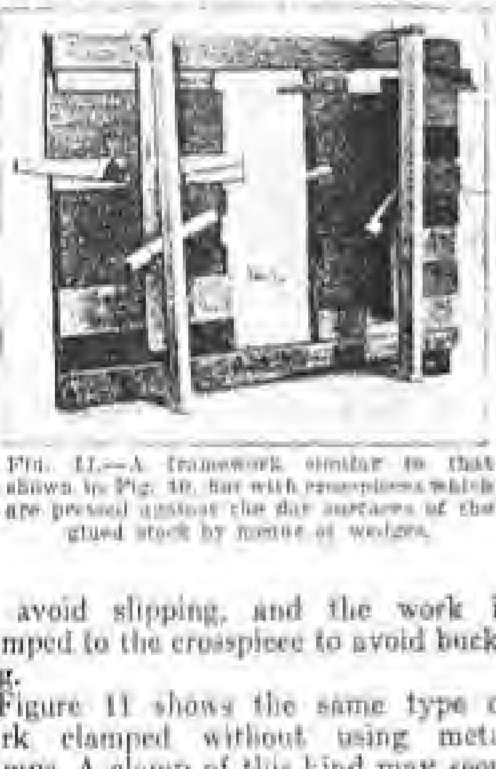


FIG. 11.—A framework similar to that shown in Fig. 10, but with crosspieces which are pressed against the flat surfaces of the glued stock by means of wedges.

to avoid slipping, and the work is clamped to the crosspiece to avoid buckling.

Figure 11 shows the same type of work clamped without using metal clamps. A clamp of this kind may seem slow and unwieldy to one who has never used it, but it is not. They save time and money, especially in the home workshop.

HINTS ON NAILING

Old dovetailed joints will become loose and "rickety." These should not be nailed until every joint has been disassembled, cleaned of accumulated dust and dirt, and glued. If the old joints are loose enough to require nailing as well as gluing, use cut nails to a length not more than three times the thickness of the board being nailed. Cut nails hold better and longer and also drive straighter than finishing nails.

Where nails are found to have been driven in the face of the work, they should be removed without marring the piece, if possible. Some may be backed out with a nail set, others removed with a claw hammer or pincers. If this cannot be done, they should be set deep enough to allow a small patch to be placed over them.

All woodworking mechanics know that nails should not be driven in the face of good cabinetwork, if it can be avoided. Wherever possible, face material should be fastened from the back with screws, but where it becomes necessary to do face nailing, secret nailing should be employed. One method of secret face nailing is as follows:

Drive a chisel of medium width and with an extra long bevel and razor edge into the wood about 1/8 in. deep at an angle of about 45 degrees to the face of the work. Lift a wedge-shaped piece of the wood high enough to allow a nail to be driven under it. Be careful not to tear the piece out. Remove the chisel and drive the nail in the incision; put a little glue in the cut and press the piece back in place.

If the chisel has been properly ground and the work carefully done, no clamping will be necessary. With ordinary care this kind of nailing may be done in the face of fine work and be invisible in the finished job, but it requires a certain amount of skill, therefore it is good policy to keep in practice on scrap material.

HOMEMADE BAR CLAMPS

Another inexpensive but valuable clamp that the home worker can make for himself is shown in Fig. 12. Every

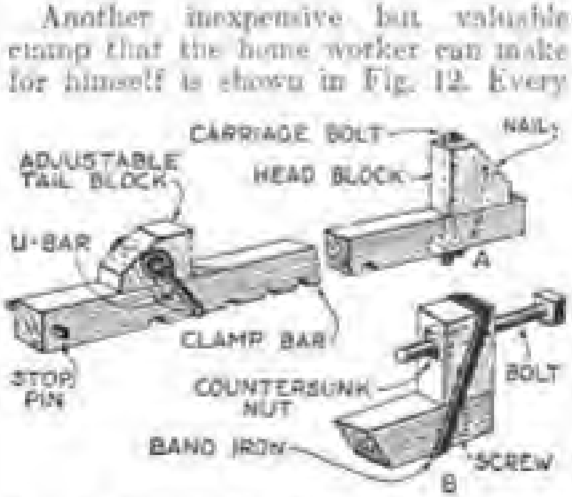


FIG. 12.—How to make inexpensive wooden substitutes for regular cabinetmaker's clamps.

shop needs at least three clamps of this kind. They may be made in many sizes, but a good heavy-duty bar is of 1¾ by 2 in. stock. Yellow pine, maple, and oak are excellent materials to use for the construction of this kind of clamp.

The head block construction shown at *A* is for the use of wedges, but the second method of head block construction, indicated at *B*, is for a bolt, which passes through a countersunk nut. If the second method is used, the hole for the bolt should be the same size as the bolt, so as to keep the bolt in a straight line with the clamp bar.

Clamps of this kind may be made with 4 by 4 in. bars and set on legs the same as saw horses. These kinds of clamps are for the heaviest of work.

UPHOLSTERING OLD CHAIRS

Discarded chairs, whether modern or antique, can be salvaged in many cases by replacing the upholstery or by substituting upholstery for rush, splint, or other types of seats.

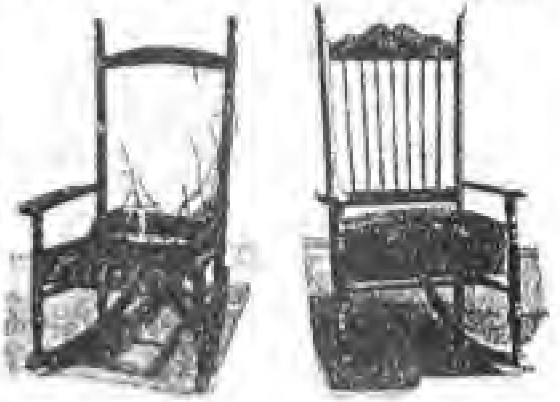


FIG. 13.—If the chair at the left could be made into as comfortable a one as that shown at the right, is any chair without hope?

It is surprising what can be done with an apparently hopeless-looking chair. Some can be made fully as good as new; others, less attractive in their original design, can, nevertheless, be made comfortable and serviceable for use in a spare room, a child's room, or other room where extra seats are needed.

The chair shown at the left in Fig. 13 was junked until the writer salvaged it to serve as an illustration of what can be accomplished in repairing a particularly poor specimen. At the right is the same chair with all of the old willow removed and the old back replaced by a "slat and spindle" back. The new seat is of the bar and spring type, pieces having been added to form an apron to prevent the springs from showing under-

FIG. 14.—The bar and spring method of upholstering a seat. Note how the springs are tied.

neath. Note in Fig. 14 how the springs are tied to keep them in position.

In Fig. 15 is shown a very important part in the reconstruction of seats. Two layers of the best grade of burlap have been stretched over the springs and tacked to the apron. A 3/4-in. wooden rod is nailed to the top of the apron to form a "roll," which holds the seat filling in position and retains the shape given the new seat. This "roll" also may be made with rope or with flax tow twisted into a roll and similarly nailed.

The next step is to fill the seat with a good grade of flax tow. There are a number of materials with which seats may be filled, but tow serves the purpose very well. Indeed, few fillings will remain in good condition for so many years of hard service as tow.

Fill the seat well and evenly; don't skimp the filling. The reason for all chairs is the seat, which should be comfortable.

Three pounds of tow were required to fill the seat as shown in Fig. 13. Stretch burlap or any kind of cloth over the filled seat and tack it to the apron; this gives the seat the form desired.

Now is the time to clean and refinish the chair. If this part of the job were the first to be done, it would more than likely have to be done over again after so much handling. The chair illustrated originally had a clear varnish finish; it was refinished with mahogany varnish stain. Figure 13 shows it a better and more comfortable chair than when new, although with this particular kind of chair it is hard to decide where it belongs; it is being used now in a bedroom.

After the job is refinished, the final covering is put on. A good layer of sheet

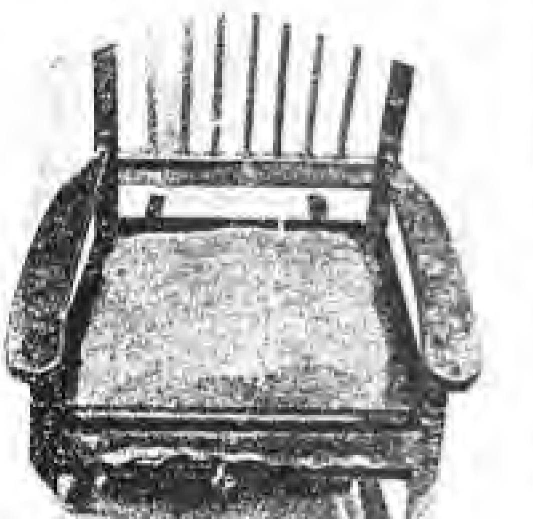


FIG. 15.—The springs are covered with two layers of burlap and a rod is added to form a "roll."

cotton must be spread over the cloth which covers the filling, and all irregularities filled out with cotton. Then the upholstering material is stretched over this and tacked underneath.

All upholstering over springs is done in a similar manner. In many cases the bar and spring method is replaced by webbing and springs, the webbing being tacked to the underside of the framework, as shown in Fig. 16. Coil springs are sewn to the crosses, then tied as before. The bar and spring method is more durable and should be used when possible.

In many old pieces where the wood has been badly weakened by tack holes, the webbing is replaced by bars and

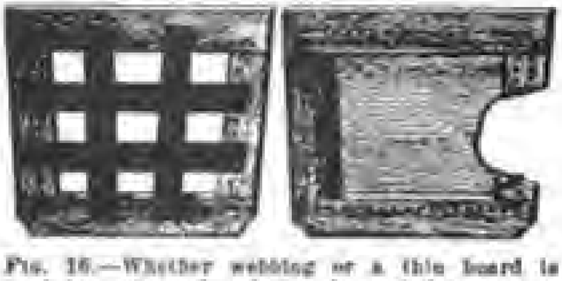


FIG. 16.—Whether webbing or a thin board is used to make a foundation for upholstery on a flat seat frame, it is applied on the underside.

springs. As each bar is suspended from the top of the frame, it is not likely to give way.

Springs should be used with webbing only where the seat frame is of the apron type and forms a box in which to set the springs. At the left of Fig. 16 is illustrated the flat type of seat, in which burlap should be tacked directly over the webbing, then the seat filling applied, and the upholstering completed as described.

At the right of Fig. 16 is shown another and more economical, only not quite so comfortable, a way of renewing worn-out seats. In this instance a board of suitable size and thickness is nailed or screwed to the underside of the seat, then filled and upholstered as just suggested. The dotted line shows the edges of the board.

Figure 16 represents excellent ways of renewing cane, splint, or rush seats. Anyone can make this type of upholstered seat, but it is almost impossible to find a man who can or will renew the seats as they originally were.

Any of the materials whose use is recommended here may be obtained from upholsterers and repair men, as, ordinarily, they carry them in stock. Pieces of upholstery materials may also be found at the same places. Many upholsterers stock a goodly supply of samples and remnants of tapestry, velvets, velours, mohairs, plushes, imitation leather, and other materials. These are kept for sale and may be had for from one twentieth to one quarter of the regular price a yard.

There is one kind of upholstering which no one should ever try to duplicate; and when a piece which has this kind of upholstery on it is gone over, it should be changed to plain filling. This kind is called "biscuit tufting"; it consists of wads of tow or other filling with the covering drawn down between the wads with buttons. This method not only catches dirt and dust, but it holds all it catches.

Upholstering, as such, is actually a trade in itself; for those who have had no experience at all, a visit to some repair shop might prove of value. Repair men as a rule are genial fellows. They are usually willing to show others how to do anything they can do themselves.

RESEATING A CHAIR WITH CANE

The materials and tools necessary to reseat a chair with cane webbing are as follows:

Cane webbing, either open or close woven; splines, preferably of reed, if the groove in the chair is curved; glue, and a sponge or cloth, and water.

Machine-woven cane webbing may be obtained in either open or close weave, in various widths by the running foot, and in several sizes of canes and meshes. Open-woven cane webbing of "fine-fine" cane is the kind and size generally used for reseating chairs.

Splines are narrow wedge-shaped lengths of reed or wood. They are forced into grooves with the webbing, and their function is to hold the cane securely in place. These are sold in lengths of about 10 ft. each and in three sizes. The medium size should be used with fine-fine cane webbing.

The tools required are a mallet or hammer; 1/8-, 1/4-, and 3/4-in. chisels; wooden wedges (to be made); a pair of heavy scissors or tinner's snips, and a jackknife.

To prepare the seat frame for caning:

1. Cut off the webbing with a knife next to the spline. 2. Remove the spline with chisel and mallet (see Fig. 17, A). 3. Clean out the cane ends and glue with a chisel. 4. Wash the frame with soap

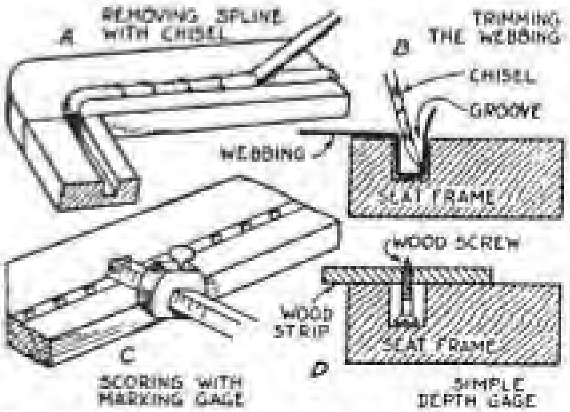


FIG. 17.—Steps in removing a spline, cutting the cane, and marking and testing a groove.

and water. Scrape the inner surface of the frame if necessary.

Next prepare the materials for use as follows:

1. Make about five wedges of 1/4-in. hardwood in several widths varying from 1 to 2 in. Taper them at one end to 1/8 in. in thickness.

2. Lay the webbing over the frame and with scissors or snips cut the piece so that it extends over the groove about 1 in. all around.

3. Soak spline and webbing in water until thoroughly pliable. Warm water will speed the softening process.

4. Fit the spline loosely in the groove, if the groove is a curved one, and cut it to length. Make the joint at the back of the frame. If the corners are angular, cut miters on the splines.

The actual caning of the seat involves these steps:

1. Place the webbing over the seat frame, allowing the parallel strands of cane to run parallel with the front edge of the frame. Drive the webbing into the front groove with a wedge. Let the wedge remain.

2. Drive the webbing in with a wedge in the opposite groove.

3. Repeat the process with two more wedges at the other two grooves.

4. With another wedge force the webbing in the groove entirely around the frame. Remove the fixed wedges as the work progresses.

5. Cut off all ends of the webbing with a chisel in the bottom of the groove at the outer corner (see Fig. 17, *B*).

6. Run glue into the groove and distribute it over the cane and side of the groove.

7. Drive the spline in with a mallet, protecting it with a block of wood. Be careful that the curved edge of the spline is not driven below the surface of the frame (Fig. 18).

To finish the cane:

1. Sponge off all excess glue.

2. When the webbing is nearly dry, the hairlike projections, if any, may be removed by passing the webbing over a gas flame. Be careful not to burn the cane.

3. When the cane webbing is to be left a natural color, it will look better and last longer if it is given a coat of tough, elastic varnish.

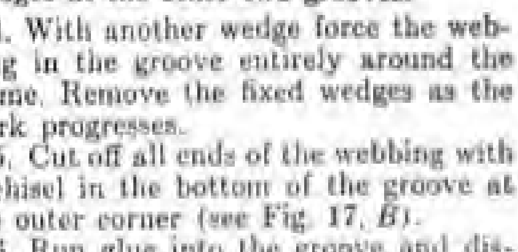


Fig. 18.—A corner of a seat frame which shows webbing trimmed at *A* and spline inserted at *B*.

When hand-woven seats are to be replaced with machine webbing, the process is as follows:

1. Cut off the old seat with a knife, clean out all ends of cane from the holes, and then wash the frame thoroughly with soap and water.

2. File the spur of a marking gage to a knife edge. Set the spur to coincide with the inner edges of the holes, and gage entirely around the seat frame. Repeat the process several times so as to make the scoring reasonably deep. Continue the scoring in inaccessible places with a knife.

3. Increase the gage setting 3/16 in. and again score entirely around the frame (Fig. 17, *C*).

4. Cut the groove 1/4 in. deep with a chisel in the same manner as spline is removed (Fig. 17, *A*). It is advisable to make a simple depth gage (*D*). A router plane may be used to finish the cut if available. Clean out the groove thoroughly. Round the corners slightly with a chisel or sandpaper.

5. Proceed with the reseating as previously explained.

WOOD TURNING SIMPLIFIED

YOU can add greatly to your enjoyment in making things and at the same time improve your craft work in quality and variety by learning how to do wood turning. And this is not hard to do, especially now that such excellent motor-driven lathes are available at reasonable prices.

There is an unescapable fascination about wood turning. The shapes seem to form by magic under one's gouge and chisel. Perhaps that is why kings and princes and even queens and ladies of high rank amused themselves by practicing wood turning during the seventeenth century. Examples of their handwork are to be found in many European museums.

Simple as wood turning is, the beginner will make much faster progress if he takes the pains to observe some preliminary suggestions.

Much that is called wood turning is in reality what may be termed more accurately "wood scraping." This can be mastered more quickly and, generally speaking, is more exact than orthodox wood turning. While it is not quite so fast, this is a matter of small importance from the standpoint of the amateur. Almost anyone can do scraping at once without the many discouraging and disheartening slips of the tool and consequent spoilage of work so characteristic of wood turning practice.

Those who have learned or taught wood turning in the generally accepted way may disapprove of this method. In its justification, however, it may be stated that pattern makers do all turned work on wooden patterns by means of scraping. If the method is effective in such accurate work, why is it not equally useful in producing turned parts for other purposes? Many manual training teachers will permit scraping in difficult places and on what is called faceplate work. Why not then be frank about it and teach a method that will give the most pleasure and profit to the learner?

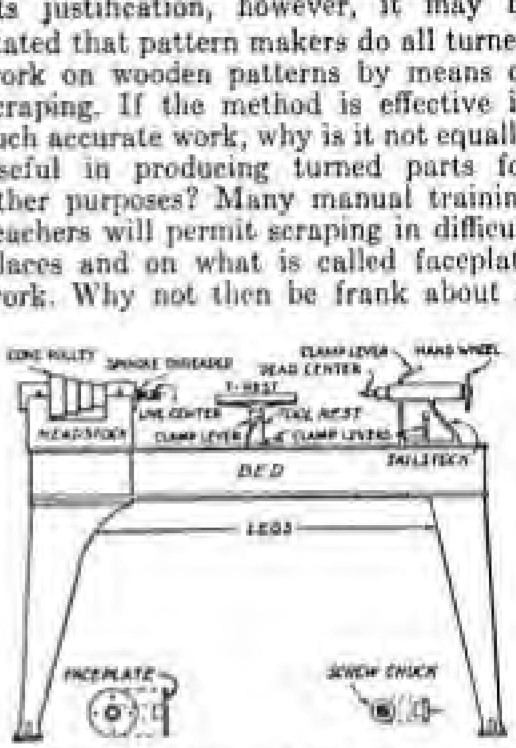


Fig. 1.—A typical wood turning lathe. All lathes have substantially the same parts.

It is with this need in view that the following instructions, which have proved successful in actual school work, are given. The procedure is the same whatever the size of the lathe and whether you are turning a candlestick on a small motorized home workshop outfit or a table leg on a larger lathe such as that shown in Fig. 1. Note well the names of the various parts, for they will be mentioned repeatedly.

CHOOSING A LATHE

Selecting a lathe depends, of course, on several factors, such as the type of work to be done, the space available and the price. The majority of the many small lathes now on the market suitable for home work are equipped with attachments for sawing, boring, grinding, buffing, sanding and the like. A surprising amount of work can be done on such an outfit.

For general woodworking and furniture making, it is well to select a lathe that is at least 30 in. long between centers—the standard length of a table leg—and has a swing of at least 9 in. The height of the lathe center over the bed indicates the swing; that is the diameter of the stock which can be turned. If it is 6 in. above the bed, the lathe has a 12-in. swing. Lathe beds of extra length can usually be obtained at a slight additional cost.

A motor-head lathe, that is, one with a variable speed motor mounted directly on the headstock, is the most convenient to use and takes up the least space. The more common type of lathe shown in Fig. 1 is driven by means of a cone pulley belted to a countershaft, which has a similar cone pulley and also a tight and loose pulley. The countershaft is generally fastened to the ceiling beams above the lathe. A small motor drives the countershaft and this in turn drives the lathe. By means of a belt-shifting device, generally consisting of an iron fork to which a wooden handle is fastened, the belt is moved from the loose to the tight pulley when it is desired to start the lathe. Sometimes a special motor is furnished with the lathe and is fastened to the legs below the headstock. This makes the countershaft unnecessary.

A lathe should run at a speed of about 2500 revolutions a minute when the belt is on the smallest step of the cone pulley. If it is necessary to buy new pulleys when installing a lathe, their diameters can be easily calculated if it is remembered that the diameter of the driven pulley times the number of revolutions it makes is always equal to the diameter of the driving pulley times the number of revolutions it makes.

Suppose we buy a lathe with its corresponding countershaft and the cone pulleys have three steps, the smallest being 3 in. in diameter and the largest 9 in. The tight and loose pulleys measure 6 in. in diameter. We have a ¼-H.P. motor with a speed of 1200 revolutions a minute. The motor is equipped with a pulley 4 in. in diameter. Will this motor drive the lathe at the proper speed?

It is first necessary to find the speed at which the countershaft will revolve when it is belted to the motor.

The revolutions of the motor multiplied by the diameter of the pulley equal the revolutions of the countershaft multiplied by the diameter of the loose pulley.

$1200 \times 4 = \text{rev. of countershaft} \times 6$
$4800 = 800 \times 6$
$4800 = 4800$

The countershaft makes 800 R.P.M., therefore the cone pulley on the countershaft also makes 800 R.P.M. The problem now is to find how many revolutions the lathe spindle makes.

The revolutions of the countershaft multiplied by the diameter of the large cone pulley equal the revolutions of the live spindle multiplied by the diameter of the small cone pulley.

$800 \times 9 = \text{rev. of live spindle} \times 3$
$7200 = 2400 \times 3$
$7200 = 7200$

Stock not more than 3 in. in diameter can be turned at the highest speed of the lathe (2500 R.P.M.); stock from 3 in. to 6 in. in diameter should be turned at a medium speed with the belt on the second step of the cone pulley, and stock over 6 in. in diameter should be turned at the slowest speed of the lathe.

Before the stock is rounded off and runs true in the lathe, it causes a good deal of vibration. The lathe should, therefore, be run at a lower speed until this process has been completed, as excessive vibration may cause the stock to be thrown violently from the lathe.

For the first lathe work, the following tools (see Fig. 2) are sufficient: 1-in. gouge, ¾-in. square-nose chisel, ½-in. skew chisel, ⅛-in. parting tool, ½-in. round-nose chisel, ½-in. diamond-point chisel, 6-in. outside spring caliper, 6-in. inside spring caliper, 8-in. wing dividers, rule, oilstone and slip stone.

The gouge is ground to semicircular shape with the bevel extending well around to the sides so as to leave no sharp corners as on the carpenter's gouge. The bevel should be about twice as long as the gouge is thick. It is ground on a sandstone or an emery wheel. If no water or kerosene runs over the stone, care should be taken to dip the tool frequently during the grinding process to prevent overheating and drawing the temper of the steel.

Grasp the handle with the right hand, hold the blade to the surface of the stone with the left hand and move the gouge across the face of the stone with a rolling motion.

When ground, the gouge is whetted on an oilstone. The bevel is brought in contact with the stone and the gouge moved back and forth and simultaneously rolled from one side to the other. The wire edge, which is bent towards the inside by this process, is removed by rubbing the rounded edge of a slip stone back and forth over it. Keep the whole edge of the slip stone in contact with the inside of the gouge during this operation.

While the square-nose turning chisel is longer than an ordinary chisel, any common chisel can be used in place of it if it has a long blade and is fairly heavy. To sharpen this type of chisel, place the bevel in contact with the oilstone, raise the chisel and slowly move it back and forth, pressing on the blade with the left hand. Reverse the chisel, place it absolutely flat on the oilstone, press on it with the left hand, and move it back and forth a few times. Repeat the process until the wire edge is removed.

Test the sharpness of the iron on the thumb nail as in Fig. 3. If the iron is sharp it "takes hold;" if it is not sharp, the nail slides over it.

The skew chisel is ground so that two bevels are formed instead of one. The cutting edge should be at an angle of about 65 degrees to the side of the chisel. While grinding, grasp the handle firmly in the right hand, press down on the blade with the left, and hold the chisel at such an angle that the

FIG. 3.—Thumb-nail test for a chisel; if it "takes hold," it is really sharp.

FIG. 4.—The edges of scraping tools are sometimes turned over with a burnisher to form a burr or almost microscopic hook.

cutting edge is parallel with the axis of the grindstone or emery wheel as in Fig. 5. Whet the chisel on the oilstone.

The parting or cutting-off tool has two bevels, which should be of equal length and meet in the ridge that runs through the center of the blade. If they do not meet at this point the tool will bind and stick in the wood.

The round-nose chisel is ground in much the same way as a gouge, and the diamond-point or spear-point chisel is held on the stone at an angle so that its edge is parallel to the axis as shown in Fig. 5. The method of grinding the various chisels used in work is very simple and will be easily mastered.

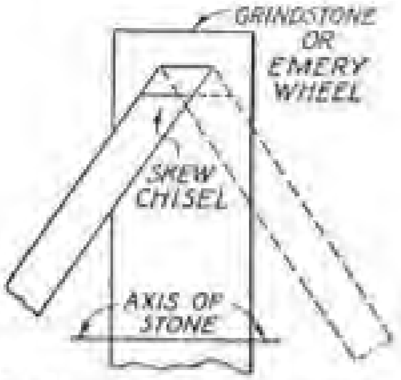


Fig. 5.—A skew chisel is held in an angular position for grinding

When a tool is used for scraping, its cutting edge dulls more quickly than when it is used for cutting. To overcome this disadvantage and also to make the tool cut better, the edge is sometimes turned with a burnisher so that it forms a sort of miniature hook or burr. This is done after the tool has been sharpened as explained above. A good way to turn the edge is to clamp the tool in a vise and stroke its edge with a burnisher. The first stroke should be at about the same angle as the bevel. In the following strokes the burnisher is gradually raised, so that at the last stroke it is held almost in a horizontal position (see Fig. 4). It may be of advantage to turn the edge of square- and round-nose chisels and diamond-point chisels. The gouge and skew chisel are cutting tools and should not have their edges turned, neither should the parting tool, which has two bevels. The burnisher illustrated in Fig. 4 was made by grinding the teeth off a triangular saw file.

The oilstone and slip stone are hard, smooth stones used for whetting tools. Machine oil thinned with kerosene is a good lubricant to use on them.

FIRST STEPS IN TURNING

When a lathe is purchased, the manufacturer usually gives directions for

Fig. 6.—Use a wooden mallet to drive the live center into the wood. This is particularly important when the stock is hard wood.

setting it up and provides a set of the more essential tools, but the actual operation has to be learned by experience.

Saw the stock to dimensions. If it is square or rectangular, draw diagonals on end, and bore a small hole in the center of the other end.

Remove the live center from the headstock of the lathe. Usually this is done by pushing it out with an iron rod, which can be inserted from the opposite end of the headstock. Drive the center with a *mallet* into that end of the wood on which the diagonals were sawed, so each end. The center of the piece lies in their point of intersection. If the stock is irregularly shaped, set a pair of dividers to approximately half the thickness of the piece, hold one of the legs of the dividers against one of the edges, and scratch a line parallel to it. Repeat on the other three edges. The center then may be determined. A marking gage may be used instead of the dividers (see Fig. 7). If the wood is very hard, make a saw cut on the two diagonals on one

Fig. 17.—Start the cut near the dead center and move the tool toward it. Hold the tool as illustrated and stand in the position shown.

that the prongs enter a saw cut. Do not drive the wood on the live center while it is in the lathe if it can be avoided.

Turn the other end of the wood up and drip machine oil on it. Allow the oil to soak in. If the wood is not oiled or if the oil has dried, the friction on the dead

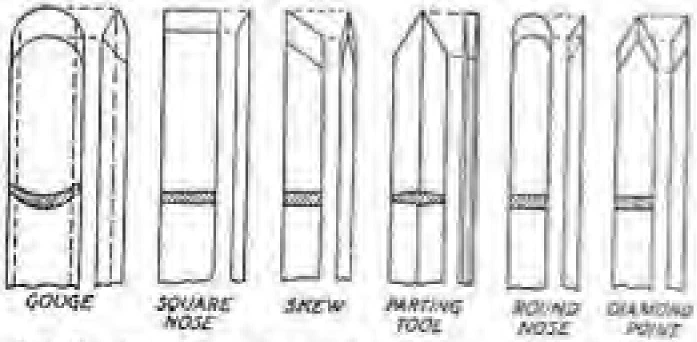
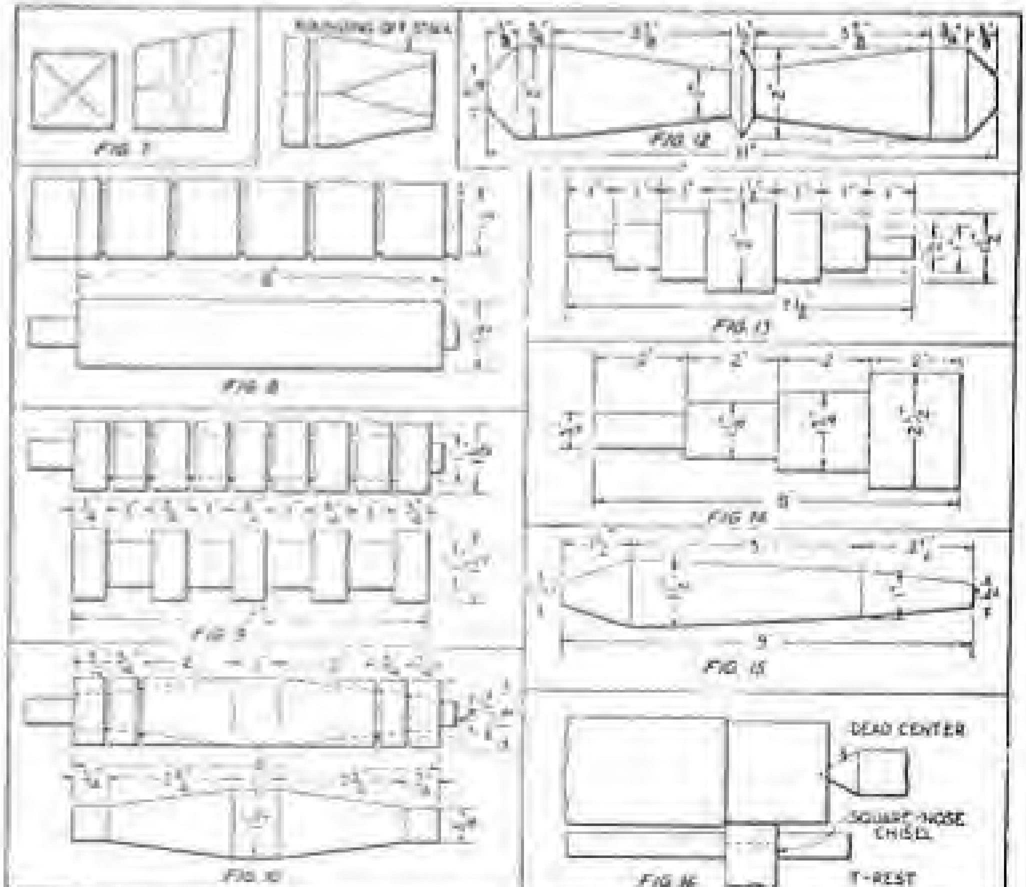


Fig. 2.—A set of turning tools for the beginner. They need be supplemented by calipers, dividers, rule, oilstone, and slip stone.



Figs. 7 to 16.—Steps in centering the work and in turning cylinders and various other forms that are derived from the cylinder.

center will cause the wood to burn.

Replace the live center in the headstock and press the wood against it, so that its spurs enter the depressions previously formed in the wood. Clamp the tailstock firmly so that the point of the dead center is a couple of inches away from the end of the wood; then turn the handwheel until the dead center enters the end wood so deeply that the wood cannot be revolved by hand. Loosen the handwheel a little until the wood can be revolved quite freely by hand. Clamp the dead center in this position.

Adjust and clamp the tool rest so that it is about ⅛ in. away from the edge of the wood that is nearest to it when the stock is revolved. Fasten the T-rest at the correct height, which varies somewhat with the height of the person; it is never below the center of the piece, how-

FIG. 18.—Use a parting tool and calipers. Groove the work to the required diameter at points about 1 in. apart. The grooves serve as depth guides and make it easy to turn a true cylinder.

ever. It is generally from ⅛ to ¼ in. above the center. Turn the pulley by hand and make sure that the wood has sufficient clearance. See that the clamps are all tight before turning on the power.

If the stock is well centered and not over 2 in. square, the lathe may be started with the belt running on the smallest step of the cone pulley—that is, at full speed. Suppose you wish to turn a cylinder (Fig. 8). Use the gouge for the first cut. Grasp then the handle near the end with the right hand; hold the blade firmly against the T-rest with the left hand, so that the palm of the hand

FIG. 19.—Smooth the cylinder with a square-nose turning chisel or a firmer chisel with a long blade.

near the wrist and also the little finger are in contact with the T-rest. Hold the handle of the gouge well down and roll the gouge a little towards the right. This will throw the shavings away from you. Raising the hand holding the handle will start the gouge cutting (Fig. 17).

Start cutting a couple of inches from the dead center and move the gouge away from you towards the dead center. Begin the next cut a couple of inches farther to the left and continue making similar cuts until only an inch or so is left. Roll the gouge towards you and move it towards the live center to round off the last part of the stock. When too long a cut is taken while rounding off the corners, large chips are liable to fly off and injure the operator.

Move the gouge freely from one end of the piece to another until it is perfectly cylindrical and a little larger in size than actually needed. Stop the lathe and move the T-rest closer to the stock.

Set the outside calipers to about ⅟₁₆ in. more than the finished diameter. Grasp the parting tool in the right hand and the calipers in the left. Cut into the wood with the parting tool while holding the calipers in the groove being cut

FIG. 20.—Use a skew chisel to square both ends. Be careful not to cut too close to the live center, to avoid damaging the tool.

until the calipers slip over the cylinder (Fig. 18). Make several cuts about 1 in. apart.

Smooth the cylinder with a square-nose turning chisel or an ordinary firmer chisel with a long blade. Hold the beveled side down and place the chisel flat on the T-rest (Figs. 16 and 19). Cut to the bottom of the grooves made with the parting tool until the cylinder is smooth and of the same diameter throughout. Test it by placing a straightedge along it.

Square the end running on the dead center with the parting tool. If the hole left by the dead center will be unsightly in the finished object, this cut should be made about ½ in. from the end. Cut down to about ¼ in. on both ends. When the piece is removed from the lathe, the ends can then be sawed off with a back saw and smoothed with a chisel. The ends can also be squared with a skew chisel; it is placed on its side, flat on the T-rest, and the cutting is done with the toe, where the cutting edge makes an acute angle with the side (Fig. 20). Test for squareness by holding the side of the tool against the end (Fig. 21). Measure the length and make a cut on the other end.

To make shoulder cuts, proceed as follows: You may use the cylinder just turned or make a similar one, laying it out according to Fig. 9. Place a rule on it and mark all the points without moving the rule. Steady the pencil on the T-rest and press its point against one of the marks on the cylinder. Revolve the cone pulley with the left hand so that the pencil scores a line all around the cylinder. Repeat at all the other points.

Set the calipers to a little more than 1 in. in diameter and cut with the parting tool on the inside of the lines indicating the 1-in. divisions (Fig. 18). Leave a little stock for finishing.

Remove the wood between the cuts with the square-nose chisel, making that part of the cylinder 1 in. in diameter. Finish the shoulder cuts with the parting tool or skew chisel. Cut off the projections on both ends.

Two other problems are suggested in Figs. 13 and 14. Any lumber may be

FIG. 21.—Test the end for squareness by testing the side of the tool against the wood. If no light can be seen between the tool and the work, the edge must be perfectly square.

used and the dimensions changed as necessary. However, start out with a drawing and definite dimensions. See how closely you are able to follow them. A good plan is to make two turned pieces from each drawing and compare them. Lay off the measurements as explained before. Cut down to the proper diameters with the parting tool, but allow ⅟₁₆ in. more than the diameters needed on the taper cuts. Finish the square sections on the ends with a square-nose chisel.

With a ½-in. gouge or a round-nose chisel, remove the wood on the tapers almost down to the cuts made by the parting tool. The round-nose chisel, like the other scraping tools, should be held flat on the tool rest with the bevel down. Finish the tapers with a square-nose chisel, a diamond-point chisel or a skew chisel as shown in the remaining drawings.

Two supplementary drawings (Figs. 12 and 15) are given for practice purposes on page 147.

CONCAVE AND CONVEX CUTS

As soon as the amateur wood turner has learned how to turn a cylinder and make shoulder and taper cuts, he is ready to undertake ornamental work that requires concave and convex cuts.

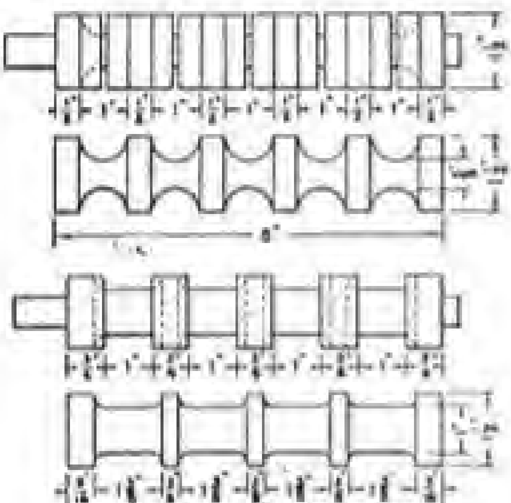


Fig. 22.—Two simple exercises in making concave cuts. Once mastered they give the wood turner power to do ornamental work.

To practice making concave cuts, first turn a cylinder 1½ in. in diameter and 8 in. long and lay it out as shown in Fig. 22 at the top. Set the calipers to 1/16 in. more than the smallest finished diameter and cut down with the parting tool at the center of the curves. Use the round-nose chisel for making the concave cuts and hold it perfectly flat on the T-rest (see Fig. 23). Begin the cuts a little inside the lines and gradually work down to the bottom of the cuts made with the parting tool.

Another exercise is shown at the bottom of Fig. 22. Use a cylinder with shoulder cuts made as suggested in Fig. 9 and lay off the measurements indicated in Fig. 22. Make the concave cuts with the round-nose chisel. The supplementary exercise, Fig. 24, is designed to give practice on curves of longer and shorter sweep.

Convex cuts come next. Turn a cylinder 1½ in. in diameter and 8 in. long, lay out measurements according to Fig. 25 at top. Make small V-cuts with the diamond-point chisel. Round off the sharp corners with the diamond-point or skew chisel. For a second exercise (Fig. 25 at bottom) lay out a cylinder as shown and cut down to the smallest diameter with the parting tool; then round off the corners with the diamond-point (see Fig. 23) or the skew chisel.

Beads of different diameters, such as the ones shown in Fig. 25 and on the supplementary exercise, Fig. 26 at top, are used extensively on turned work. It is therefore important to be able to make smooth and well-rounded beads. Specially shaped turning chisels, called beading tools, from ⅛ to ⅝ in. in width, can also be obtained and used for this purpose.

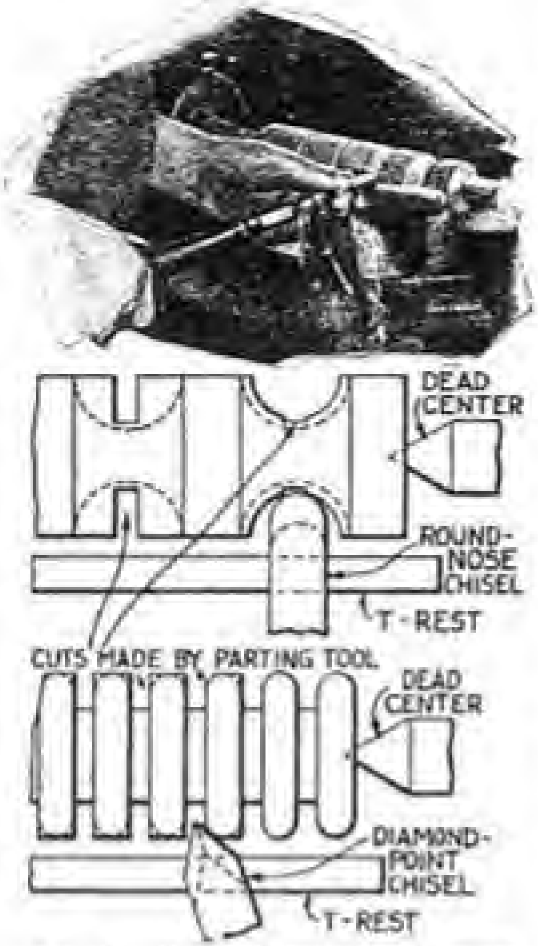


Fig. 23.—Above: A round-nosed turning chisel held flat on the T-rest is used for shaping concave surfaces. Below: How the round-nose and diamond-point chisels are manipulated.

Fig. 24—A design which combines the two exercises shown in Fig. 22.

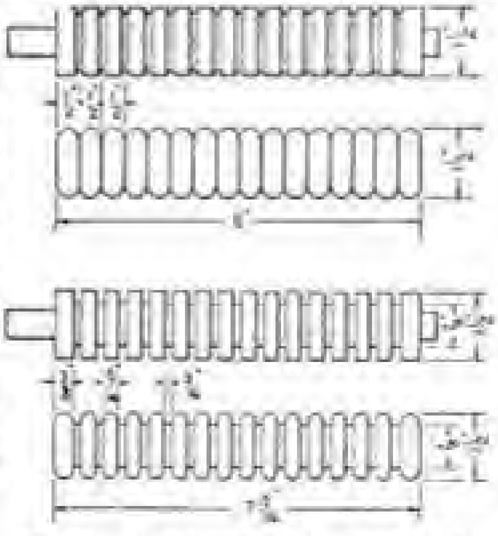


Fig. 25.—Useful exercises in making beads, which are frequently used in ornamental wood turning.

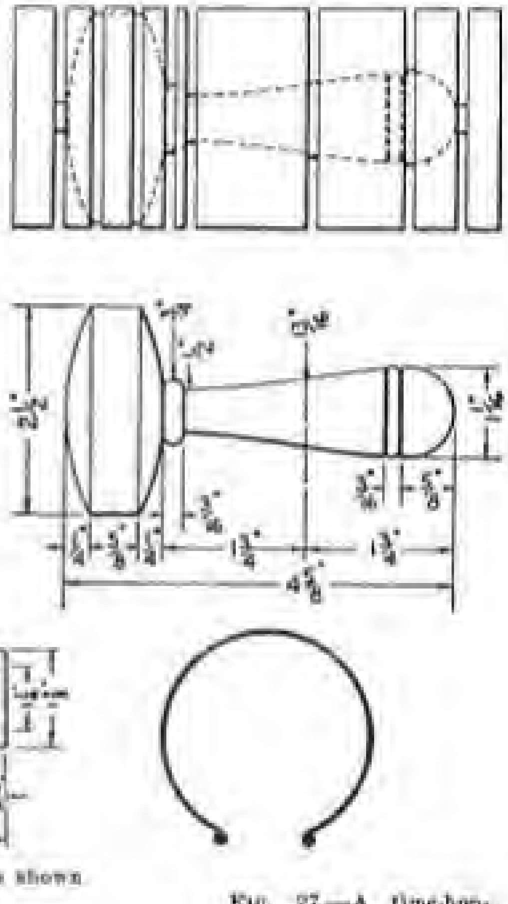


Fig. 27.—A time-honored wood turning project—a stocking darner with a springy steel clamp for holding the stocking in place.

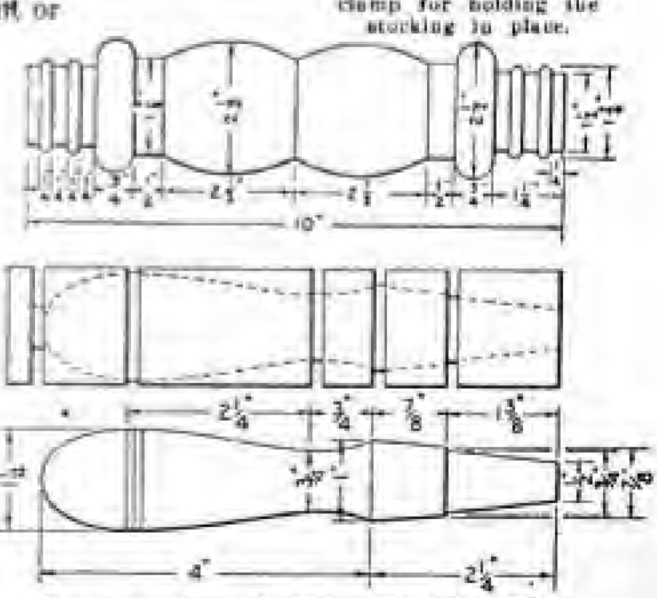


Fig. 26.—Above: Another exercise in turning. Below: A tapered handle for a socket chisel.

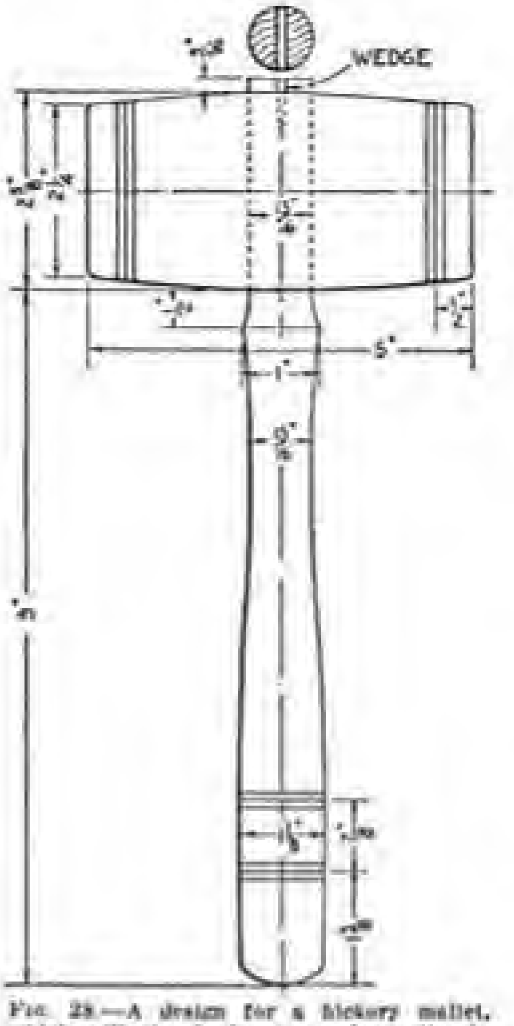


Fig. 28.—A design for a hickory mallet, which will give beginners good practice in accurate turning.

Fig. 29.—A tilt-top table with a turned column. The top is decorated with an inlaid insert and border.

It should be remembered that the smaller end of all turned work should be run on the dead center, so that the end may be squared or rounded more easily and safely. In this case, therefore, the tapered end of the handle should run on the dead center. As the hole made by the dead center will not be objectionable in the finished product, it is better not to cut it away.

For the purposes of illustration, each of the preceding exercises has been designed to deal with only one type of cut. In most turned work, however, two or more of these cuts are combined, as in the simple projects illustrated at the bottom of Fig. 26 and in Figs. 27 and 28.

Chisel handles are of two kinds. One type, illustrated in Fig. 26, is tapered to fit into the socket of a chisel. As these tapers vary, it is necessary to verify or change the dimensions of the taper, as the case may be.

It is recommended to turn the taper first. The stock may be removed from the lathe and tried as often as necessary, until it fits the socket. The rest of the handle is then finished in the usual way, the concave part with the round-nose chisels and the convex part with the diamond-point or the skew chisel. The three lines on the handle near the end are cut for ornamentation. They are made with the point of the skew chisel.

The other kind of chisel handle is for the tang type of wood chisel. Each handle is fitted with a brass ring called a "ferrule," which prevents the wood from splitting when the tang of the chisel is driven into the handle. Ferrules can be bought in different diameters, according to the size of the chisel. They should fit so tightly on the chisel handle that they must be driven in place with a mallet. All handles should be sandpapered as smooth as possible.

When sanding in the lathe, it is best to remove the T-rest. The sandpaper is folded into narrow strips and moved rapidly back and forth over the work. If it is held in one place, rings will appear on the object being sanded. Care should be taken not to round sharp edges. When the tools are kept sharp very little sanding is needed. Ordinarily sandpaper No. ½ or 0 and No. 00 should be used.

Stocking darners are made in many different shapes. The one illustrated in Fig. 27 may be made in either one or two pieces. A clamp may be made out of an old clock or phonograph spring and fitted around the head of the darner. This will hold the stocking tightly over the convex face during the darning process. If the ends of the spring are heated, they may be bent as shown. The edges should be smoothed with file and emery paper.

The mallet, Fig. 28, is a serviceable tool for any woodworker. It is made in two pieces. The end of the handle entering the mallet head should be turned very accurately to the diameter indicated. To do this, a gage is made by boring a $^{13}/_{16}$-in. hole in a thin piece of wood. This gage may be hung on the dead center while the handle is being turned, so that it is not necessary to remove the stock when testing.

When the head has been turned to size, the exact center between the ends is measured and a line marked around the head at this point. Wrap a narrow strip of paper around the mallet head on this center line and cut it so that the two ends just meet. Remove the paper and fold it once. Wrap it around the mallet head again and mark a point on the center line at each extremity of the folded paper. These points, directly opposite each other, indicate the centers of the hole to be bored for the handle. The hole should be bored halfway from each side in order to get it true. If the halves should not meet exactly in the center, any unevenness may be removed with an inside-bevel gouge.

The mallet head may be held between the lathe centers or in a vise while the hole is being bored. In any case it is well to have someone "watch" the bit to see that it is held horizontally and parallel to the ends of the mallet head.

Before joining the pieces, the end of

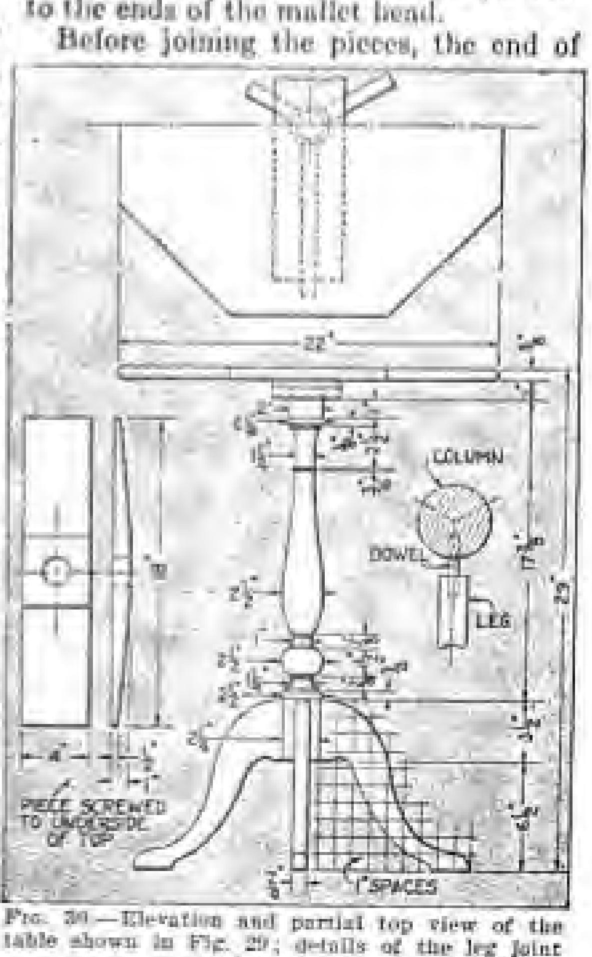


Fig. 30.—Elevation and partial top view of the table shown in Fig. 29; details of the leg joint and top brace.

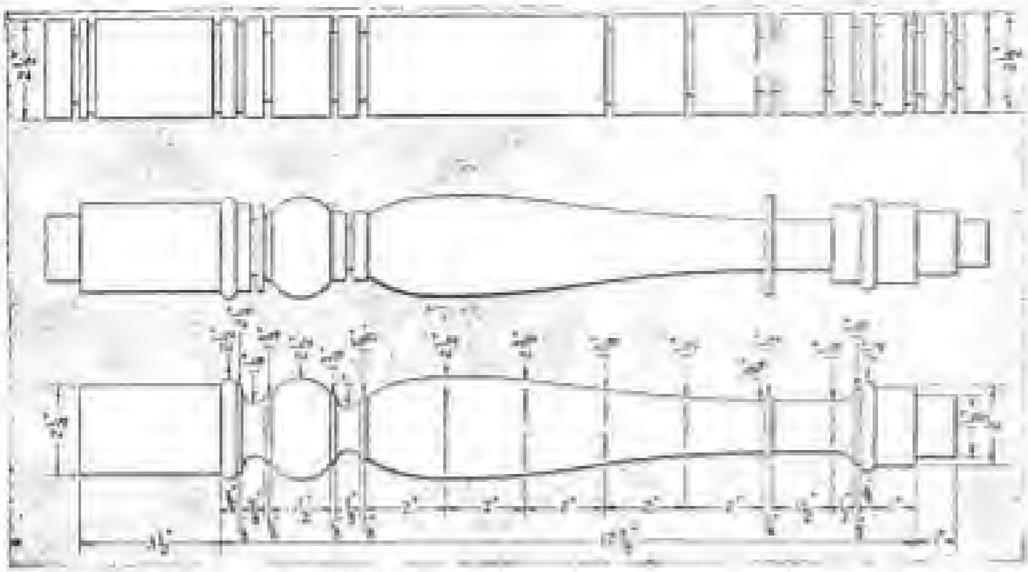


FIG. 31.—Three steps in turning the tilt-top table column. Grooves are first turned to the correct depths, as previously described, and these guide the finishing cuts.

the handle should be split along the center with a hack saw. When the handle and head are ready to be glued together, a wedge is made and driven into this saw cut. The end of the handle may be allowed to project a little, or it may be cut off flush with the head. Hickory is the best of the commonly available woods for this project.

SMALL TABLE

The stand or small table illustrated in Figs. 29 and 30 is an example of what the woodworker can accomplish in the line of furniture making when he has an elementary knowledge of wood turning. From the wood turner's point of view, this project is very simple, as there is only one turned piece. The turning of this piece, moreover, does not involve any particular difficulties. The method of procedure is clearly shown in Fig. 31.

A cardboard pattern should be made for the three legs according to the method of laying out shown in Fig. 30. In placing the pattern on the wood, see that the grain runs the long way, otherwise the legs are likely to snap at their

FIG. 32.—Using a sandpaper-covered cylinder to shape the legs to fit the turned column.

narrowest point. They may be fastened to the turned column either with a mortise and tenon joint or with dowels. The latter method is the easier and, indeed, gives a stronger joint than a poorly made mortise and tenon.

First cut the legs with a turning saw or on a band saw, square the ends, and round the outer edges with spokeshave, scraper, and sandpaper. The part of the legs that fits the column must be curved. This can be done easily by turning a cylinder a little less in diameter than the column—in this case about 1¼ in. Glue a piece of No. 1½ or 2 sandpaper to it. When dry, put the cylinder in the lathe and hold the end of the legs against it until a curve of the proper shape has been formed (Fig. 32).

Locate the centers for the dowels as

FIG. 33.—One of the legs with dowels inserted all ready to be glued to the turned column.

follows: Wrap a piece of paper around the column and cut it so that the ends just meet. Fold it into three equal parts and lay off these divisions on the column. Place each of these marks level with the top of the tool rest and draw horizontal lines on the column.

Mark the corresponding center lines on the legs with a marking gage and lay out the points for the dowels. Set the marking gage to 1 in. and, holding the block of the gage against the lower end of the column and against the corresponding edge of the legs, mark lines crossing the six center lines already marked. Set the gage to 2½ in. and from the same edges mark another set of lines crossing the center lines. Bore for dowels at these twelve points (Fig. 33) and fit each leg to the column.

Glue one leg at a time as shown in Fig. 34, using three hand screws. One of these is clamped firmly to the leg to be glued, and the other two force it tightly against the column.

The top may be octagonal, round, elliptical, or kidney shaped; it may be embellished with inlays or painted deco-

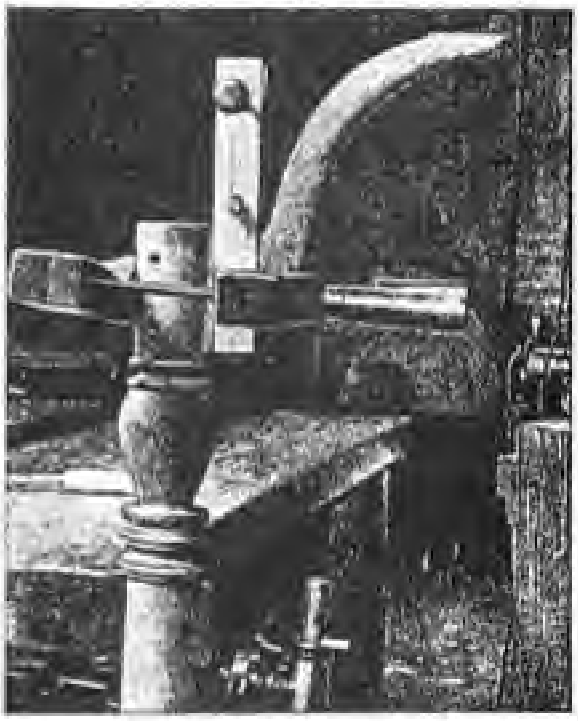


FIG. 34.—One leg at a time is glued to the column and held firmly with three hand screws.

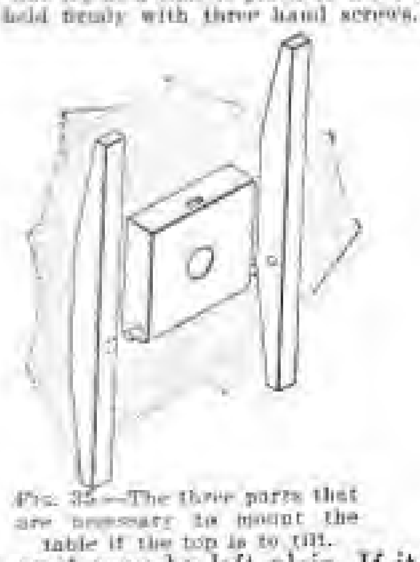


FIG. 35.—The three parts that are necessary to mount the table if the top is to tilt.

rations, or it may be left plain. If it is to be fixed firmly to the base, a piece

1 by 4 by 18 in. with a 1½-in. hole bored in the center, is screwed to its underside. The top is then fastened to the base.

If the top is to be made to tilt, two strips ⅞ by 1 by 18 in. and a block 1 by 6 by 6 in., as shown in Fig. 35, provide the tilting mechanism. A 1½-in. hole is bored in the center of the block, which is later glued to the top of the column. Two dowels are also glued into one end of the block, and corresponding holes are bored in the side strips. The upper rear end of the block is rounded off so that the top can move freely.

It should be remembered to glue the block to the column in such a way that one leg is perpendicular to the surface of the top when the latter is tilted to a vertical position, as otherwise the stand would be unstable. A brass catch, called a table catch, is screwed to the underside of the top and locks it to the block when in a horizontal position.

ORNAMENTAL FOOTSTOOL

The footstool illustrated in Fig. 36 is a simple project from the standpoint of both wood turning and joinery. Notice that the upper parts of the four legs are square, and that the rails are joined with dowels to this square part in such a way that the outside faces of the legs and rails are flush.

When getting out the stock for the legs, cut it somewhat larger, say 1¾ in. square, so as to allow for the final squaring after the legs have been turned. In this way any unevenness in centering or any slightly broken-off corners can be remedied.

When beginning the turning, lay off the square part by squaring a pencil line all around on the four sides of the piece. Start cutting a little outside the lines with a very sharp skew chisel; rest its edge on the T-rest and bring the point gradually in contact with the wood. This will nick the corners of the square piece. After a light cut with the skew chisel, cut down to the same depth with the parting tool. Then repeat the process until the parting tool is in contact with the wood at all points. Round off the rest of the piece with a gouge and finish to the proper diameter as described in previous articles.

Finish the square cut with the skew chisel, as shown in Fig. 37. If by accident the square corners should be broken off beyond repair, turn this part of the stock down to form a round tenon ¾ in. in diameter and 1 in. long. Blocks 1½ in. square and 1¾ in. long then may be cut, a ¾-in. hole 1 in. deep bored in the center of one end of each, and the turned legs afterwards glued to them.

If you succeed in turning the legs in one piece, the square part is planed down to 1½ in. so that the turned part is perfectly centered. The rails are then squared to dimensions. Be careful to see that all the ends are square and that each pair of rails are exactly the same length.

Mark the outside faces of the legs and rails and set a marking gage to half the thickness of the rails. Gage a line through the center of the ends of each rail, and corresponding lines (two) on each leg, holding the block of the marking gage against the outside faces of the legs and rails. Next set the gage to ½ in. and mark lines from the top edges of legs and rails crossing the lines already marked. Then set the gage to 1¼ in. and mark another set of lines also from the top edges, crossing the vertical lines first marked. Bore holes ⅜ in. in diameter and ¾ in. deep at all points of intersection. If the work has been accurately done, the rails and legs when joined will be flush both on the top and on the sides. If it is found that a hole has been bored inaccurately, glue a ⅜-in. dowel into it, cut off the dowel flush, and bore a new hole after the glue has set.

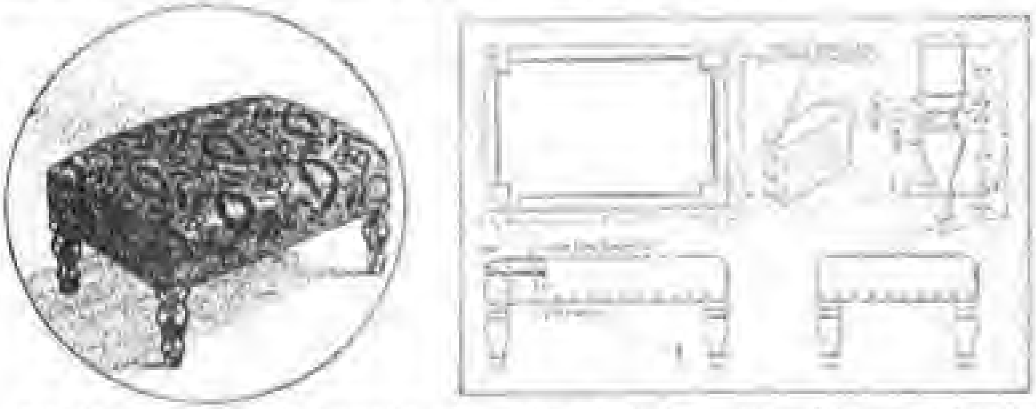


Fig. 36.—Left: A neatly finished footstool with simple turnings. Right: Side and end views, top view of the framework, and details of the legs and doweled joints.

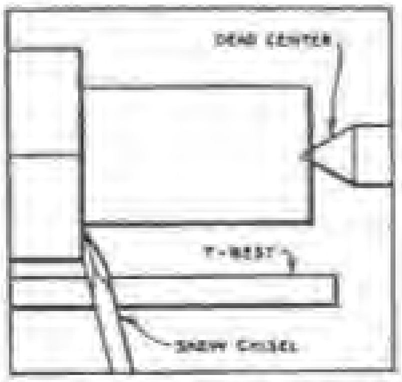


Fig. 37.—Finishing the shoulder of the square cut on the leg.

When all joints fit perfectly, the legs and rails may be glued together. It is best to glue either two ends or two sides first and let the glue set, rather than attempt to glue the whole stool together at once.

The stool may be upholstered very easily as follows: Smooth off any little unevenness from the joints, nail a piece of ¼-in. plywood to the top, and plane it flush with the sides of the stool. Plane a bevel on the plywood top on all four sides and tack a piece of webbing or burlap about 3 in. wide to it so that the tacks are driven into the center of the bevel and the burlap hangs over the sides of the stool.

Buy 1½ lb. of fine tow from an upholsterer and form it into an even roll ½ in. in diameter. Place it on the bevel and fold the burlap over it, tacking the burlap to the plywood top so that a hard roll is formed all around the top edges of the stool.

Place a layer of tow evenly over the top of the stool, picking or separating it well so that it becomes light and fluffy. Stretch a piece of muslin over the tow and tack it to the sides of the rails near the lower edge. Drive the tacks only part way into the wood, because the muslin must be restretched several times and the tow manipulated until the seat is smooth.

Hair is an excellent material to use for this purpose, but more expensive than tow. A layer of hair or moss on top of the tow will improve the seat.

After the muslin has been finally tacked in place, it is covered with a piece of upholsterers' blue cotton wadding, after which the covering, such as tapestry or leather, is stretched over it and tacked. The edges are trimmed with a pair of scissors and covered with a narrow band or "gimp" made of the same

MATERIALS FOR FOOTSTOOL

No. Pcs.	T.	W.	L.	Part
4	1½	1½	6	Legs
2	⅞	1¾	7	Rails
2	⅞	1¾	11	Rails
1	¼	10	14	Top
1	..	15	24	Muslin
1	..	12	16	Cotton wadding
1	..	15	24	Covering

1 lb. fine tow, tacks, and upholsterers' nails.

All dimensions are in inches.

material or bought ready-made to match. This is nailed in place with upholsterers' fancy nails.

The legs should be stained and finished before the covering is tacked in place.

TABLES WITH TURNED LEGS

In no other way can you turn your wood turning to better advantage than in making legs for decorative tables. Rarely has a home too many small tables; there is always room for a graceful occasional table like that illustrated in Fig. 39 or a book-trough end table such as is shown in Fig. 40.

The occasional table with its folding top may be used, as its name implies, for different purposes and in a room with almost any type of furniture. When folded, it takes up the minimum space but still remains an ornament. Because of its adaptability, it is particularly suited to modern requirements.

Three turned parts are required: two

FIG. 39.—When tilted down, the top of this little occasional table is supported by a graceful pivoted wing.

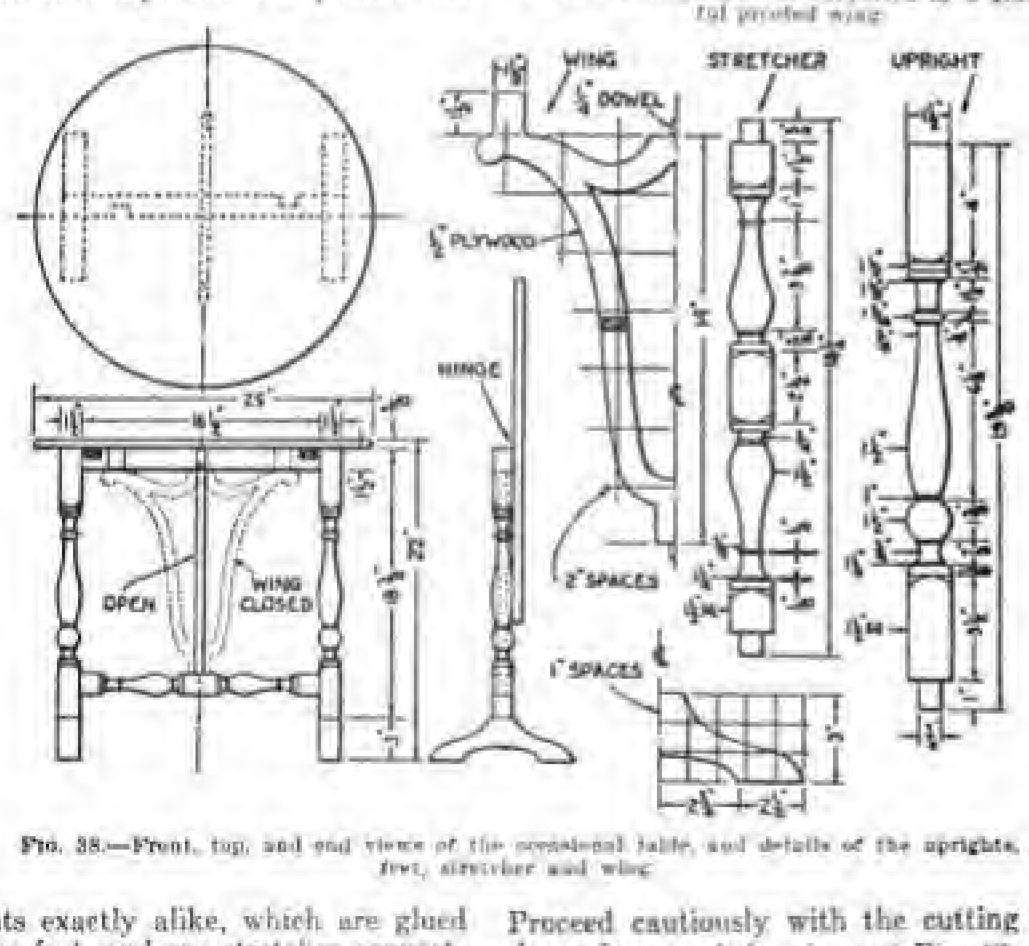


FIG. 38.—Front, top, and end views of the occasional table, and details of the uprights, feet, stretcher and wing.

uprights exactly alike, which are glued into the feet, and one stretcher connecting them (Fig. 38). The uprights have two square parts and the stretcher three. As to the method of turning, refer to the directions given for the footstool. After those portions which are to be turned are finished and the cuts at the square parts have been made, round the corners slightly with a skew chisel held flat on the T-rest. Lay off the distance of the rounding—about ⅜ in.—by squaring lines on all sides of the square pieces.

Proceed cautiously with the cutting as shown in one of the views of Fig. 42.

A plain square rail, the same length as the stretcher, is used between the legs at the top. The joints may be made with either dowels or mortises and tenons. To this upper rail the top is hinged. Between the rail and the stretcher is pivoted the winglike table top support. Notches are cut on opposite sides of the rail to receive the projections at the upper part of the wing when it is turned parallel to the rail. The wing support is cut from ½- or ⅜-in. plywood and a ¼-in. dowel is glued into each end to enter corresponding holes in the centers of the top rail and the stretcher. If desired, an additional turned rod may be inserted in the wing as suggested in Fig. 39. Obviously, the wing must be put in place before the table is glued together.

If, for the sake of simplicity, it is desired to omit the wing, a table catch may be bought and fastened to the underside of the top in such a way as to lock the top to the upper rail when the top is in the horizontal position.

A line of inlay near the edge of the top and an insert in the center will add to the decorative quality of the table if it is to be stained and varnished. Similarly, an art transfer (decalcomania) can be used in the center of the top if the table is finished with brushing lacquer or enamel.

The end table, Figs. 40, 41, and 42, requires the turning of four legs. Care must be taken to have them exactly alike. In making the ornamental book-trough end pieces, it is well to square them and cut the dadoes (grooves) before shaping the edges. Remember to

FIG. 40.—Book-trough end table made of maple and stained a rich antique amber color.

plane and sandpaper the two boards which form the trough before laying out the dadoes into which they are to fit, so as to insure tight, workmanlike joints.

The shaped ends, as well as the upper rails, may be joined to the legs with dowels. Glue up the two ends of the table separately. When the glue is dry, complete the assembly of the framework by joining the two ends, the two long rails, and the two book-trough boards.

The top is fastened by means of cleats about ⅞ in. square, screwed to the inside of the rails flush with their upper edges.

The choice of lumber and of the finish for both these projects is a matter of individual preference. The end table illustrated in Fig. 40 was made of maple

MATERIALS FOR TABLES

No. Pcs.	T.	W.	L.	Part
				For Occasional Table
2	1½	1½	19⅝	Legs
2	1½	1½	18¼	Stretchers (plain and turned)
2	1½	3	10	Feet
1	½	14	14	Support
1	⅝	25	25	Top
1 pair			2	Fast joint butt hinges
				For End Table
4	1½	1½	26½	Legs
2	¾	2½	10	Rails
2	¾	2½	24	Rails
1	¾	13	27	Top
2	¾	8½	8	Sidepieces
1	½	4	24	Trough
1	½	4½	24	Trough

All dimensions are in inches.

and given an amber stain to imitate the color of antique maple. The stain was followed by a thin coat of shellac, which, when dry, was rubbed with No. 00 steel wool. A coat of clear brushing lacquer

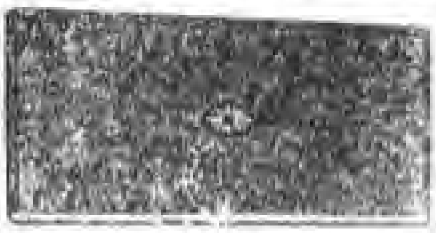


FIG. 41.—Looking down on the inlaid top of the end table. The wood is bird's-eye maple, beautifully figured.

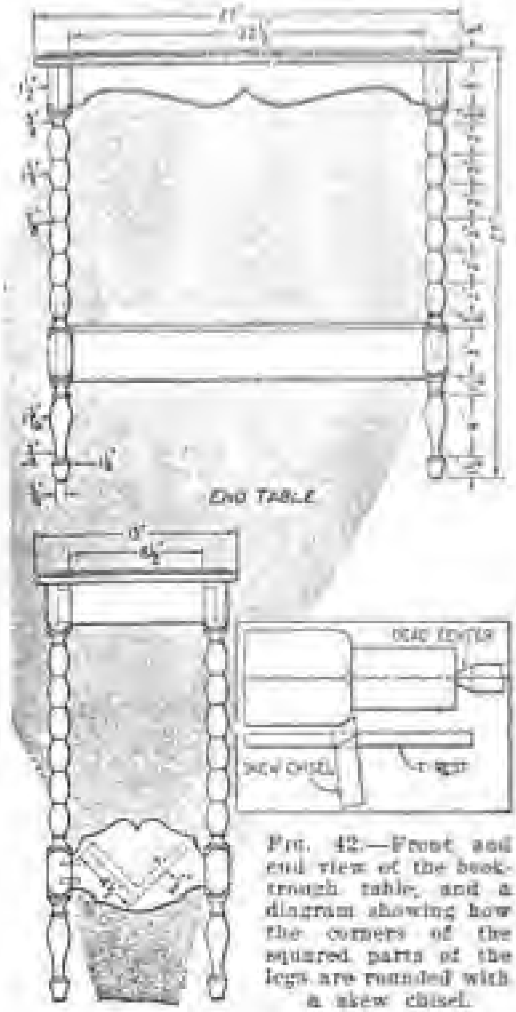


FIG. 42.—Front and end view of the book-trough table, and a diagram showing how the corners of the squared parts of the legs are rounded with a skew chisel.

was next applied, and this was rubbed smooth with powdered pumice stone and crude oil. A coat of liquid wax was finally applied and rubbed to a soft sheen. The result was perfect.

TURNING CANDLESTICKS

Faceplate turning, the next phase of the work, is no more difficult than spindle turning; and no set of exercises need

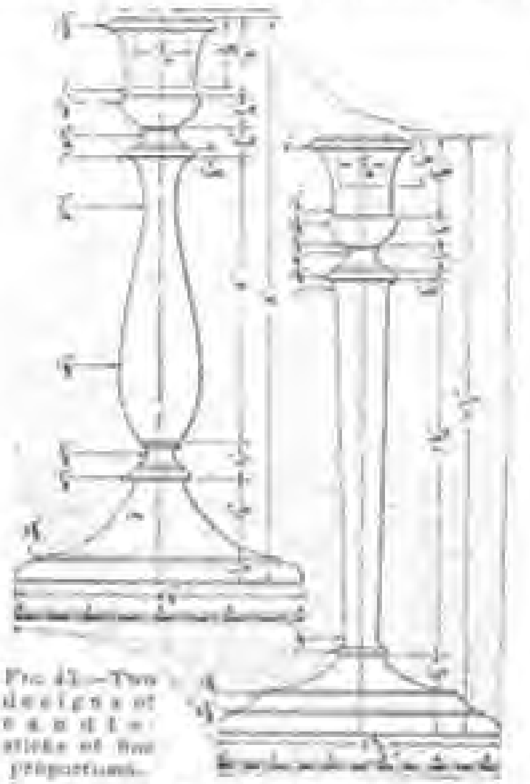


FIG. 43.—Two designs of candlesticks of fine proportions.

be mastered before real work can be attempted.

The tools are the same as those described in the beginning of this chapter, and the methods of using them do not differ materially from the ones employed in spindle turning.

By mastering faceplate turning, you can make candlesticks, lamps, smoking stands, frames, rings, boxes, trays, and bowls. These projects can be turned only by the use of chucks and faceplates.

A candlestick (Figs. 43 and 44) consists of two parts, the upright and the base. Let us turn the upright first. One end of it has a round tenon fitting into the base. The other end must be bored for the candle. Bore this hole with an auger bit before putting the stock in the lathe. As candle ends vary in diameter from ¾ to ⅞ in., it is best to bore a hole 13/16 in. in diameter and of about the same depth. A quick boring auger, that is, one with few threads on the spur, is the most satisfactory for end-wood boring.

Turn a plug or short cylinder to fit this hole accurately. It shoul' be about 1½ in. long, but in cutting it off be careful not to cut away the end with the hole made by the dead center. The plug

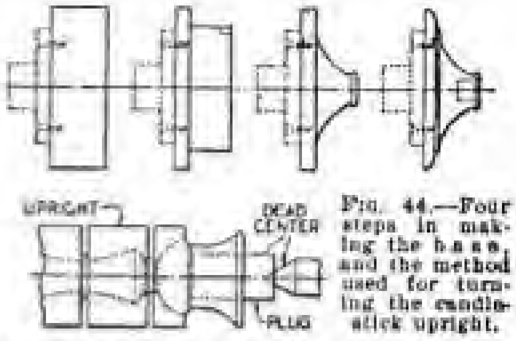


FIG. 44.—Four steps in making the base, and the method used for turning the candlestick upright.

should fit so that it can be forced with the hands into the hole in the candlestick. If too tight, it is likely to split the wood when it is turned down to size; if too loose, it may have a piece of paper wrapped around it.

When the plug is placed in the hole, the end having the mark of the dead center should project so that it can run on the dead center of the lathe (Fig. 44). In this manner the hole bored for the candle will be accurately centered when the stock is turned. Turn the upright according to either of the designs given in Fig. 43.

Get out the stock for the base, plane it flat and true on one side, and cut the sharp corners off it. Screw a faceplate to the planed side of the piece, centering the plate as well as possible. The screws should be rather heavy, and their length depends upon where the screw holes in the faceplate are placed; there must be no danger of cutting into them.

If a small enough faceplate is not available, it will be necessary to use a screw chuck, which is merely a small faceplate with a screw in the center. In hardwoods small holes must be bored for the screws, and soap put on the threads of the screws will act as a lubricant and make it easier to drive them.

After the stock has been securely screwed to the faceplate, the live center is removed from the headstock of the lathe, and the faceplate is screwed on the end of the live spindle.

Adjust the T-rest so that it is parallel to the face of the disk (at right angles to the lathe bed), at a height a little below the center of the stock and ¼ in. away from it. See that the work revolves freely and start the lathe at its medium speed.

With the toe of a skew chisel held at right angles to the face of the base,

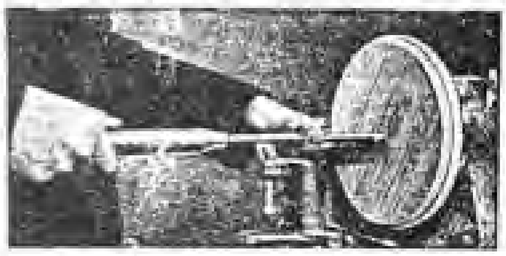


FIG. 45.—Making the base circular by removing wood from the edge with the toe of a skew chisel. Note the position of the T-rest.

remove enough of the material from the edge to make the base circular (Fig. 45). This will diminish the vibration caused by uneven centering. The cut should be stopped about 1/8 in. from the rear face of the base, for the wood may split if the cut is extended all the way across the edge of the base.

If the face of the base is rough or much material has to be removed, first use a round-nose chisel, holding it flat upon the T-rest and at right angles to the base. Move the chisel across the face of the base from the front to the center and back again. Smooth the face with a square-nose chisel and test for flatness with a try-square as in Fig. 46.

Mark the diameter of the base by setting a pair of dividers to a distance equal to the *radius*. Place one leg on the center and scribe the circle with the other leg while the stock is revolving.

Another way is to set the dividers to the required *diameter*. Rest one leg of the dividers on the T-rest and place it in contact with the revolving stock. Bring the other leg of the dividers gradually in contact with the stock. If two circles are marked, shift the dividers so that the points come in contact with the stock halfway between the two circles, when only one circle will be marked (Fig. 47, lower view).

Fig. 46.—After the base has been trued with a round-nosed chisel and smoothed with a square-nosed tool, it should be tested for flatness.

The second method is more exact and is especially useful when the center has been cut away. It is very quickly mastered.

Reduce the base to the required diameter as explained before. Then adjust the T-rest parallel to the lathe bed and to the edges of the base, and with the square-nose chisel remove the thin piece of material left on the rear edge of the base.

Next mark a pencil line all around the base to represent the thickness of the part which is to be of the greatest diameter. To make the explanation simpler to follow, the base of the candlestick shown at the left in Fig. 43 will be used as an example. The line just mentioned will accordingly be 3/8 in. from the rear face of the base (see Fig. 44).

Change the T-rest to its first position (parallel to the face of the base); set the calipers to 3 3/8 in. and mark another circle with the dividers as described above. Cut down to the pencil line with the skew chisel on this diameter (3 3/8 in.). Set the dividers to 7/8 in., mark the circle, and cut the concave curve between this circle and the one previously marked (3 3/8 in.). To do this, adjust the T-rest at an angle and as near to the surface being turned as possible. Cut the square bead and round off the corners on the 4 1/8 in. part with a skew or square-nose chisel.

With the dividers, mark the diameter of the hole in which the tenon of the upright piece is to fit. Cut on the inside of the line with the toe of a 1/4-in. skew chisel and remove the center with the skew chisel or a round-nose chisel (Fig. 47, upper view). Cut the hole so that the tenon fits snugly.

Fig. 47.—Upper view: Using the toe of a 1/4-in. skew chisel to bore the hole that is to take the tenon of the candlestick upright. Lower view: Marking the diameter of the hole with dividers held on the T-rest and centered by trial.

Leave the base as it is in the lathe, put a little thin glue on the tenon and in the hole, and fit the tenon in place. Clamp the base and the upright together in the lathe by pressing the dead center into the plug in the end of the upright. Wipe off any surplus glue with a piece of waste moistened with hot water, and leave the candlestick to dry in the lathe.

Sandpaper and stain the candlestick to the desired color. If a water stain is used, it is well to wet the wood before applying the stain. The water raises the grain, making it feel rough to the touch, and it is therefore necessary to sand the candlestick again when it is dry. It will be found that the wood will dry more rapidly if the lathe is running. A second wetting of the wood with water stain will not raise the grain.

If the wood is very porous, such as oak or Philippine mahogany, it should be filled with paste wood filler thinned with turpentine until of the consistency of cream. Apply it to the candlestick with a brush. After a little while it will lose its luster and become flat. The lathe then should be run at its slowest speed while the filler is rubbed into the pores of the wood with a cloth. Wipe clean with a piece of waste, and allow the filler to dry for twenty-four hours.

A thin coat of shellac as an undercoat for the finish next should be applied with a brush. On relatively close-grained woods, such as birch or Santo Domingo mahogany, the filler coat may be omitted and the shellac coat applied directly after the stain has dried.

The shellac should be allowed to dry for several hours. The lathe then may be started and this coat rubbed down with No. 00 steel wool. Be careful not to rub through the stain on sharp edges and beads.

Next a coat of clear lacquer may be brushed on evenly. Do not brush twice over the same place. The lacquer, which dries very quickly (within an hour), may be rubbed down with No. 5/0 waterproof sandpaper or powdered pumice stone sprinkled on a rag dipped in soapsuds or rubbing oil (crude oil). If a higher gloss is desired, two coats of lacquer may be applied, only the second coat being rubbed. Do not use an oil stain or oil in any form under a lacquer finish.

Fig. 48.—Gracefully turned table lamp of a type any home worker can make on a small lathe.

A thin coat of liquid wax also adds to the luster. This is applied with a piece of cotton waste or a rag and polished with a flannel cloth while the work is revolving in the lathe.

The candlestick is now finished. The plug is removed from its upper end (a pair of gas pliers may be helpful for this purpose), and the faceplate is unscrewed from the base. The holes left by the screws may be plugged by filling them with wood cement or stick shellac. This is sold in all colors; it looks like sealing wax and is melted in the same way.

A piece of thin felt may be glued to the base. Apply the glue to the bottom of the base, *not to the cloth*, press the cloth in place, and set away to dry. The edges of the cloth may be trimmed later with a pair of scissors.

Another method of turning the base, so as to avoid the screw holes, will be explained in the following section.

TABLE LAMP

The turned table lamp illustrated in Figs. 48 and 49 consists of two parts, the upright and the base. Before the upright can be turned, a hole must be made lengthwise through its center for the electric wires. This hole may be made either by boring through a solid piece of wood or by gluing two pieces together after first cutting a groove in each.

In the first method the advantage of having a solid piece of wood is offset by

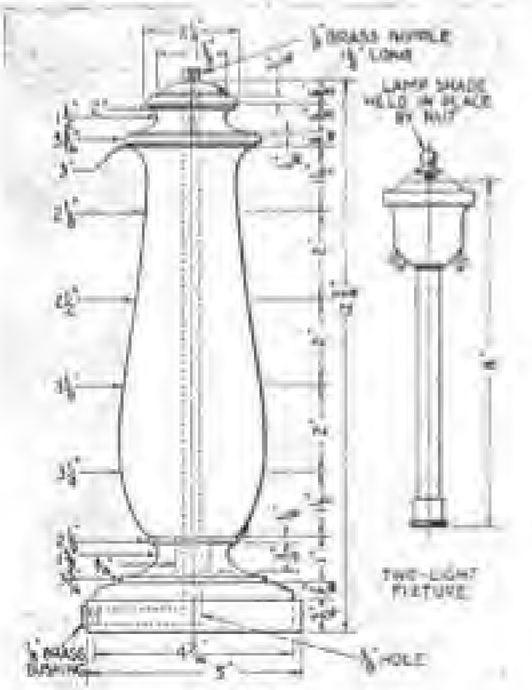


FIG. 49.—The base of the lamp is turned in a wooden chuck as shown in Fig. 50.

the difficulties encountered in boring the hole. The auger bit to be used should have a spur for end-wood boring, and, as the ordinary auger bit is not long enough, a hole must be bored from each end. If the ends are squared accurately with the sides and the holes started on a drill press, there is a good chance to have them meet in the center; moreover, any little unevenness may be readily removed by inserting a red-hot iron rod.

The only difficulty about the second method is to plane the faces of the two pieces accurately, so that they will make a perfect joint. A groove 3/16 in. deep and 3/8 in. wide should be cut in the center of each piece before gluing.

When turning the upright, block the hole in the end running on the live center (the tenon) with a piece of soft wood. The hole in the other end is left the way it is and runs on the dead center.

The base may be turned so as to avoid screw holes in the bottom. Get out the stock, plane one side, and screw it to the faceplate as explained in the preceding section.

Reduce the wood to the thickness and diameter required and cut a little depression in its center about 1/16 in. deep and about 1 in. less in diameter than the total diameter of the base (Fig. 50). This is the bottom of the base, and the depression is cut to make it stand well.

Bore a hole with a 3/8-in. auger bit into the edge of the base and well past its center. Sandpaper the bottom and edge of the base and remove it.

A device called a "chuck" is now made from a piece of wood, preferably soft and at least 1 in. larger in diameter than the base. This is screwed to the faceplate, faced off, and turned to its largest possible diameter.

Caliper the diameter of the lamp base carefully, mark this diameter on the soft wooden disk, and cut a recess into it about 1/4 in. deep. The base should fit

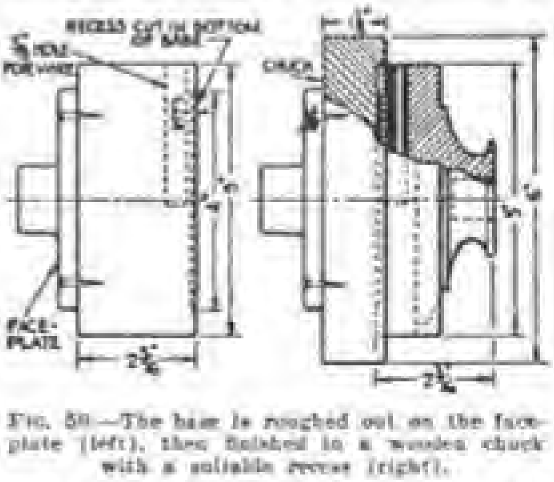


FIG. 50.—The base is roughed out on the faceplate (left), then finished in a wooden chuck with a suitable recess (right).

very tightly in this recess. To begin with, cut well within the line marked and gradually enlarge the recess until the right diameter has been reached.

If the recess should be too large, place a piece of paper over it and drive the base in place. If this should not hold the base tightly, face the disk off and try again. When the base fits properly and is driven tightly up against the bottom of the recess so that it runs true, it may be turned in the usual manner without danger of coming loose. This operation is called "chucking." To remove the base from the chuck, grasp it firmly with one hand and tap the face of the chuck with a hammer.

It is best to stain and finish the upright and the base separately. A 1/8-in. metal bushing is screwed into the hole bored into the side of the base, and a 1/8-in. brass nipple about 2 in. long is screwed into the top of the upright so

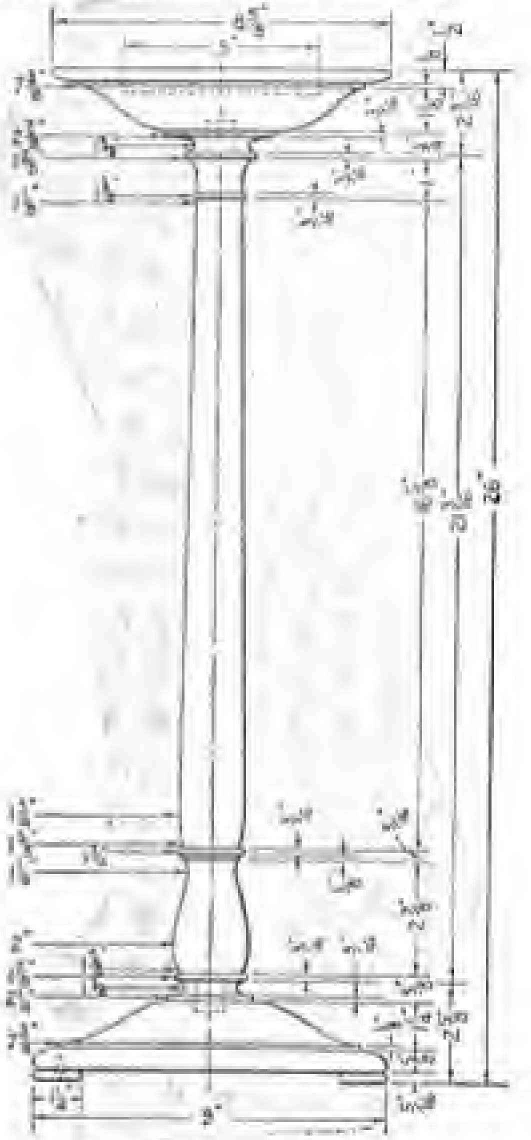


FIG. 51.—This smoking stand is an interesting project from the turner's standpoint and makes a fine gift.

as to project about 3/8 in. From the lower end of the upright, remove the wooden plug; pull the lamp cord through the hole, and glue the upright to the base. The lamp may be held in the lathe until the glue has set, the base fitting in the chuck and the brass nipple over the dead center.

A two-light fixture, such as shown in Fig. 49, is screwed to the nipple. It is fitted with two pull sockets to which the proper wire connections are made. The other end of the lamp cord is fitted with a plug.

The shape, color, and fabric of the shade is a matter of individual taste.

SMOKING STAND

Similar problems in wood turning are involved in making the smoking stand shown in Fig. 51. It consists of three main parts—the base, the upright, and the top. First turn the upright.

The base should be turned without chucking it, as it is not important to

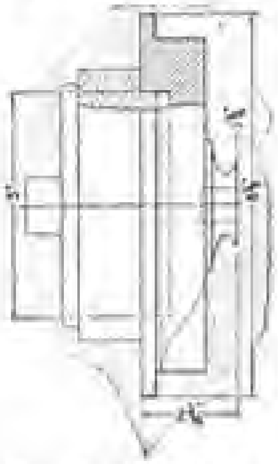


Fig. 52.—How the top member of the smoking stand is held on a wooden chuck.

hide the screw holes. When the three little feet are screwed to its underside, it will stand firmly. Before turning these, bore $\frac{3}{16}$-in. holes for the screws through the center of the stock. The feet are turned exactly as in one of the exercises given under convex turning (see Fig. 25).

Unlike the base, the top must be chucked before being turned to avoid unsightly screw holes. Instead of fitting inside the chuck, as in the case of the base for the table lamp, it fits over it and against a shoulder turned on it (see Fig. 52). The recess cut in the top is for a glass or metal tray. The diameter and depth of this recess, therefore, will vary according to the dimensions of the ash tray.

Glue the parts together and finish the stand as previously suggested.

SIX DESIGNS FOR GIFTS

A variety of attractive objects is suggested in Fig. 53. They were selected because of their suitability as gifts and also because they are small and simple. In making them, the following outline of the processes will be of assistance to the inexperienced wood-turner:

Flower Holder. Step No. 1—Base: Stock 1¾ in. thick and 3½-in. in diameter. Turn on a screw chuck. Work the bottom side to correct form. Rechuck and turn face. Step No. 2—Shaft: Bore hole for test tube, plug hole, and turn around this hole. Fit the shaft dowel into the base. Step No. 3—Stain and polish in the lathe.

Teapot Stands. Step No. 1—Turn the bottom to shape and rechuck. This operation may be omitted, if desired, to simplify the turning. Step No. 2—Turn the face side. Step No. 3—Stain and polish in the lathe. Step No. 4—Fasten an etched copper or German silver top to the stand.

Picture Frame Moldings. Step No. 1—Turn the face side or molding design. Step No. 2—Stain and polish in the lathe. Step No. 3—Rechuck and turn the rebate for the picture and glass. Five designs are given below.

Lady's Writing Set. Look around the house for a small ink bottle of about the size shown on the drawing. Step No. 1—Box part: Turn out the inside of the box to fit the bottle. Step No. 2—Rechuck and turn the outside. Step No. 3—Cover: Turn the inside of the cover to fit over the neck of the bottle. Step No. 4—Rechuck and turn the outside of the cover to design. Stain and polish in the lathe. Step No. 5—Make the base and screw into the box part from the bottom. Glue felt to bottom.

Boudoir Watch Case. Purchase the watch first; a cheap one with radiolite face will be satisfactory. Step No. 1—Turn the face portion first, rechucking and turning the back to fit the watch. Step No. 2—Turn the back portion, fitting it to the face portion.

Sewing Set. Step No. 1—Base: Turn the bottom side. Rechuck and turn the face side to design. Step No. 2—Turn

Fig. 54.—As a gift for any woman, what could be more appropriate than this graceful sewing set?

the disk on both sides. Step No. 3—Turn the cushion holder. Step No. 4—Turn the shaft between centers. Step No. 5—When gluing the parts together, do not fasten the disk; it should be free to revolve. Cement the brass dowels in place. (See above illustration, Fig. 54.)

TURNING RINGS

The turning of a solid ring of wood represents an advance in the line of faceplate work previously discussed. An example of ring turning is the napkin holder illustrated in Fig. 55 at *A* and *B*. This is turned partly between centers and partly on the faceplate.

If it is desired to turn two napkin rings, cut a piece of wood at least ¼ in. thicker and wider than the finished outside diameter of the ring and about 2 in. longer than the combined length of two rings. For two rings of the dimensions indicated at *A*, the rough stock should be 2¼ by 2¼ by 6 in.

Square one end of the piece carefully with the sides, an operation which may be done conveniently by sawing the stock in a miter box. Locate the center by drawing diagonals and bore a $\frac{3}{16}$-in. hole about ½ in. deep and a gimlet or twist bit. Fasten the piece to a screw chuck, which is simply a small faceplate with a single heavy screw in the center.

If a screw chuck is not a part of the lathe equipment, an ordinary faceplate

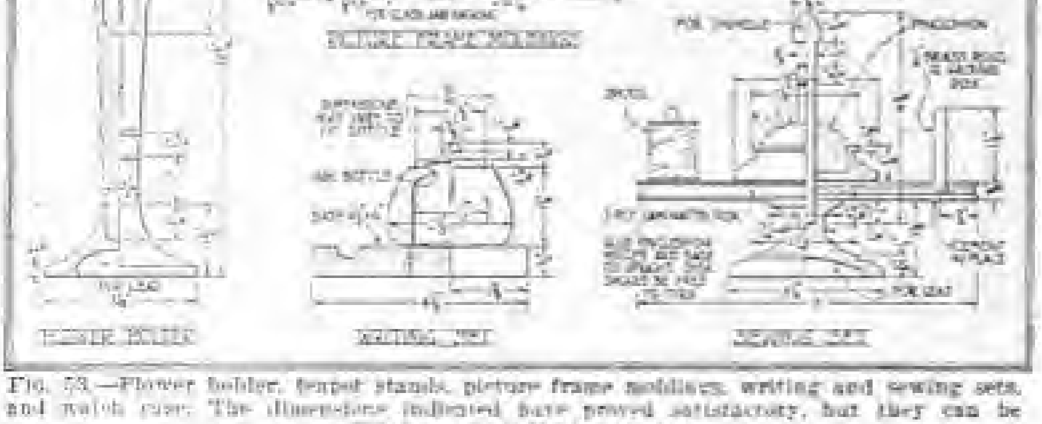


Fig. 53.—Flower holder, teapot stands, picture frame moldings, writing and sewing sets, and watch case. The dimensions indicated have proved satisfactory, but they can be modified by the individual worker.

may be used. Screw a piece of wood to the faceplate and turn a circular disk. Mark the center on the disk while it is revolving in the lathe and bore a 3/16-in. hole, countersinking it on the side which is against the faceplate. Insert a heavy flat-head screw of the proper length (depending upon the thickness of the disk) and fasten the piece to be turned firmly to the disk as at *C*.

The dead center is now run against the free end of the 2¼-by-2¼-by-6-in. piece, which is rounded off and smoothed in the usual manner. The napkin rings are then laid out, turned, and sanded as explained in previous articles.

When the outside shape of the rings has been formed, the dead center is moved out of the way and the tool rest placed close to the end of the piece and at right angles to the lathe bed. Mark the diameter of the 1½-in. hole with a pair of dividers (use the second method described in the section on candlesticks) and start the boring of the hole with a very sharp round-nose chisel. Begin in the center and gradually work out towards the edge. Alternate with a ½-in. skew chisel, which should be held so that it cuts with the toe (see Fig. 47, upper view). Test the diameter of the hole with a pair of inside calipers. Then round the edges and sandpaper the work.

The dead center should now be moved up again, so that its point bears against the wood at the bottom of the hole just cut. This added support is needed for cutting the first napkin ring away with the parting tool. The remaining one is then bored and cut off in the very same manner.

The remaining end of the 6-in. piece is now turned until it is equal to the diameter of the holes which have just been cut halfway through the two napkin rings. The length should be a little less than the depth of the hole, so that the napkin rings will butt up against the square shoulder formed on the piece as at *B*.

While turning this chuck, try the fit of both napkin rings frequently, because the hole cut in one napkin ring is likely to be slightly larger than the hole cut in the other. Finish the larger one first and then cut down the chuck to fit the smaller one. Do not force the rings too tightly on the chuck or they may split.

Bore the other half of the hole in each ring as explained above. Then stain and polish the rings.

When a ring having a circular cross section is to be turned from a solid piece of wood, the stock, after being faced off, should have the same thickness as the diameter of the cross section of the ring, as indicated at *D*. A piece of ¼-in. plywood is placed between the screw chuck and the material to be turned and prevents the screw in the chuck from penetrating the ¾-in. disk.

After facing off the disk and turning it to the required outside diameter—in in this case 4 in.— it is cut down as shown at *D*. The square corners are then cut off (*E*), after which the ring is rounded as shown at *F*.

A template may be made of a piece of strong cardboard or veneer about 2 in. square. Proceed as follows: Draw a straight pencil line about in the center of the piece of cardboard. Tack it to a piece of wood, place the screw of an auger bit of the desired diameter—in this case ¾ in.—on the center line, and bore a hole. Cut on the line with a knife, thus dividing the cardboard in two pieces. Use half of it as a template as at *G*.

Chuck the partly turned ring as shown at *F*. The wood used in making the chuck may be soft, and it is well to have it thick in case the recess cut in it should be too large; in that case it may be faced off again and another recess cut. The center is now cut away and the turning of the ring completed.

Such rings may be used for the hanging of curtains or portières, or as towel or necktie rings. A necktie holder is shown at *H*. It fits into another turned piece, which is screwed to the wall or to a closet door.

A small section is cut out of the ring, thus permitting it to be sprung a little and slipped into a hole bored in each side of the turned piece. The center of these holes is found by wrapping a strip of paper ⅞ in. wide around the piece. Cut the ends of the paper so that they just meet. Remove the paper and fold it once in the center. Draw a pencil line lengthwise through the center of the paper, wrap it again around the wood, and prick a hole on the center line where the ends of the paper meet and another where the pencil line crosses the fold as at *I*. Bore these holes while the turned piece is in the lathe and before the ends have been cut off.

A towel ring should be a little larger. It may be flattened slightly on one side and fastened at right angles to a wall or a door with a round-head screw as in the upper drawing of Fig. 56.

These rings may be made stronger and more interesting if they are made of three or more layers of wood, preferably of contrasting colors, such as walnut and birch. Thin layers of ebonized wood about 1/16 in. thick will appear as black

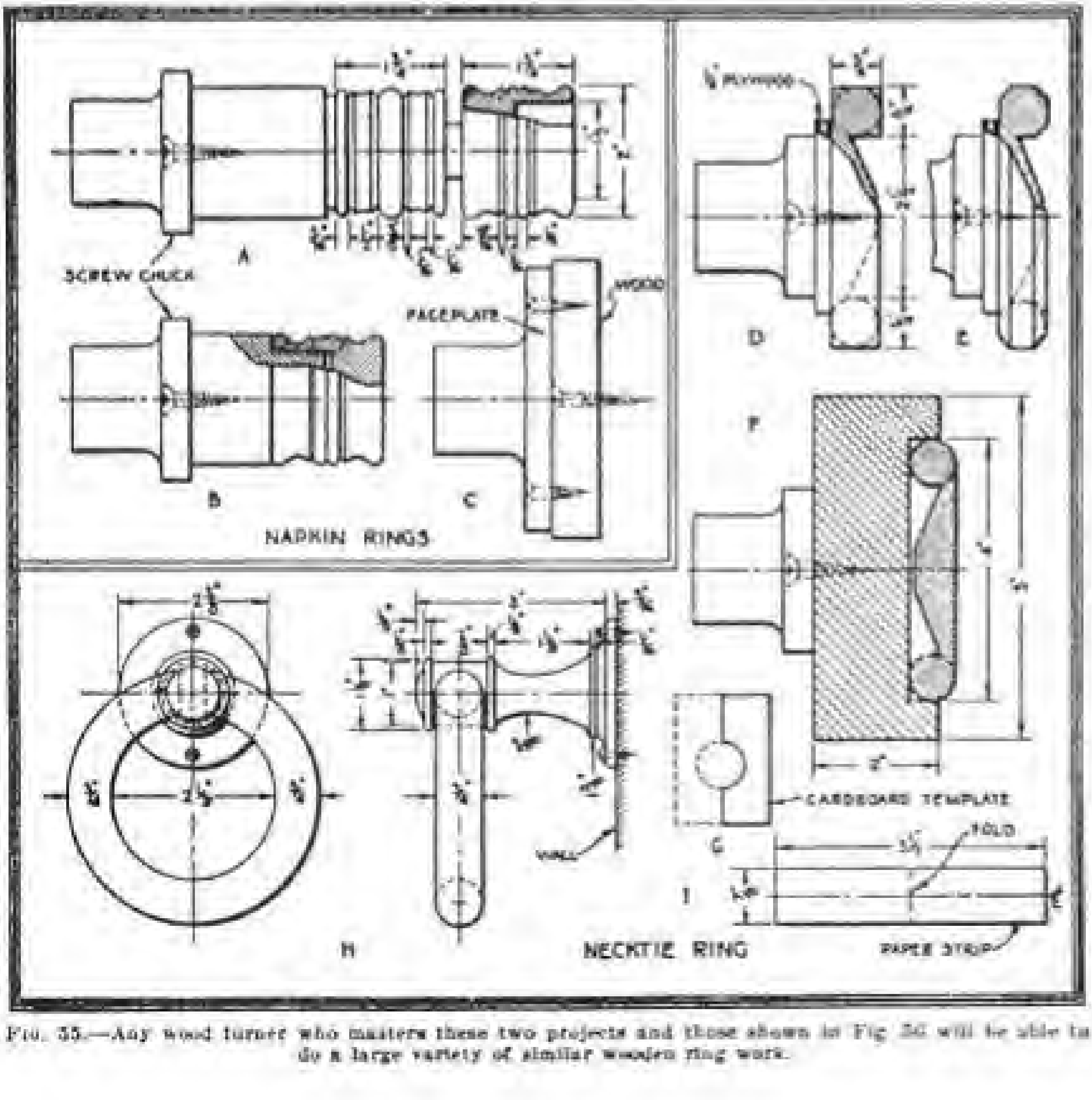


FIG. 55.—Any wood turner who masters these two projects and those shown in Fig. 56 will be able to do a large variety of similar wooden ring work.

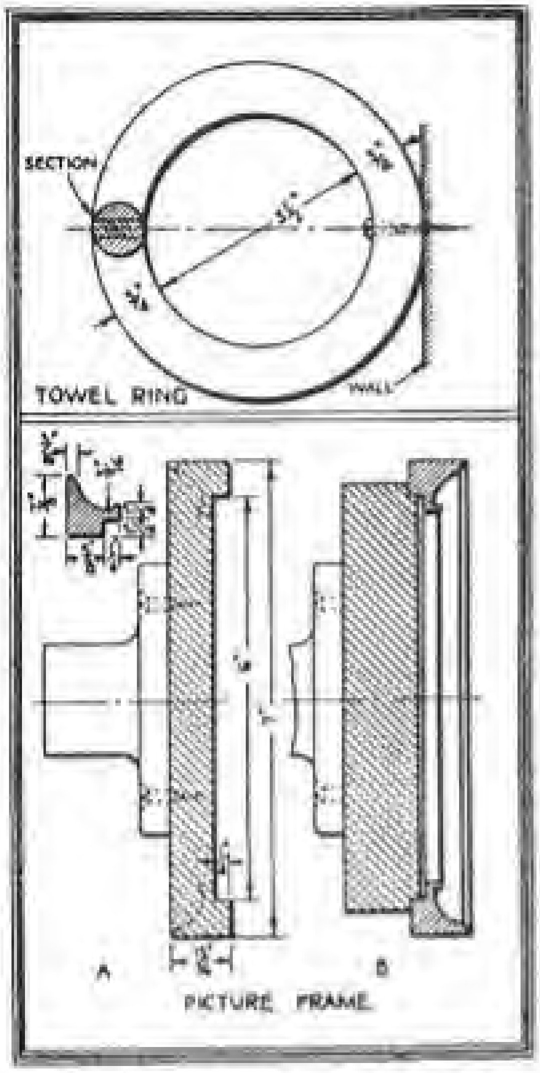


FIG. 56.—For these two pieces, as well as those shown in Fig. 55, a close grained wood such as birch, mahogany, or walnut should be used, or, for more ornamental effects, a combination of contrasting woods glued in layers.

inlaid lines. The layers should always be an uneven number. If three are used, the inside layer should run at right angles to the two outside layers (see the sectional view). It is obvious that the layers should be glued up into a solid block or disk before the ring is turned.

The turned picture or mirror frame (Fig. 56, lower drawing) is simply another type of ring. Make a full size drawing of the frame and screw a piece of wood of the required dimensions to a small faceplate. Face off and turn the piece to the desired diameter. Cut the recess for the picture, glass, and backing as shown at *A*. If the frame is going to be thinner than the one shown, it will then be necessary to back it up with a piece of plywood as shown in Fig. 55 at *D* to prevent cutting into the screws.

Remove the disk from the faceplate and turn a chuck as shown in Fig. 56 at *B*. The disk is now fitted to the chuck, its center cut away, and the design of the molding turned.

Some wood turners prefer first to turn and polish the face of the frame, then to chuck it, and finally to cut the recess for the glass. The method described above permits the molding to be finished and polished after all the cutting has been done and prevents it from being marred by chucking.

Other designs for picture frame moldings are shown in Fig. 53. Books on wood turning having many attractive designs may also be consulted in most public libraries. The following are to be recommended: *Course in Wood Turning*, Milton and Wohlers; *Art and Education in Wood Turning*, William W. Klenke; *Wood Turning*, George A. Ross.

To obtain the best results, a close grained wood such as birch, maple, mahogany, or walnut should be used for rings and frames.

TURNED AND INLAID TRAYS

In turning and inlaying trays, the tool processes involved are only a step in advance of those previously described.

The tray illustrated in Fig. 57 at *A* is turned from a solid circular disk not less than 1⅛ in. thick and 6¼ in. in diameter. A circle 6¼ in. in diameter is scribed on the wood with a pair of dividers. The wood is then sawed as nearly round as possible and screwed to a faceplate.

Its outside shape is first turned. For this work it is advisable to use a template of cardboard or thin wood such as shown at *B*. If it is to be guided properly, the template should bear against a flat surface—in this case the underside of the tray. The recess in this surface is therefore cut after the outside shape of the tray has been completed. Obviously, the purpose of this bottom recess is to make the tray stand well on a flat surface.

The tray is now unscrewed from the faceplate and chucked as at *C*. It is well to support it during the hollowing-out process by running the dead center up against it. When the tray has been hollowed to the extent shown at *C*, the tailstock is moved out of the way and the central part turned down level with the rest of the bottom.

On the half plan at *A* is shown a circular inset, which is inlaid in the bottom of the tray. Such insets are sold by manufacturers of marquetry and are inexpensive. They are made up of many separate small pieces of wood about 1/28 in. thick, which are glued to a piece of brown paper. A piece of veneer surrounds the inset for protection; it should be carefully cut away with a pocketknife.

A shallow recess of the correct diameter to receive the inset is cut with a skew chisel in the bottom of the tray. The inset is glued into this recess face down, that is, with the papered surface towards the top of the tray. If glue were applied to the papered surface, a good bond would not be made, because the paper might split and parts of the inset come loose.

The gluing may be done by clamping a block of wood over the inset, which should be allowed to dry for at least six hours. Then the bottom of the tray is faced off and sandpapered smooth. The

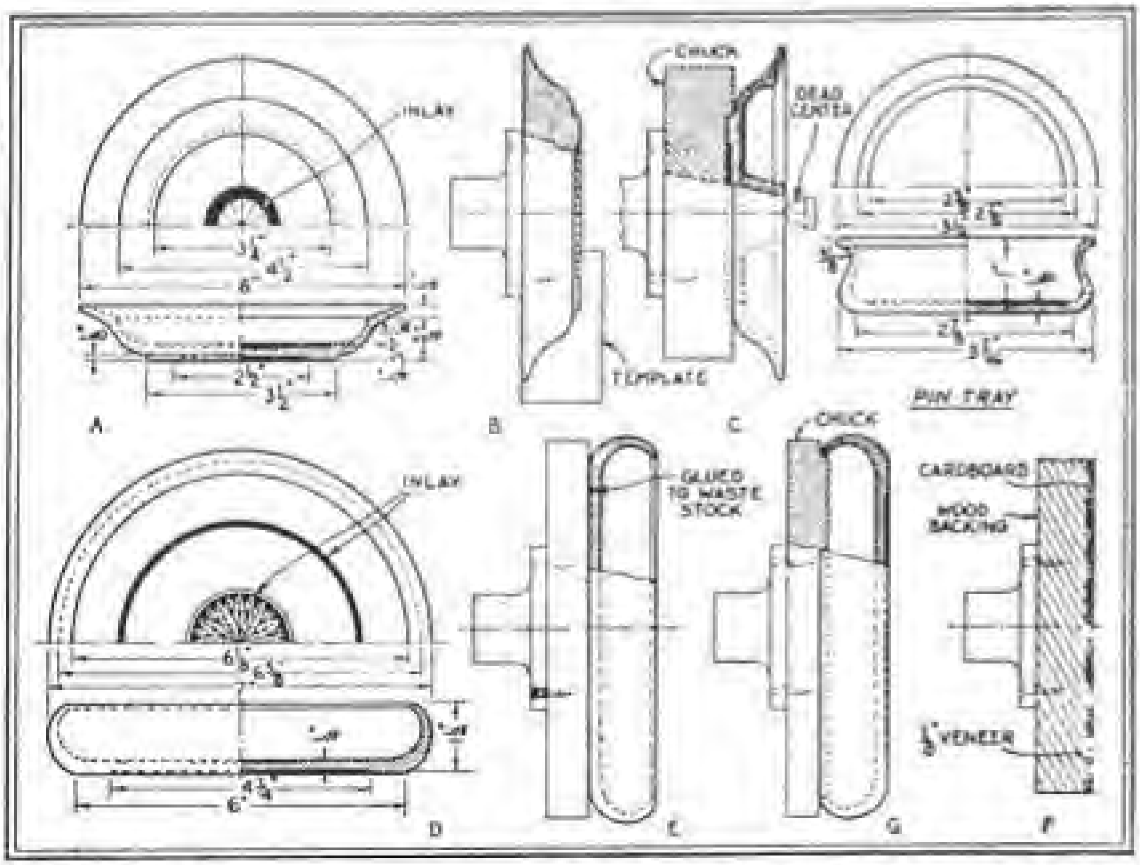


FIG. 57.—A tray with an inlaid ornament (*A*) and how it is turned (*B* and *C*); a tray with an additional line or band of inlay (*D*, *E*, *F*, and *G*), and a design for a pin tray.

brown paper is removed by this process and the inset now stands out clearly and beautifully.

The tray shown at *D* is turned by a process known as "gluing to waste stock." This is done as follows:

Turn a circular disk of the proper diameter and face it off very carefully, so that it is absolutely flat and level. Prepare the stock from which the tray is to be turned. Plane one of its surfaces true and level and saw the stock to the required diameter.

Glue the planed surface of the tray to the waste stock, but *place a piece of paper between the two glued surfaces.* In order to center the stock for the tray

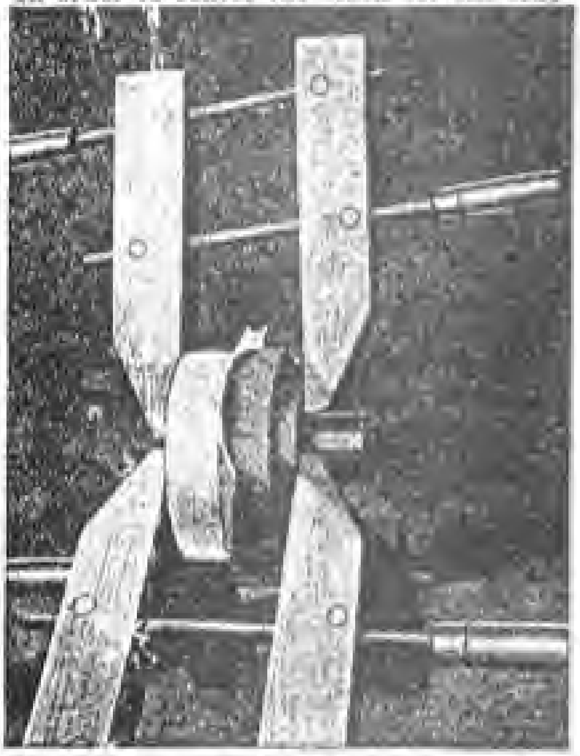


FIG. 58.—How the wood for a tray is glued to a piece of waste stock with a sheet of paper between, to facilitate splitting them apart.

accurately, first glue the paper to the waste stock and then mark the diameter of the tray on this papered surface with a pencil. This is easily done while the waste stock is revolving in the lathe. Remove it from the lathe and glue and clamp the stock for the tray securely to it as shown in Fig. 58. When the glue is thoroughly dry, turn the tray as shown in Fig. 57 at *E*.

Besides an inset in the center, which is inlaid in the manner described above, this tray also has a line inlay. Ordinary straight lines of inlay cannot be bent to form a circle of such a small diameter. This line is therefore turned from a piece of veneer in the form of a ring.

To accomplish this, a piece of ⅛-in. veneer is glued to a circular disk, with a piece of cardboard between the disk and the veneer as at *F*. When the glue is dry a ring of the desired width and diameter is turned from the veneer. Use two pairs of dividers with very sharp points, one pair to mark the inside diameter of the ring, and the other pair to mark its outside diameter. Mark lightly, then cut on these lines with the toe of a very sharp ¼-in. skew chisel. The ring can now be separated from the cardboard layer.

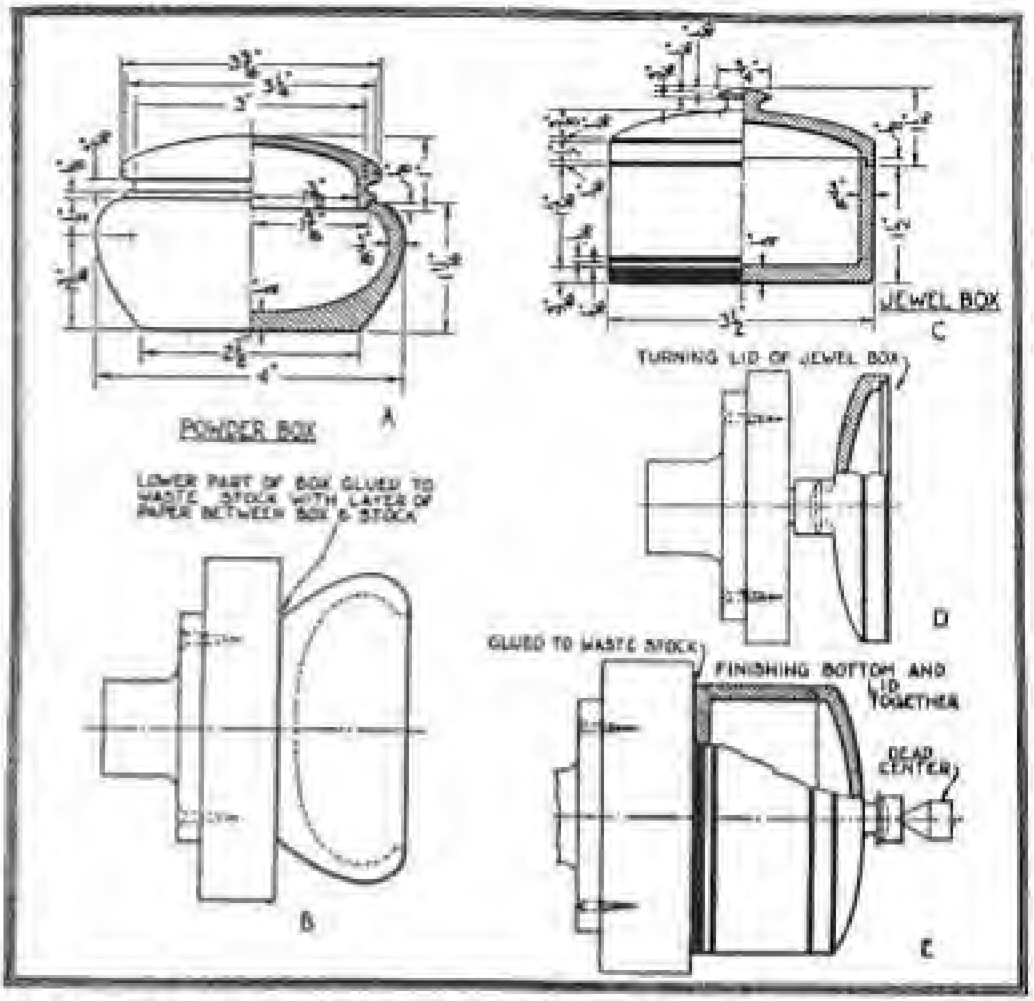


FIG. 59.—Designs for a powder box and a jewel box, and how the lower part of each box is glued to waste stock to facilitate turning.

Mark the bottom of the tray without resetting the dividers, turn a recess for the ring, and glue it in place. When the glue is dry, face off and sandpaper the inlaid bottom, and then stain and polish the tray.

The tray is removed from the waste stock by driving a sharp chisel into the latter ⅟₁₆ in. back of the glue joint. This will cause the paper between the tray and the waste stock to split. The tray may now be chucked as shown at *G* for the purpose of cutting the recess on its underside. The chuck may be made from the waste stock.

A supplementary design for a pin tray, which is turned by the same method, is given in Fig. 57 for those who wish further practice in wood turning.

BOXES AND BOWLS

Making small boxes is one of the most interesting and fascinating types of work that can be done on a lathe.

The cover of the powder box, Fig. 59 at *A*, is turned from a piece of wood at least 1 in. more in diameter than the finished dimensions call for. This piece of wood is securely screwed to a faceplate or screw chuck, after which it is turned to diameter and leveled. It is best to turn the inside of the cover first, and then to cut the recess which fits into the lower part of the box. Use a template for this work. When the outside of the cover has been turned, it is cut off with a parting tool or skew chisel as near to the line as possible. Hold the parting tool with the right hand and grasp the lid with the left when it is cut away from the waste.

The lower part of the box is turned in the same manner as the tray shown in Fig. 57 at *D*. It is cut to approximate size, glued to waste stock (Fig. 59, *B*), and turned in the usual manner.

Particular care must be taken to turn the diameter of the opening so that the cover will fit snugly and yet not so tightly that it must be forced in place. The size of the opening should be tried while it is being turned by fitting the cover to it.

The lower part of the box may be used as a chuck for the lid, which must be smoothed off and sanded at the central point where it was cut with the parting tool. The whole box is now stained and polished, after which its lower part is removed from the waste stock by driving a sharp chisel into the latter ⅟₁₆ in. behind the glued joint. A recess may be cut on the underside of the box by

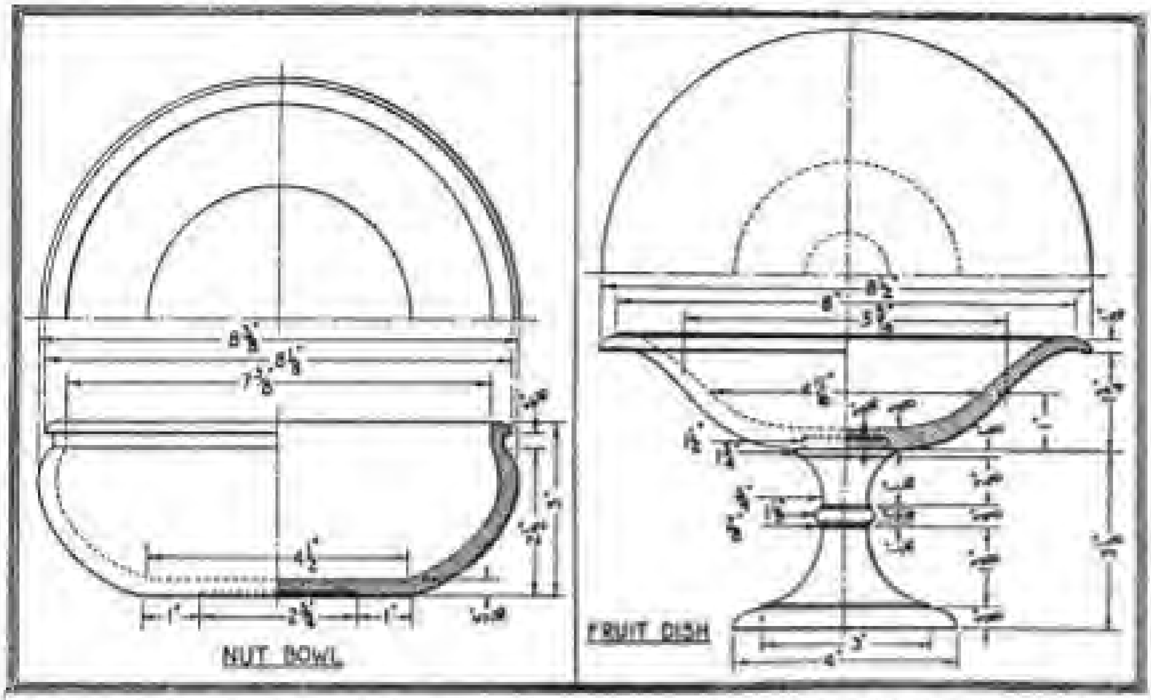


FIG. 60.—Designs for a nut bowl and a fruit dish with suitable dimensions. Variations in the designs can be made to suit the individual taste.

chucking it as shown in Fig. 57 at *G*.

The jewel box, Fig. 59, *C*, is turned in exactly the same manner as the powder box; but as it is inlaid, the stock must be prepared in a different way. The lines of inlay are produced by gluing different colored woods together in layers. The lowest layer, for example, may be a dark-colored piece of wood, such as black walnut or imitation ebony, 3/16 in. in thickness. The next layer is a light-colored wood, such as maple or birch, 1/16 in. thick. This is followed by a dark layer 1/16 in. in thickness, and this again by a layer of light colored wood 1 5/16 in. thick.

If these layers can be had in the thicknesses required, they may be glued up in one solid block as shown in Fig. 61. The block is then prepared and turned in the usual manner. If this is not possible, the following slower method is recommended: The lower part of the box may be built up by gluing a piece

FIG. 61.—How layers of woods of different colors are glued together for making an inlaid box.

of dark wood to the waste stock as explained above. When the glue is dry, it is turned down to 3/16 in. in thickness and made perfectly level and flat. The next layer of light wood is glued in place and faced off, followed by the dark layer and then the final light layer. When the required layers, reduced to the proper thicknesses, have been glued together in this way, the stock is ready to be turned. The cover for the box is built up in the same manner. The first lay of light wood is 2 in. thick and is screwed directly to a faceplate. This is faced off and followed by a dark layer, this in turn by a light layer, and this by a dark layer.

As the cover must be of exactly the same diameter as the lower part of the box, these two parts are put together as shown in Fig. 59 at *E*, smoothed, and sanded. The dead center is run into that part of the cover from which the knob is turned. This adds to the stability of the box during the final smoothing and sanding.

The knob is the last part of the box to be turned. This is easily done while the whole box is mounted between centers as shown at *E*. Enough material should be left on the knob when the cover is cut off so that the mark made by the dead center may be entirely cut away.

In all inlay work it is well to remember not to have too violent a contrast between the inlay and the inlaid surface. If, for example, imitation ebony (ebonized wood) and maple are used for the jewel box, the maple should be stained a darker color such as amber, which resembles antique maple.

After completing the trays and boxes, the woodworker who has followed this series of articles should be able to analyze and determine for himself the best way to do any ordinary job in spindle and faceplate turning.

The nut bowl, Fig. 60, is turned by the "glue-to-waste-stock" method as explained before. The design may be modified so that a small circular block is left in the center similar to the one shown in Fig. 57 at *C*. In this case, however, the block is not removed. Instead, small holes are bored in it for receiving the nut picks when not in use.

The fruit dish, Fig. 60, consists of two parts. The base is turned between centers in the usual way. The top may be turned in the way the covers of the boxes were turned (see Fig. 59, *D*). It has to be chucked so that a hole may be bored in its underside for the 3/8 by 1½ in. tenon on the base. In gluing the parts, leave the upper part in the chuck and center the lower part by running up the dead center.

RADIO TABLE AND MIRROR

Split turning is a form of furniture decoration that came into vogue in the early part of the seventeenth century during the Jacobean period. Jacobean furniture has again become popular and reproductions adapted to modern needs are made by many high-class furniture manufacturers.

As the name implies, split turning means that ordinary turned work is split or divided into two or more parts, which in turn are glued to flat wood surfaces (see Figs. 62, 63, and 64). Obviously, it would be impracticable to split or divide a solid turned column; split turnings are made from separate pieces of stock fastened together before they are turned.

If turned halves, such as those used to decorate the radio table and the mirror frame, are to be made, the method of procedure is as follows:

Prepare two pieces of stock, making them a little wider than the greatest diameter of the turned pieces, and about 3 in. longer. The thickness of these two pieces should be equal to half their width, and they should be planed so that their faces fit accurately against each other. They may be fastened by screwing their ends together in the manner suggested in Fig. 65, at *A*, by gluing their ends together for a distance of about 1½ in., by gluing them throughout their entire length with a piece of paper placed between the joint, by bolting them together as at *B*, or by driving corrugated fasteners into the end wood at both ends. The work of fastening them together must be carefully and securely done.

The pieces are now set up in the lathe and turned between centers in the usual way. When the turning is completed, the pieces are removed, and the two ends holding them together are cut off with a saw.

When quarter sections are wanted, four pieces are fastened together as shown at *B*, Fig. 65. At *D* is indicated how a quarter section may be used in a corner. Turned quarter sections are often used on chests of drawers, clock cases, mirror frames, and other pieces of furniture.

Sometimes it is desired to fit a turned column over a square corner as at *E*. In this case a quarter section is sawed out of the solid piece from which the column is to be turned. On account of the waste in sawing, this piece cannot be used, but another piece of the proper dimensions is prepared and glued in its place with a piece of paper dividing the joint, as at *C*. When the turning has been completed, the glued piece can be easily removed by forcing the blade of a chisel into the joint, thereby causing the paper to split. The remainder of the paper and glue is now removed from the column, after which it may be glued in place.

Turned moldings, which are decorative and easy to make, should be of especial interest to amateur woodworkers who have difficulty in working out moldings by hand. The various steps in the procedure of turning moldings are illustrated at *F*. Step No. 1 shows the end of a square piece of stock, to the sides of which four pieces of wood are glued. A piece of paper is placed between the joints, so that the finished strips of molding may be separated easily from the square stock.

It is very important to center the square piece accurately in the lathe; otherwise the four strips of molding will not be uniform in size. It is well to cut into the square piece near each end with a parting tool until the tool is in contact with the wood all around. If it is found that the parting tool has cut deeper into one or two sides than into the others, these sides should be planed until the cut of the parting tool is uniform on all four sides.

The stock is now rounded off as shown in Step No. 2, after which the design of the molding is laid out and turned. The four strips of molding are then separated from the square core by forcing the blade of a thin, sharp chisel into the joint at either end. This causes the paper to split. The molding may be glued to a backing of any desired shape as shown in Step No. 3.

The radio table, Figs. 62 and 63, is a typical adaptation of Jacobean furniture design to modern needs. Although the piece is ornate in appearance, the construction is really simple.

First lay out and turn the four legs;

Fig. 62.—A radio table which has a rich and ornate appearance yet is not particularly difficult to make.

then get out the side rails and stretchers and join them to the legs with mortise and tenon joints. The two sides are next connected by means of a central stretcher mortised into the side stretchers, a rear rail, and two front rails. The upper front rail is joined to the legs with a half-lap dovetail joint as shown on the plan view, and the lower rail or apron is joined to the legs with dowels as shown in the detail. This completes the framework.

The drawer front consists of a ½-in. piece to which four 1½ by 4 in. blocks, shaped as shown at *A* in the drawer front detail, are glued at each end, and a block *B*, ½ by 4 by 4 in., in the center. A suitable molding is fitted and glued around these blocks and along the top and bottom edges. The drawer is then constructed and fitted in place.

The split turning is applied to the front legs as shown, after which the top is made and then screwed to the rails by means of cleats. Two pear-shaped drawer pulls (and a lock, if desired) should be applied and then removed until the table has been sandpapered and finished. Any good cabinet wood is suitable for this table.

In the mirror frame, Fig. 64, split turnings again form the decoration. The frame itself consists of two side pieces, a top piece, a bottom piece, and a narrow central piece. These pieces, which are all rabbeted to receive the glass and back, may be joined with dowels. After

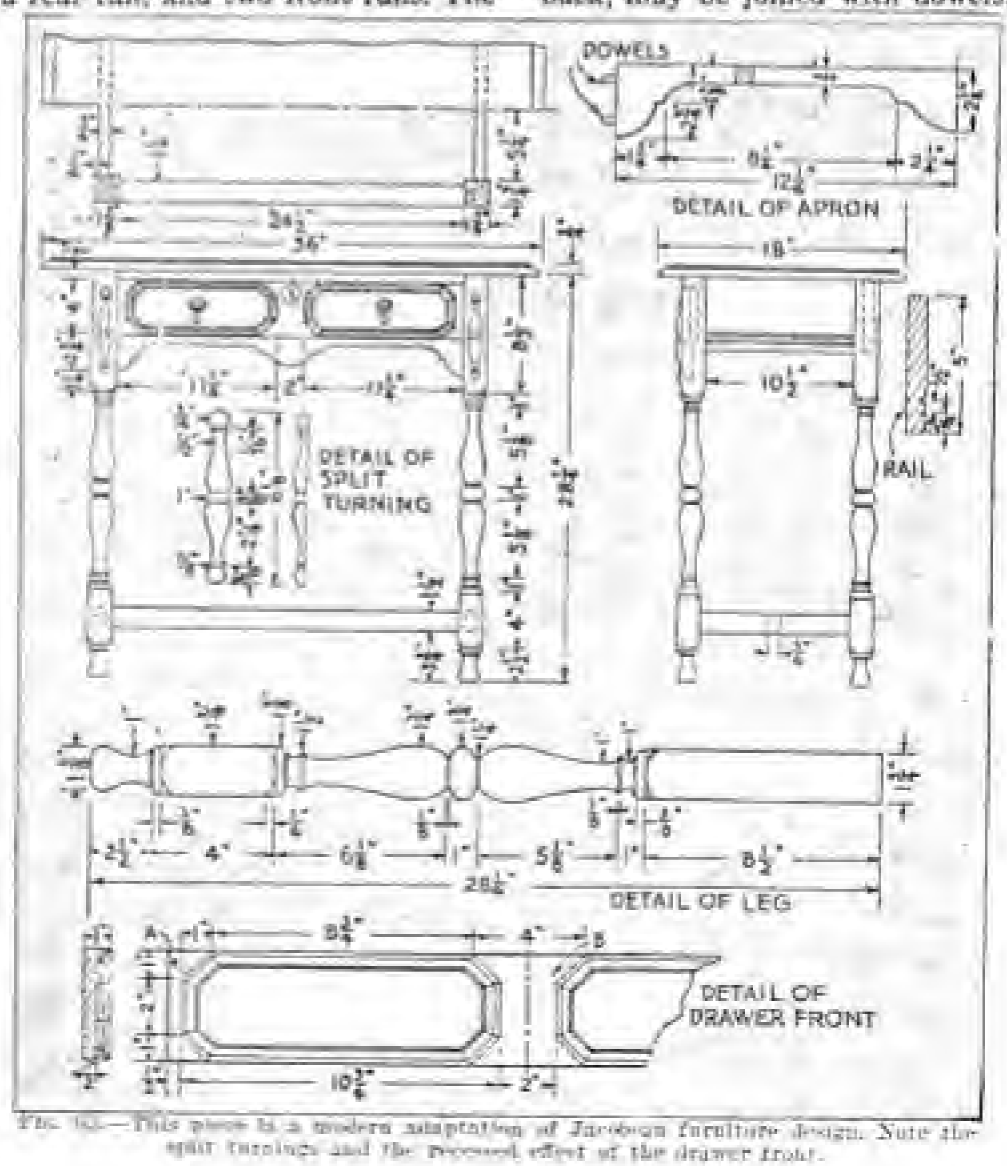


Fig. 63.—This piece is a modern adaptation of Jacobean furniture design. Note the split turnings and the recessed effect of the drawer front.

being glued, the frame is planed level and smooth.

The two half columns then are made and glued in place. Each column consists of the reeded central part, two turned caps, and two rectangular blocks. The columns may be turned in a single piece or they may be made in several parts; that is, the rectangular blocks, the caps, the bases, and the central part may be made separately, fitted together, and glued to the sides of the frame. A simple molding is now made and fitted around the top part of the frame as shown in the plan view. A top and a bottom piece screwed or doweled in place complete the frame. A turned molding may be used instead of the one shown, if the top piece is made plain like the bottom piece. The process of reeding will be explained in a following section.

It is advisable to place a piece of paper between the mirror and the backing. The backing itself is of plywood. If the frame is constructed of thinner stock or the rabbet is made more shallow, the backing may be made in one piece and screwed to the outside of the frame.

OVAL AND IRREGULAR TURNING

A knowledge of oval turning occasionally may be found useful, although

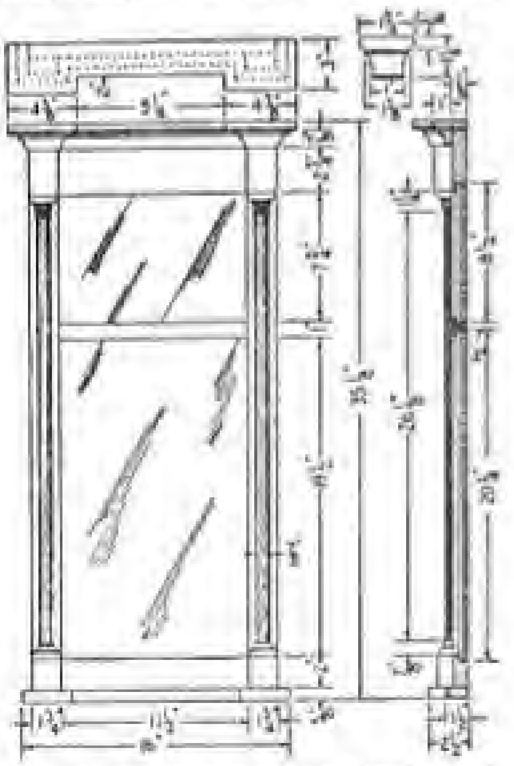


Fig. 64.—Split turnings in the form of reeded columns form the principal ornaments of this mirror.

it is hardly worth while to turn such things as a hammer handle, which can be bought so cheaply. As a matter of interest, however, the process deserves description. The shape of the oval is laid out on the end of a piece of stock of slightly larger dimensions (see Step No. 1, Fig. 65, *G*). The larger center line, that is, the longest axis of the oval, is marked all around the stock as shown. The other center line is then marked and the centers determined and laid out on both ends. Small holes should be bored in the ends at these points.

Mount the stock in the lathe, using a pair of centers nearest to the operator, as in Step No. 2. Run the lathe at slow speed and turn the stock until the center lines marked along it are reached. Stop the lathe frequently and inspect the work, as it is impossible to take any caliper measurements.

Next mount the stock on the pair of centers farthest from the operator and turn as before (Step No. 3). The stock is finally mounted on the true centers and the sharp points cut away (Step No. 4); then it is sanded until it is smooth.

Pieces that are not straight, such as the rear leg of a chair, may be turned as shown at *H*. A piece of wood is glued at one end of the piece so that there will be the same weight of material on each side of the centers. An uneven weight would cause excessive vibration and make the turning difficult. The block is removed as soon as the turning is completed.

BILL OF MATERIALS

No. Pcs.	Part	T.	W.	L.
	For Radio Table			
4	Legs	1¾	1¾	28½
2	Side rails	¾	5	12
2	Side stretchers	¾	1⅜	12
1	Rear rail	¾	5	26
1	Front rail	½	1½	26
1	Apron	¾	2¾	24½
1	Center stretcher	¾	1½	26½
1	Drawer front	½	4	24½
1	Drawer front block	½	4	4
2	Drawer front blocks	½	1½	4
1	Molding	½	¾	84
2	Drawer sides	½	4	12
1	Drawer back	½	3½	24
1	Drawer bottom	¼	12	24
2	Split turnings	½	1	6¼
1	Top	¾	18	36
2	Drawer pulls			
1	Lock with escutcheon			
	For Mirror			
2	Sides for frame	⅞	1¾	33¾
1	Top for frame	⅞	3⅝	11½
1	Bottom for frame	⅞	2	11½
1	Center for frame	⅞	1	11½
2	Lower column blocks	1	2	2
2	Upper column blocks	1	2	3⅝
2	Column caps	⅝	1¾	1½
2	Column bases	⅞	1¾	⅝
2	Columns	9/16	⅞	28¾
1	Top	⅝	3	18
1	Bottom	⅝	2½	16
1	Back	¼	8½	12¼
1	Back	¼	20¼	12¼
1	Molding	⅝	⅝	24
1	Mirror	⅛	8½	12¼
1	Mirror	⅛	20¼	12¼

All dimensions are in inches

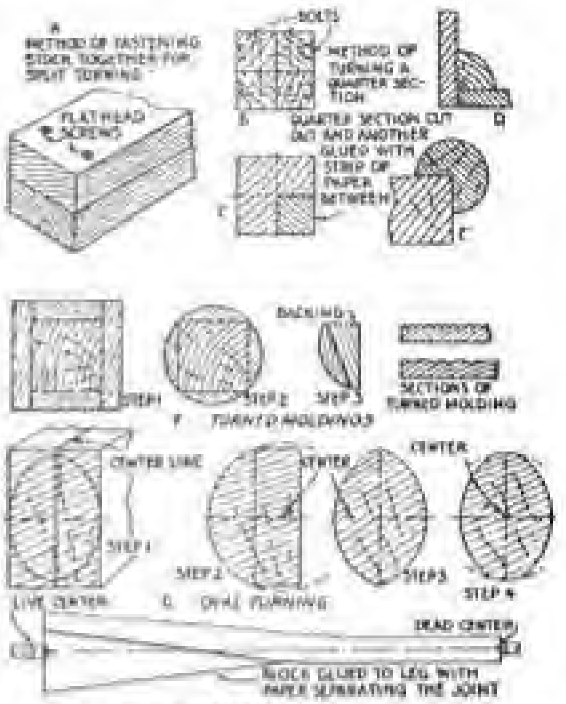


Fig. 65.—How the stock is prepared for split work, and how oval and irregular pieces are turned.

Fig. 66.—Marking a column to be reeded. The divisions are transferred from a paper strip.

REEDING AND FLUTING

Turned work may be decorated by a few simple forms of wood carving. Although such carving greatly enhances the beauty as well as the intrinsic value of the piece, it requires little practice and no outlay for new tools.

Reeding may be described as the process of carving beads or astragals on a turned column. First make the sides and ends of a box such as would be needed if the column had to be packed and shipped (Figs. 66 and 67). Remember that this box has neither cover nor bottom.

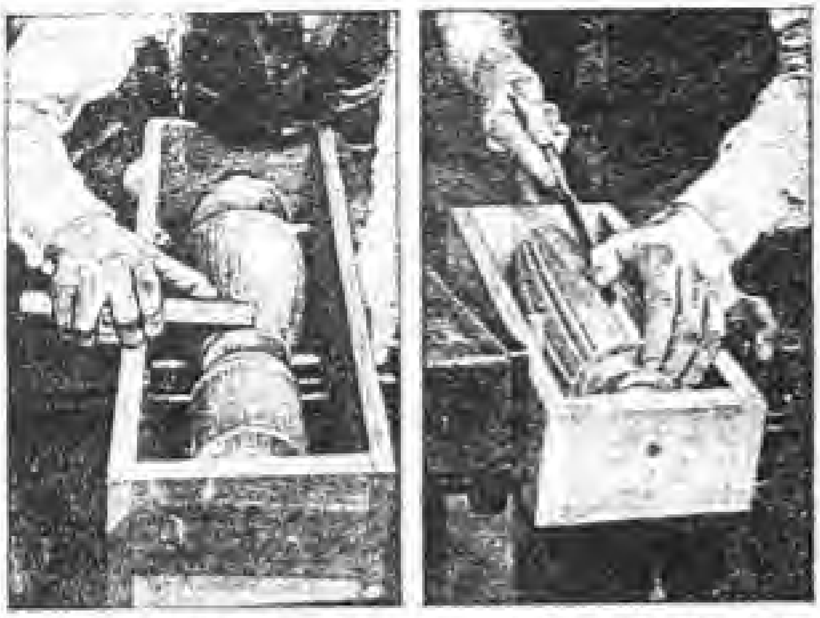


Fig. 67.—Left: How the marks for the reeds are scored with a marking gage. Right: The method of chiseling out the reeds.

Draw a vertical center line on the ends of the box and place the turned piece in the box so that the surface to be reeded is about level with the upper side of the box. Mark where the centers of each end of the piece should be located on the vertical center lines drawn on the ends of the box. Bore 3/32-in. holes at these points, insert ordinary wood screws from 1½ to 2 in. long, and screw them into the centers of the turned piece.

In Fig. 67 (at the left) the screw at one end is much nearer the top of the box than that in the other end. This is because the turned piece is of a larger diameter at one end than at the other; and in order to bring the surface to be reeded level with the top of the box, the end having the greater diameter must be lower than the other.

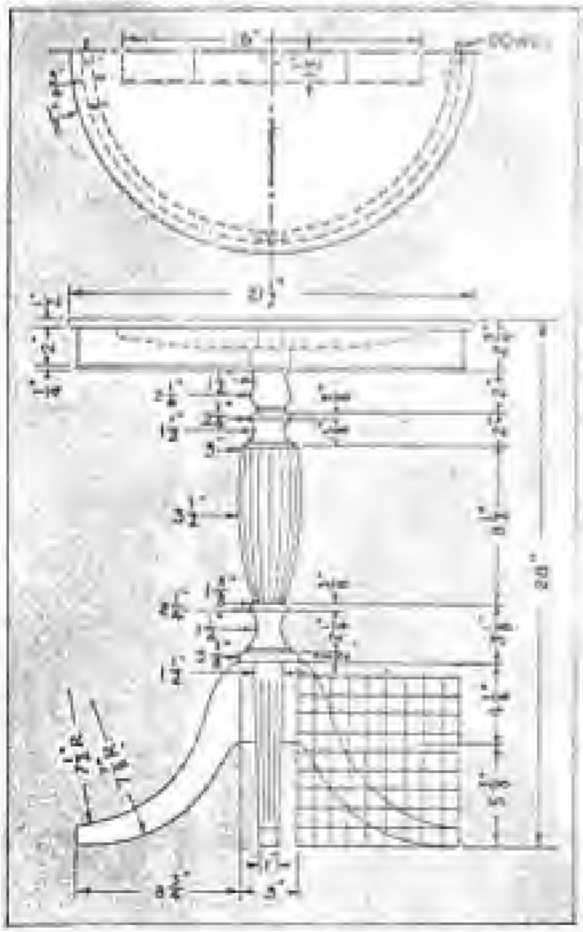


Fig. 68.—A graceful round table with a turned and reeded column and hand sawed and reeded legs.

The column is now divided into the desired number of divisions. Wrap a strip of paper around the column at any point, cut it so that the ends just meet, remove it, and lay out the divisions. For an even number like sixteen, this may be done by folding the paper; for an uneven number, the divisions should be stepped off with a pair of dividers. Wrap the paper around the column again, hold it firmly in place, and transfer the divisions to the column with a pencil as shown in Fig. 66.

Now set a marking gage to half the outside width of the box, and gage lines along the entire length of the portion to be reeded at all the division points laid out from the strip of paper as shown at the left of Fig. 67. Let the point of the marking gage project about ½ in. and hold the block firmly against one side of the box.

Begin chiseling V-cuts on the lines just gaged as indicated at the right of Fig. 67. Use an ordinary ½-in. paring chisel, preferably with a long blade that is beveled along its sides. Fasten the box holding the turned piece in a bench vise and drive a small wedge between the side of the box and the turned piece so as to hold it firmly during the carving process.

Be careful to note the direction of the grain, and do not make too deep or too large cuts, thereby losing control of the chisel. Gradually deepen the V-cuts and then round the edges slightly. Finish with a scraper and sandpaper.

Reeds may be applied to advantage to a number of projects such as lamps, stands, tables of many kinds, mirrors (see Fig. 64), and the edges of table tops.

The tables shown in Figs. 68 and 69 (which differ in respect to the shape of the top) are typical of how turned work may be decorated by reeding.

To make the round top and the apron, as in Fig. 68, draw a full size layout on a plywood panel or a piece of heavy paper. Templates should be made from this full size drawing, from which the four pieces forming the apron may be cut. As the apron is only 2 in. wide, it may be cut from a 2-in. plank. These pieces should be sanded in the lathe by the method illustrated in Fig. 70.

The segments must be fitted together and joined with ⅜-in. dowels. To mark for the dowel holes, gage a vertical center line on both ends of each of the four pieces forming the apron. Do this by holding the block of the marking gage against the convex sides of the pieces. Then set the marking gage to ½ in. and gage horizontal lines on both ends of each piece. With a setting of 1½ in. gage another set of horizontal lines on the ends of the four pieces. The intersection between the two horizontal gage lines and the vertical lines are the points where the holes for the dowels are to be bored.

Glue the four pieces of the apron together by wrapping a piece of sash cord twice around them and twisting it tightly with a small stick. Clamp the apron to a flat surface while the glue is drying—the table top will do. When the glue is dry, sand off the unevenness at the joints on the disk sander. Finish by hand sanding, and screw the apron to the underside of the top.

The column is reeded as explained above. The method of sawing out the legs and fitting and gluing them to the

Fig. 69.—A clover leaf top, a reeded column, and fluted legs are the features of this little table.

column is the same as for the small table illustrated in Figs. 29 and 30.

The column and the top are joined together by means of a piece 1 by 3 by 16 in., shown by dotted lines in Fig. 68. This is screwed to the underside of the top at right angles to the direction of the grain in the latter. The tenon turned on the end of the column is glued into a corresponding hole bored in the center of this piece.

The photograph, Fig. 69, shows flutes cut into the legs. Flutes are laid out in the same way as reeds, but they are cut with a gouge. They are more difficult to cut than reeds.

If it is desired to make spiral reeds instead of straight reeds, the part of the column to be reeded is divided into the same number of parts at each extremity by the method shown in Fig. 66. Then cut a strip about ½ in. wide from a piece of heavy paper or flexible cardboard and use this as a ruler. Select a point at the lower end of the part to be reeded and wrap the flexible strip about the column, for example, halfway around. Draw a line along its edge, move it to the next pair of points, and continue in this manner until all the reeds have been marked. Cut and shape the reeds as described above. Spiral reeds are easier to cut than straight reeds because they do not follow the grain of the wood.

SPIRAL TURNING

Spiral turning is of Eastern origin. In the seventeenth century examples of this form of decorative art were brought to Europe by Portuguese explorers. It was incorporated in the prevailing type of furniture design and became very popular.

Spiral turning is done commercially on special wood-turning lathes. The method described in this article, however, is the old-fashioned hand carving used by the individual craftsman. Like reeding, spiral carving is easy to do and requires little or no previous practice.

Figure 71 shows the method of laying out various types of spirals. At *A* is shown a common single spiral. The part to be carved is turned as a plain cylinder and divided lengthwise into a number of equal parts, the length of each being about equal to the diameter of the turned cylinder, in this case 2 in. Divide each of the major parts into four equal parts and mark circles at all these points around the cylinder.

Wrap a strip of paper around the cylinder and divide it into four parts. Move the T-rest close to the cylinder and draw four horizontal lines, *a*, *b*, *c*, and *d* at the points laid out from the paper strip.

Start the spiral line at one end of the cylinder on one of the horizontal lines (in this case line *a*). Proceed to the intersection of the line *b* and circle *1*, then continue to line *c* and circle *2*, then to line *d* and circle *3*, and around to line *a* and circle *4*.

One complete revolution of the spiral line has now been made. Continue drawing the spiral in this manner until the other end of the cylinder has been reached. Do not let the spiral begin or end too abruptly, but make it more nearly parallel to the turned beads at both ends.

With a backsaw cut along the spiral line, at the same time revolving the lathe slowly by hand. Chisel a V-cut with an ordinary ½-in. chisel to the bottom of the saw cut. Then file along the bottom of the V-cut with a round file. Round off the edges with a half-round file or rasp and finish with sandpaper. These various steps are clearly shown at the left in Fig. 72.

If the spiral is to taper, it is laid out as shown at *C* in Fig. 71. Measure the diameter at the larger end and lay off this distance along the cylinder. Then measure the diameter at this point and lay off the distance along the cylinder. Continue in this way until the small end of the cylinder has been reached. The lengths are now slightly adjusted so that they diminish proportionately and add up to the total length desired. The subdivisions are arranged in a similar way. The spiral is drawn as at *A*.

If it is desired to lay out a double hollow spiral such as shown at the right in Fig. 72, proceed as in *B*, Fig. 71. In this case each of the major divisions is divided only in two. The first spiral line —that shown as shaded with short vertical strokes—starts on line *a*, goes to line *b* and circle *1*, then to line *c* and circle *2*, from there to line *d* and circle *3*, and then to line *a* and circle *4*. This makes one complete revolution. The second spiral line, which has been left white, starts at line *c* and goes to line *d* and circle *1*, then to line *a* and circle *2*, from there to line *b* and circle *3*, and then to line *c* and circle *4*.

The spiral lines in this case are about 3/16 in. wide. They may be laid out from a strip of heavy paper cut 3/16 in. wide and wrapped around the cylinder. The spiral lines on *B* form the ridge (see Fig. 72 at right).

The ropelike tapered double spiral shown in the center of Fig. 72 is laid out according to the method explained above

FIG. 70.—How pieces such as the segments of the apron under a circular table top are sanded.

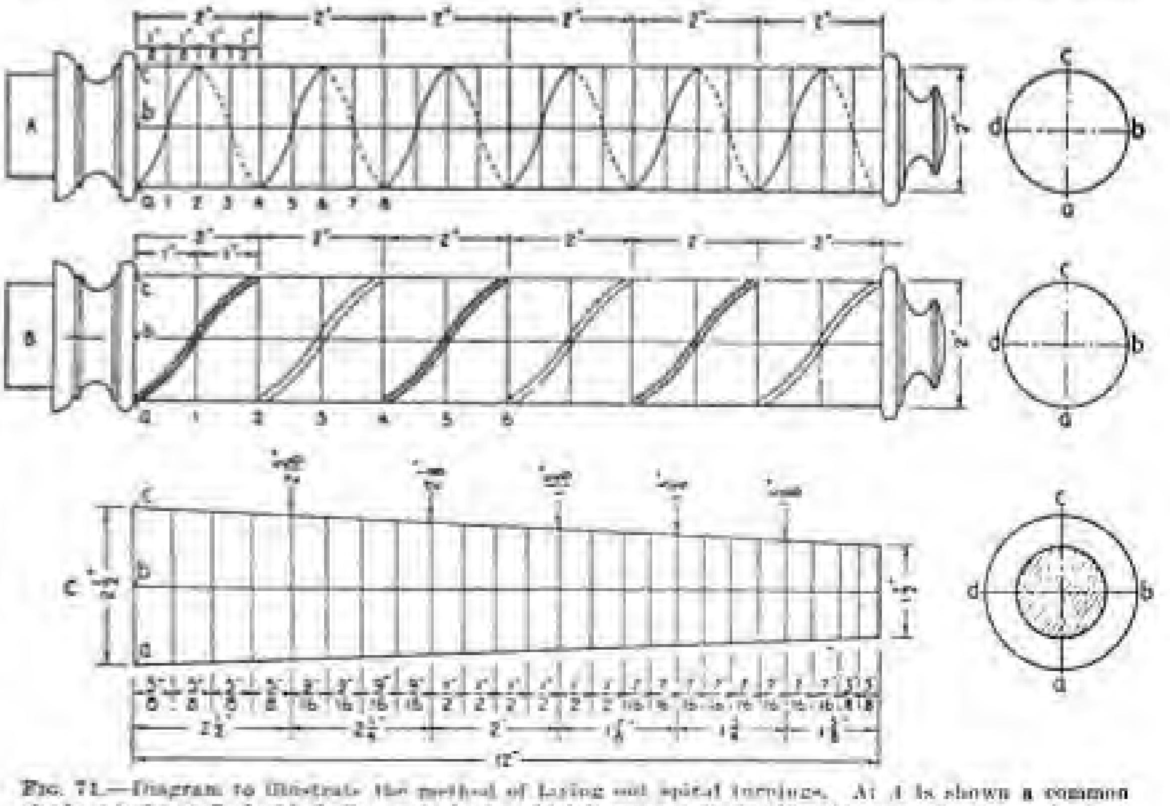


FIG. 71.—Diagram to illustrate the method of laying out spiral turnings. At *A* is shown a common single spiral; at *B*, double hollow spirals, in which lines are left high like ridges; at *C*, a tapered spiral.

Fig. 72—Single spiral turning (at left); tapered double spiral (center); hollow spiral (at right)

(Fig. 71, C), but in this case, as in other double spirals, the major divisions are subdivided only in two.

The coffee table, Fig. 73, is a typical example of the use of spiral turning in furniture construction. The shaped stretchers cross each other and are joined with a cross-lap joint.

TRICK TURNING

To turn the curious "Congo cup" illustrated in Fig. 74 from a single block would seem a difficult problem; yet anyone who owns a lathe can do it when the principle is understood. The example shown, made by E. T. Armstrong, of Pasadena, Calif., contains twenty-five rings and is considered by him to be the record. He calls it a "Congo cup" because it recalls those African belles who wear rings around their necks.

Fig. 74.—Twenty-five ring cup and the special tool used in making it.

The requirements are a block of thoroughly seasoned pear, apple, orange, or lemon wood, a double-ended tool (Fig. 75), and a steady hand. Turn the outside of the bowl of the cup with the two rings which encircle it, before hollowing the inside. Cut the rings halfway through with one end of the tool and finish with the other end. In cutting the rings around the stem, be sure to turn the top one first.

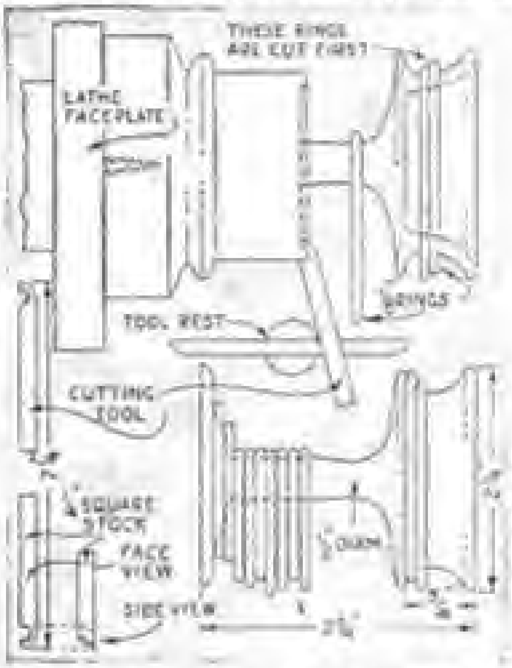


Fig. 75.—Turning a "Congo cup." Each finished ring is moved to one side before work is started on the next.

BORING TRUE SOCKETS IN LONG TURNED WORK

By using the simple homemade steady rest illustrated in Fig. 76, it is possible to bore holes for the tenons of a three-piece floor lamp standard or similar parts in the lathe with certainty that the joints will be perfectly aligned.

The framework of the steady rest is a piece of plywood, cut as shown and screwed to a block that can be clamped to the lathe bed. The three guides are 1½ in. wide, each being provided with a slot wide enough to take a ¼-in. machine screw. One is placed at the bottom, and the others are spaced at 120° apart.

Fig. 76.—The steady rest holds the stock on its true center line and insures a centered hole.

In preparing the stock to be bored, it is necessary to nail a piece of ⅜-in. plywood to the end which is to receive the screw center at the headstock. The purpose of this piece, which is turned down with the stock, is to give a good grip for the screw center so that the stock will not slip during the boring operation.

After the stock has been thus prepared and turned to shape, the steady rest is mounted on the bed, and the tailstock is again brought up and engaged with the dead center. This insures that the work is lined up with the centers, and the guides can be adjusted to suit, snugly but not too tight. A little oil or grease is next applied to the guides to allow smooth turning. The dead center then can be removed and the hole bored with great accuracy.

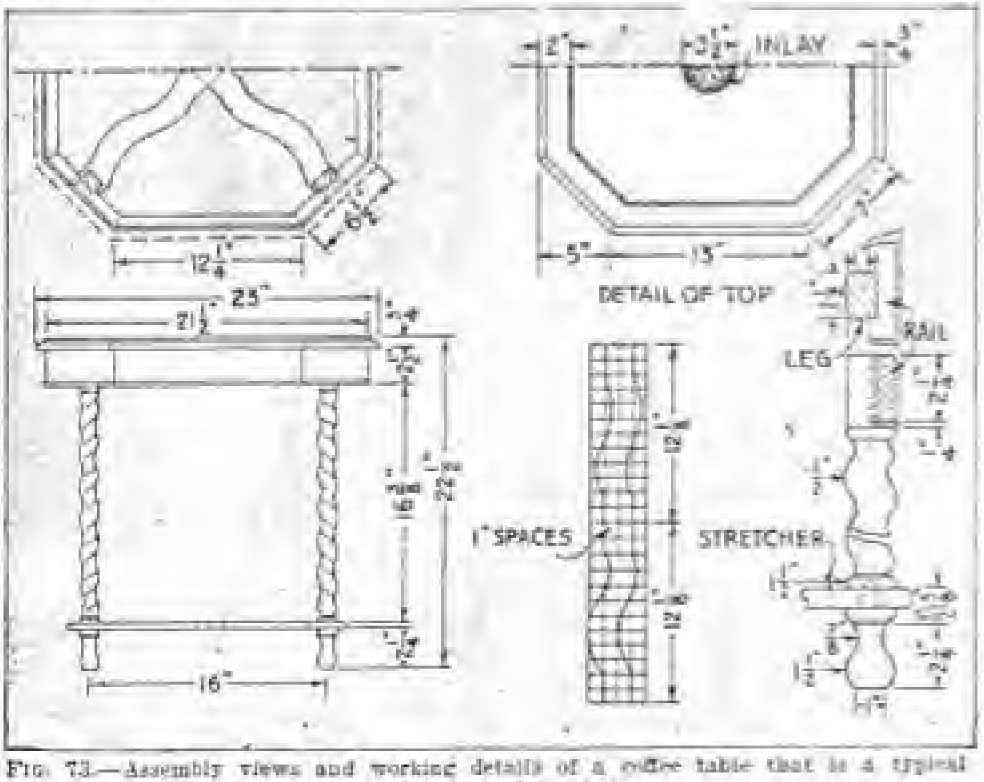


Fig. 73.—Assembly views and working details of a coffee table that is a typical example of spiral turnings.

PAINTING AND DECORATING

THANKS to the great popular interest in home painting and decorating which has developed in recent years, all the ordinary problems are reasonably well understood. Indeed, the paint manufacturers distribute such excellent literature on all phases of the household use of paints, varnishes, enamels, and lacquers, that there is little excuse for repeating the information in a book of this type. What follows in this chapter, therefore, are a number of suggestions on processes and treatments with which the average amateur is not so familiar or upon which no complete, practical information is readily available elsewhere.

REFINISHING AN AUTOMOBILE WITH LACQUER

If modern methods are employed, it is not difficult to refinish an automobile at home. Quick-acting chemical paint removers and electrically operated paint sprayers are rapidly replacing tedious scraping and brushing operations.

The cost of a small motor-driven spraying outfit can be more than saved by doing the job in one's own garage, and the outfit remains to become a permanent and valuable addition to the home workshop equipment. Several reliable, ruggedly built outfits are now on the market, priced under fifty dollars.

Although not hard, the work takes time—for a novice, about forty hours of actual working time. With lacquer finishing there is no waiting for paint to dry, as one side of the car will dry while the other is being sprayed. The car therefore need not be out of commission more than a week or ten days, which is about the time required by a professional finishing shop.

Before the work is undertaken, the following materials should be assembled. The quantities listed are sufficient for a sedan having a 120-in. wheel base and will cost about twenty dollars.

- 3 quarts paint remover
- 2 quarts red oxide of iron primer
- 2 quarts undercoat (color similar to finish)
- 2 quarts finishing lacquer for final gloss (sometimes called "retarder thinner"; it contains approximately 80 per cent thinner and 20 per cent body material)
- 1 gallon lacquer (total for one or more colors)
- 5 gallons lacquer thinner
- 1 tube glazing putty
- 1 gallon high test gasoline
- 1 gallon benzole
- 1 steel scraper
- 2 steel scratch brushes, one 2 by 6 in., and one ¾ by 6 in.
- 6 sheets No. 2/0 emery cloth
- 6 sheets No. 280 waterproof sandpaper (also numbered 8/0)
- 6 sheets No. 400 waterproof sandpaper (also numbered 10/0)
- 2 rolls masking tape (if two colors are to be used)
- Sufficient tin to be cut into 3-in. strips for holding paper over the windows.

First, have the running gear washed at a garage under high pressure water and specify that the wheels be washed with gasoline to remove all grease. Then remove all easily detachable accessories, plated side lamps, and door handles. The engine hood should be taken off and used to experiment with; that is, every unfamiliar operation should be tried first on this part. Cover the wheels, engine, tires, and top with paper or rags (Fig. 1).

Proceed to remove the finish as follows: Brush a coat of paint remover on the hood and allow it to stand until

FIG. 1.—Cover the motor, wheels, and top with paper or old clothes before applying the paint remover.

the finish crinkles up; then scrape the loose material off with the steel scraper (Fig. 2). As some patches will be harder to loosen than others, another brushing should be given and the remover allowed to stand twenty minutes while a part of the body is being brushed over. The second treatment will loosen all but a few traces of paint in the corners and along the edges of the metal. Remove the thoroughly softened residue by scrubbing with the larger steel brush (Fig. 3). Continue this process over all the steel parts, not overlooking the underside of the hood, but under no circumstances allow the remover to come in contact with any of the wooden parts.

All the steel should now be rubbed with the emery cloth until bright and clean, special attention being given to corners around windows and pressed in or raised parts of the body and seams which form any sort of decoration.

If the wheels are to be refinished, they may be removed and the tires taken off, but this is usually done after the body is finished, as the process is much simpler.

Before proceeding further, run the car out and sweep up the dried finish scraped from the body. Also sweep down the walls of the garage and remove anything that would be injured by spots of lacquer. It is not necessary or desirable to wet down the walls or floor as in the case of other methods of finishing; in fact, the final three coats of lacquer should not be sprayed on in rainy or humid weather.

All the usual precautions should be observed in regard to fire. There must be no smoking nor open flames in the vicinity of highly volatile liquids, such as the gasoline, benzole, and thinner.

Good ventilation is also essential, for, although the fumes of lacquer solvents have a pleasant banana odor, continued breathing of the atomized material itself might cause dizziness to anyone unused to it. Keep a window and the main door of the garage open unless the breeze is too strong. If one is especially sensitive to strong fumes, a small respirator, costing fifty cents, may be worn while one is operating the sprayer.

Neatness and cleanliness are equally

FIG. 2.—Scraping off the old finish. The crinkled finish peels off easily when softened by the remover.

essential in the actual application of the priming coats and the finishing lacquer.

Start with the hood, which should be set up on an old table or box and given another good washing with benzol. Do not run over the surface hurriedly, but rub it hard. After it seems as though nothing could possibly be left, rub the whole surface with a lintless cloth dampened with thinner. During the cleaning, remember that the edges and seams require the most attention.

Mix a pint of rust inhibitive red oxide of iron with a pint of thinner and fill the jar of the spray gun three quarters full. Start the motor and try the spray against a piece of tin. If the mixture is of the right consistency, a smooth, even coat will be deposited. A lumpy or pitted surface indicates that the liquid is too heavy and should be cautiously thinned further. If it sags or runs, it is too thin and more primer should be added. Now spray the hood all over the outside, keeping the spray constantly in motion and held about 8 in. from the surface. Move the spray at an even speed back and forth horizontally and keep it pointed directly at the surface at all times. Start the gun in operation away from the work and swing it on while

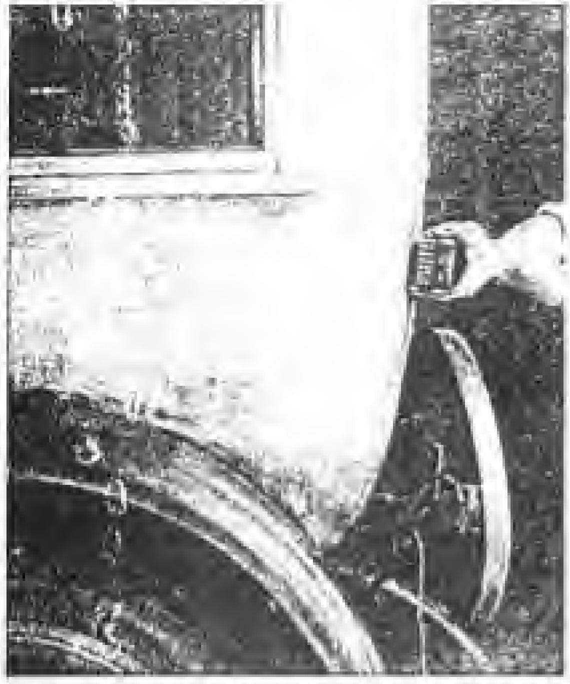


Fig. 3.—Thoroughly clean the body of all old paint by "scratch brushing" it with a stiff wire brush

spraying. Lap each parallel deposit about one quarter over the previous stroke. Never stop the gun abruptly on the work; swing it away so that any necessary joining of sprayed surfaces will be "feathered."

Do not be startled by the appearance, as the correct color is bright orange. Allow the primer to dry one hour and inspect for "wet spots." If there are only a few small shiny places (½ in. in diameter or so), they may be overlooked because they will disappear as more of the finish is applied. If there are many spots or streaks, or one or two large spots, wash off the whole coat of primer with the thinner and scrub again with benzole and thinner. When judgment of cleanliness has been developed, apply the primer over the entire body.

Between each filling of the paint jar it should be half filled with thinner, shaken, and operated a few seconds to flush out the tubes and nozzle. If the gun does not discharge freely, partly clogged tubes are to blame; do not turn it against the car again until a full spray is delivered. It is well to have three or four extra mason jars on hand, one for clear thinner and the others for different colors.

Do not apply a heavy coat of primer, just enough to cover the metal thoroughly. Allow it to dry at least an hour and sandpaper lightly with the No. 280 paper or equivalent, using the paper dry.

The hood may now be given three coats of surfacer, each coat following the other at intervals of at least twenty minutes. The surfacer behaves somewhat differently and is harder to lay evenly on account of its quicker drying qualities. Special pains must be taken to dilute it sufficiently to prevent the formation of a rough "orange peel" surface. A little over fifty per cent of thinner will be required.

It is advisable not to stop the gun until the jar of material is completely sprayed, otherwise the tubes will clog slightly. If this happens, spray some thinner through the gun. After learning how on the hood, proceed with the body. Do not be disturbed if the coat looks somewhat rough in spots; the sanding operations will eliminate all traces of such unevenness. However, it saves labor to lay the coat on smoothly in the first place.

Now go over the surface for visible file marks or depressions and fill them with glazing putty. This should be allowed to set overnight and then scraped and sanded flush with the surface. The car should now be given a water sanding with waterproof sandpaper. Under the paper hold a piece of folded cloth, and keep it well soaked with water. Rub rather gently, making only three or four passes over any one spot. To check the smoothness of the surface, rub the fingers along the sanded parts as the work proceeds and resand all places that do not feel glass smooth. If any spots are rubbed through, the place should be resprayed after washing with gasoline and wiping with a cloth dampened (not wet) with thinner.

The whole car should now be washed with gasoline and wiped with a lintless cloth to prepare it for the lacquer finish coats (Fig. 4). Three coats are required, using a fifty per cent dilution.

If two colors are being used, spray the upper one first and then cover it with paper bound on with masking tape. Spray, the other color in the same manner as the first. If a molding strip is to be still another color, cover the surface on each side with the tape before spraying. Do not attempt to peel the tape off for at least two hours after the last spraying, and then only after thoroughly soaking it with water applied with a paint brush. This will prevent any of the finish being lifted off with the tape.

The whole car is now to be sanded again with No. 280 paper soaked in gasoline and held over a cloth pad as before. Sand gently and make strokes "every which way" until a glasslike surface is obtained. Wash thoroughly with gasoline and give another sanding, using the No. 400 paper. Wash again with gasoline and wipe clean of all free color which has been sanded off. Spray on two coats of retarder thinner. This will smooth all traces of unevenness in tone and leave a natural gloss, which may be further heightened with any of the standard auto polishes compounded for lacquer finishes.

To refinish the wheels, sand with gasoline and with waterproof sandpaper, just enough to smooth the old finish unless the coating is badly flaked off, in which case the entire finish should be removed.

Fig. 4.—The sprayer should be held at about 8 in. from the work and kept in motion at all times.

Spray on three coats of finishing enamel, several varieties of which are available in quart sizes.

To complete the work, spray the underparts of the fenders with two coats of black lacquer; an inexpensive enamel will do if diluted with turpentine. The top should be painted with a brush in the regular way; that is, brushing lengthwise and using the dressing just as it comes from the can. If any work is required on the inside of the car, use a brushing lacquer on the instrument board and spar varnish for the molding around the windows. If any striping is required, the car should be taken to a professional striper, as a steady, experienced hand is necessary for this finishing touch.

As a precaution against the chipping of the finish, run a safety razor blade along the edge of all metal moldings before the finish has thoroughly sét. Cutting down to the metal in this way will prevent any slight movement of the parts from breaking the glass-hard lacquer surface. Save any small portions of material left over as it will come in handy for the purpose of retouching scratches or scraped fenders.

WHAT UNDERCOATS TO USE

The question of what undercoat to apply for some specific painting job is one that generally bothers the amateur painter, but the selection of the proper priming coat is little more than following a few common sense rules.

For all general purposes undercoats can be divided into four classes: for use under enamel, varnish, lacquer, and flat wall paint.

In enameling, the procedure is to build up a foundation of flat undercoats before the final finishing coat or coats of full enamel is applied. The process is substantially the same regardless of the surfaces being finished. However, where new woods of the open-grain type are to be finished, the pores should be filled with paste filler. This also should be done on previously finished open-grain woods from which the old coatings have been removed with paint and varnish remover.

The material generally used for enamel undercoats is a prepared "enamel undercoater," sold at most paint stores for the purpose. White lead and oil paint is also used, but the home craftsman usually avoids mixing his own paint. Flat wall paint also makes a good enamel undercoat. While it is softer than the specially prepared undercoaters and therefore does not make quite so hard and firm a foundation, it has the advantage of coming in a variety of colors.

The prepared undercoaters generally come in white only and are adapted for use under white enamel and the light tints of ivory, cream, and gray. The amateur painter will find it better, when enameling in stronger and brighter colors, to use flat wall paint of a color closely approximating the enamel finish. Any skipped or too thinly spread-out places will not be so apparent when there is not so great a contrast between the undercoating and the finishing coats.

The surface should be rubbed down with fine sandpaper (No. 00) to platelike smoothness before the first coat, and lightly between coats, to remove brush marks and level off nibs, bits of grit, and dust. The loose particles must be dusted off thoroughly.

Just a word about the application of enamel undercoats. A three-coat job is generally used for white and the light tints, as follows: first coat, flat undercoater; second coat, a mixture of equal parts of flat undercoater and enamel; third coat, full enamel.

Yellow pine, cedar, cypress, and similar pitchy, resinous, or oily woods, should be sealed over with a coat or two of thinned shellac before starting to build up the enamel foundation, as it prevents the pitch or oily substance from coming through and discoloring the finish.

In the refinishing of mahogany and other dark, stain-finished, woods with light colored enamels, a sealing coat of shellac should be applied before the first undercoats; this will prevent the stain from bleeding through in the majority of cases. It is, however, almost impossible to apply a light enamel finish satisfactorily over some types of penetrating red mahogany and cherry stains.

The most practical way to build up a varnish foundation, especially for the home finisher, is to apply as many coats of varnish as necessary over a foundation provided by the use of paste filler, if the wood is of the open-grain type.

The filler, which ordinarily comes in paste form either in a light or "natural" color, or stained dark, is reduced with benzine or turpentine to about the consistency of heavy cream, and is applied to the surface with a brush. After standing a few minutes until it commences to set—this is indicated by a dulling out or loss of gloss—it should be vigorously wiped off with a cloth, across the grain. Care should be taken that every bit of the filler is removed except that which has entered the pores. Allow the work to stand for at least twenty-four hours, until the filler in the pores has dried. The surface is now ready for the finishing coats of varnish.

Liquid fillers are used to some extent on close-grain woods, where paste filler cannot be forced into the pores. Although it is a general practice in the varnish finishing of interior woodwork and floors of close-grain woods to start applying the varnish directly over the wood without any undercoat material of any kind, a liquid filler may be used to advantage on furniture and other surfaces where the finest finish is desired.

Some finishers also apply a coat of liquid filler to open-grain woods after the paste filler has dried thoroughly hard, to fill the tiny wood cells that are not filled by the paste filler, thus giving an absolutely smooth surface and permitting a finish of mirrorlike appearance. Liquid filler is applied with a brush and after it is thoroughly dry is rubbed down close to the wood with fine sandpaper or steel wool.

A brushing lacquer, which dries a few minutes after application, is somewhat different from other finishing materials. It is reasonably satisfactory without undercoats. In the first place, though it does not have any wood-filling properties to speak of, its make-up is such that it seals over the surface, very much as shellac, instead of soaking into it as do painting materials made with oil and turpentine. Therefore it will stand out on the surface fairly well without the use of an undercoating. It also has better hiding power than the transparent enamels; hence, surface discolorations are usually hidden and a solid covering finish obtained with two coats of lacquer without the use of undercoats.

For the finest possible lacquer finish on new work, however, open-grain woods should be filled with paste filler (as previously described for varnish undercoats). Close-grain woods also may be brought to a better finish if liquid filler is employed to fill the small pores.

A practice favored by many is to apply a wash coat of thinned shellac (regular four-pound cut shellac reduced with about an equal part of denatured alcohol) as a primary coat. Since lacquer can be applied perfectly over shellac, this method may be regarded as good general practice for the amateur finisher. Of course, the advantage of this sealer coat is much greater in the case of the softer woods, and with the extremely soft woods the use of shellac is almost necessary for satisfactory results, unless several extra coats of lacquer are applied.

The use of shellac as a first coater in refinishing old painted, varnished, enameled, and stained surfaces with brushing lacquer also renders the use of the lacquer more satisfactory.

Prepared undercoaters for use under lacquer are sold by some manufacturers. They combine the qualities of a sealer with a higher solid content than the lacquer itself, thus adding fullness and richness to the finish. These should be used according to the directions accompanying the particular make of undercoater that is being used.

In conclusion, a word should be said about undercoats on interior walls. It is absolutely necessary that bare plaster walls which have never been previously painted be given a sizing coat to seal over the extremely porous plaster. If this is not done, an indefinite number of coats could be applied to the surface, soaking in as fast as applied, without producing a satisfactory finish.

Regular wall size or varnish size (sold at all paint stores), mixed with equal parts of the wall paint being used for the work, is extensively employed for the sizing coat. Prepared wall primers also are now available in most localities; in these the size is already incorporated, making a very convenient form of material to use. Either type of material is thoroughly satisfactory.

FOUR-HOUR FINISHES

The utility of the quick-drying brushing lacquers is well known to amateur painters, but the relatively new varnishes and enamels that dry in four hours appear to be less familiar, perhaps because they are a later development in painting materials. With them you can refinish a floor or other woodwork in the evening and use it the next morning, or you can apply one coat in the morning and a second in the afternoon.

These exceptionally convenient and durable finishes can be obtained at all up-to-date paint stores in the larger cities, and in the course of time they will be available everywhere.

As they undoubtedly mark another great step forward in finishing materials, especially from the standpoint of the home owner and amateur painter, a word about their manufacture will not be amiss. They are not merely old-line varnishes and enamels with the drying forced by driers to the impairment of their durability, but an entirely different product, made possible through the use of a new form of synthetic resin. This is produced from formaldehyde and phenol and is closely allied to bakelite. It is used in making the four-hour varnishes in place of fossilized varnish gums. After being incorporated with linseed oil, china wood oil, and other materials in accordance with the formula of the particular varnish being made, it is cooked over varnish fires of the standard type. The enamels, of course, are a combination of four-hour drying varnish with the necessary pigments to give the desired coloring.

Let us now compare these new quick-drying materials with ordinary varnishes and enamels. Which is preferable is entirely a matter of whether or not quickness of drying is of importance. If there is ample time for drying, there is no reason for using the new type materials. In most homes, however, quick drying is a great convenience, if not of extreme importance. This is true where there are children in the household, especially in the varnishing of floors, from which it is next to impossible to keep the little folks until the varnish has dried.

Even with varnishes that normally dry overnight, the weather and the temperature of the room have so much to do with their drying that often they are still tacky or sticky the next day; and sometimes under unusually unfavorable conditions, it is at least forty-eight hours before the finish has become thoroughly hardened. With the four-hour drying materials there is never the least question about the finish drying overnight.

As to appearance, there is no difference between the finish produced by the new and old materials. The four-hour materials also are quite as easily applied as other varnishes and enamels.

Now let us compare the four-hour finishes with the cellulose brushing lacquers which came in with almost startling suddenness a little more than two years ago and have since enjoyed great popularity. It is not likely that four-hour varnishes and enamels will be used to any great extent in the field in which brushing lacquers have been almost exclusively used up to this time; their field is one in which the brushing lacquers have never been extensively used. Lacquer has been used largely for finishing unpainted novelty furniture, such as magazine racks, tilt top tables, and the like, and for refinishing chairs and other small pieces of furniture about the house. For such work it is seemingly best adapted. There is a very definite advantage in being able to go right over the surface with a second coat almost immediately after finishing the first coat and also in applying the trimming colors and finishing the piece at one time. There is a fascination in using materials that dry before your eyes. Besides, the semidull sheen of lacquer finishes is very pleasing to the majority of people and corresponds with the sprayed lacquer finishes of the highest-class furniture. With the improvements that have been effected in brushing lacquer during recent years, the home worker as a rule has no difficulty in using them for the finishing of small pieces.

When it comes to comparing the four-hour varnishes and enamels with lacquer for such requirements as the finishing of floors and interior woodwork, the advantages are in favor of the newer materials. The varnishing of a floor, for instance, is a different matter from doing a small end table or a sewing cabinet. It is not so easy to apply the cellulose-type lacquers on a large surface of this kind and handle the brush so deftly that laps will not show. This also is true of interior woodwork. Very little brushing lacquer has been used for this purpose by home decorators, although professional painters have made effective use of lacquer finishes in some public building work of the better class.

The durable new four-hour varnishes and enamels, on the other hand, are just the thing for floors and woodwork. They can be used as easily on large surfaces by the amateur painter as the ordinary varnishes and enamels which he has been accustomed to use.

In summarizing, the best current practice for amateurs seems to be as follows:

Brushing Lacquers. Use for unpainted furniture and woodenware novelties, for refinishing furniture, and for all similar decorative requirements.

Four-Hour Varnishes and Enamels. Use for floors, interior woodwork and other architectural requirements.

Standard Varnishes and Enamels. Use for all purposes where a varnish or an enamel finish is desired and there is ample time for the surfaces to dry before use.

It should be remembered, of course, that there will always be those who have a decided preference for either an enameled or a lacquered finish, as well as certain individual requirements which may make one or the other way more suitable. The preceding classification is purely for the convenience of those who have had little or no experience with the various finishes; those who have used them to a reasonable extent will understand the differences from actual experience and can use their own judgment.

Four-hour varnishes and enamels may be applied over either new wood or previously painted, varnished, enameled, or lacquered surfaces. Prepare the work in the usual way in respect to cleaning, sandpapering, and dusting.

Generally speaking, the handling of the new materials is the same as the old-line varnishes and enamels; however, a few precautions should be taken. Being generally of a heavier nature than the ordinary varnishes and enamels, they should be flowed out in a thinner coat than has been the usual practice. The surface cannot be brushed for as long a time and a closer watch must be kept for sags, runs, and other defects. Formerly some painters made it a practice to coat a considerable amount of surface before going back and "picking up" runs with a corner of the brush, but it will be found that this cannot be satisfactorily done with the four-hour drying materials.

While durability was sacrificed to some extent in the first finishes of this type placed on the market, improvements have been discovered, until now many of the high-grade makes of four-hour drying floor varnishes have practically the same durability under hard wear on floors as long-oil and spar varnishes of well-proved quality.

NOVELTY FINISHES FOR ART WARES

The vogue for home painting and decorating offers many opportunities for making smart gifts at a cost far less than their actual worth and market value. Because of their individuality, such gifts are far more appreciated than ones that are bought. Boxes, book racks, book ends, and novelties finished in the modernistic fashion and in colorings to correspond with the decoration and furnishings in the home of the recipient, are gifts of real personality.

New treatments and fashions are being constantly brought into popularity. At this time the trend is toward the modernistic—angles, triangles, rectangles, and geometrical forms. The use of *pure* color in the decoration of furniture, accessories, and art wares is a prevailing characteristic, as is the use of rich gold and silver for edgings.

After objects have been finished in the usual manner with enamel, lacquer, or other painting materials, we can decorate them in any of the following ways.

First, with art transfer patterns (decalcomanias). Modernistic designs have been developed by transfer manufacturers, and many decorative requirements, therefore, can be easily met from patterns available at up-to-date paint stores. The method of applying transfers will be described in detail in a following section. Usually the manufacturer supplies brief instructions with the transfers.

Stencils are also obtainable in nearly every locality. Since the advent of sprayers, stenciling has been used extensively for the decoration of furniture novelties and accessories. The stencils should be held very tightly against the

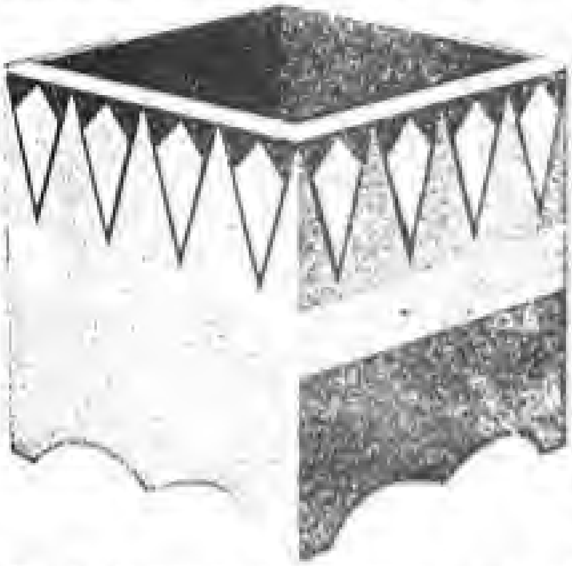


Fig. 5.—Modernistic design applied to a potted plant holder by the new and very simple method of using masking tape, as illustrated in Fig. 7.

surface to guard against blurred or ragged edges.

Pins or tacks cannot be put into fine art wares and furniture, but a stencil usually can be held down with weights around the edges, or holes can be made in the stencil at intervals around the edges and gummed paper or pieces of tape placed over the holes and pressed through onto the surface being decorated. Ordinarily this will not leave any mark on the surface, but in case it does, the remaining adhesive can be readily removed with a cloth moistened with water or a mild mixture of half gasoline and half water.

When stenciling is done with a sprayer, any type of material may be used—enamel, lacquer, or paint. The surface surrounding the stencil design must, of course, be protected from the spray. Cut a hole a little larger than the design part of the stencil in wrapping paper or newspaper and place the mask on the surface you are decorating. Then fasten the stencil in position over the hole, letting its edges overlap the mask.

When stenciling is done by pouncing with a brush, lacquer has a tendency to pick up the undercoatings; if carefully done, however, it can be put on through the stencil openings with a soft camel's-hair brush.

Oil colors reduced with turpentine are ideal for stenciling, but, of course, give a flat finish. The design can be brightened up, however, with a coat of clear varnish or lacquer applied with a small brush over the design part only, or as a protective coating over the entire surface.

Another method of obtaining modernistic designs, and one which permits more individual treatment, is to take a suitable design in the new dress goods or draperies or from a magazine illustration, trace it on a sheet of oiled paper, and cut a stencil with a sharp knife or razor blade, leaving the necessary "ties" at frequent intervals to prevent portions of the design from dropping out.

Those with a talent for free-hand drawing can make original designs for stencils or paint directly on the piece being decorated. In modern art, the expression of one's personality is unhampered by precedent or traditions; and motifs, while taken largely from nature, are rendered in cubist style, or geometrically, or in other novel ways.

The use of "masking tape" often helps in painting modernistic angular ornamentation (Figs. 5, 6, and 7). The tape temporarily covers portions of the surface to keep them from being coated with the colors you are applying.

Regular masking tape is sold by dealers in the large cities who sell supplies to automobile paint shops. However, gummed craft paper tape used for wrapping packages makes one of the best kinds of masking tape. It has a straight edge, is tough and durable, and comes off easily without disfiguring the surface. Craft tape can be obtained in cities from large commercial stationers and wholesale paper houses. It comes in various widths and costs little. In smaller towns it usually can be had at some factory or

Fig. 6.—After it has protected one part while another is being painted, the masking tape is peeled off.

store that uses tape for wrapping.

Angular designs of various forms can be produced by pasting strips of tape on the surface so tightly that there will be no opportunity for the paint to run under the edges. When the paint has dried, the paper will generally peel off readily, but in case it does stick, it can be soaked off with water.

Masking tape also will be found useful for striping borders. Along the edge of the table top or whatever is being decorated, coat a strip about an inch wide with the color desired for the border stripe. Then cut a piece of tape the width of the stripe and of the necessary length. Cut it with a knife and straightedge to be sure the edges are absolutely straight. Paste this down and then coat the entire surface with the body color. When the color is dry, peel off the tape to expose the straight, even stripe of border color.

The use of gold and silver for edging and otherwise ornamenting furniture and art objects is effective with any type of

Fig. 7.—Gummed tape is used to make masks for shielding certain parts of the design before painting.

decoration. While the most widely used method of gilding is to brush on a mixture of gold bronze powder and a bronzing liquid ("banana oil" or some other type), a much stronger, brighter color with greater depth and richness is obtained by coating the surface with japan gold size, and, as soon as it gets tacky, pouncing on the gold or silver bronze with a chamois or soft cloth (Fig. 8). Surplus particles should be blown off.

The very finest gilding, of course, is

Fig. 8.—Dusting gold bronzing powder on a pearl box previously coated with japan gold size.

done with pure gold leaf. This may be applied by the home decorator if done with extreme care, although it is really a job for the skilled craftsman.

Metal leaf, gold and silver, and substitutes for them come in small sheets with thin paper between. The surface to be gilded is coated with japan gold size put on evenly and only where the leaf is to adhere. Necessarily, the size must be applied over a well sealed surface so that it will not soak into the wood.

As soon as the size becomes sticky or tacky to the proper degree, a sheet of the leaf is removed from the box, lifted

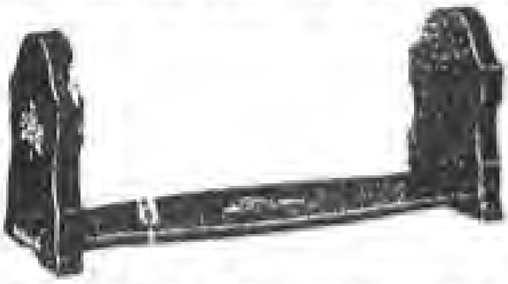


FIG. 9.—Chinese red bookrack, sponge-stippled with gold and bright green and decorated with transfers.

gently by a corner, and laid on the tacky size. It is then smoothed out with cotton batting and patted down.

Where small or narrow surfaces are being gilded, the leaf may be cut to the desired size with a razor blade. Wherever one piece of leaf overlaps another, the laps are allowed to remain until the size has dried hard, when all surplus portions of the leaf are wiped off.

The gilded surfaces, if not to be subjected to much handling or wear, may be left without a protective coating, but if they are to receive any amount of hard wear, they should be coated over with a thin, pale varnish, which may be rubbed with fine pumice stone powder and oil if it is not desired to leave them in a gloss finish.

Among other new finishes are the stippling lacquers recently brought out under various names. Artistic work can be done by stippling them on with a sponge after the piece has been lacquered with a suitable foundation color (Fig. 9). Stipple effects are especially suitable for use in panels and surfaces inside of a molding or a border, or for a finish around a panel of ornamental design.

Stippling lacquers usually are furnished in the form of a colored bronze powder and a special liquid preparation in two separate tin compartments. The bronze powder and liquid are mixed together immediately before use, and only as much should be mixed as will be needed for the particular work, because the material does not keep well after being combined.

For stippling, use a close-grained sponge. Soften it in water and wring it out practically dry; then dip it, flat side down, into the stippling mixture, which can be poured out on a plate, saucer, or even a piece of paper folded to several thicknesses. Tap the sponge a few times on a sheet of paper to remove the excess; then tap it lightly on the surface to be decorated.

It is often desirable to go over the surface two or more times to even up the effect. A second or third stipple color

FIG. 10.—Candlestick with marbled finish obtained by drawing it through a film of floating colors.

may be applied by cleaning out the sponge with lacquer thinner or using another sponge, and going over the surface again in the same way.

Another type of treatment particularly suited for gift wares is what is generally termed "spatter" finishing. Small spatters of color are flecked onto a plain-color background by dipping a brush into the spatter color, wiping it off on the edge of the container until only scant full, and then striking it against a stick or the back of the hand to jar off countless tiny specks of color onto the surface being decorated.

Two or more spatter colors may be applied, one following the other. A fine or coarse brush may be used, according to the effect desired, and a little practice will soon develop uniform workmanship. Either one or two strokes should always be made against a sheet of paper or other trial surface to make sure the brush is not too heavily loaded with paint or enamel.

An enamel finish is generally used for the background and enamel of a harmonizing or contrasting color for the spatter work. The spatter color should be thinned a little. If applied while the foundation coat is still wet, the spatters will sink level with the surface, but if the ground coat has become dry, they will lie on top of the surface in a raised or pebbled effect.

Another novelty treatment that produces a remarkable blending of colors is as follows: Fill a deep dish with water and drop a little of each of three or four colors of enamel on the surface of the water. Run them together somewhat with a spoon or small paddle to form a pattern like marble.

The object to be decorated, as for instance the candlestick in Fig. 10, is then let down into the water by means of a wire loop, and pulled up slowly through the film of enamel floating on top of the water. This coats the surface with a finish of unusual beauty.

With a few practice dippings, anyone can get the knack of the operation. Unsatisfactory attempts can be wiped off with gasoline. After being dipped, the object should be allowed to drip and dry. Suspend it over a newspaper by means of a hook formed on the other end of the loop of wire.

Now that we have covered various methods of home painting and decorating, we shall take up the art of preparing gifts at low cost.

GIFTS AT LOW COST

Artistic and genuinely desirable gifts can be prepared at absurdly little expense if you know the secret. It is just this: Buy well designed but cheaply finished novelties and art wares, or else get entirely unfinished articles, and decorate them yourself by the methods just described or by any of those to be outlined in this section.

All manner of things may be decorated (Fig. 11). Vases, candlesticks, flower holders, bowls, book ends, plaques, boxes, door stops, salt and pepper sets, cake boards, wooden spoon and fork sets and the like may be found in ten-cent stores, variety shops and hardware and house furnishing stores. Woodenware, glass, pottery, china and metal articles may be purchased unfinished in artists' supply and department stores. And in every home there are already many objects waiting to be redecorated.

Polychroming is one simple and effective method of decoration. It is the application of a plastic composition, which is stippled into textured or relief effects and then colored, bronzed, and wiped off to produce a multicolored surface.

Various plastic materials are employed. Gesso clay or Italian clay, sold in small cans, is extensively used, as is plastic wall paint. A gesso preparation may be made by mixing together about ½ pt. whiting, ¼ pt. liquid glue, and 3 teaspoons each of varnish and linseed oil. The proportions may be varied slightly as necessary to produce a composition of good working consistency; it must be sufficiently stiff to stay put when modeled into relief effects.

Fig. 11.—Wall plaque, made from a color print, covered with cheesecloth and shellacked so that it resembles an oil painting. The frame is polychromed gesso. Below: "Pour-finished" preserve jars, one with a transfer design, and other articles bought for ten cents each and lacquered in any colors.

The material is brushed on to the surface or applied with a knife. After it has set for a few minutes, it is stippled in various ways. A brush, spoon, spatula or paring knife may be used to produce scrolls and fanciful designs. Confectioners' icing tools or pastry ornamenting tubes are sometimes used for more elaborate designs.

When thoroughly dry, the surface is usually given a sealing coat of shellac or special size adapted for that purpose. With some plastic compositions this is not absolutely necessary, but it is always a safe practice. It may then be given any color treatment desired.

A typical method is to give the surface a foundation coating of gold, silver, copper or green bronze, or a suitable tint of flat wall paint, enamel or lacquer, and then to use for the polychroming either oil colors, flat wall paint, glazing colors or the new brushing lacquers. The glazing colors are applied with a brush. Before they have commenced to set, they are wiped with a cloth from the high spots and other places, as may be desired. One or more colors may be applied and wiped off, followed when thoroughly dry with other colors handled in the same manner. One color peeps from beneath the edge of another, producing beautiful effects. Frequently the polychroming is completed entirely with bronze powders—first a foundation brush coat of gold, silver or any desired shade, then a coating of japan gold size, and a "patting" on of bronze powders of other colors with a piece of velvet.

"Pour finishing" is one of the newer forms of treatment. Brushing lacquer seems to be especially adapted for this work, both as to working properties and appearance. The only supplies necessary are several cans of lacquer of different colors and a drip pan, which may be any pan, plate, or other shallow receptable.

The object to be decorated is placed in the drip pan and one color of lacquer poured over it so that it runs down the sides (Fig. 12). If the object is set up on a block a little smaller than its base, the color will drip off and not form a bead around the bottom edge. Before the color has commenced to dry, another color is poured on, or as many colors as may be desired, until the surface is entirely covered. The lacquer runs down in irregular streaks and stripes, blending in fanciful formations and producing the most exquisite effects.

A little variation of the treatment will cause a different appearance. For instance, if each color is allowed to dry until it becomes "tacky" before the succeeding color is poured, there will be less blending and a more definitely streaked effect. Still different blends can be made by those with freehand or china-painting experience by pouring on one or two colors and working up scrolls and other designs. Vases, cruets and bottles of artistic shapes also are sometimes decorated by pouring the lacquer into the object and twirling until the entire inside is colored; the excess lacquer is then poured out. By pouring in two colors, a unique streaked effect is obtained. The pour finish is not wasteful; surplus lacquer is poured back into the can. Vases so decorated cannot be used for flowers; standing water may loosen the paint.

Spraying allows the amateur to produce many shaded and stippled effects. Inexpensive sprayers for the purpose are sold by some paint dealers, and an ordinary insecticide spray gun may be used.

Regular brushing lacquer may be sprayed quite satisfactorily with this equipment by reducing it from ⅕ to ⅓ thinner, which must, however, be made by the same manufacturer as the lacquer. Some practicing should be done to learn the manipulation of the sprayer, and the spray should be used rather cautiously.

Frosting is a pleasing effect, which may be obtained by blowing gold, aluminum, green or copper bronze powder from a paper onto an enameled or lacquered surface while it is still wet. On a lacquered surface it is necessary to work speedily before the quick-drying lacquer commences to set.

Texturing colored prints is another new idea. Fine prints such as are found in magazines or bought at a nominal cost can be given an appearance closely resembling that of a real oil painting.

Lay the print, picture side up, on a clean, perfectly level surface, and place a piece of cheesecloth over it. Then apply a coat of shellac over the cheesecloth, brushing it out evenly and thoroughly into the meshes. As the shellac dries, it will cement the cheesecloth to the print. The texture gives a surprising softness and richness to the print and makes a truly artistic picture, which can be framed, passe-partouted or mounted on a plaque and polychromed, as desired. It may be used without glass, as the shellacked surface will permit wiping off with a damp cloth whenever necessary.

The cheapest grade of cheesecloth, very sleazy and with wide meshes, should be used. The better grades, which are closely woven, hide the picture too much.

The cheesecloth should be shaken just before using to remove loose pieces of lint. In some cases the shellac "bleeds" the colors in the print and causes them to run a little, but this is seldom objectionable. The colors generally seem to blend together so that the effect under the meshing is quite delightful. If the picture does not show through plainly enough, apply a second coat of shellac.

ART TRANSFERS

So popular has become the use of transfer patterns on commercial furniture and art wares that it is surprising more home workers have not taken advantage of this decorative vogue. Many, of course, do not understand how easily transfers are applied and still fewer amateur decorators appreciate the variety of brilliant effects made possible by these designs.

The decalcomania (de-kal-ko-mania) transfers, as they are called, have been used in the furniture trade for years to give expensive pieces the artistic finishing touches they need. Now they are available, too, in almost all department stores (usually in the paint or art materials departments), as well as in many neighborhood hardware, wall paper, and paint stores; and they are carried by the larger mail order houses. An almost endless variety of designs, motifs, colorings, shapes and sizes can be thus obtained.

A transfer is nothing more or less than a paint film attached temporarily to a paper backing. When applied to enameled or lacquered furniture or other finished surfaces, the paper backing is moistened and removed, the paint film being left attached to the surface.

Some transfers are quite flat, while others have a texture and depth that make them appear almost as if hand

FIG. 13.—The application of a transfer design of this type will give a piece of painted furniture a really artistic touch.

painted. The best types have virtually the appearance of hand painting; you can see the brush marks!

The main use of transfers is, of course, on painted furniture, that is, on pieces which have already been finished with white or colored enamel or lacquer. They are used less often, but frequently with striking effect, upon natural finished furniture—pieces that have been stained and varnished. The many ways in which this can be done are best learned by observing closely good examples in a high class furniture store.

Among the most popular motifs are *floral* designs, which are appropriate for almost every decorative purpose. *Ships* are much in vogue at present, although their use is more restricted, as are *bird* and *fruit* designs. Many colorful *nursery* pictures can be obtained; these work wonders in brightening up both the furniture and permanent woodwork in children's rooms. *Silhouette* transfers fill the need for a contrasty, posterlike style of treatment (Fig. 13). *Medallions* are useful for more formal decorative work. Other classifications from which one can choose are *conventional* designs, which

FIG. 12.—How a preserve jar or any inexpensive piece of pottery may be decorated by pouring lacquer over it.

FIG. 14.—A center line on the back of the transfer is a great aid in placing it centrally and vertically.

are for the more formal pieces; *oriental* designs resembling the work of Chinese and Japanese artists, especially desirable for red or black lacquered radio cabinets, secretaries, chests, telephone stands and so-called occasional pieces in oriental color schemes; *landscapes*, for rather ornate painted furniture in period designs, and *Colonial* designs, which are now enjoying great popularity.

If you decide which of these classifications is most appropriate for the piece you wish to decorate, you will find the process of choosing appropriate transfers will be much easier than if you make a hasty and haphazard hunt through the large variety of samples of all these types which you will be shown in any well-stocked shop.

In addition to these classifications, there is another type of transfer intended especially for use over natural finished furniture, which gives the effect of inlaid bandings and inserts. So perfect are some of these that it is almost impossible to tell them from actual inlays, although they can be obtained for a fraction of the cost and require none of the skill which genuine inlaying calls for.

When you have decided upon the type of design you wish, make up your mind as to the approximate size. It should be proportionate to the surface on which it is to be applied. The tendency is to select a design that is too small. The shape,

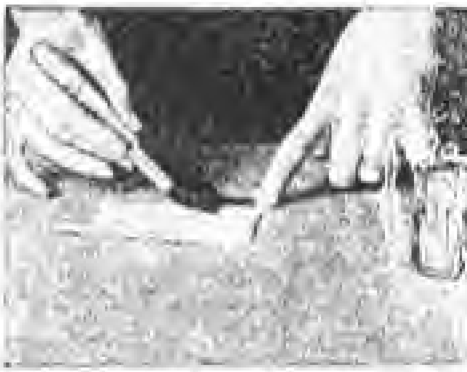


FIG. 15.—Varnish or other adhesive is applied to the transfer and allowed to stand until "tacky."

too, should correspond to the surface on which the transfer is to be used.

Your good taste will govern in selecting the coloring. If you can take a small sample of the background color with you when buying transfers, it is a simple matter to choose.

Some articles can be decorated with almost any type of pattern. A magazine rack, for instance, would be in good form decorated with any motif with the exception, perhaps, of fruit. Breakfast sets are generally done with four corner designs. Card tables and other small tables often have a central design combined with corner pieces and occasionally a narrow border is run entirely around the table top or connected with the corner designs. Lineal borders are obtainable for this purpose in 2-ft. lengths.

You will find that the back of each transfer usually is marked with vertical and horizontal guide lines. These are to aid you in centering the design and applying it exactly horizontal or vertical (Fig. 14). If there are no guide lines, trim the top of the transfer paper to a straight edge just above the design and mark the vertical center line.

Make careful measurements before applying transfer and do not rely merely upon your eye. The best design will not be satisfactory if off center or crooked.

A thin, quick-drying varnish is an ideal adhesive for transfers, as it is elastic and does not cause puckering. The various proprietary adhesive cements made on a varnish base also are usually excellent. A good grade of liquid glue is

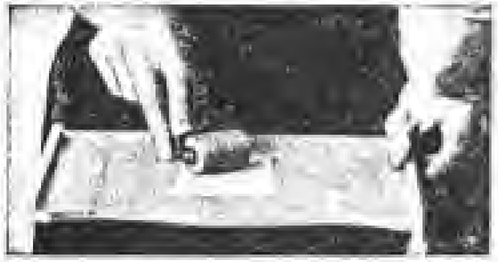


FIG. 16.—The transfer is pressed down from the center outwards, with a rubber roller or a cloth.

often used by home decorators because it is so convenient; its adhesive properties are entirely satisfactory, but there is some tendency for glued transfers to draw and pucker up while drying.

Apply a thin, even coat of the adhesive selected to the face of the transfer, covering every bit of design (Fig. 15). Allow to stand until the adhesive is "tacky" or sticky. Place the transfer on the surface to be decorated and rub down hard with a cloth or, preferably, with a rubber roller such as is used for

FIG. 17.—After being saturated with water, the paper backing is either lifted up or slipped off.

mounting photographs (Fig. 16). Work from the center outwards to avoid wrinkling.

Next saturate the paper backing with lukewarm water. Wait about thirty minutes before doing this, however, if glue has been used as an adhesive. If any air bubbles are seen after applying the water, smooth them with the roller. Then lift or slide off the paper backing as shown in Fig. 17.

Clean the surface immediately by sponging with water (Fig. 18). In case the transfer has been applied with varnish, the water will not remove surplus deposits of varnish, so go over the entire surface a second time with gasoline diluted about 50 per cent with water. No hesitation need be felt in doing this if the surface, whether paint, enamel, lacquer or varnish, is thoroughly dry, as it will not appreciably affect its appearance. Even should the finish become streaked for some reason or other during the application of the transfers, it can be polished with furniture polish or wax to restore the luster.

It is important to wash up the surface at once after removing the paper backing because the gum remaining on the face of the transfer is otherwise almost certain to pucker and crack the design.

Even the best of transfers sometimes seem a bit temperamental and occasionally one may go wrong, but if reasonable care is used, there will rarely be any difficulty.

If one has had any experience in art work or decorative painting, it is often possible to touch up designs with artist's oil colors so as to bring out the high lights and shadows and tone down or change the colors, where necessary, to bring the design more in harmony with the body color. If well done, this makes the design appear wholly hand painted. It is frequently resorted to by professional furniture decorators.

Whether a protective coat of varnish should be applied over the transfers depends upon the individual piece, how it will be used, and the effect desired. If it is going to have any hard wear over the decorated surface, as, for instance, in the case of a breakfast table or the back of a chair, the transfer must be protected; otherwise the hand-painted effect will be most fully preserved by leaving the transfer uncoated.

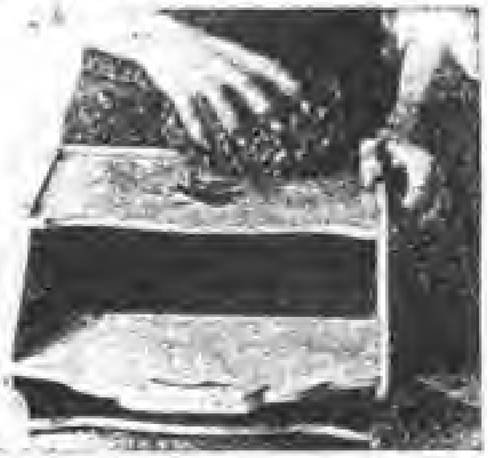


FIG. 18.—The surface is cleaned first with clear water, then with gasoline diluted with water.

Varnish, when used as a protective coating, is generally applied with a small brush, following the outline as closely as possible. This gives a glossy luster to the design and changes the effect considerably. Clear brushing lacquer may be used and, as it has not so high a gloss, gives a more artistic effect than varnish; indeed, it is an ideal coating for this purpose. Clear lacquer does not, as one might expect without trying it, "pick up" the transfer colors or cause them to "bleed." Flat varnish also may be used; it dries without gloss, but has little wearing qualities.

Sometimes a pleasing effect is obtained by coating the entire surface of lacquered articles with clear lacquer. One should always make sure of the effect in advance, however, by trying a small sample, as this treatment will change considerably the appearance of a colored lacquer finish. If the piece had been finished with enamel instead of colored lacquer, do not conclude that varnish can be similarly used over the entire surface, because it gives a distinctly yellow tone, especially over light and delicate tints.

After making a few experiments with decalcomania transfers, you will find you have at your command one of the most inexpensive and attractive methods of decoration ever developed for furniture and craft work.

ENAMELING FRONT DOORS

Although we expect much of the front doors of our homes, we pay scant attention to them once they have been selected to give the right atmosphere and architectural detail. There is, however, something else besides the character and design of the front door that conveys to guests their first impression of the home, and that is its state of preservation.

Too many fine doors with outside exposure have come to be a source of annoyance because the finish has crumbled away, faded or blistered in the sun, or because they have warped badly or even show signs of falling apart on their hinges.

For the exacting service of finishing doors it must be remembered that only the finest paint, enamel, varnish, or lacquer should be used. Furthermore, every inch of the door must be protected, not merely the front and back faces and the lock edge. Even painters, in their rush to finish a job taken on a price basis, often fail to coat the top and bottom edges of doors to seal the surface against moisture. And what is the use of sealing the front and back if we leave the top and bottom edges to draw up water like a sponge?

Some doors, particularly those of the flush-panel type, consist of a soft wood core of many small pieces glued together and veneer glued on the exposed surfaces. Even if waterproof glue has been used in the construction of a door of this kind, it will be affected by moisture unless well protected with a waterproof finish, and if ordinary glue has been used, it has about as much chance to hold together in the presence of moisture as a Japanese lantern.

Doors made of planks or of solid wood stiles with solid panels will withstand water reasonably well, but they are likely to warp as much as ½ or ¾ in. out of line unless well protected. Doors are made from very dry wood, and it is well known that unless they are given a coating of some protective material the minute they arrive at a new building they are likely to absorb enough moisture, if only from the damp air, to cause them to warp.

This section will describe in detail the application of enamels of the varnish-base type (not brushing lacquers).

Be sure to choose an enamel made specifically for exterior wear. It will cost from $5 to $8 a gallon, but you will need only about one quart for a door. Exterior enamel usually comes in white alone, but sometimes it can be obtained in light tints. White enamel can be tinted by adding to it a little of the desired color ground in japan—that is, in varnish. If only a small amount of color is needed for a very light tint, it is possible to use the more common and easily obtained tinting colors ground in oil. In either case, thin a little of the color with turpentine and break up the lumps, if any, of course; then strain it through cheesecloth before adding it to the white enamel.

Before the enamel is applied, however, a new door should have at least two coats of enamel undercoater. This also must be of a type made for exterior use. An enamel undercoater for interior wear may turn gray or black when exposed outside. In place of a prepared

FIG. 19.—Applying the first coat of enamel on a front door.

undercoater, you can use a coat of white lead thinned with a mixture of three parts turpentine and one part boiled linseed oil.

An old door that has been varnished should first be sandpapered well with No. 1 paper to cut the gloss. If the old varnish is simply dull or shows fine hairline cracks, there is no need to remove it. If, however, it is scaling off, sandpaper hard enough to take off all the varnish. Unless it comes off easily, use a liquid varnish remover, which will hasten the work.

If you have to finish an old door from which all the varnish has been removed, use as a first coat the enamel undercoater as it comes from the can (Fig. 19). If some of the varnish remains, however, the first coat of enamel undercoater should have a few ounces of the enamel added to it to make it take a firmer hold on the old surface. For the second coat, use the straight undercoater.

One of the best brushes for applying both the undercoats and the enamel is a 2- or 2½-in. flat varnish brush. You must have a good one.

A convenient procedure is to remove the door and stand it on the front or back edge. Paint the top and bottom edges, hang the door again, and paint the front and back edges. Then paint the front and back faces. In the case of a four- or six- or eight-panel door it is well to paint the edges, then the moldings on the edges of the panels, front and back, then the panel faces, and finally the remainder of the face surfaces.

As to the handling of the brush, avoid stretching the enamel undercoater out too much. While it should be firmly brushed into contact with the surface, it should not be spread to make a very thin film, as is done with outside paints. Applying the enamel is a bit more difficult. Fill the brush well and, except on the edges, apply the enamel with the idea of covering about one square foot with a brushful. Just flow it on and do not brush it any more than you must to distribute it evenly. Repeat with a second brushful and do not work over the first area until you have coated in about a square yard.

Then wipe the brush on the side of the pot until all surplus enamel has been worked out, and brush over the surface which you have coated. This is to distribute the enamel finally and to pick up any excess. Repeat this series of operations until the whole surface has been coated. Watch closely for about twenty minutes. If too much enamel has been put on in places, it will sag or "curtain." If you act quickly you can brush out the enamel evenly again and eliminate any defects.

In enameling the panels or in working around lights of glass in a door, as in Fig. 19, be careful to avoid leaving too much enamel on the edges of moldings and in the corners.

Each coat of enamel undercoater should be rubbed lightly with No. 00 sandpaper—merely to cut off any dust and dirt nibs. Then wash the surfaces clean with a sponge and water and let them dry before painting again.

If a hand-rubbed effect is wanted on gloss enamel, wait two or three days until the second coat of enamel is hard and then rub it with fine powdered pumice stone and water on a piece of soft felt tacked to a block of wood as in Fig. 20. Fold the felt over the ends of

FIG. 20.—For the finest effect on a front door, the enamel is rubbed smooth with pumice stone and water.

the block and place the tacks in the ends; otherwise they would scratch the surface. Wet the enamel with water, wet the felt, and pick up some of the dry pumice stone. Rub with an even pressure up and down, that is, lengthwise of the boards, and do the same amount of rubbing on each division of the area.

Do not rub the moldings and door edges, as it is very easy to cut through the enamel at such places. At most give these places one or two strokes with the rubbing pad, or use a short stiff bristle brush.

If a noticeable amount of dust collects on the first coat of enamel, it is well to water-rub it instead of merely sandpapering it lightly. Do not rub any more than is necessary to cut off the gloss.

The task of rubbing enamel is not nearly as hard as amateur painters are likely to imagine. By stroking off the sludge with one's thumb and inspecting the surface, it is easy to see just how far the rubbing process should be continued to give the smooth, satiny appearance which is so greatly prized and is always indicative of the highest grade enamel work.

A satisfactory effect can be obtained without rubbing through the use of a special semiflat drying enamel instead of a high gloss enamel. The last coat of this type of enamel does not require to be rubbed.

There is something to be said, too, in favor of using high gloss enamel and letting the last coat stand without rubbing. It is claimed that an unrubbed gloss enamel resists the elements a little better than one which has been rubbed because it presents such a tough, smooth, and unbroken film. Furthermore, the shiny glare of a newly enameled door, even if it is not rubbed, becomes softened quickly enough in most localities because of the dust and soot in the atmosphere and the consequent necessity of frequent washings.

OIL RUBBING FURNITURE

When all the necessary patching and repairing have been done to a piece of antique furniture and the old finish has been removed, one of the best ways to refinish it is by rubbing it with oil and polishing it with wax.

You may wonder why the removal of the old finish should be delayed until after the patching has been done. That is because it is not the best practice to wash off surplus glue from newly made joints. If the gluing is done before the old finish is removed, the surplus glue comes off with the old finish. If the finish were removed first, the surplus glue would have to be scraped off, and the scraping would mar the surfaces.

Genuine boiled linseed oil is the best agent for giving a deep, lustrous appearance to old wood. Brush the oil out thin so as to apply no more than will be absorbed by the wood. The oil will require from twenty-four to seventy-two hours to dry thoroughly, the time varying with the temperature.

There are a number of opinions as to how linseed oil should be applied—whether full strength or diluted, whether boiled or raw. A very hard wood will not absorb as much oil as a softer one, so it is well to examine the wood and dilute the oil enough so that all will be absorbed. A good practice is to use one part boiled oil and one part turpentine for all wood, but to apply more than one coat if the first coat sinks in so that it is clear the wood will absorb more. If too much oil is applied, the surplus will dry on the surface and must be removed with steel wool—a very tedious and annoying job. It should, therefore, be avoided.

The accepted method for refinishing antique furniture is to leave it in the natural wood, that is, to polish the wood without the use of stains or varnish. If this finish is desired, allow the piece to stand a day after removing the old finish so that the varnish remover will evaporate entirely; then oil the wood and allow ample time for drying.

If the patches appear new and of a lighter color than the surrounding wood there are a number of ways in which they may now be treated:

1. Make a paste of dehydrated lime and water, the consistency of thick cream. Apply this paste about 1/16 in. thick to the new wood, let it stand for a day, and remove it carefully with a scraper and steel wool. If the wood still does not look old enough, repeat the process.

2. Dilute nitric acid with an equal amount of water and apply with a fine brush or a small swab to the new wood. Allow a day for the action of the acid and then wash it off with alcohol. This method is convenient and is used by many, but has several serious disadvantages. The acid is dangerous in the hands of those who are not accustomed to using it; and, furthermore, it often seems to give the wood an unnatural appearance.

3. Commercial wood dyes of the alcohol type, or spirit stains, as they are sometimes called, can be diluted with alcohol to the desired shade. These dye the wood a fast color and can be given a rubbed oil finish without difficulty.

When the new wood matches the old and the entire piece has been well oiled, polishing can be started (Fig. 24). Use any good grade of floor wax. Apply it with cotton cloth that has been washed and is perfectly free from lint. Rub the wax back and forth across the grain or use a circular movement. Continue rubbing until the wax has been rubbed in and both the surface and the cloth are almost dry. Apply more wax and repeat the rubbing. Continue until the grain of the wood is thoroughly filled.

Let the piece stand until the turpentine in the wax has evaporated and then give a final polish. A good rubber for this purpose may be made from a piece of wood 2 by 2 by 8 in., padded on one side and over all of the face edges with a layer of cotton from 1/4 to 1/2 in. thick, and covered with strong cloth. Tack the cover to the block halfway up the edges and ends. Place over the rubber a loose cloth.

You will find the rubbing is strenuous exercise, but the result will be a polish to delight those who appreciate a beautiful patina.

FURNITURE POLISHING SECRETS

After a piece of old furniture has been oiled and waxed, the grain of the wood, especially in dark wood, may appear white. This is nothing to be discouraged over; it proves that the grain has been well filled with the wax, as should be the case.

"White grain" is easily eliminated by rubbing the piece down with either raw or boiled linseed oil or with a good furniture polish. The use of a polish does not remove the wax from the grain.

There are also times when wood that has had undue exposure to the weather will look "sick" and lifeless after it is oiled. The life, or deep luster, which the wood should have, may be restored by a modification of the French polish.

To apply this polish, make a rubber (large enough not to cramp the hand) from cotton cloth and apply a good grade of clear varnish to the rubber with a small brush or swab as shown in Fig. 25. With the finger tips or a very small brush or swab, add a few drops of raw linseed oil to the center of the varnish already applied. Then rub the wood with a circular or across-the-grain stroke. Repeat the application of varnish and oil as often as necessary and rub well until a good coat of varnish has been applied. It will be noted that the fine color is

Fig. 24.—The final polish is given to the oiled and waxed top of a low boy with a rubbing block.

Fig. 25.—Applying clear varnish to a rubber made of cloth for use in a modified French polishing process.

returning to the wood because, with the aid of the oil, the varnish is being rubbed into the wood instead of onto it.

When the color has been restored, time must be allowed for the varnish to dry, and the presence of the oil will probably prolong the process. When dry, the piece will appear cloudy because of the oil. This cloudiness may be removed by rubbing with wood or denatured alcohol.

If a dull rubbed natural wood finish is desired, the piece should be sandpapered with No. 0 or ½ sandpaper, then rubbed down well with No. 0 steel wool (this will remove some of the varnish but not the restored color), and waxed and rubbed as previously explained.

If a highly polished surface is desired, the polish is carried to a finish by sanding lightly with No. 00 sandpaper the first coat of oil and varnish, after the alcohol rub; then adding two or more coats in the same manner, treating all coats alike except the last, which is given only the alcohol treatment and a thorough rubbing with a good furniture polish or polishing oil.

The French polish does not change the color of the wood; it merely brings out the natural color and shows it to best advantage. In many instances, however, it is desired to make a walnut or mahogany piece darker to match other pieces with which it is to be used. This must be done with the first application of oil.

In using the penetrating wood dyes previously mentioned (brown mahogany is best for walnut and dark mahogany for mahogany; the other colors as recommended on the manufacturers' labels), add enough of the required color to the linseed oil, diluted as before, to give the wood the shade desired. Try it out on some unexposed part of the piece to be sure it is the right tone. Apply this colored oil as a first coat and the wood dye will dry in with the oil, imparting a permanent color which will take a rub finish. Carry out the finish as before.

Boiled linseed oil diluted with equal parts of turpentine is excellent for all wood except old curly maple, which it darkens too much. This is one wood on which gasoline or benzine should be used, in the proportions of one part linseed oil to three parts of the other. These liquids are highly inflammable.

A great number of antique pieces are found which have black spots and rings on their tops. Some would rather have these marks, while others will not allow them at all.

If it is desired to remove them, proceed in the usual way as far as the first coat of oil. After this is dry, use a cabinet scraper to scrape out the spots and enough of the surrounding surface so that the scraped places do not show as holes dug in the wood. Apply the diluted boiled oil frequently to the parts being scraped. After the spots are removed, apply the modified French polish described above to the places scraped, and finish as before.

PLASTIC PAINT FOR WALL DECORATION

The rough textured walls that have become increasingly popular in recent years are produced with what is known as "plastic paint." Ordinarily this is sold under various trade names in the form of a white powder. Only water and color need to be added. The mixture is applied with a large brush, and while it still is tacky the texture is developed.

FIG. 26.—Before being added to the plastic paint, the tinting color is mixed into a paste with water.

Perhaps the best way to learn to use this remarkable finishing material is to buy a 10-lb. package and practice on a piece of wall board. Usually a booklet of instructions is furnished with the paint.

In experimenting with the paint, follow directions exactly. First, clean the surface thoroughly and apply a coat of size. The size comes in powdered form separate from the plastic paint and is mixed with water. The size should be allowed to dry for at least six hours.

Later, when doing an entire room, use pails for mixing the plastic paint, but for the test job a kitchen mixing bowl will serve. The proportions of the mix will probably be about one pint of water to one pound of plastic paint. This usually gives a consistency of heavy cream. Next, mix the tint in a separate pan. If, for example, you have decided

FIG. 27.—The Spanish texture is obtained by stroking the wet paint with the bowl of a common kitchen spoon.

on a buff color and a rough texture adapted from Spanish style architecture, use dry yellow ochre mixed with water to the consistency of a paste. Add the color to the plastic paint and stir the whole until the color is evenly distributed (Fig. 26). The plastic paint comes out a very little lighter on the walls than in the paint, and this must be allowed for.

For applying the paint, use a Dutch kalsomine brush and lay the material on from $\frac{1}{8}$ to ¼ in. thick. When it begins to "set up" slightly, try the development of the Spanish texture. The tool to use is an ordinary kitchen spoon, and all that is required is to move the back of the spoon across the paint in short, partially curved strokes (Fig. 27).

It is now necessary only to repeat the performance on the walls and to observe the one extra precaution of mixing

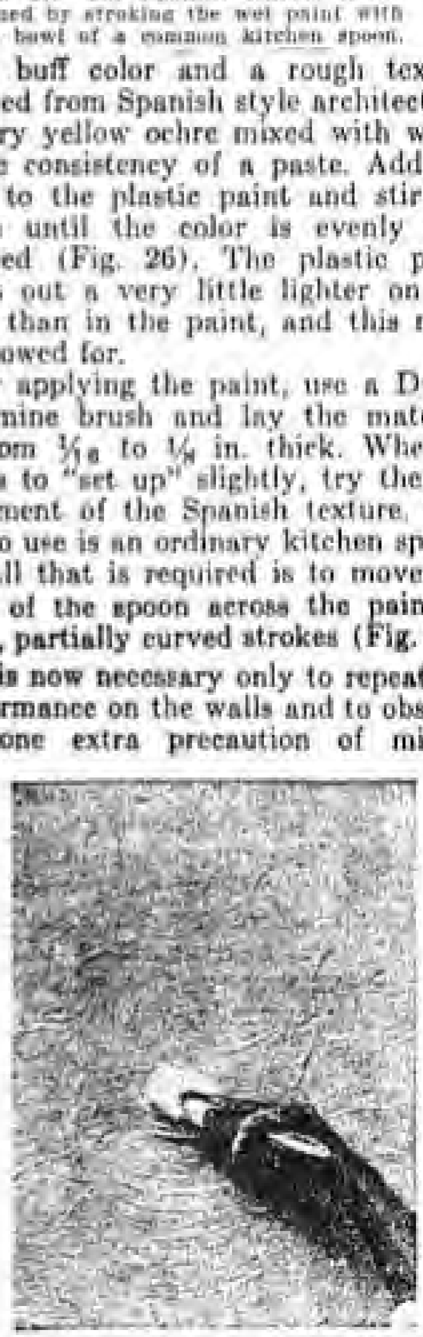


FIG. 28.—Semicircular sweeps of a 4-in. wall brush produce the so-called "monastic" texture.

enough material to cover the entire wall area. If two or more batches have to be mixed, it will be difficult to match the color exactly.

If you are decorating over a painted

wall it is not necessary to apply a coat of size; but where the paint is scaling or loose, it must be scraped off. Small

FIG. 29.—The Italian texture, which is copied after a finish found in many fine old Roman villas.

crevices may be filled with a thick mixture of the plastic paint and then sandpapered.

For the ceilings what is called a "monastic" texture is excellent. This is similar to wall finishes often found in old monasteries. Yellow ochre, only this time less of it, can be used to tint the paint a cream color. Again make a test panel so as to be sure of your ability to reproduce the texture before starting on the ceiling. Incidentally, this method of practicing on a panel is the way of "making sure you're right before going ahead."

For reproducing the monastic texture, a 4-in. wall brush is worked in short, semicircular sweeps so that one brush sweep crosses another or starts out from it (Fig. 28). Actually, the brushing can be called "at random"; the entire surface virtually is covered with brush marks.

In order to get the best effect, go over walls and ceilings, after they are thoroughly dry, with a piece of sandpaper to soften the welts that seem too sharp. And to make the finish more washable,

FIG. 30.—Developing a Colonial stipple finish. The brush is known as a painter's "stippling block."

give the walls and ceiling a coat of size.

The finished appearance is practically certain to exceed your anticipations. The walls and ceilings will be of different but harmonious tints. The rough textures will break up the light waves and diffuse a soft glow through the room. And the furniture will have an interesting and effective background.

The possible textures are almost unlimited. Indeed, the handbooks distributed by the various manufacturers of plastic paints usually give directions for a large number.

In a dining room, for example, it might be desirable to have an Italian texture (Fig. 29) in turquoise blue, with a ceiling lighter than the walls and finished in the monastic texture previously described. The pigment and paint will be mixed just as before, but the Italian texture is developed by leaving large brush marks as the paint is applied and then smoothing them down to some extent with sweeping strokes of the palm and heel of the hand.

For a kitchen a light, clean looking finish would be pure white or slightly tinted walls and ceiling textured in a stipple such as is found in some old Colonial houses. If white is used, merely mix the plastic paint to a thick consistency and brush it on, letting it "set" slightly before producing the stipple by dabbing the wall all over with an ordinary stippling brush as shown in Fig. 30. Later on the stipple may be lightly sanded to remove sharp points. A final coat of size then should be applied.

What is known as the English texture is produced with a 4-in. semiflexible putty knife drawn over the wet paint in such a manner that welts appear on either side of the knife, the extent of each sweep being about an eighth circle. In connection with this finish, and indeed with many others, it is good taste to leave the ceiling a plain brush texture, the color being one or two shades lighter than for the walls. If the ceiling is made the same color as the walls, it will appear darker in the finished job.

For an entrance hallway, a sun porch, and similar places, an excellent texture to use is what is known as imitation travertine marble. This is often seen as the background of store windows and in public buildings. As expensive as it looks, it is, nevertheless, simple to produce. Each step in this development is shown in Fig. 31, except the blowing in of the greenspar—a sand from Florida's beaches.

First, the plastic paint is tinted with raw sienna to approximately a deep cream. It is then applied to the walls and stippled with a stippling brush. Next, the greenspar is blown in simply by placing a little of it on a sheet of paper, holding the paper about a foot from the wall, and blowing the powder off the paper and on to the wall.

A draftsman's celluloid triangle or a special celluloid tool furnished by some plastic paint manufacturers is drawn across the surface in such a way as to smooth down most of the stipple. The pits that remain complete the effect of true travertine stone.

After the wall has thoroughly hardened it is sandpapered with No. 1½ sandpaper and the stones are marked

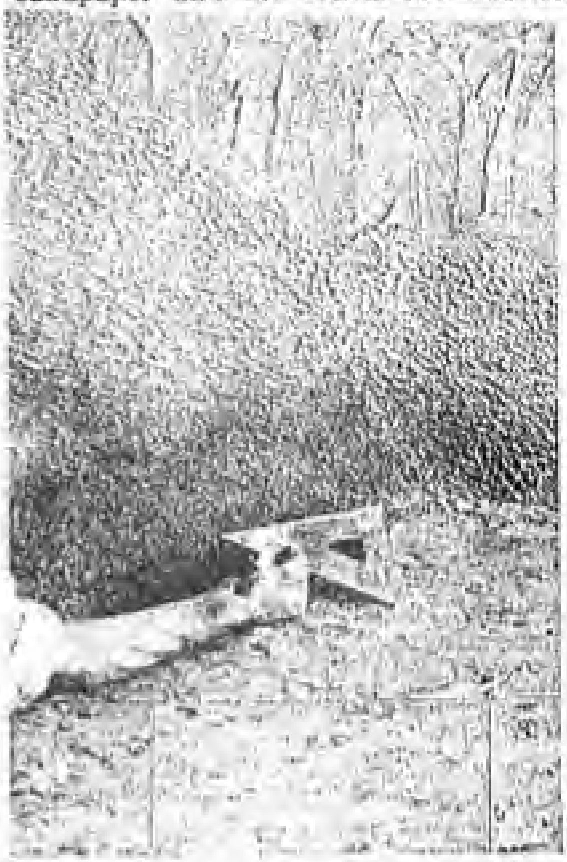


FIG. 31.—Developing a travertine finish. Greenspar is blown on the paint after it has been stippled.

off with a common file bent at right angles at the tang or handle end. A yardstick and ruler are used to keep the scoring straight. A coat of size completes the job.

All the finishes so far mentioned are what may be called plain plastic paint. Since, however, these textured finishes are especially well adapted for polychrome effects, it is possible to do much to enhance their beauty by glazing them with special glazing colors. The materials for glazing can be purchased at any well-stocked paint store, but the success of their application is largely a matter of individual taste. The chosen colors are applied irregularly and then blended with a cloth to give whatever type of variegated effect is desired.

When a room has been wallpapered, it is always best to remove the paper before attempting to apply plastic paint.

FIG. 32.—Many striking effects may be obtained with the fingers, as in this simple scroll texture.

Then wash the entire surface with a solution of sal soda and hot water.

Cracks in the wall can be filled with the joint finisher (or patching plaster) used with plaster wall board, and then sandpapered. It is not necessary to apply a coat of size if the plaster appears to be well filled with the original size.

When a kalsomined wall is to be refinished with plastic paint, it is essential to wash off all the old color. Be particular to leave no color in the corners or around the trim. If the cleaned surface turns out to be glossy, wash it down with steel wool and a strong solution of hot sal soda water. Another washing with clean water will be necessary to remove all traces of alkali and steel wool. Let the surface dry and then scratch it thoroughly in every direction in order to give a reasonably rough tooth for the application of the plastic paint.

PLASTIC PAINT NOVELTIES

Plastic paint can be used for decorating novelties of many kinds and for such objects as imitation fireplaces and treasure chests.

It has become quite customary in small modern homes and apartments to install fireplaces which have no connection with a chimney and cannot be used for heating purposes—fireplaces intended purely as ornaments. One of these can be made without difficulty and at small expense if plastic paint is used for the finish. An example is shown in Fig. 33.

The first step is to make the framework from any scrap lumber as shown in Fig. 34. The framework then is covered with gypsum (plaster) wall board. The joints between the various pieces of wall board must be reinforced with strips of strong fabric, which usually can be purchased with the wall board. Plastic paint is used to cement the joints. First the joint is "buttered" with a thick mixture of plastic paint. Then the fabric is pressed lightly along the joint and a semiflexible putty knife is drawn down the joint with sufficient pressure to force the plastic paint through the mesh of the fabric. Nailheads should be spotted with plastic paint. Then, after the whole has dried, the joints and nailheads should be lightly sandpapered.

The plastic paint is mixed in the usual way, applied over all surfaces, and stippled with a stippling brush. A draftsman's triangle is dragged lightly down the surface to flatten some of the stipple, as in preparing the travertine finish previously described. The keystone, corner stones, and the plaque (the rectangle with the lion on it; you can see it if you look closely at Fig. 33) are smoothed down with the triangle and the whole is allowed to dry.

The next step is the application of the

Fig. 33.—A fireplace of wood, wall board, and plastic paint. The small chest on the mantel and the decorative panel above were stenciled with plastic paint.

lion in the plaque and the fleur-de-lis in the two top cornerstones and out near the edges of the fireplace on a line with the plaque. These are made with uncolored plastic paint applied through stencils bought at a paint store. Then the joints are scored with a file to produce the effect of stones as in the case of travertine stones.

After a day has been allowed for drying, the surface should be sandpapered lightly with No. 1½ sandpaper to remove all rough edges. Mix one-half pound each of rottenstone and size with water and apply with a Dutch kalsomine brush. As the mixture is brushed on with the right hand, wipe it off with a soft cloth held in the left. It will stay in the depressions and joints but will be removed from the high spots, and the result will be a rich finish like old stones. This completes the process except for

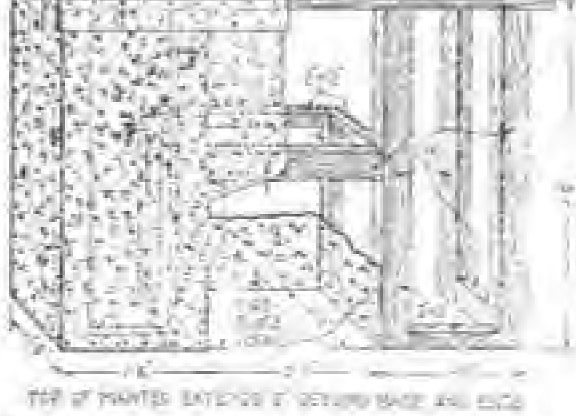


Fig. 34.—How the fireplace framework is built and covered with wall board ready for finishing.

coloring the lion in the plaque, which can be done several days later with raw umber (artists' oil color), wiped partly off.

The chest shown in Fig. 35 was suggested by an illustration in the picture section of a Sunday newspaper. This illustration showed a movie scene in which a pirate was standing on a sea beach beside an old brass-bound chest. The chest was so picturesque that it seemed a promising subject for a living room or hall ornament.

The box can be constructed in any convenient way from any available wood, but after it is made all the joints should be treated with the same reinforcement used in building the fireplace. The next thing is to cover the whole, except the bottom, with a thick coat of uncolored plastic paint. This is streaked and swirled with the brush to reproduce the grain and knots of old wood. After the paint has dried, it must be sandpapered lightly.

Stencils are cut in common stencil paper for the hinges, flanges, and locks, and the plastic paint is applied through them with a 4-in. semiflexible putty knife to a thickness of about ⅛ in. To give these imitation hinges, flanges, and locks the appearance of hammered iron, tap them at random with the end of a pencil or stipple them with a stippling brush.

To make the corner bands, bottom bands, and surface bands, stick on adhesive tape to define exactly where the bands are to be. This will give a straight line or gage. Then apply the plastic paint with a putty knife to a thickness of ⅛ in. and repeat the imitation hammering process. When the bands are dry and have been lightly sandpapered, pull off the adhesive tape.

To complete the realistic appearance of the ironwork, place brass-headed upholstery nails in a vise and dent the heads with a hammer; then nail them into the imitation iron. Wormholes can be added, if desired; an ice pick is a good tool for making them.

For the front hinges, break a lead pencil into three parts, dip each part in the plastic paint, and stick it on the box. Sandpaper them lightly and score them to complete their shape and give them the correct appearance.

Give the box a coat of oak stain, which should be wiped off lightly with a cloth to produce high lights and shadows. When this is dry, apply a coat of clear varnish. While the varnish is still "tacky," dust the box with rottenstone and wipe off the excess. The surface will now resemble old wood.

The next step is finishing the iron work. Apply a coat of aluminum paint to the flanges and similar parts. When this is dry, mix lampblack with a small quantity of varnish and brush it on the parts supposed to be iron, but wipe it off

Fig. 35.—Touching up the [illegible] of the treasure chest with black. The lock plates, hinges, and straps are of plastic paint.

immediately with a soft cloth in such a way to leave the black only in the depressions.

For those who are interested in metal work, it is a simple job to make suitable handles. Those shown in Fig. 35 were handmade. However, handles of many sorts, antique and otherwise, may be purchased, and they will serve the purpose very well.

Many other decorative articles can be prepared with the aid of plastic paint —candlesticks, vases, bowls, trays, panels, wall ornaments, and the like. A few examples are illustrated in Fig. 36.

Fig. 36.—Glass, pottery, and wooden objects with plastic paint ornamentation. The candlesticks and bowl are blue; the stenciled bonbon dish is silver; the vase is bronze.

PAINTING WITH KALSOMINE

Kalsomine may be the most suitable finish for the walls and ceilings of your home, or perhaps for the ceilings alone.

"But how can I decide that?" you ask.

Well, take the case of a new house. Usually the owner wants to occupy it at the earliest possible time. Plain white plaster walls are not very inviting, yet it is generally known that to paint new plaster immediately is risky because of so-called "hot spots," which are apt to fade oil colors and burn the life out of the oil or varnish binder, causing dead, flat looking blotches. Furthermore, new plaster is expected to settle and probably crack in places during the first winter. For these reasons it is desirable to decorate the walls and ceilings in the least expensive manner, and kalsomine serves well.

Kalsomine is to be recommended, too, when a frequent change of color is wanted, and also when it is desirable to get the decoration done in the quickest possible time. Kalsomine gives artistic, plain, absolutely flat or pastel coloring and merits consideration for that reason, aside from its inexpensive character.

Fig. 37.—Old kalsomine must be washed off before new is applied.

On the other side of the account we should consider the limitations. While good kalsomine today does not rub off like whitewash and as kalsomine did years ago, it is not washable. It is applied in one coat over a size coat on either new or old walls. While you save in the first place by decorating with kalsomine, a part of what you save will have to be paid when redecorating at a later date, for the old finish must be washed off before redecorating with kalsomine, with paint, with wall paper or wall fabrics, or with lacquer.

There was a time when professional decorators mixed up their own kalsomine from whiting, glue, dry colors, and water, but little of that kind of kalsomine is used today by anyone. The bulk of the kalsomine is made in factories. After the addition of water, the dry prepared kalsomine is ready for the brush.

Prepared kalsomine can be had at any paint store in small and large packages and in one or two dozen delicate tints and shades. In a majority of cases the desired color can be selected from the color card; all you have to do is to add the water and mix up the material. When some unusual tint is needed, buy one of the available tints that is very near to what you want and then add to it a little of one of the other colors on the color card to give the exact tint desired.

New plaster of the smooth type to be kalsomined calls for little preparation aside from sizing and clipping off any splashes of plaster. It is best to cut off such splashes or fins with a putty knife rather than with sandpaper, although fine sandpaper can be used. The troweling of the plaster produces a hard glaze or shell on the surface and it is better not to cut through that if it can be avoided.

Sand-finish plaster, if new, usually requires to be swept down with a broom to remove loose sand.

Old kalsomine finished walls must be well washed (Fig. 37). Use two pails of warm water and a good sponge. Some painters first take a kalsomine brush and wet three or four square yards of the old kalsomine with some water. Then the sponge is soaked and used to wipe off the kalsomine. And when the sponge is loaded with kalsomine, rinse it out in one pail and wipe the wall again until the surface is clean. The final wiping should be with the clean water in the other pail, after the sponge has been rinsed out as well as possible.

If old kalsomined walls have had a varnish or gloss oil size on them, that size will not be removed by the washing and it will not be necessary to size again before applying the new kalsomine. Gloss oil size serves well enough for kalsomine, but it is decidedly out of favor, because later on it may be desirable to use paint, wall paper, or wall fabric, and none of these decorations adhere well to this kind of size. Wall paper and fabrics will not stick unless a special treatment consisting of a coat of flat paint and a size of sugar or molasses and glue is first applied. If the size under the old kalsomine was a glue size, it will be largely removed with the kalsomine, and the wall should be sized again.

Kalsomine on a sand-finish wall cannot be removed completely, but the new size coat binds in place what kalsomine is left in the low pores of the plaster. A stiff brush aids in washing off the kalsomine from a rough surface.

When papered walls are to be refinished in kalsomine, it is best for sanitary as well as practical reasons to remove the old wall paper by soaking it off with water and scraping with broad scraping knives. Occasionally ingrain and plain wall papers are sized and kalsomined, but the job is not generally satisfactory for a very long time.

Kalsomine can be applied over painted walls. If the paint is dead flat, simply size it like new plaster; if it has some gloss, wash it down with hot water and a washing powder or sal soda to cut the surface a bit and then size it.

Old walls that are very dirty should be washed before the application of kalsomine, or the kalsomine will loosen the dirt, which will be smeared around, making dark streaks in the finish. Sometimes it is easier and cheaper to apply a coat of flat paint than to wash a very dirty wall.

Any holes or cracks in the old walls should be cut out with the putty knife to remove loose edges. Undercut the edges so the filling will wedge itself in place. Wet the cracks or holes with water and fill with a patching plaster or with ordinary plaster of Paris, smoothed over with a putty knife or soft wood paddle. When dry, coat the fillings with shellac to stop suction.

Various sizes are suitable for kalsomine finishes, but glue size is most commonly used. It is made by soaking flake sizing glue—say a pound—in a little cold water overnight. In the morning add one pail of hot water and stir the glue until dissolved, or work it with your fingers. If you are not sure that the glue is of a good strong grade, use a little less water. Some like to add also about a pint of table vinegar to make the size penetrate better.

Apply this size freely to the walls and ceilings with a kalsomine brush, taking care to catch up any runs or puddles in the corners. Let it dry at least overnight and longer if possible.

If a varnish size is wanted, make it by mixing together equal parts, by volume, of first-class floor varnish and turpentine. Then add a handful of fine pumice stone to give it a "tooth." Some like to add also a little flat paint to give color and thus help hide the surface to a limited extent.

Prepared kalsomines are sold in five-pound and larger packages. On an average one pound will cover about 100 square feet. Consequently, a five-pound package will cover with one coat an average room about ten by twelve feet with the usual eight-foot-six-inch ceiling height.

Follow the directions on the package in mixing the kalsomine. They may call for hot water or for cold. Lukewarm water is better for the so-called cold water kalsomines. If the directions call for boiling water, be sure to have it boiling hot, not just warm.

FIG. 38.—Dutch kalsomine brush, scraper, putty knife, wood paddle, and pointing trowel.

One of the first-class kalsomines is to be mixed in the proportion of four pints of boiling water to five pounds of the dry kalsomine. The water goes into the pail first in all cases of dry pigment mixing, and the dry pigment is then poured a little at a time into the water while the mixture is stirred well. Then, after dissolving, the kalsomine is allowed to stand until cold.

Such a mixture will be about as thick as cream when first prepared. It should be strained through cheesecloth while hot. When cool it will be thicker. It will "jell," as they say, and is ready to be brushed in that condition when the walls also are cold. In hot weather any kalsomine with a glue binder, if used in the cold jell condition, is apt to run or sag because of the heated condition of the walls. In order to avoid that trouble, it is best to use the kalsomine while it is still warm and before it has jelled.

When you want to mix two kalsomine colors together, it may be done while they are in the dry powder state or by mixing each color separately and then adding one to the other. Keep in mind that you cannot tell what color kalsomine is until it has been applied and is dry. It looks darker while wet than when dry. By mixing a little of the second color into the first, dipping a piece of cardboard in, and drying it over a stove or other source of heat you can test the color. Strain the mixed kalsomine while warm.

It is in the brushing that amateurs are most likely to get into trouble with kalsomine. This is because they are likely to try to brush it out to stretch it out, like oil paint. A good kalsomine brush of the standard type or of the Dutch type is necessary, and it must be dry when you start to use it (Fig. 38). A wet brush is too soft and flabby to work well.

Kalsomine should be flowed on freely and brushed as little as possible (Fig. 39). Flow it on evenly keeping the brush well filled. Take up a brushful, apply it to about one square foot, and let it alone. Follow with another brushful and join up the second patch with the first with a light stroke or two, using the bristle tips. Then let it alone. Do not go back and brush over the first patch.

Repeat this action until the surface is coated. Use semicircular strokes. Start at the upper left-hand top of the wall and carry a stretch down the wall about one yard wide. After reaching the bottom, return to the top and carry down another stretch. Coat the ceiling first and use the same method.

As a rule only one coat of kalsomine is applied. A skillful brush hand can often "top over," as it is called, with a thinner second coat after the first is dry. Sometimes it is necessary to apply a second coat of size on top of the first coat of kalsomine before topping over. The trouble is that the application of a second coat is apt to lift the first coat and reveal the bare wall unless the correct brush action is used—thin kalsomine and light strokes with the tip of the brush. Where good covering has not been gained, it usually is best to wash off the first coat and try again.

COLD WATER PAINT

"What shall I use for painting the basement walls?" is a question often asked. One of the most convenient materials is cold water paint, especially in the typical basement or cellar with a furnace in the middle of the floor, laundry tubs, a washing machine, and perhaps also a workbench in the corner—a reg'lar basement, and not one of the nicely finished and furnished basement rooms one sometimes sees.

Cold water paint is not kalsomine, although kalsomine is mixed with water. Kalsomine is not satisfactory for use on basement walls where there is the least bit of dampness or moisture, for it is made with a glue binder, and when it

FIG. 39.—Kalsomine is flowed on freely with a broad brush made especially for this purpose. Only one coat is necessary

gets wet it runs—and you have a terrible mess. Of course, if the basement is thoroughly dry all the year through, and no water gets on the walls from the weekly wash or from cleaning the floors, kalsomine will be entirely satisfactory, as it adheres well to any kind of surface—concrete, brick, or wood.

There is no similarity, either, between cold water paint and the old-time whitewash made with lime and water, which used to be the popular coating for base-

FIG. 40.—One coat of cold water paint makes an excellent and inexpensive basement finish.

CHART FOR TINTING WHITE PAINT

To Make—	Tint White with—
Ivory	Chrome yellow medium or raw sienna.
Cream	Yellow ochre (with a touch of Venetian red and white, if desired).
Buff	Yellow ochre.
Colonial yellow	Raw sienna and chrome yellow medium (about equal parts).
French gray	Raw umber with a little lampblack added.
Steel gray	Lampblack with a touch of ultramarine blue.
Warm gray	Yellow ochre with a touch of lampblack and Venetian red.
Drab	Yellow ochre and raw umber (about equal parts).
Slate	Lampblack.
Pea green	Chrome green medium and chrome yellow (about equal parts).
Sky blue	Ultramarine blue (a very little, added cautiously).
Light brown	Burnt umber, burnt sienna, and raw sienna (about two parts of the umber and one part each of the sienna).
Chocolate brown	Burnt umber and about one third as much burnt sienna, with a touch of chrome yellow medium added.
Terra cotta	Yellow ochre with a little Venetian red.

ment wall surfaces, whenever they were painted at all. Whitewash is a temporary finish. It has nothing to hold it together and soon disintegrates and scales off; before long it begins to look very unsightly.

Cold water paint is a distinct type; most paint stores sell it and any of them can get it for you. A dry powder, it has to be mixed with water immediately before use. It is made with a special type of binder that has the property of absorbing and taking up water and giving it off again, so that when wet it dries out to its original condition without running or discoloration.

This paint, of course, is not better than the oil paints and concrete wall finishes. If you have a *de luxe* basement room where the finest finish is wanted—or if money is no particular object—the oil paints and concrete finishes are among the highest types of finish obtainable. However, the average idea of a paint for walls of an ordinary basement is the kind that will answer the purpose with thorough satisfaction and at the same time not cost much.

Cold water paint is cheap. For a dollar or two you can do the whole basement. It is durable, stands being wet, and covers well; one coat produces a fine job. You can turn the hose on it, and it will dry out nicely. It can be used on wood surfaces as well as concrete, cement, brick, or stone. When you want to repaint, you can cover over it, while with kalsomine, for instance, it is hard to do a satisfactory job of refinishing without removing the old coating. Cold water paint is usually made in white only, but it may be tinted as desired with dry colors, sold by most paint stores for all tinting purposes of this nature.

To make a good French gray, for example, proceed as follows: Mix some raw umber and just a little lampblack with the white cold water paint—say about a quarter pound of the raw umber to five pounds of white paint. You can start with a small amount of the tinting color and add slowly until you get just the shade you want. Or if you would rather have more of a steel gray, use lampblack instead of raw umber—probably a little less than a quarter of a pound will do—and add just a touch of ultramarine blue.

The dry color should be mixed with a little water and stirred thoroughly, then poured into the previously made mixture of cold water paint and water. This will prevent any tendency toward streaking caused by undissolved particles of dry color. Each color, as, for instance, the raw umber and the lampblack, should be mixed and added separately, and then the paint is ready for use.

The accompanying tinting chart indicates what colors to use for tinting white to different popular shades. The same tinting colors can be used, of course, for tinting regular oil painting materials—only oil colors should be used for tinting, instead of dry colors.

PAINT SPRAYING

Many handy men and amateur painters and decorators are asking just how much of the painting and decorating about the house and workshop can be done with spray guns of the hand pump, foot pump, or small motor-operated types. They wish to know also what methods are required and if really first-class finishing can be done with this new tool.

Perhaps answers to these questions by one who has done finishing with most of these tools of various types, as well as with the larger outfits employed by professional finishers on furniture and automobiles, will be helpful.

In the first place, it should be remembered that the spray gun is a tool and, like any other tool, calls for a certain amount of practice and knowledge of its use before the best results can be gained. There is more to it than putting in the material and starting the machine. It is not an automatic machine. To learn its effective use, however, is not difficult.

The first step is to study carefully the manufacturer's directions. Take it for granted that the manufacturers know more about their products than anyone else.

The smaller types of spray guns operated with air by hand or foot or by a small motor are capable of doing good work with sufficient speed on the surfaces for which they are designed—furniture, wicker chairs, radiators in homes, and all small articles such as picture frames. They are also useful for touching up automobiles. With these guns difficult work, such as finishing radiators and wicker furniture, can be done in a fraction of the time required by the most rapid brushing.

After some experience, perfectly smooth finishes can be obtained with these tools on furniture and cabinetwork with lacquer, paint, enamel, or varnish. The size of the round or flat spray projected by such small spray guns is, however, too small to make them practically useful on large surfaces or for painting houses and barns.

One finds many odd uses for sprayers. For instance, when removing kalsomine or wall paper it helps greatly to spray the surfaces with water. When it comes to the application of glue size coats to wall paper in preparation for varnishing them to make them waterproof, these guns are superior to the brush because with the latter there is a tendency for some of the colors to run under the brush, whereas the spray does not affect the colors. Varnish or lacquer coats on wall paper also can be applied with the small spray guns, especially in bathrooms and halls where the areas are not large. Shingle stains are easily applied with these guns and with fair speed even on the moderately large surfaces of garages and small houses.

In operating a sprayer successfully it is necessary to consider the material to be sprayed; that is, taking it for granted that the surface has been made clean and fit to receive the finish.

The mixing of the material is very important. The color pigments of lacquer, enamel, and paint settle to the bottom of the can, and unless they are completely mixed into the liquid, the color will not be correct, the opaqueness or ability of the coating to hide the surface will be less than you expect, and the material is sure to clog up the small portholes in the gun, making it necessary to clean them frequently. Therefore, pour most of the liquid off the lacquer, enamel, or paint, and break up the pigment thoroughly. Then add the liquid to it a little at a time as you mix.

When you think the mixing is done, strain the material through cheesecloth tied over the top of a can, and you are likely to find some skin, grit, or lumps of pigment on the cloth. This straining also helps to mix the material better.

Thick liquids like lacquer, enamel, and paint are more easily handled by the spray gun if thinned from ten to twenty-five percent with the proper thinning liquid. For lacquers, use only the special thinner provided for use with the same brand. For enamels, use turpentine; for varnishes, use a very little turpentine; for shellac, alcohol. As a rule it is not necessary to thin stains at all.

Thin liquids atomize more easily and with less air pressure than thick liquids. Thin coats dry more quickly; and while they do not hide the surface so well, more coats can be put on in less time because of the rapid drying of each coat. Thick lacquers are apt to run or sag, and thick paints are slow to dry. It is much better to apply two or three thin coats evenly distributed than to try to hide the surface in one thick coat.

Handling the spray gun is the next consideration. Load the material cup on any siphon-feed style of gun (such as the hand pump, foot pump, and small motor types) only about two thirds full. Hold the gun as far as practical in a horizontal position and always exactly at right angles to the surface. Take particular care not to tip the gun to one side or the other and never turn it upside down.

Work the pump or turn on the motor while holding the gun facing some surface of no account in order to try out the adjustment of the nozzle. Go at it cautiously at first and turn the nozzle-adjusting screw until a solid stream of material comes out. Then turn it in the opposite direction until the material is atomized and comes out in a solid, uniform spray, not in spatters. Having obtained this adjustment, set the nozzle in that position by backing up the lock-nut or using whatever device is provided on the gun to hold the adjustment constant.

You are now ready to begin spraying. Keep the gun about ten inches from the surface, but never hold it still in one place. Once you start spraying, the gun must be kept moving at a slow and steady pace.

Spraying, like brushing, is done by a sweeping movement. If you stop the movement for an instant while the spray is being projected, you are apt to flood the surface with paint, lacquer, or whatever you are using; and then a run will occur at that point. In that event, have handy a camel's-hair or soft badger brush, one or two inches wide, and use it to smooth over the run. In the case of lacquer it may be necessary to dip the brush in lacquer thinner to dissolve the lacquer run long enough to let you smooth it out.

If runs or spatters cannot be avoided by the adjustment you have, alter it. Possibly, too, you have on the gun a nozzle that is too large. Most guns are furnished with two or more nozzles having holes of different sizes. The larger holes are for thick, heavy liquids; the smaller for the thinner liquids.

Until you are experienced, it is well to turn the surface down to a horizontal position as soon as you have finished coating it, especially with lacquer. Then, even if you have applied too much in one or two places, it will not run. The rule is to apply a thin coat, evenly distributed over the whole surface, and let it dry before the next coat is applied. It is better to use two or more thin coats than one thick coat. Thus you avoid runs, and the drying is faster.

If you want to spray part of a surface and not all of it, mask the part not to be sprayed with wrapping paper, adhesive tape, or the gummed tape used in shipping departments. There is also a special masking tape made for this purpose. Parts not to be coated also may be protected by a coating of vaseline or other grease, but you must be very careful not to get grease on the part to be finished or the lacquer, enamel, varnish, or paint will not stick.

Having finished a job, pour the material out of the gun and put clear thinner into it and shoot it through to clean the screen and the small tube and nozzle of the gun. Empty it again and put clean thinner in a second time to make sure of leaving a clean tool for the next job.

PAINT BRUSHES

Skillful handling of a brush and thorough brushing-in of the painting materials are the fundamentals of painting. To these the amateur should give close attention, because they largely determine the success of the work; provided, of course, that high-grade paint and first-class brushes are being used.

To hold and use a paint brush improperly wears off the bristles and destroys or damages the shape. Generally speaking, a brush should be held lightly and firmly with the narrow part of the handle between the thumb and the first two fingers, much as a pencil is held in drawing lines with a rule. It should be used in such a way that it wears down uniformly and keeps its original shape. Do not grip a brush by the stock with the thumb or fingers extending over the bristles, and do not bear down too hard on it.

Use a moderate, even pressure in spreading the paint, and a light, even pressure in finishing. The muscles of the wrist, which do most of the work, can be relieved by those of the shoulder.

While the brush is being drawn back and forth across the surface, do not let the hand lead, but keep it directly over the brush. Lift the brush from the surface before starting a return stroke. Poking or jabbing the brush into corners or cracks breaks off the valuable flag or split ends and ruins the bristles.

The flag ends are what makes a brush valuable (Fig. 41). One unfailing test used by practically all professional painters in judging the quality of bristle in a brush is to spread the bristle stock into a fan shape, hold it up to the light, and look for the flag ends on individual bristles. The professional knows that only a good brush has these valuable flag ends.

Fig. 41.—The bristles of a good brush have flag ends

When a fine Chinese hog bristle paint brush has these flag ends, it is an ideal tool for brushing, but the amateur must use it properly so as to accomplish six results, as follows:

Penetration. Work the paint thoroughly into every fissure and crevice. Let the flags dig down into the surface, securing deep penetration of the painting material.

Surface Moisture. Every surface has a certain amount of surface moisture that must be thoroughly rubbed out.

Surface Tension. Because of contraction and expansion caused by changes in temperature, there is always a certain amount of surface tension. The strokes of a good bristle brush relieve this and the finishing material does not crack or wrinkle.

Air Bubbles. These must be thoroughly brushed out if a smooth, mirror-like surface is to be obtained.

Coverage. Only when the brush digs down into the pores of a surface—not merely slides across it—can proper coverage be obtained.

Adhesion. When well brushed, the paint becomes an integral part of the surface itself—not merely a "paint film" which will eventually crack and peel off.

The professional painter knows from experience that paint materials will produce a better surface and last longer when thoroughly rubbed into the surface. This applies to everything but lacquer, which should be flowed on the surface with a very full brush. Lacquer should never be either backstroked or leveled off.

Too thick paint, varnish, or other materials will not harden properly and will tend to leave blisters instead of a smooth, glossy surface. Paint must thoroughly wet the surface to which it is applied, and the combined thickness of all coats should be just sufficient to harden and protect the surface.

Experience quickly points out the fatal mistake of attempting to paint with a brush that is not of good quality, absolutely clean, and the right size. The question therefore arises as to how to select a good brush. Paint brushes are of such a nature that they can be easily "doped"; that is, the mixture of bristle stock used may be blended with various adulterants, such as horsehair or vegetable fiber. The average person, when selecting a paint brush, will rely upon the recommendations of a dependable hardware or paint store.

When a painter is selecting a paint or varnish brush, he bends the bristle stock over the back of his hand to judge the flexibility of the brush and whether the bristles are springy and full of natural "oily life," as they should be. Next, he considers the length of the bristle stock, for that is one of the primary differences between a cheap brush and a good quality brush. The greater the amount of bristle stock, the more painting material it will hold and spread without redipping in the paint can, thus making the work easier.

Bristles make up, by far, the biggest single item in the cost of brushes, for the bristles alone cost anywhere from two to fifteen times the cost of the next largest component of which the brush is made. Bristles used in cheap brushes are usually left-overs after the best grades have been selected for the better brushes.

Fig. 42.—Small brush keepers may be made from [illegible]

Next to the bristles, the most important construction feature of a brush is its setting. This is the trickiest feature of a brush to judge, and often even a professional painter depends upon the judgment of the paint dealer or the reliability of a brush manufacturer.

It is quite as important to select brushes adapted for the work you are doing. Varnishing and enameling require one type of brush, floor work another type. Wall painting calls for regular wall brushes. Outside painting is done with house painting brushes.

For varnish, enamel and the new brushing lacquers, brushes of the soft bristle type are best. Fitch, bear-hair and ox-hair are all used. Professional auto finishers and some others like camel's-hair, but it is better for the amateur to use one of the other types. A 2-in. or 3-in. flat brush, preferably the latter, is a good size for average requirements. You also ought to have a 1-in. or 1½-in. brush for small surfaces, as well as a very small brush such as a pencil brush or a ¼-in. square-cornered brush of soft bristle.

For walls and ceilings a flat wall brush should be used, preferably 4 in. wide.

For floors, you will have a choice between a 2½-in. round or oval brush or a 4-in. flat brush. While some painters prefer a flat brush, it is generally considered that the round type produces best results, especially in the hands of an amateur.

When doing outside painting, either a flat or a round brush may be used. The advantage of the round brush is that it carries more paint and compels one to brush the paint well into the surface, especially on siding. The sizes most extensively used are 2½ in. and 4 in. for round and flat brushes, respectively. A flat or oval sash tool, which is a small, long-handled brush, is needed for window sash and small trimming. A duster, preferably of the 4-in. flat type, is useful.

Fig. 43.—This varnish pan was cut from the bottom of a one-gallon can. It has a removable wire rest for the brush.

Bristles are set in rubber, glue or cement. Glue-set brushes never should be put in water. Cement-set brushes are not to be used in shellac or anything containing alcohol. Rubber-set brushes can be used in practically any material.

Even the best new brushes have a few loose bristles. They can be worked out with the fingers after wetting the brush with oil or turpentine, or by dipping the brush in oil or paint and brushing it on a clean board. The brush can be very well cleaned, simply by striking the dry bristles across the extended fingers, as a boy runs a stick along a picket fence.

The best way to keep your brushes in good condition is to clean them thoroughly after each painting operation. Gasoline is the most economical cleanser, although turpentine, benzine and naphtha are all good.

For brushes used in enamel, varnish or paint mixtures, a good cleanser may be made by mixing two parts of gasoline and one part turpentine.

Brushes that have been used in shellac must be cleaned with wood or denatured alcohol, or if hardened, with varnish remover followed by alcohol. The cleaning process may be carried further by washing brushes with warm water and soap, but do not make the mistake of some amateurs who take all the life out of their brushes by using a cheap soap, strong in alkali.

Hang the clean brush up by the handle until dry, then wrap it in paper folded flat so as to keep the bristles properly shaped and protect them from dust. Do not store brushes in a hot, dry place, as the block may shrink or the bristles become loose.

When brushes are used rarely, that is at intervals of a month or more, it is best to treat bristles with vaseline or paraffine oil, and wash them out with gasoline just before using. This keeps the bristles straight and full of life.

Some painters prefer to keep brushes in a receptacle of oil or some preparation such as one part oil and one part turpentine, which they term a "brush keeper." This is an excellent method if one remembers to renew the liquid as it evaporates. Provide a cover for the container. Either drive a tack into each brush handle and suspend it from the edge of the receptacle, or hang it from a wire or stick across the top. If the brushes are allowed to stand on the bottom of the container, the bristles are certain to curl.

Small brush keepers may be made from carefully opened vegetable cans as shown in Fig. 42. The varnish pan at left of Fig. 42 was cut from the bottom of a one-gallon can. It has a removable wire rest for the brush.

One excellent type of permanent brush keeper is illustrated in Fig. 43. A cross wire runs through the brush handles and rests in stirrups soldered inside the can, as can be seen in the empty container. The cans, which are 4½ by 6½ by 14½ in., may be made from a standard sheet of tin, 20 by 28 in. The top of each container slants slightly so that nothing will be piled on it. The hinges and hasps are made of brass.

TOOLS FOR WOOD AND METAL

TOOLS, like fine weapons, are very wonderful things when you come to know them well. They have made history. Every time we pick up a saw or an automatic drill or our "mikes," we are taking advantage of tool-building discoveries and achievements that run all the way back to the Age of Bronze.

Little excuse exists for any home workshop enthusiast who does not have his tools always in good condition. There is not much more excuse, in these days when the choice of tools is so large and their cost relatively so small, in his not having sufficient high-grade equipment to accomplish any task he sets out to do. And yet how many times have you seen a handy man laboriously hacking a shelf or whatnot out of a board with a dull and rusty saw! No wonder he misses the satisfaction in his work always felt by those who have the true craftsman's attitude toward tools—pride in their good condition.

There are a few pointers which should recommend themselves to the home worker, whether he is inclined towards woodwork or metalwork, whether he has an elaborate shop or wishes to do merely a few odd useful jobs around the house.

Buy only the best tools; they may be a little more expensive at first but they are true economy in the end.

Be sure to get the tools you really need. Only the expert mechanic can do good work with makeshifts, and he usually will not try, for often the time and material wasted on a single job are worth more than the cost of the proper tool. If, however, you have only a limited amount to spend on tools, choose a few good ones rather than a number of cheap and second-grade tools.

No matter how excellent the tools may be, their effective use depends largely upon the skill of the workman. Therefore learn to use them with the utmost precision so that your work will always be finely done. The best way invariably is the easiest, the simplest, and the quickest in the long run.

To maintain edge tools in proper condition, notice the cutting angles that have been given to them by the manufacturers and, as nearly as possible, preserve the same angles through the life of the tool. The angles may range all the way from those of a penknife to a heavy lathe tool. It is always a matter of selecting an edge that will be sharp and reduce friction and at the same time be strong and permanent enough to stand up under the work to be done. You may be sure the toolmaker has worked out the angles very carefully, so that all you have to do is to use your grindstone and oilstone constantly to keep those angles right. Having edge tools well sharpened and well lubricated is half the battle.

Tools in what may be termed, roughly speaking, the hammer, punch, trowel, and wrench class will not trouble you much, but the tools you use for making and testing measurements deserve your utmost consideration. Even a heavy steel square or a try-square can be spoiled in no time by a little carelessness; and rules, gages, calipers, surface plates, protractors, levels, and the like, require the best of treatment if they are to retain their accuracy. Protect these tools in every way from being strained, warped, nicked, or damaged.

TOOLS FOR WOODWORKING

As the amateur mechanic gains experience, he does not need much advice as to what tools to buy. This is determined by the sort of work he is doing, his own special interests, the space available for his workshop, and other individual factors. The beginner, however, is very likely to make the mistake of buying the wrong tools if he does not have some advice at the outset. Yet it is not at all easy to tell the beginner what tools he is likely to find most useful, any more than it is a simple matter to advise the man who has never owned an automobile as to what car will prove the most satisfactory for his own family use.

In order to avoid the prejudices of any one man, six expert craftsmen who contribute to the Home Workshop Department of *Popular Science Monthly* were asked to act as a jury to select a small household tool assortment, a small home workshop set of tools, and a complete, ideal home workshop outfit.

For the first and smallest assortment they selected tools which they thought best for doing repair jobs about the house and garden and for simple woodworking—a typical handy man's set that no household should be without.

HOUSEHOLD TOOL ASSORTMENT

Nail (or claw) hammer, bell face preferred
Crosscut (or hand) saw, 24 in. or 26 in., 8

points to the inch
Carpenter's chisel, socket firmer, bevel edge, 1 in.
Carpenter's chisel, square edge, ½ in.
Bit brace, 8-in. sweep, ratchet preferred
Auger bits, ⅜, ½, and ¾ in.
Bit-stock drills for metal, ⅛ and ¼ in. (useful also for wood)
Screw drivers, 4 in. and 8 or 10 in.
Combination pliers, 6 or 8 in.
Files—saw files, 6 or 7 in.; flat or mill bastard, 8, 10, or 12 in.; auger bit file
Jack plane
Try-square, 6 or 8 in.
Steel (framing) square
Zigzag folding rule, 4 ft.
Marking gage
Pipe wrench, 10 in.
Monkey wrench, 10 in.
Miter box
Wrecking bar, small
Oilstone, artificial, combination
Nail set, 1/16 in.
Oil can
Half hatchet
Cold chisel, ⅝ in.
Putty knife

Several of the same jurymen wished additional tools included in this assortment. Three of them thought that a ripsaw was necessary but disagreed as to the size, one voting for a 22-in., another for a 24-in., and a third for a 26-in. ripsaw. The remaining jurymen, however, felt that whatever ripping had to be done in connection with the average small repair job could be accomplished satisfactorily with a 24- or 26-in. crosscut saw, provided it was sharpened for general work and was not finer than 8 points to the inch. The always useful hand drill, with its assortment of drill points, also received three votes.

The next assortment selected was for the home worker who wishes to do a certain amount of simple bench work and make furniture, toys, household utilities, sporting equipment, and the like. The tools selected and the number of votes cast for each were as follows:

SMALL HOME WORKSHOP OUTFIT

Nail hammer, bell face preferred (6 votes)
Machinist's ball peen hammer, 1¼ lb. (4)
Round mallet, hickory or lignum vitae (5)
Crosscut saw, 22 or 24 in. or 26 in. (6). See note following this list
Ripsaw, 24 or 26 in. (6)
Back saw, 10 or 12 in. (4)
Hack saw frame and blades (5)
Coping (fret) saw frame and blades or bracket saw frame and blades (6)
Compass saw (6)
Ratchet brace (6)
Block plane (6)
Smooth plane (5)
Jack plane (5)
Fore plane or jointer (4)
Rabbet plane, ⅞ or 1 in. (3)
Chisels—mortise, ¼ or ⅜ in. (5); socket firmer, ¼, ⅜, ½, ¾, and 1 in. (6)
Gouge, firmer, beveled outside, ⅜ or ½ in. (6)
Auger bits, ¼, ⅜, ½, ⅝, ¾, and ⅞ in. (4 or more votes each)
Expansive bit, ⅞ to 3 in. (4)
Rose countersink (4)
Screw driver bit, ⅜ in. or ½ in. (6)
Bit stock drills for metal, ⅛, 3/16, ¼, and ⅜ in. (4 or more votes each)
Automatic drill with drill points (4)
Hand drill with drill points (4)
Screw drivers, 4 in. and 8 or 10 in. (6)
Pliers—combination, 6 or 8 in. (6); round nose, 5 in. (5)
Files—Saw files, 5 and 6 in. (4); flat or mill bastard, 8, 10 or 12 in. (6); round bastard, 6 or 8 in. (6); half round bastard, 6 or 8 in. (5); cabinet or wood file, 8 or 10 in. (5); cabinet rasp, 8 or 10 in. (5); auger bit file (5)
Try-square, 6 or 8 in. or combination square (6)
Steel (framing) square (4)
Sliding T-bevel, 8 in. (6)
Boxwood folding rule, 2 ft. (5)
Zigzag rule, 4 ft. (3)
Cabinet scraper, 3 by 5 in. (6)
Marking gage, wooden, or mortise gage (6)
Dowel plate (5)
Scriber or divider with pencil point, 6 in. (6)
Bench, Sloyd, or pocket knife (4)
Spokeshave (4)
Drawknife, 8 or 10 in. (4)
Pipe wrench, 10 in. (4), 16 in. (2)
Monkey wrench, 10 in. (5), 12 in. (1)
Tinner's snips (6)
Level and plumb, 24 in. (4)
Miter box, wooden or metal (4)
Glass cutter (6)
Tool grinder (5)
Hand screws, one pair, 10 in. (6)
Cabinetmaker's clamps, one pair 3 ft. or 5 ft. (6)
Burnisher for scraper (4)
Saw set (4)
Wrecking bar, small (4)
File card or cleaner (5)
Oilstone, artificial combination (4), Arkansas (a natural stone) (3)
Nail sets, 1/32 and ⅛ in. (6)
Oil can (6)
Half hatchet (5)
Cold chisel, ⅝ in. (6)
Saw vise (4)
Soldering copper, 1½ lb. (4), ½ lb. (3)
Putty knife (6)
Glue pot and brush (4)
Bench with quick-acting woodworker's vise (6)

One point of interest in regard to this list is the fact that a wide difference of opinion developed as to the best lengths of saws. Two of the jurors thought that both a 22-in. and a 24-in. crosscut saw should be included in the list; two of the jurors held out for a 26-in. crosscut saw, and the remaining two gave a vote apiece for a 22- and a 24-in. saw.

In the ripsaw classification one vote was cast for a 22-in. saw, two for a 24-in. saw, and three for a 26-in. saw. The difference of opinion, of course, was due to the belief of some of our jurors that the amateur mechanic should follow the example of the professional woodworker and select a large saw so as to get the benefit of a long stroke, and if he wishes to do fine and delicate work, obtain a saw specially designed for fine cutting and sharpen it accordingly. The opposing view was that in doing small work, which comprises the majority of home workshop jobs, the amateur usually finds it easier to control a shorter saw. Boiled down, it is largely a matter of personal preference, provided the time element does not enter into consideration; for fast work a large saw should be used.

Finally the jury was asked to name the ideal home workshop outfit—a complete equipment, such as will take care of the needs of the amateur mechanic interested alike in house repairs, general woodwork, and all the many varieties of cabinetmaking.

THE IDEAL HOME WORKSHOP OUTFIT

All the tools mentioned in the preceding list and—
Tack hammer (4 votes)
Light bell-faced nail hammer, about 13 oz. This is in addition to a hammer weighing a pound or a little more for ordinary work (3)
Riveting hammer, 8 oz. (2)
Upholsterer's hammer, ⅜-in. face (3)
Soft mallet, rawhide or rubber (3)
Crosscut saws, 22 and 26 in. in place of the single crosscut saw mentioned in the preceding list (4)
Dovetail saw, 8 in. (2)
Turning saw, 18 in. (3)
Combination plane (6)
Rabbet and fillister plane (3)
Router (3)
Chisels—socket firmer, ⅛ in. (3); beveled edge butt, 1¼ in. (3)
Gouges—firmer beveled outside, ⅜, ½, and ¾ in. (4); beveled inside, ½ in. (5)
Auger bits—complete set up to ⅞ in.
Bits—gimlet, Nos. 2 to 8 (3)
Square reamer (3)
Screw driver bit, ¼ in. (3)
Automatic (spiral) screw driver (4)
Jeweler's screw driver (5)
Pliers—flat nose, 6 in. (4)
Files—saw, 4 in. (3); flat or mill bastard, 8 and 12 in. (6); hand file, smooth, 10 in. (3); square, 6, 8, or 10 in. (3)
Combination square (5) (as well as try-square)
Mortise marking gage (2)
Bit depth gage (4)
Pincers, carpenter's, 6 or 8 in. (4)
Bradawl (4)
Pipe wrenches, 10 in. (5), 16 in. (3)
Adjustable iron miter box (4)
Cabinetmaker's miter block (2)
Doweling jig (5)
Bench duster (3)
Plumb bob and line (3)
Hand screws, at least a pair each, 4 and 10 in. (6)
Cabinetmaker's clamps, one pair 3 ft. (5), one pair 5 ft. (4)
Inside calipers, 6 or 8 in. (3)
Outside calipers, 6 or 8 in. (3)
Oilstones—Arkansas (4), India combination

(4), assorted slipstones (4)
Carving chisels—set of 6 or 12 (3)
Prick punch (4)
Scratch awl (3)
Center punch (5)
Machinist's vise, 3½-in. jaws (6)
Cabinetmaker's bench with two wooden vises and bench stops, or bench mentioned in the preceding list (6)
Blowtorch (5)
Pipe vise, if machinist's vise does not have pipe jaws (3)
Taps and dies, small set (6)
Sandpaper block, cork or rubber faced, homemade or purchased (6)

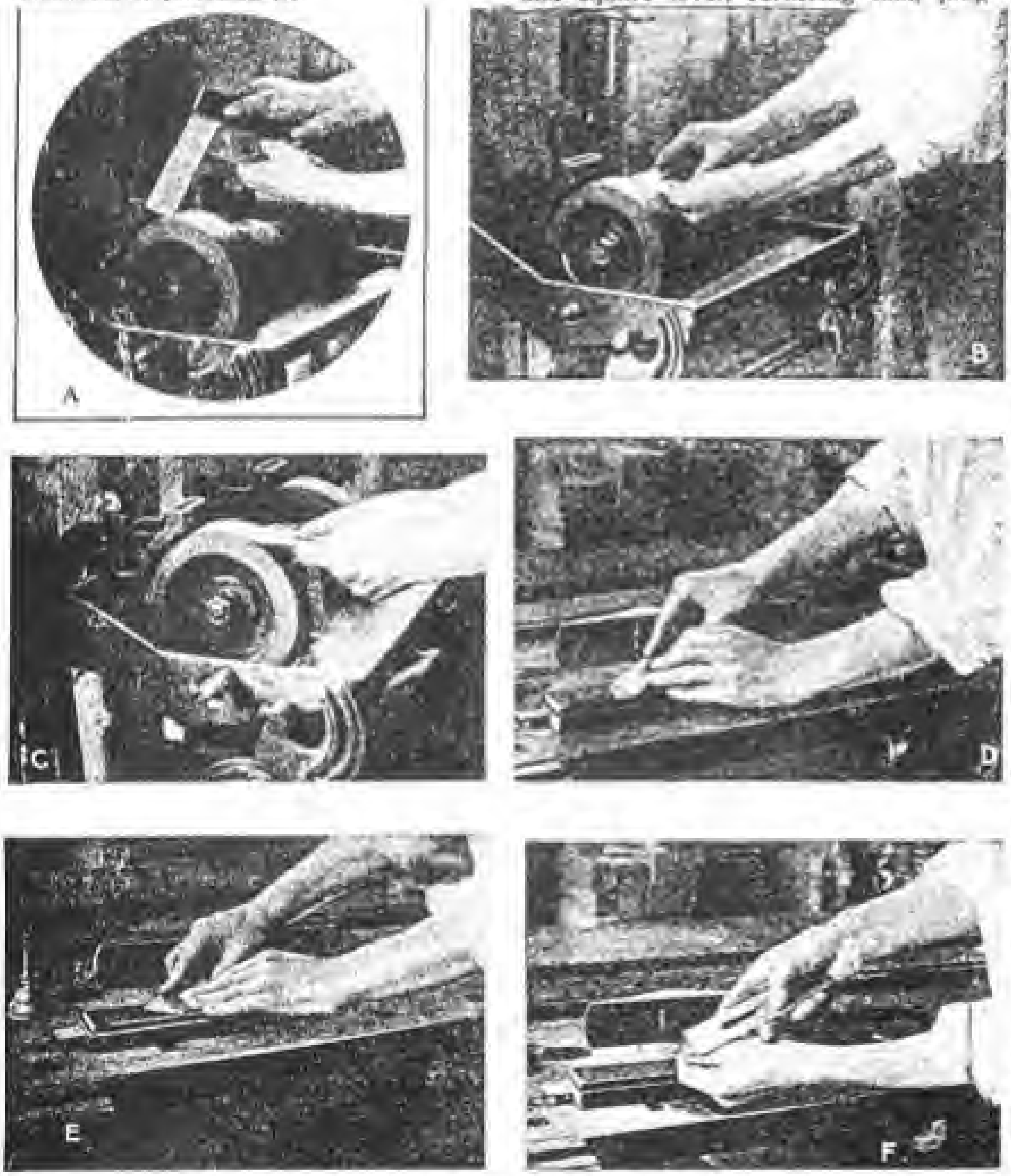


FIG. 1.—Steps in sharpening chisels, plane irons, and other chisel-edged cutters. How the keenness of the edge may be tested on the thumb nail

Many other woodworking tools, of course, were given consideration. It was conceded by the jurors that additional tools often came in useful for special work, but the consensus of opinion was that the wisest plan for the average home worker is to purchase such tools as the need for them arises, so that they will not merely lie around in his tool-chest, but will be of service from the outset.

Tools in this classification are:

Edge trimming plane, scraper plane, dado plane, curve rabbet plane, dovetail plane, tongue-and-groove plane, shooting board and plane, various special cabinetmaker's planes, corner chisel, many types of files and bits, butt gage, bolt clipper, special duty pliers, picture frame and other special types of vises, bench brackets and bench dogs, panel and cutting gages, beam compass, bit and square level, cornering tool, plug cutting bit, dowel sharpener, extension bit holder, circular glass cutter.

The tools listed are mainly for woodworking; for what might be called a "home machine shop" the assortments would be altogether different.

It is becoming generally believed, of course, that no home workshop can be regarded as complete without a bench lathe and several motorized machines or a combination electric workshop such as those illustrated in Chapter III. A lathe, a circular saw, a grinding and polishing head, and an electric drill are now almost as much a part of a well-equipped shop as chisels and planes.

SHARPENING CHISELS AND PLANES

Better and faster work can be done when plane irons and chisels are kept sharp. The first step in sharpening is to test the edge for squareness with a try-square as shown at *A*, Fig. 1. Grind the cutting edge straight and square by holding it against the side of a tool-grinding wheel as at *B*. A power grinder, small hand wheel, or common grindstone may be used for sharpening the bevel as at *C*. The tool can be held with or without the aid of a support. The bevel angle ranges from 15 degrees for soft wood to 20 degrees for hard wood.

The fine "wire edge" left by grinding bevel flat on the stone and rub either with a circular or a back-and-forth stroke as at *D*. Turn the plane iron or chisel over and lay it perfectly flat on the stone as shown at *E*. Take a few strokes back and forth to remove the fine "wire edge." Stroking the edge may be pulled off by making a slanting cut in a bit of soft wood. The finishing is done on a fine oilstone, upon which a few drops of oil have been placed. Hold the through a piece of soft wood may again be necessary, and sometimes the entire whetting process will have to be repeated for best results.

Test the tool for sharpness by letting it bite on the thumb nail as at *F*. If it does not catch on the nail when resting with only its own weight, it is not properly sharpened. The final stropping is sometimes given on leather. Mechanics often strop the edge a few times in the palm of the hand in order to give a last keen finish.

HOW TO FILE A HANDSAW

First true up the edge with a saw jointer or a flat file held on a block of wood as shown at *A*, Fig. 2. Take smooth, forward strokes. The edge should be a trifle convex or crowned.

Using a properly adjusted saw set, bend out every alternate tooth slightly for not more than half its depth as shown at *B*. Then reverse the saw and set the remaining teeth the opposite way.

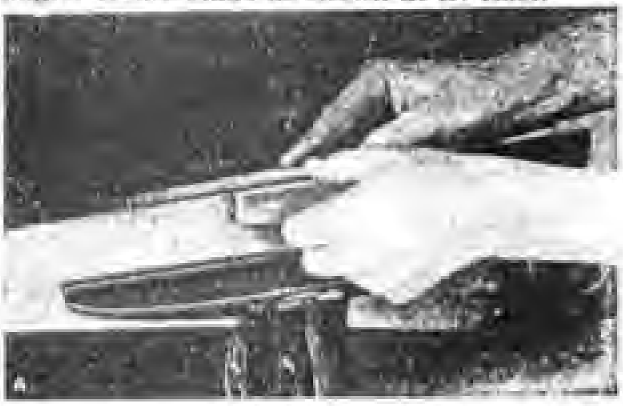
A crosscut saw may be filed either against the cutting edge of the teeth or with the teeth. The first method is illustrated at *C*, with the file pointing toward the handle. (Many experts use this method, but it is perhaps easier and undoubtedly more common to point the file toward the end of the saw.) Run the file in front of every tooth that points out toward you.

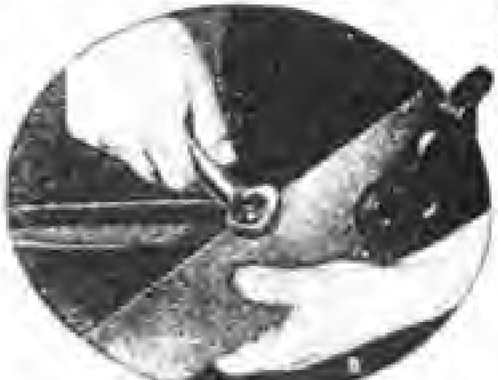
Turn the saw in the saw vise and file the remaining teeth. The file is horizontal, but points back toward the handle as shown at *F*. Watch the points and stop filing when they are sharp.

When the teeth are sharp, lay the saw on a flat surface and take a stroke or two on each side with a fine oilstone as shown at *D*.

To file a ripsaw, hold the file at right angles to the blade as shown at *E*. Each tooth must be perpendicular on the front edge. Some mechanics prefer to lower the file handle a trifle. In either case it is well to file every alternate tooth from one side and then turn the saw. This compensates for errors.

How to straighten a kink with block and mallet is shown at *G*. Beginners will find it a good plan to leave a few teeth at the extreme handle end of the blade untouched. It is these few teeth that will serve as a standard guide for setting and filing the saw.





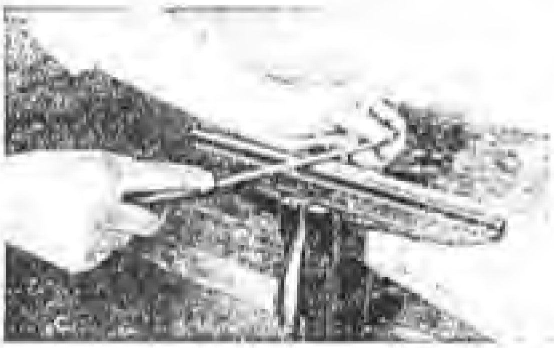


FIG. 2.—How to file a handsaw: jointing the teeth, setting them, filing both crosscut saws and ripsaws, and removing kinks.

SHARPENING AUGER BITS

The auger bit is one of the most delicate tools in the woodworker's kit. It must be of high-grade manufacture to begin with; even so, it will stand little abuse, and if it is not kept in first-class condition there is no pleasure in using it.

Cutting into nails with a bit is probably the most common cause of damage. In many instances, however, a bit that has apparently been ruined can be restored by proper treatment.

Auger bits of various types may be had for different kinds of work, but the principal specification in which the average user is interested concerns the speed with which the bit is drawn into the wood. The boring speed depends upon the pitch or twist of the thread at the screw point. In this regard auger bits usually are classified as slow screw, medium screw, and fast screw. For all ordinary work the medium screw is most satisfactory, but it is well to get advice from the tool dealer before making the purchase.

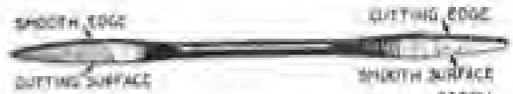


FIG. 3.—An auger bit file and the cutting end of a typical bit, showing screw point, spurs, and lips.

It is well to remember also that the original cost of an auger bit, or any other tool, is not the sole consideration, but that it is more important to obtain a tool that will "stand up" and give satisfactory service.

There are three principal parts of the auger bit (Fig. 3) that may receive injury through contact with foreign substances in the wood—(1) the screw point (the screw that feeds the bit); (2) the lips (horizontal cutting surfaces); (3) the spurs (vertical cutting edges). All of these can be reconditioned, provided the damage done has not been too great.

For sharpening auger bits, either a file or a small sharpening stone may be used. A suitable file is one about 4 in. long, very fine cut ("dead smooth"), and half round in shape. It is better, however, to use a special auger bit file (Fig. 3), which can be obtained in any large hardware store. Such a file is made with "safe" edges adjacent to the cutting surfaces, and there is no danger of filing in the wrong place.

The lips are filed or sharpened with a stone on the top side, the bit being held in the position indicated in Fig. 4. The edge must be kept thin, and filing should not be carried beyond the point where a fine wire edge or burr appears. If a small sharpening stone is available, it should be used for a very light stroke or two on the underside of the lip in order to remove the wire edge; if no stone is at hand, the file may be used for the same purpose. For this delicate operation, the bit is turned with the spurs upward and laid against the edge of the workbench. Care must be taken not to file too much and to follow the original surfaces.

The spurs are sharpened with the bit in the left hand and held against the edge of the bench as shown in Fig. 5. It should be kept in mind that the spurs must be long enough to cut deeper into the wood than the lips when the bit is in operation, hence no wasteful strokes should be made at this point. If they are worn too short, the lips probably can be filed back in order to relieve the difficulty. Needless to say, all filing on the spurs must take place on the inside, except the smoothing up or removing the burr, as previously described.

Sometimes, after striking a nail at a certain angle, the spurs are bent inward very decidedly. In such cases, instead of removing all the distorted metal with the file and thus losing a large part of the nibs, it is possible to reshape the bit by bending the point back into position with a pair of small pliers. In doing this care must be taken not to break off any part. After the tip is put into position, it is sharpened in the usual way.

The screw point is probably the most difficult part to put into condition after it has been injured. Patient work with a special oilstone having a very thin edge as shown in Fig. 6 will usually give satisfactory results. If considerable injury has been received at this point, the bit may afterwards require a slight pressure to assist the screw in feeding; but since that requirement can be met with in all ordinary work, its efficiency is not materially reduced.

Fig. 4 (above).—How the lips of the bit are sharpened on top by means of an auger bit file.

Fig. 5 (at right).—Filing the spur on the inside. To file the outside would ruin the bit.

An auger bit which has been bent out of shape may be straightened as in Fig. 7. A block of wood, preferably some hard variety, is used as a support, and a wooden block, held on end, makes contact from above. A smooth-faced wooden mallet may take the place of both hammer and block. A good way to test an auger bit for straightness is to lay it on a straight surface and revolve it slowly while watching for irregularity in the space between the bit and the surface at various points.

SHARPENING A CABINET SCRAPER

If the scraper is of the usual square-edged type, first drawfile it with strokes taken horizontally away from you as shown in Fig. 8 at *A*. Lift the file when it is pulled back on the return stroke. Continue until there is a burr on the cutting edges.

Lay the scraper flat on an oilstone as shown at *B*, and smooth it. Use a fine stone and one that is straight on the surface. Do not lift the outer edge of the scraper while doing this. Alternate between this position and that shown at *C* until the burr or wire edge is removed. A square piece of wood may be placed against the steel blade, if necessary, to help to hold the scraper upright.

Hold a burnisher (the tool sold for burnishing scrapers) or a nail set at about 75 degrees to the flat side of the scraper as shown at *D*. Press hard and push away from you. One firm stroke should be sufficient. If accidentally turned too far, the cutting edge can be raised with the burnisher point as shown at *E*.

Knife-edge or beveled scrapers are sharpened like plane irons and the edge is then turned with a burnisher in the same way as a square-edged scraper.

How the cabinet scraper is held and pushed is shown at *F*. It should be keen enough to cut fine shavings when held at an angle of from 60 to 45 degrees.

HOW TO KEEP YOUR KNIFE KEEN

Take out your pocketknife, open the most used blade, and hold it vertically before you as illustrated in Fig. 9. Your back should be toward a strong light.

Scan the edge carefully from tip to base. Is it one long, bluish, indistinct line, so thin that it seems more imaginary than real? Or is the edge in places quite clear and distinct, like a white line? If it is, the blade has lost its keenness. To what extent, you can judge by the width of the white line.

Test it further by drawing the ball of the thumb lightly at right angles across the edge. If you notice a slight clinging effect, the blade is sharp. If it slips over the flesh very easily, it is dull.

Next, draw the edge of the thumb nail along the blade (Fig. 10). A sense of friction indicates that the blade is keen. If there is the most minute nick, the test will reveal it.

There is still another test—one especially valuable when you buy a new knife. Take along a small hardwood block, say beech or maple, and, after picking out the style of knife you want, ask the salesman for permission to cut a thin shaving across the end grain. If the blade is too soft, it will bend over along the edge and a sort of hook will be felt when the thumb is drawn across one side or the other of the blade. If, on the other hand, it is too hard, small particles are apt to break off the edge, leaving it ragged. If the blade is correctly tempered, tough and hard, the edge will remain keen and undamaged.

The best of knives, however, will not long give good service unless they are kept sharp. Deep nicks should be ground out on a grindstone or an emery wheel. Lay the blade flat upon the tool rest so that the edge will come squarely against the wheel. Press lightly and draw the blade slowly and evenly back and forth across the stone.

When you are satisfied that the edge is true, set the rest at the proper beveling angle, or hold the knife freely in the hand at this angle, and grind down both sides, moving the blade constantly across the face of the wheel while so doing.

FIG. 6—Dressing the screw point with an oilstone (usually called a "slip") that has a thin edge

FIG. 7—To straighten a bit, lay it on a hardwood block and strike another block heavily against it with a hammer or mallet

Exert very light pressure so as not to overheat the edge. Water should be poured on a grindstone during this process, and, in the case of an emery wheel, upon which water is never applied, the tool should be dipped frequently in water to cool it off.

Blades need to be reground only when very dull. Ordinarily it is sufficient to hone them on an oilstone. Indeed, even when they have been ground, the sharpening must be finished on a stone.

Slight nicks can be removed by placing the edge down squarely on the oilstone and working it back and forth. Clamp the stone in a vise or otherwise fasten it down, if possible, and lubricate the surface with clear oil, kerosene, or a mixture of olive oil and kerosene.

One method of honing is to place the blade across the center of the stone in such a way as to give the longest possible bearing upon the cutting bevel and lay the tips of two fingers of the left hand upon the upper side of the blade (Fig. 11); work the steel back and forth from end to end of the stone, keeping the angle as shown in Fig. 12. While it requires considerable practice to do properly, some experts, instead of holding the blade flat, lift the point slightly above the stone and draw the knife with a slanting stroke so that it is sharpened from heel to point by contact with the stone along a relatively narrow path near the edge of the stone. This is

FIG. 9 (at left).—Scrutinizing the cutting edge to note the width of the white line

FIG. 10 (below).—The thumb-nail method of testing sharpness.

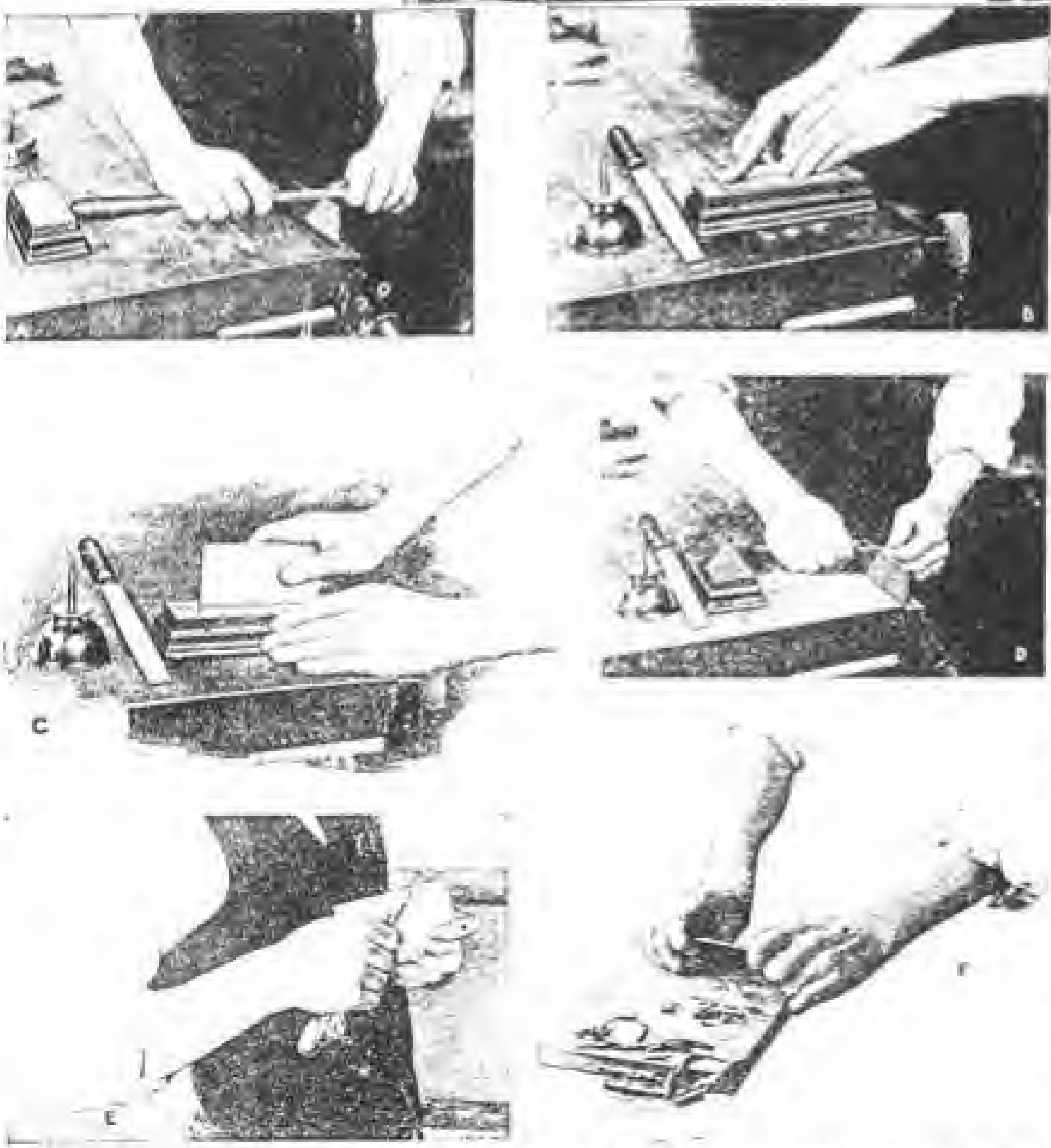


FIG. 8—Steps in sharpening a cabinet scraper, first by draw filing, second by rubbing it on an oilstone, and third by burnishing it. How a scraper is held in action (?)

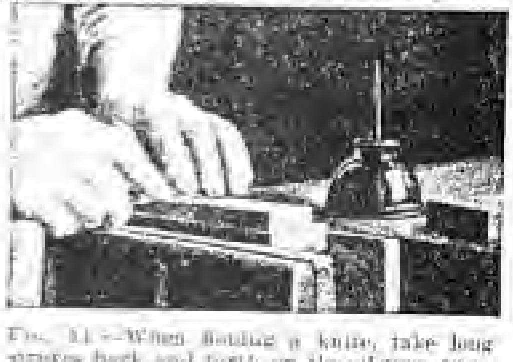


FIG. 11—When honing a knife, take long strokes back and forth on the oilstone, turning the blade at each stroke and sharpening against the edge. In other words, the cutting edge is pushed forward

easier to do than describe, and is so effective that a stroke or two, expertly given, will sharpen the edge to factory-like perfection.

After honing both sides of the blade, wipe off the surplus oil and test for wire edge by drawing the sides slantwise across the ball of the thumb. If considerable honing has been done, one or the other side of the blade will have a sort of hooked roughness where the exceedingly thin edge has been bent over. This wire edge can be removed in two ways. One method, a rough and ready one, is to hone it down with lighter pressure. The other, for finer results, is to strop it off by "wiping" the blade upon a piece of oiled leather or an oiled basswood block. A mechanic sometimes strops the blade on the palm of his left hand.

Oil the blades and joints lightly with a good grade of thin machine oil. Avoid cutting apples, oranges and lemons with the knife, but, if it must be done, be sure to wipe the juice off with a dry cloth. If water gets into the knife, dry the blades and the interior at once.

To remove rust or discoloration from the blades, rub them with fine emery cloth moistened with kerosene.

Incidentally, notice the uses to which you commonly put your pocketknife so that when you go to buy a new one you will be able to select the size and style of blades that will best serve your purposes.

For ordinary whittling and all-around cutting the spear point blade, called a pen point in the smaller sizes, is considered the best. The clip point is useful for working in recesses and for carving. The bevel point is excellent for cutting paper, cardboard and cloth, and it is also a good veiner and chipper for carving. The sheep-foot point is useful for sharpening pencils, scribing, and some types of carving. The Wharncliffe can be used for the same work, but possesses a slimmer point. The various saber points are for heavier cutting. Farmers, nurserymen and those interested in gardening will find a pruning blade of advantage, and a budding blade has no superior for grafting purposes.

Another important consideration is to buy a pocketknife that will open easily, yet with blades that will spring shut when about two thirds closed.

CARE OF JACKKNIVES

How long does a jackknife last? Statistics show the average knife carried by man abides with him only ten months. This period can be lengthened if reasonable care is taken and if the following suggestions are observed for overcoming the general run of knife troubles. By adopting them you can make your own jackknife stand by you a longer period of time than the average.

Initialing a Knife. If your initials are on your knife, it is more likely to be returned to you in case you lose it. You can make the graver from an old chisel or any good piece of tool steel. Grind the chisel or blade down to the dimensions given at *A*, Fig. 13, and hone the cutting edge or point on an oilstone until it is keen. Whittle out a short handle, as at *B*. Outline the initials with a soft pencil or a sharpened piece of soap. Set the graver as at *C* and push it forward, while, at the same time, you roll your hand from side to side. The rocking creates a series of V-shaped cuts, as at *D*.

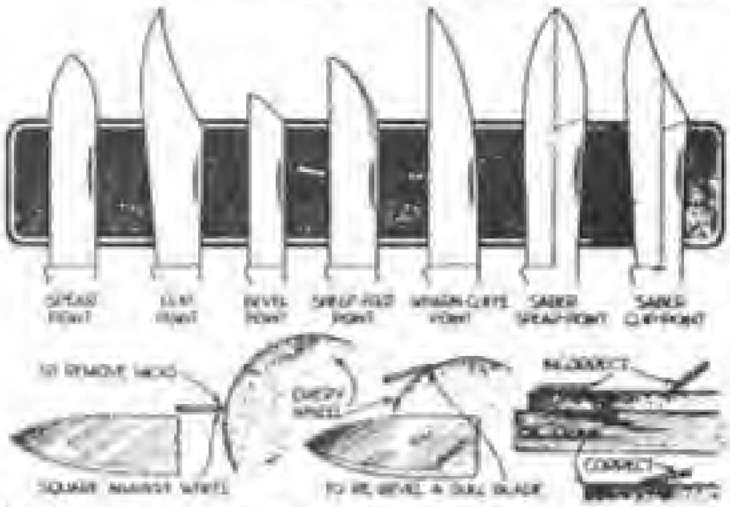


Fig. 12.—Some of the more common shapes for pocketknife and jackknife blades; how to remove nicks and regrind and hone a dull blade

Projecting Blade Points. To remedy these it is necessary only to grind or file off the projecting nub of the blade tang, as at *E*.

Repointing a Broken Blade. At *F* are shown four different points you can produce by grinding and honing a broken blade tip. You may find that you will like one of these better than you did the original one. Be careful not to draw the temper of the blade during the grinding process.

Folding Screw Driver. When a penblade has been broken off too hopelessly for redemption as a cutting tool as at *G*, it can be transformed into a neat folding screw driver for light work. Grind off the broken end until it is

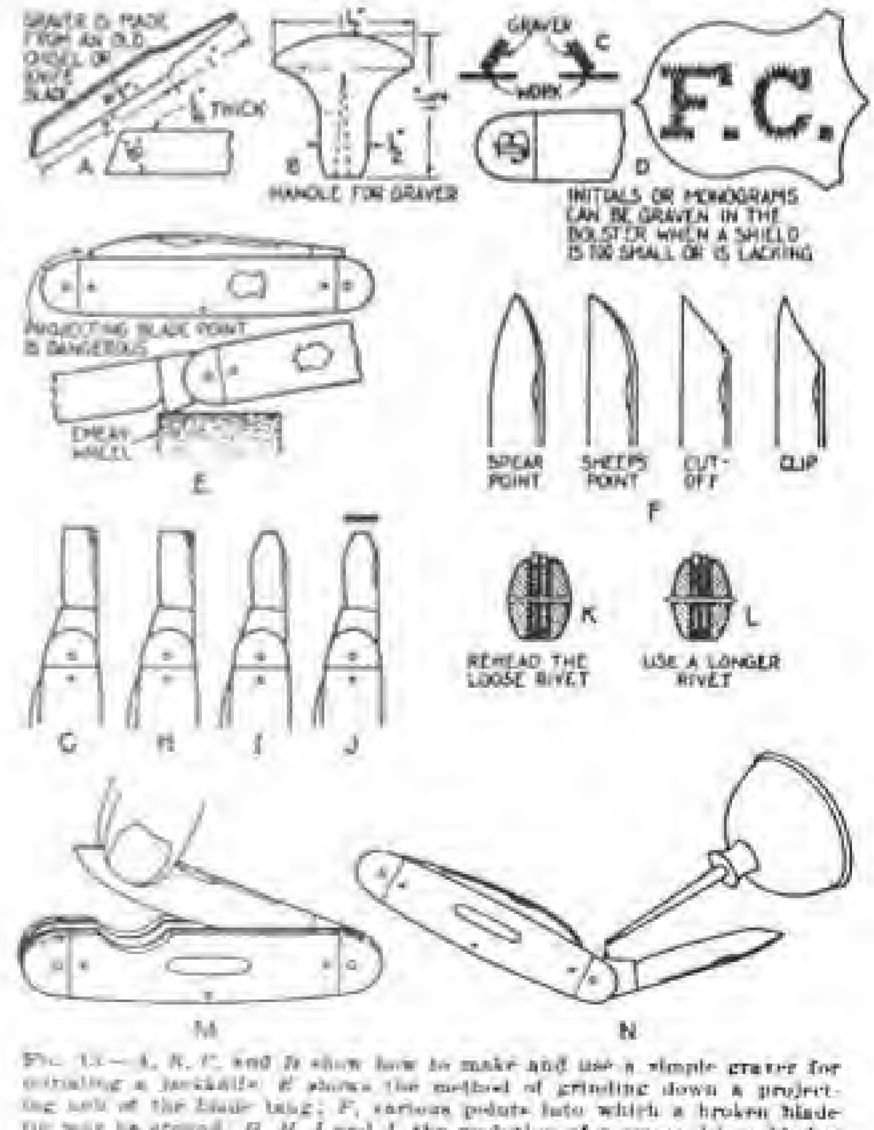


Fig. 13.—A, B, C, and D show how to make and use a simple graver for initialing a jackknife; E shows the method of grinding down a projecting nub of the blade tang; F, various points into which a broken blade tip may be ground; G, H, I and J, the evolution of a screw driver blade; K and L, how to tighten a loose blade; M, how to make a thumb-and-forefinger grip; and N, where to oil a sticking blade

square as at *H*, taper the cutting edge and the back edge as at *I*, and slightly bevel the sides of the blade as at *J*.

Stiffening a Wobbly Blade. After a knife has been in use for some time, especially in heavy whittling, the heads of the rivets upon which the blades are pivoted often crumble off. The simplest remedy is to countersink the hole slightly at the loose end, then rehead the rivet in the cavity by using a nail set or blunt punch as at *K*. Another method consists in withdrawing the rivet and inserting a slightly larger one made from a piece of brass wire or a wire brad as at *L*. This should then be headed at both ends by tapping while the knife rests on a piece of iron.

Providing a Thumb-and-Finger Grip. Sometimes it is desirable to provide a way of lifting the blade of a knife by gripping it with the thumb and forefinger as at *M*. With a round file, make a curving notch about 1 in. wide in the handle of the knife, reducing both wood and lining plates.

Relieving Sticking Blades. You can usually renew the easy action of a blade that sticks by putting a few drops of kerosene oil between the bolsters and the blade as at *N* and working the blade back and forth for a few moments. Repeat the process if necessary.

TOOLS FOR DECORATIVE METAL WORKING

Much decorative metal work—hammered copper and brass, jewelry and models—can be made at the bench with the tools shown in Figs. 14 and 15. Some of these you may already have, particularly if you do radio or model work.

While some of the special tools must be purchased at a jewelers' tool supply house, others may be obtained from any well-stocked hardware store or large mail-order firm.

The tools shown, which are the essential ones for bench use, are numbered in order to correspond with the list which is subjoined:

No. 1. Snips or Shears. For very small work at the bench, light snips, 8 in. long over all, are best. If only one pair is purchased to start with, get a pair of 10-in. snips. The ideal equipment is one pair of 8-in. snips, one pair of 10- or 12-in., and one pair of heavy bench shears with a 6-in. cut and a length of perhaps 24 in.

No. 2. Jeweler's Saw Frame. For general bench work this should be about 5 or 6 in. deep from the saw blade to the back of the frame. Fitted with an appropriate metal-piercing or jeweler's saw blade, this saw is used to cut out shapes from flat sheet metal. A large variety of work may be done with jeweler's saw blades held in a coping-saw frame of the better grade. The writer uses one about 8 in. deep for large work. For very small jewelry or similar work, a jeweler's light saw frame 4 in. or even 2 in. deep is useful; these frames may be obtained from 2 to 18 in. deep.

No. 3. Jeweler's Saw Blades. These are sold in bundles of one dozen or by the gross, which is the cheaper way to buy them. They should not be confused with coping or scroll saw blades for wood; they are very hard and made like tiny back saws. There are eighteen sizes running from Nos. 8/0 to 12, the largest. No. 4 is a good size to begin with, and at least two or three dozen should be purchased if you are far from a source of these supplies. Some of the finer sizes may be purchased later on for very small work; Nos. 0 and 1 are much used.

No. 4. Hand Drill. This should have an accurate chuck for holding twist drills at least up to 1/8 in. in diameter and it should be rather small and compact in design for bench work. As you will have much use for it, it should be a good one.

No. 5. Twist Drills. These are made for drilling holes in metal. The fluted drills usually furnished with hand drills are not hard enough for drilling metal. To start with, drills 1/32, 1/16, 3/32, and 1/8 in. in diameter should be purchased and perhaps one or two larger ones, if your hand drill will take them. Several each of the smaller sizes should be obtained as they will break now and then. The 1/16-in. diameter size is much used to pierce metal when sawing inside work.

No. 6. Center Punch. The small cone-shaped point is used to make a slight depression in which the point of a drill is rested when starting to drill. The metal to be center punched is placed on a steel or iron anvil.

No. 7. Flat File. An 8- or 10-in. flat file about 1 1/8 in. wide, rough or bastard cut, is used for filing work roughly to shape before the smoother files are used.

No. 8. Mill File. An 8-in. single cut smooth mill file, about 1 in. wide, is used to smooth up all sorts of metal work and particularly to round or chamfer edges. The wooden handles for these files are sold separately and should be purchased for them.

No. 9. Crossing File. A 6-in. crossing file, cut No. 2 or No. 4 (fairly smooth) is useful for a variety of work such as smoothing up the inside of curves. Pointed half-round files are more common and are almost as good.

Nos. 10-13. Needle Files. These are used for finishing small work. At least four should be purchased, one knife shape, one round, one half-round or crossing (elliptical), and one three-square (triangular) in section. These files are very slender, from 4½ to 5 in. long, and each is provided with a smooth round shank and does not require a wooden handle. It is worth while to get a dozen assorted shapes. Smaller files much like these are called escapement files and are most useful for very small jewelry and model work.

No. 14. Wooden Mallet. Much used for flattening out and shaping sheet metal. A good thing to remember is "Do it with wood, on wood, when you can." The mallet may be purchased or made at home. It should be of beech or hard maple with a head about 2½ in. in diameter and 4 in. long, either square or round. Carpenter's mallets are rather clumsy for metal work. Sometimes hardware stores carry lighter ones, as the jewelers' supply houses always do.

No. 15. Machinist's Light Ball Peen Hammer. The head should weigh ½ lb. or slightly less. This tool should be of a very high grade.

No. 16. Chasing Hammer. This has a broad, flat face and an elongated ball peen, and is mounted on a peculiarly shaped handle, which is thin in the shank. The handles are scraped or filed down to the individual craftsman's liking. Hammers such as this are used for repoussé work or metal modeling. While

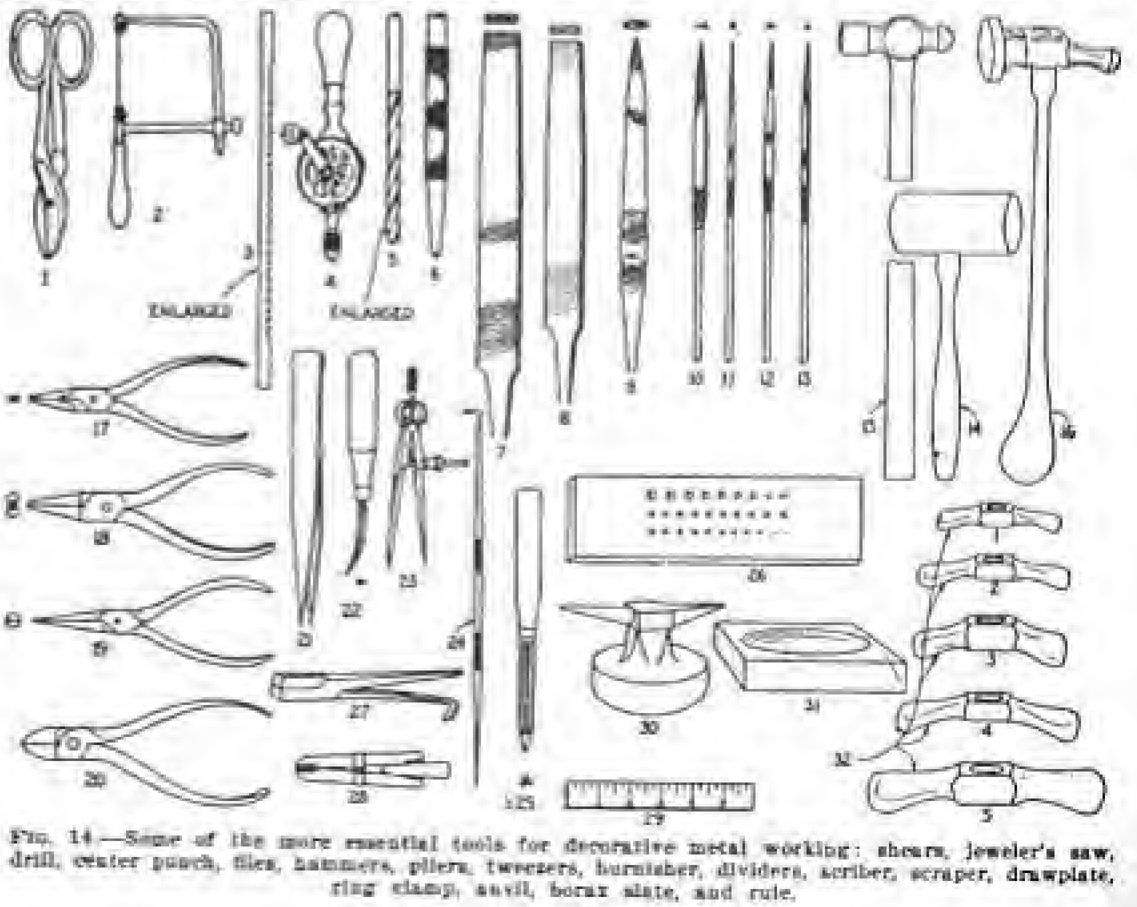


FIG. 14.—Some of the more essential tools for decorative metal working: shears, jeweler's saw, drill, center punch, files, hammers, pliers, tweezers, burnisher, dividers, scriber, scraper, drawplate, ring clamp, anvil, borax slate, and rule.

not absolutely essential for some beginners' work, it is well worth purchasing. If you are to do any small work, particularly jewelry making, you are sure to need one. A chasing hammer with a 1-in. face is suitable for light work. Both the hammer and the handle must be purchased at a jeweler's or silversmith's supply house.

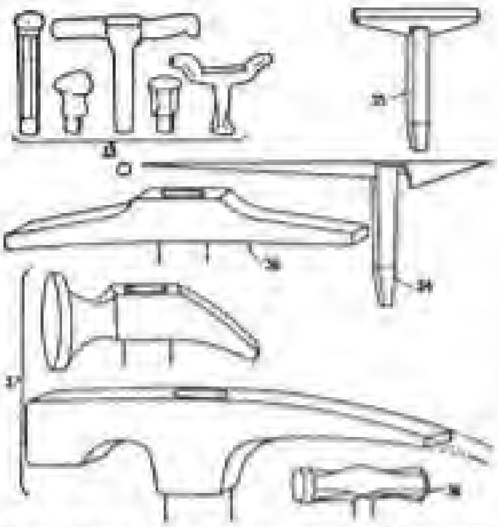


FIG. 15.—A set of stakes, and raising and planishing hammers. A shoemaker's hammer will serve for planishing, and a brick hammer makes an excellent hammer for raising operations.

No. 17. Flat-nosed Pliers. This tool should be from 3½ to 4 in. in length over all without side cutters or deep scoring on the jaws. It is better if the points of the jaws taper down to rather thin ends, to get into small places.

No. 18. Round-nosed Pliers. The jaws or nose are round in section and should taper down to rather fine points.

No. 19. Chain-nose Pliers. These have jaws which are half round or D-shape in section and taper to fine points. They should be 3½ or 4 in. in length, and if the jaws are long and slender, so much the better. For professional work these and the other types of pliers mentioned may be obtained with long noses, which are useful for many delicate operations, but they should not be purchased at first.

No. 20. Side Cutting Nippers. It is generally better to have a separate pair of side cutting nippers. The other types of pliers are so much used for forming metal shapes that cutters are apt to get in the way or mar the metal. The nippers illustrated are provided with jaws that cut right up to the ends, making it easy to reach in small places and snip off excess metal or wire.

No. 21. Tweezers. These are much used by the metal worker for picking up tiny bits of silver solder and small parts. They should be of spring steel 3½ in. long and taper down to very fine points. They usually have to be purchased at a jeweler's supply house.

No. 22. Oval Steel Burnisher, Curved Blade. These burnishers, which are made with hard, polished steel blades, are used for smoothing the edges of bezels or bandlike forms which are used to set precious or semiprecious stones. They are necessary if you are to do any of this work. Burnishers are also used for smoothing or polishing certain portions of metal work. The blade should be 1½ or 2 in. long. Many other types of burnishers are sold under the name of silversmith's burnishers.

No. 23. Spring Dividers. These form an important part of the metal worker's equipment for scribing circles in the metal and for accurately spacing division marks.

No. 24. Machinist's or Engraver's Scriber or Marker. These tools are like a thick needle and some of the best ones have one end bent over at right angles to enable the user to reach difficult places. A common ice pick of the shorter variety makes an excellent scriber and a common steel knitting needle may be ground to a sharp point and used. Large steel sewing needles, provided with a wooden handle made of a short length of dowel stick, are useful in laying out extremely small work.

No. 25. Hollow Scraper. The 2½ or 3 in. long blade is three sided or bayonet shaped, each side being hollowed out and each edge for the entire length of the blade being ground sharp. Scrapers are used to brighten up metal before soldering and for other purposes. Many mechanics make their own scrapers by grinding triangular files smooth and sharp. A knife blade makes a fairly good scraper, but it is handier to have a real one, if you do much work.

No. 26. Round-hole Drawplate. Drawplates are used in making wire and tubes. While copper, brass, silver, and gold wire may be purchased in practically any desired diameter, it is often necessary to draw down a wire to a smaller diameter, or to take a length of flat sheet metal and draw it out into smooth round wire. Then, too, if you have a drawplate you can make thin sheet metal into very accurate small tubes for hinge work and clasps. As a model marker you will find many uses for drawplates. It is not essential that a beginner own one, but most well equipped shops have one. The holes in drawplates are made in many shapes—round, square, triangular, star shape and so on. For general use a drawplate having from twenty to forty holes, from ³⁄₁₆ in. in diameter to a mere pinhole, are best.

No. 27. English Draw Tongs. These special tongs are used to grip the end of the wire as it is pulled through the drawplate. Common pliers are of no use, so if you get one or more drawplates you had better buy a pair of 8-in. draw tongs specially designed for the work.

No. 28. Ring Clamp, Double End. This tool, which works much like a hand vise, is made of two hinged pieces of wood faced with leather jaws; one end is rounded over and the other is square across. A wooden wedge is pushed in one end to force the opposite jaws together. This tool is much used by craftsmen when making jewelry, particularly silver or gold rings.

No. 29. Steel Rule. A good 6-in. steel rule is splendid for laying out designs on metal, as it is more accurate than the cheaper wooden rules. For larger operations, a steel rule 12 in. in length is useful. Thin flexible corset steels, or pieces of clock spring, make excellent rulers for bending about cylindrical or curved work as a guide for scribing lines.

No. 30. Anvil with Base. This tiny bench anvil, about 3½ in. long, is much used by jewelers and craftsmen for light work. One horn is round and the other square in section. An old flatiron with the handle removed makes an excellent bench anvil for flat work. The heads of large round steel nails may be cut off and the nails gripped firmly in the vise so that the shanks can be used as anvils. Small round or square iron or steel bars or nails may be filed tapering at the ends to make anvils or mandrels.

No. 31. Borax Slate. A thick piece of slate about 3 in. square with a circular hollow ground in it is indispensable for hard or silver soldering. A little water is placed in the hollow and a lump of especially prepared borax is rubbed in it to make a creamy borax solution for use as a flux.

No. 32. Embossing Hammers. For raising and embossing the larger pieces of metal work such as bowls, trays and lanterns, specially shaped hammers and stakes or anvils are required. Embossing hammers are usually for inside work; that is, work placed over a hollow form or cushion and hammered to deepen it one way or another. The lightest one weighs about 3 oz. and the heaviest one 2¾ lbs.; they vary in length from 3 to 6 in. It is handy to have at least five of them, but if only one is to be purchased, it should weigh from ¾ to 1 lb. A good blacksmith can forge excellent hammers of this kind from mild or tool steel, provided a suitable model is furnished him. Sometimes a tack hammer with a long head can be used as a small embossing hammer for light work. The edges of the head must be well rounded over, or the head filed slightly dome shape and polished with emery cloth.

No. 33. Stakes and Anvils. This is a good set of stakes for a beginner. They are of

FIG. 16.—An excellent "raising" hammer made from a common brick hammer.

malleable iron or cast steel and all the working surfaces are highly polished. The object of the strange shapes is to provide a number of curved or flat surfaces for supporting metal while it is being hammered with a raising hammer (quite different from an embossing hammer). The craftsman may find material at junk yards or about the scrap heaps of plumbing or machine shops that will serve as stakes.

No. 34. Tinner's Blow-horn Stake. The long horn or mandrel is about 18 in. in length and tapers to a fine point. The other end is half cone shape and comes in handy when making lantern tops. A blow-horn stake may be obtained from dealers in tinners' tools; any plumber can tell you where to get one.

No. 35. Tinner's Hatchet Stake. The craftsman will find this stake with its 10-in. blade a help when making sharp angles or bends in sheet metal, as when making lanterns. A length of hard maple board with a sharply beveled edge may be used for making angles in light sheet metal.

No. 36. Raising Hammer. Strictly speaking, "raising" means in metal craft work the placing of a disk of sheet metal over a stake and hammering around and around on it with a raising hammer. By this process the metal is raised up into bowl or other forms. This hammer is made of tool steel with the ends tempered for hard use. It is 6 in. long, 1 in. wide, ⅞ in. high or thick; one end is ⁵⁄₁₆ in. thick and the other end is about ⁵⁄₁₆ in. thick. The ends of these hammers are most carefully formed. First they are filed or ground off square across with the lower side of each end slanted in slightly toward the handle. Then

FIG. 17.—Old hack saw blades are softened by heating them in a dull red and cooling them in dry ashes.

all sharp edges and corners at each end are carefully rounded off, but the face itself remains quite flat. These may be forged by a good blacksmith or purchased of a dealer in metal craftsmen's tools.

No. 37. Homemade Hammers. A common brick hammer, such as used by masons, makes an excellent raising hammer. (See also Fig. 16.) Grind back the chisel-like end until this part of the hammer is about ⁵⁄₁₆ in. thick; then round off the edges and the corners. Grind the other hammer end square across and round over the edges and corners. Then you will have a fine planishing hammer, as well as a raising hammer. Brick hammers have a large eye in which the handle is firmly set—a decided advantage in a raising hammer. A good drop forged shoemaker's hammer serves well as a planishing hammer. After work has been shaped up with the raising hammer, planishing hammers are used to flatten the marks into the beautiful glittering facets seen in fine copper and silverware.

No. 38. Silversmith's Planishing Hammer. One end is flat and the other slightly rounded or dome shape. One weighing ½ or ¾ lb. is commonly used. A machinist's hammer with a smoothly polished face may well be used for planishing. Illustrations showing how various hammers for metal work are held appear on pages 189, 193, 194, 211, and 212.

TOOLS FROM OLD HACK SAWS

Many useful tools for the home workshop can be made from dull or broken

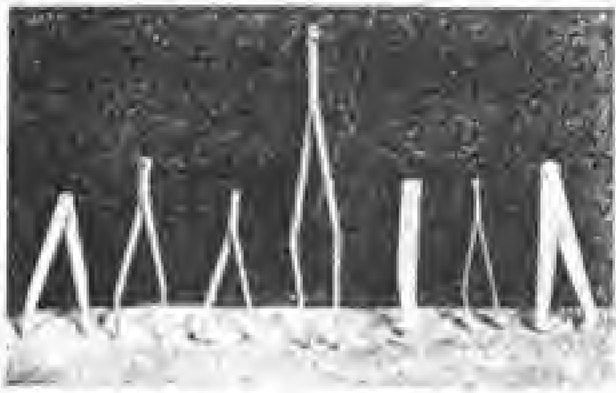


FIG. 18.—Tweezers of various shapes, calipers and scribers made from old hack saw blades.

FIG. 19.—Homemade tools for ship model making and other delicate work: knives, saws, small grooving cutter, and palette knife, all made from discarded saws.

hack saw blades. These blades are of fine tool steel and very hard; it is necessary only to heat them to a dull red and allow them to cool slowly, when the steel will be found soft enough to be filed and bent into various tools, which then may be hardened, tempered, and ground. For tweezers and saws, however, the steel remains just hard and springy enough after softening; in fact, no further hardening and tempering need be done except on cutting tools.

There are two kinds of hack saw blades in common use, one with the blade hardened evenly throughout and the other with hard teeth but a soft back. The former make the best tools, but either kind may be used. Be sure there are no cracks in the blades you are to use.

To soften the blades (Fig. 17), heat them in the flame of a blowtorch or in a forge or stove to a dull red, so that they show red *but no more*. Lay them on a brick to cool slowly, or, better still, thrust them under warm, dry wood or coal ashes and leave them for two or three hours.

When the blades are soft, put them in a vise and use a fine file to remove the teeth, or grind the teeth off before softening if you prefer.

The tweezers *D*, Fig. 18, are made from two 10-in. hack saw blades, with a rivet through the holes already in the ends. Place the riveted pieces in a vise, cut off the free ends just above the holes in them, and file the ends to long, tapering points. Make the bends with flat-nosed pliers. Smooth up the edges with emery cloth and, if you wish, apply aluminum paint, which prevents rusting and makes the tweezers easy to find on the bench.

Tweezers *B* are made from a single 10-in. blade, which is softened and then heated again in the center so that the two ends may be bent.

Tweezers *E* are useful for picking up small objects. The blades are filed down, as shown, to the holes, and the rounded ends squared off.

Two short pieces of blade are riveted together to make tweezers *F*. The ends are left blunt and domed out from the inside with a center punch over a block of end-grain wood. These are for picking up ball bearings, silver balls in jewelry making, or other small round objects. Tweezers *C*, with in-bent square ends, will be found useful in pulling.

Calipers *G* and dividers *A* are

the remaining tools of Fig. 18. The blades of the dividers are given a trough shape by opening a vise to about three-quarters the width of the blade, laying the blade lengthwise over the opening, and hammering it with a cross-peen hammer or a piece of hardwood cut like a blunt cold chisel.

The cutting tools shown in Fig. 19, while not intended to replace regular woodworking tools, will be found advantageous in building ship models, in wood carving, making linoleum patterns for block printing, and in delicate craft work of various kinds.

Fig. 21.—Two special tools made as shown in Fig. 20 for cutting fine grooves to represent the planks or other divisions in ship models and similar work.

The knife blades *K* and *H* are made from unsoftened hack saw blades. Grind off the teeth and shape the ends; then, as a preliminary to tempering the steel, grind one side bright or polish it with emery cloth. Heat a flat iron bar red

Fig. 20.—Either an old hack saw blade or a common paring knife can be converted into a tool for making slight grooves to represent planking on ship model hulls.

hot. Pick up a knife blade with tongs or pliers at the handle end or tang and rub the blade over the hot iron until the polished surface turns a very light brown for its entire length. At once plunge it vertically into water to cool. The blade then may be ground and sharpened.

Ordinary tool handles may be used for these tools. Drill a row of very small holes across the end of the handle, grip the tool or blade in an iron vise, and drive the handle on it.

When grinding thin tools be careful not to draw the temper. If you use an emery wheel, keep the work cool by dipping it frequently in water. An old-fashioned grindstone with water is really best for this kind of work.

The palette knife *N* is made in the same way except that it is ground thin toward the point to make it springy. It is softened to a dull straw color as just described. The short saw *J* does not require tempering. Left soft, it is about the hardness of most saws for wood. The keyhole saw *O* is made similarly except that the back is ground or filed to a taper towards the point. These saws may be filed and set when they become dull.

For the back saw *L* the blade is left hard, if it is to be used for metal. It is a 6-in. length of blade with a back of sheet iron or soft steel about 1/32 in. thick.

A piece of steel strap used on packing cases will serve for the back. Scribe a line down the center of each side, place it in the vise and bend the steel over at a slight angle along the center line. Move the strip along and bend the remainder. Then repeat the process, bending the whole length over at a right angle.

Lay it on a flat anvil and bend to a trough shape by hammering along the upper edge. Insert the blade and squeeze the back hard against it in the vise. The back, being left 2 in. longer than the blade, forms the tang.

At *M* is shown a tool for making slight grooves to represent the planking on the hulls of ship models. It may be made from either a hack saw blade or a ten-cent kitchen knife. In the first case, use the rounded end of the blade, grind the sides to the desired thickness, soften the blade by heating, then file in several more teeth until they extend up on the curve of the rounded end. Then use a fine flat file to dull the points of all the teeth at this end slightly (see Fig. 20).

To use the tool, planking lines are first drawn on the wood, then the tool is moved back and forth with a light pressure as in Fig. 21. For straight lines a ruler may be used to guide the tool.

The blade shown at *P*, Fig. 19, is used as a scraper.

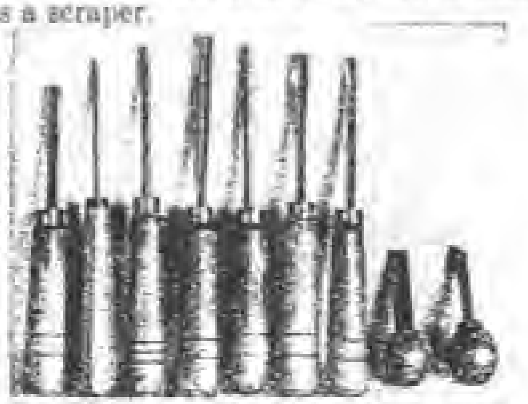


Fig. 22.—A set of wood-carving gouges and chisels fashioned from discarded hand hack saw blades.

HOMEMADE CARVING TOOLS

Wood-carving tools, always expensive to buy, can be made in a similar way from old hack saw blades.

One of the most necessary tools in wood carving is the "grounder" or flat gouge shown second from the right in Fig. 22 and in Fig. 23. It can be made from a 3-in. length of hack saw blade. The blade is first softened as previously described. After it has been allowed to cool, the teeth are removed by filing.

Fig. 23.—This "grounder" or short flat gouge cannot be purchased yet is a most useful carving tool.

The gouge shape is obtained by setting the vise at the proper width and driving the blade into the opening with a hammer, as shown in Fig. 24 at *A*. Another and more efficient method is to use a wooden swage block cut to fit the shape of the tool as at *B*.

In order to stiffen the otherwise springy blade, the channel must run the length of the tool. The edge of the tool,

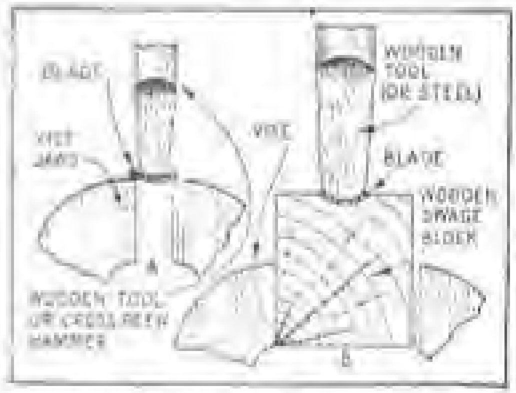


Fig. 24.—The blade of the "grounder" may be made gouge shape by employing either of the methods illustrated.

which has an outside and an inside bevel, the inner one being about one-third as long as the outer bevel, is shaped and partly sharpened before being hardened.

Heat the tool to a dull red for about 1 in. of its length; then, holding it vertically, plunge it into cold water. To temper it, brighten about 1 in. at the point and hold it over the flame so that the tool is heated in about the middle. Watch the cleaned part for the appearance of colors. As soon as a light brown or straw color appears, plunge the tool into the water. Here again the tool should be held vertically while plunging.

Hack saw steel, if treated in this way, will hold a very keen edge. The beginner is apt to soften the metal too much during this tempering process. Should the tool prove too soft, the hardening and tempering can be repeated.

All of the gouge-shaped tools shown in Fig. 22 are made in the same manner.

When making a flat chisel, the end of the blade is, of course, left flat, but the stem is made trough shape to add to the stiffness of the tool. The cutting edge is formed by two bevels of the same length, each side of the tool having a bevel.

The tools are ground and sharpened in the usual way, preferably using a water-wet grindstone for the grinding. Care must be taken if an emery wheel is used, as it is very easy to remove the temper from these thin tools.

Slip stones with round edges can be obtained in various sizes for sharpening the inside of the gouges. The finish edge is applied by using a leather strop charged with crocus or rouge.

If care is taken in making, shaping, and heat-treating these tools, a fine set of wood-carving chisels and gouges, large enough for almost any work ordinarily undertaken by amateurs, can be prepared at very little expense.

LACK of space for a workshop or even for a workbench is proving more and more to be a serious difficulty in the average small home. The modern flat or apartment is planned without any thought of giving the handy man a chance to express himself in mechanical work.

The apartment dweller who wishes to use tools does not need to give up in despair, however, nor does anyone else who is deprived of access to a regular workshop or to a workbench. In almost every household there is a kitchen table or other sturdy small table available and if not, one can be bought at a very low price. And in a few minutes' time such a table can be converted into a satisfactory workbench for ordinary work, through the use of a simple, detachable bench top like one of those shown in Figs. 1-8. When the work is completed, the top may be removed quickly and the table returned to the housewife for its customary uses.

KITCHEN TABLE BENCH

Such a bench top consists chiefly of a piece of plank 2 by 12 in. and about 8 in. longer than the length of the table top. Southern pine, Douglas fir, cypress or any other soft wood that is not too expensive is satisfactory for this. It is advisable to get the best grade available and to insist that the piece be dry in order to prevent warpage. If it is ordered surfaced on four sides (S4S), its dimensions will be 1⅝ by about 11 in., which is satisfactory. The exact size, however, is of no especial importance.

This plank is fastened to the table with two large C-clamps, one at each end, so placed as to be out of the way as much as possible. It is well to screw two cleats across the board on the underside, spaced so as to fit snugly against the ends of the table top. These take much of the strain from the C-clamps when planing or similar work is being done.

FIG. 1.—Bench top with quick-acting woodworking vise for use on a kitchen table. The top is fastened on the table with heavy C-clamps.

For the simplest arrangement, two hand screws will form an inexpensive and satisfactory substitute for a regular vise. This expedient, which is illustrated in three views on this page, keeps the top piece clear of cumbersome permanent attachments and makes it easier to store in a small space when not in use. In addition, the hand screws are of frequent use in clamping together work that has been glued, especially furniture.

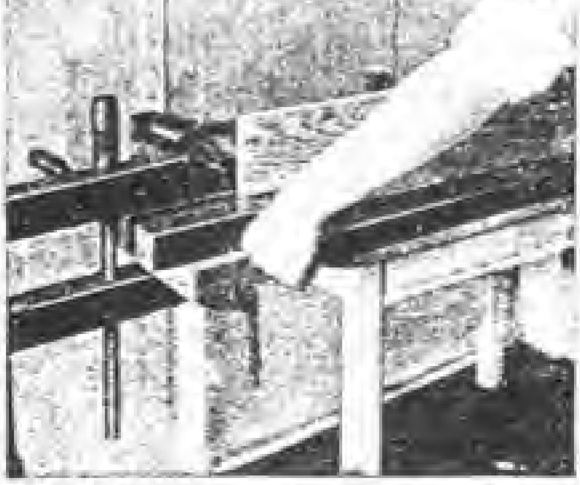


FIG. 2.—Using two hand screws as a substitute for a vise.

Figure 2 shows how the hand screws are applied to the top surface of the bench for planing the edges of boards that are not too wide to be supported in this way.

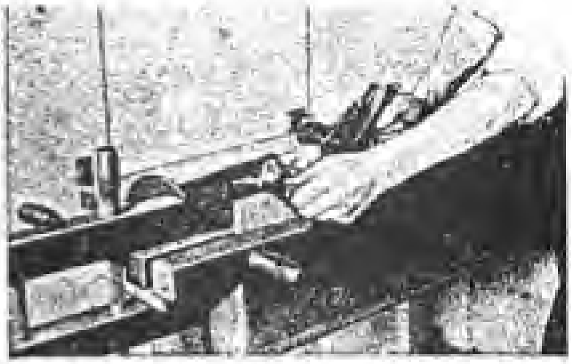


FIG. 3.—How the hand screws are placed on the kitchen table bench for planing wide boards.

For wider boards, the screws are placed so that the inner jaw of the horizontal one comes even with the edge of the bench (Fig. 3). Used in this way, the hand screws serve much like the ordinary vise. If the boards to be planed are long, the free end must have some means for support; suggestions for providing this will be given later. When attached as illustrated in Fig. 4, the improvised vise serves well for ripping because the saw can be run down past the level of the bench.

A bench stop made of wood will prove quite satisfactory for this type of bench. Such a stop will also help to keep down the cost to a minimum. It can be made by the common method of sawing a V-shaped cut in one end of a piece of wood and nailing it on the bench at the left-hand end.

A little more time and effort will produce a more satisfactory stop as shown in Fig. 5. This stop is made from three pieces of hardwood ¾ by 1¾ by 6 in.

FIG. 4.—This method of attaching the hand screws is a useful one when boards are to be ripped.

One edge of each of the two wedge-shaped pieces is beveled to prevent the clamping piece from rising when pressure is applied. If enough taper is put on the pieces, the stop will grip stock varying in thickness from ¼ to 1½ in.

Many a home worker undoubtedly will wish to increase the possibilities of this outfit by using a metal stop and a small metal vise. Both of these usually may be obtained at the hardware store. If not, they can be had on special order.

There are several excellent types of stops available, but the kind that is adjusted with a screw driver is preferred by many because it stays "put." To fit in such a stop, first bore a hole large enough to allow the bar to move freely. Then place the stop in position and mark around the horizontal surface with a knife or awl. The cutting is completed with a chisel, until the top of the plate lies flush with the bench top. The stop is fastened with screws as illustrated in Fig. 6.

The rapid-acting type of vise probably is preferable for a small bench. It may be only 4 in. in length, but one

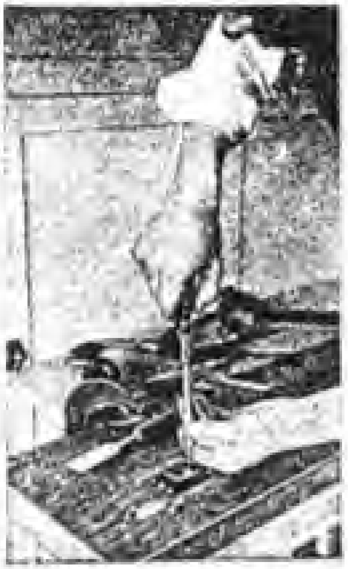




FIG. 5 (at left).—A homemade wooden stop for planing. FIG. 6 (center).—Fastening an iron stop in place. FIG. 7 (at right).—How a rapid-acting vise is fitted. The same vise is shown in use in Fig. 1.

with 6-in. jaws will prove more satisfactory in the long run. These vises are made for tops of 2¼-in. thickness, so for this job it is necessary to build up the thickness by using a ¾-in. piece of wood as a filler.

To fit the vise in place, turn the plank over as shown in Fig. 7. Detach the free jaw of the vise temporarily for convenience in working; then fit the stationary part to the top. Cut back in the edge of the top for the thickness of the jaw, and also make allowance for screwing a thin piece of wood to each of the inside surfaces of the jaws to prevent marring the work.

If an "apron" piece is to be used to hold up long boards as shown in Figs. 1 and 8, the thickness of it must be taken into account so that it will come flush with the jaw of the vise. Such an apron can be nailed to the edge of the plank or under the edge, according to the construction decided upon; the former is the easier method.

A substitute for a vise that is sometimes used is a block about 1¾ by 3 by 8 in., which is cut on a long bevel for 3 or 4 in. on one of the flat faces and screwed against the upper left-hand corner of the apron in such a way that the beveled part forms a V-notch into which one end of a board may be pushed when it is to be planed. The board is further supported by two pins inserted into holes in the apron.

When thin stock is to be planed on the surface and you have not fitted a regulation bench stop, you can nail a strip of wood temporarily across the face of the bench board to act as a stop. If you prefer, you can make a removable stop by nailing or screwing a block ¾ by 1½ by 4 in. across one end of a thin piece of hardwood ¼ by 4 by 12 in. To use this stop, the block at the end is gripped in the vise in such a way that the thin board lies flat across the bench top.

To do smooth surface planing, it is important that the table be rigid. It can be braced by cutting a stick of wood to reach diagonally from under the left end of the bench top to the juncture of the floor and wall of the kitchen or to any convenient stop on the floor. This brace will resist the tendency of the table to sway when the plane is pushed forward.

FIG. 8.—One form of portable bench top with an apron, a quick-acting vise, and an adjustable planing stop.

Because of the bulkiness for storage, it may be better in some cases to omit the apron and use instead a special support constructed like an old-fashioned window stick, having a number of notches to suit boards of various widths.

The completed top with metal stop and vise and with an apron containing a series of holes for supporting long boards is shown in Figs. 1 and 8. With such a convenience the handy man is not prohibited from doing small jobs in repair and construction even though modern civilization has forced him into restricted quarters in which to work.

A PORTABLE WORKBENCH

How one "home workshopper" overcame the obstacle of having no place to work in a small modern apartment is shown in Fig. 9. Lumber from old boxes and crates was used; in fact, the only materials purchased were four hinges 2½ in. wide, four handles for drawers, four casters, five cents' worth of 2½-in. round-headed screws, and ½ lb. sixpenny nails, costing altogether sixty-nine cents.

The tools used were a hammer, crosscut and rip saws, try-square, plane, ruler, screw driver, and drill.

First the two sides ¾ by 11½ by 30 in. were cut, and a piece ¾ by 1¾ by 19 in. was nailed across the front end of these at the top, and a piece ¾ by 3½ by 19 in. across the bottom and extending ¾ in. lower than the ends of the sides—to allow for the thickness of the bottom. Two vertical pieces ¾ by 1¾ by 25½ in. were then nailed to the sides to complete the frame of the front.

The bottom, ¾ by 11½ by 19 in., was nailed under the sides, the ends of it being flush with the sides. The back, ½ by 19 by 30¾ in., was then nailed on. Before the slides for the drawers were attached, the depth of the drawers was figured out to suit exactly what was intended to be kept in each.

The top was made of ¾-in. stock. One piece 15 by 20½ in. was cut to run from

FIG. 9.—The apartment-size cabinet workbench ready for use (above) and raised on casters (at left). It can be rolled away and stored in a closet.

front to back, extending 2½ in. over the front and ¾ in. over each side. The other section or layer of the top was made 15 by 19 in., thereby allowing ¾ in. on each end for a piece of quarter-round molding 15 in. long. The first board was nailed to the sides, front, and back, and then the skeleton of the cabinet was inverted on the other board, the grain of which runs at right angles to the grain of the first one; after an allowance of ¾ in. had been made on each side for the molding, the first board was screwed to the second. When the cabinet was right end up, it had a smooth top without visible screws or nails. The molding at the ends of the top was next nailed with 1-in. brads.

Now for the most interesting part—the method of mounting the casters on pieces of wood 3½ by 12½ in. that are fastened to the bottom of the bench with hinges set ¾ in. from the ends. The width of these pieces is of great importance; it has to be exactly 3½ in. so that when the cabinet is tilted each will flip outward of its own momentum and not hit the floor. If they were too wide, the weight of the cabinet would fall on the hinges and, of course, break them very soon. At this width, the weight rests on the corner of the cabinet, allowing a needed ¼ in. before the hinges on the tilted side are opened to capacity.

The casters are ball bearing and have flat tops or screw plates 1¾ by 1¾ in. with four screw holes. They are set in 1 in. from each side and 1½ in. from the end of the hinged pieces to which they are attached.

This simple device works perfectly. When filled with tools, including the heavy vise, it takes all the strength of two men to lift the cabinet, yet when the casters are set in place under it, the bench can be moved wherever desired with one finger.

SMALL CABINET WORKBENCH

It is all right to do model making or other light work on the kitchen table or at a makeshift bench, but sooner or later every amateur mechanic feels the need for a real workbench.

Although not large, the bench illustrated in Figs. 10 and 11 will serve ordinary needs for cabinetwork on a small scale, model making, toy building, and household repairs—in fact, all the work that is likely to be carried out by a handy man or an amateur cabinetmaker. In addition, it can be moved from place to place as easily as a piece of furniture.

A workbench must be strong and rigid. The errors of the inexperienced home worker in constructing a temporary bench and the later disappointments from inaccurate and unsatisfactory work are too common to be needlessly repeated. After all, it takes nearly as much material and time to make a poor bench as a good one; the difference is chiefly in the design and the care with which the work is done. No really expert mechanical ability is required. Accuracy in taking and working to measurements is necessary for the bench must be square and level, but this requires care rather than skill.

Fig. 10.—Planing at the small cabinet bench. Note how a drawer has been partly drawn out to help support the long board.

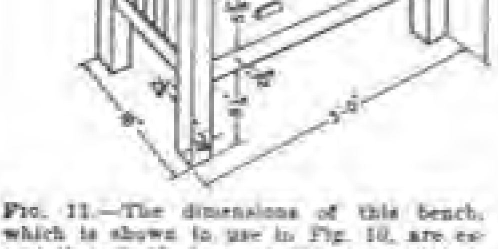


Fig. 11.—The dimensions of this bench, which is shown in use in Fig. 10, are especially suitable for a small home workshop.

The wood to be used depends somewhat upon what your lumber dealer has in stock. It is advisable to use hardwood for the top piece; but, if the bench is not to have excessive use, hard pine or even Douglas fir will last a long time. All parts except the top can well be of soft wood; indeed, it is perhaps better for the beginner not to attempt to make the framework of hardwood. Your lumber dealer will be glad to suggest the most economical and serviceable woods he has on hand for this purpose. Ask his advice.

Your order, as you will give it to the lumber dealer, will be practically as follows:

Douglas fir (or equivalent), clear, S4S (that is, surfaced on four sides)—1 pc. 3 by 3 in. by 12 ft., for legs; 1 pc. 2 by 3 in. by 16 ft., for rails; 1 pc. 1 by 3 in. by 10 ft., for three rails for drawers; 2 pcs. 1 by 1½ in. by 12 ft. (or blind-stop) for runs for drawers; 1 pc. 1 by 6 in. by 16 ft., for drawer fronts and backs; 1 pc. 1 by 6 in. by 14 ft., for ends and bottom of tool recess at the back of the bench top.

Maple or birch, clear S4S—1 pc. 2 by 14 in. by 4 ft., and 1 pc. 1½ by 2 in. by 8 ft., for the top.

Beaded ceiling, 30 lin. ft., ⅝ by 4 in., for ends and back.

Quarter round, 1 pc. ½ in., for tool trough and legs.

Plywood, pine or poplar, 3 pcs. ¼ by 18 in by 3 ft., for drawer bottoms.

The thicknesses and widths mentioned are nominal sizes and represent the sizes of the boards before they are dressed at the planing mill. When delivered, 1-in. boards will be a scant ⅞ in. thick, and the width will be about ¼ in. less than that specified.

If the 2 by 3 in. material and the 1½ by 2 in. hardwood or any of the other sizes are not in stock, purchase a shorter piece of greater width, from which the required parts can be ripped without much extra labor.

The hardware and metal fittings should be purchased at the same time as the lumber. Some of these may have to be ordered, and it is well to allow time for shipment. The following will be needed:

Twenty-two No. 14 flat-head bright screws, 3½ in. long, and 8 No. 12, 2¼ in. long.

Sixpenny finishing nails, 1 lb.

Four small iron brackets for fastening bench to floor.

Eight fasteners for fastening top to frame.

Six drawer pulls (wooden ones will do if desired).

Vise, 7-in. jaws, rapid acting, or continuous screw.

Bench stop.

When the lumber has been delivered, the first step is to cut the pieces roughly to the length in which they will be used.

Remember that haste makes waste. It is a wise plan to lay out and label each of the pieces before doing any cutting. This is the cutting list:

Legs, 4 pcs. 3 by 3 by 32 in.
End rails *E*, 4 pcs. 2 by 3 by 18 in.
Back rails and lower front rail, 3 pcs. 2 by 3 by 36 in. Other front rails *F*, 3 pcs. 1 by 3 by 36 in.
Top, *G*, 1 pc. 2 by 14 by 48 in. (probably already cut to size).
End cleats for top, 2 pcs. 1½ by 2 by 20 in.
Back edge piece for top, 1 pc. 1½ by 2 by 48 in.
Bottom for tool trough, 1 pc. 1 by 6 by 48 in.
Drawer fronts *J*, 3 pcs. 1 by 6 by 31 in.
Drawer backs *H*, 3 pcs. 1 by 6 by 30 in.
Drawer ends *K*, 6 pcs. 1 by 6 by 18 in.
Drawer bottoms *L*, 3 pcs. ⅝ by 18 by 36 in.
Runs for drawers *M*, 8 pcs. 1 by 2½ by 16 in.
Guides for drawers *N*, 6 pcs. 1 by 1 by 12½ in.
Ends and back *P*, 18 pcs. ceiling, 20 in. long.

If you can visualize the work so clearly that you know just what each piece of lumber is for, it is not necessary to cut out all the pieces at once; in fact, a workman of experience probably pays little attention to these suggestions and will prepare only the material for the frame. However, it pays a beginner to lay out the pieces in advance as a safeguard against discovering during the course of the work that some boards have been ruined for their purpose by unwise cutting.

In the method of procedure, too, the expert and the amateur do not follow the same steps. One good method to use in making the bench from this point is as follows:

Check up on the legs for squareness. If two adjacent sides can be found that are straight and reasonably square to each other, it is not necessary to do any planing, except possibly to clean the surfaces. If they are not square, it is better to plane them down in order to avoid future trouble.

Mark the two face sides of each leg thus selected and plane the other sides until all are the same size, working from the face corner.

Cut the legs to 31¼ in. in length, if the height of 33 in. has been accepted. A rather short person may like 32 in. better, and in that case the legs will be 30¼ in. The job then will be carried out exactly as shown in the drawing above, except that the distance below the lower rail will be 8¼ in.

It will probably be found that the legs are very nearly 2¾ in. square. If not, it is easier to make allowances in the plans than to reduce the legs to the exact size indicated.

True up the 2 by 3 in. rails on one side and both edges, if necessary, and mark the true face and one edge. Next, if a plow plane is available, run grooves the thickness of the ceiling, as shown in Fig. 13, on one edge of all of them except the lower front rail. Place the groove as in detail No. 1 of Fig. 12. If no plow plane is at hand, strips can be nailed on to receive the ceiling after the joints have been made. Cut the rails to such a length that 1¾ in. is allowed for a tenon

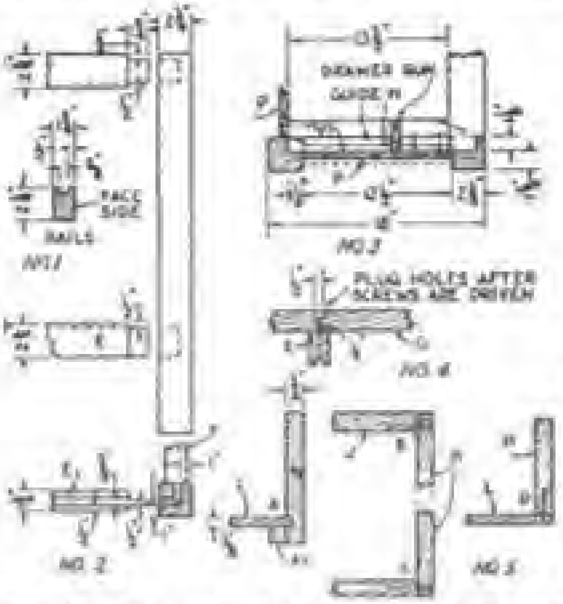


FIG. 12.—Leg and rail joints and a horizontal cross section through one end of the bench that is shown in Figs. 10 and 11, how the top is fastened and details of the drawers.

on each end. Similarly prepare the three light rails for the front.

Lay out the mortises on the legs. Take care to calculate the reduction required on account of the depth of the grooves as shown in Fig. 14. The upper mortise must not come closer than ½ in. from the top of the leg. Use ½-in. mortises, placed as illustrated in detail No. 2 of the above drawing, Fig. 12.

Bore out the mortises with a ½-in. auger bit, making holes as close together as possible and the entire length of the mortise. Then clean out the hole along the sides with a wide chisel, and at the ends with one ½ in. wide. In boring, care must be taken not to cut through the leg. A bit gage is a convenient tool to use for regulating depth. One can be made by boring a hole through a piece of wood of the right length and sliding it onto the bit. Lay out and cut open mortises in each leg to receive the drawer rails and runs as in detail No. 3 of Fig. 12.

Lay out the tenons to fit the mortises, using knife, square, and marking gage. Then cut exactly to the lines with a rip saw for end grain cutting and a crosscut saw for side grain cutting. Some workers prefer to cut a distance from the line with the saw and then chisel to the line.

Now assemble the ends and back without using glue, and nail in pieces ½ by ½ in., or quarter-round molding, on the legs as shown in Fig. 15, to receive the ceiling. These strips can be left off until the entire job is assembled.

Cut the pieces of ceiling to length, allowing not less than ⅛ in. for clearance. Also trim the last piece to correct width so that no delay will occur in the final gluing.

The upper rail on the front is fitted with a dovetail joint as shown in Fig. 16. This is easy to make and adds strength

FIG. 13.—Using a combination plane to plow grooves in the rails. Strips can be nailed on instead of making grooves.

to the bench.

Cut tenons on the ends of the drawer rails to fit the mortises in the legs as shown in detail No. 3 of Fig. 12.

Assemble the ends first, using glue on the tenons but not on the paneling. A good grade of liquid glue is satisfactory. Pull the joints together with bar clamps, if available, and be sure to test the frame for squareness.

It is better to let the ends dry before assembling the whole frame, but if the joints are tight, or if clamps can be kept on the ends, there is no need to wait. Put

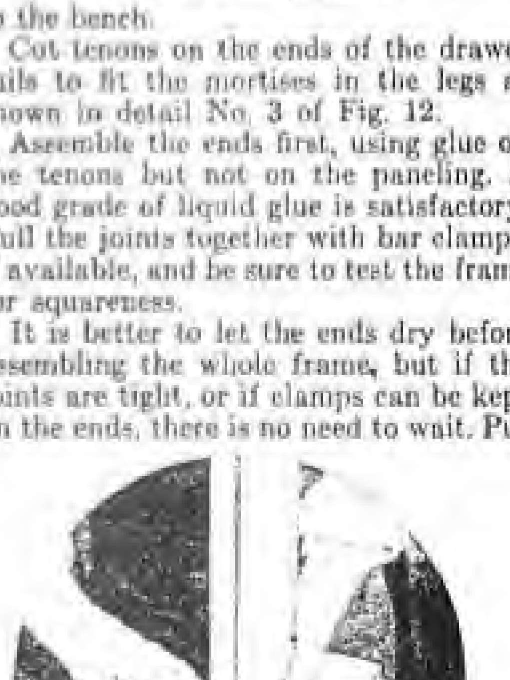


FIG. 14.—Mark the legs by placing the end of each rail in position.

the two back rails in place, insert the paneling as before; then put the front rails in and set the second end in place. Again, if clamps can be used, the joints can be drawn up tighter. Put the top rail on in front after the frame has been put together.

Now make the top as shown in Fig. 11. The end pieces are glued and screwed on with 3½-in. screws. The bottom of the tool trough is fitted into the frame and fastened with screws (or nails) on one edge and the ends, and a piece of quarter-round molding is laid around it to close the joint. A more substantial job would result from making the top piece from narrow strips and running long bolts through from edge to edge, but the treatment shown here is much easier and makes a strong bench top. Attach the vise before the top is fastened.

Fit and nail the 2½-in. drawer runs in place against the end and back ceiling; nail through the ceiling as indicated in detail No. 3 of Fig. 12. Fasten the 1-in. guides between the legs and nail through them into the runs.

Attach the top by driving 2¼ in. No. 12 screws as in detail No. 4 of Fig. 12. In front, run screws up through the upper rail. There should be no tendency for this top to pull loose, so all that needs to be done is to hold it in place.

Fit the bench stop. In doing this, first bore a hole for the main part, insert the bench stop, scribe around it, and chisel to the lines.

The drawers are easy to make, for now you have a bench to work on. Indeed, the making of the drawers can be postponed, if necessary, for more urgent work, but it is strongly advised to make them at once in order to have a storage place for tools and materials. They will also serve as supports for wide material that is held for planing as in Fig. 10.

Fig. 15—Strips are nailed to the legs to correspond to the grooves in the rails.

In making drawers, the grooving for the bottoms, as in detail No. 5 of Fig. 12, is the only problem. If no plane is at hand, it is quite possible to nail on strips all around, as at A^1 to make a seat for the bottom, and thus eliminate the groove. Or, if there is a commercial woodworking establishment in the neighborhood, you can get the work done there.

The joints at the front corners are usually the half butt or rabbeted type as at *B*, while those at the back can be

Fig. 16—The upper front rail is dovetailed into the legs to prevent them from spreading.

plain butt joints as at *C*. The back pieces usually are not grooved, but are cut off in width so that the bottom slides under as at *D*. The bottom is then nailed to the edge of the back. Since plywood does not shrink, many workers now make grooves all around and simply insert the bottom before the drawer is nailed up.

Fasten the bench to the floor with angle braces and put in some hooks on the ends to take care of the bench hook, cutting boards, dusting brush, and other articles that cannot be placed conveniently in the drawers. Also partition the drawers and make definite places for the tools that are to be kept there.

A coat or two of varnish or clear brushing lacquer will help keep the bench clean and prevent glue, stains, and dirt from discoloring it.

HEAVY-DUTY WORKBENCH

Every amateur woodworker and every man who does much household repair or undertakes reasonably large woodworking projects needs a fairly large, rigid workbench. Wherever there is room available—in the basement, garage, or large attic—the bench illustrated in Figs. 17 and 18 will make its appeal to the worker because of its strength, durability, and simplicity of design and construction.

A bill of lumber is the first concern of anyone who wishes to construct this bench. The wood can be obtained at any lumberyard. Hard (yellow) pine can be used throughout with the exception of the leg at the vise and the vise jaw, which should be made of maple or a similar hardwood. The top also will be better if of hardwood, but the construction will be a little more difficult.

For convenience two separate lists are given: first, the lumber order as it may be turned over to the mill or lumberyard; second, a stock bill showing the actual widths and thicknesses of planed lumber as it comes from the mill and the finished sizes to which the material must be cut by the worker himself. The pieces may vary slightly from the dimensions stated, but the variations will not materially affect the finished workbench.

The following order of procedure is suggested:

1. Cut the four legs to the required length. (The length indicated in the drawing, 30 in., is a good, standard height.) Attach the vise-screw nut.
2. Cut the two upper cross rails for the ends to the length given.
3. Cut lower rails.
4. Hold all four legs together with a hand screw or other clamp in such a way that their outer edges are exposed. With pencil and square, draw crosslines to indicate the location of the cross rails. The upper rails act also as backs for the tool compartments.
5. Now nail up the two ends for the bench, using glue in the joints for added rigidity, and not less than three eight-penny box nails or common nails in each joint. Check for squareness with a steel square.
6. Glue and nail the piece of $1^{3}/_{8}$-in. maple on the face of the vise leg as shown in the drawing. This should not be cut to length at this time, but should be trimmed even with the surface of the top after the top is applied.
7. Cut the two aprons to the proper length (first checking the length of the pieces for the top). Cut away from one of them the part displaced by the piece of maple facing on the front leg previously mentioned; then glue and nail them in place. Use the square fre- [illegible]
8. Take the actual measurement for the stretcher or shelf that runs between the two lower cross rails. If desired, this can be made to overlap a little at each end for effect. This wide stretcher will serve as a shelf for tools and materials.
9. Cut out the place for the drawer on the front apron. This is best done by boring holes in two diagonal corners of the rectangle to be taken out and starting the cuts with a compass or keyhole saw.
10. Fit one of the 9-in. boards at each

side of this opening, making them also support the top at these points. Before fastening these boards, nail on them the slats which form supports for the drawer.

11. Fit the shelves in the ends, nailing them to the under edge of the cross rails or against these rails as may be determined by the width of the boards and the distance the aprons extend.

12. Joint (plane the edges) and glue up the two planks for the top. Use four ½-in. dowels for the joint. Care must be taken to mark accurately for the dowels; use a marking gage, knife, and square.

13. Trim the top to the length of the aprons and fasten it with 2½-in. No. 12 flathead screws. First bore a ½-inch hole

FIG. 17.—A man-size bench of the carpenter's type for the amateur mechanic who does much woodworking and repairing.

½ in. deep to receive each screw; then drill a hole right through into which the screw thread will slip easily. Hold the top in place, drill $\frac{3}{16}$-in. holes into the rails, drive the screws, and glue plugs into the ½-in. holes.

14. Cut the board for the bottom of the tool trough for length and also for width, if necessary. Nail this in place and nail on the strip along its outer edge.

15. Form the vise jaw to required shape, making it about 7 in. at the top and 4½ in. at the bottom. Plane a bevel on the outer edges of this, but do not attempt to finish the top end of it until after the vise screw and the follower have been fitted.

16. Clamp the vise jaw in place with the upper end protruding slightly above the top. Locate center of vise screw to coincide with the flanged nut center; bore a hole to allow screw to pass freely, and fasten collar.

17. Now tighten up the vise and bore a series of holes through both jaw and leg in one operation for the follower or "lock strip." These holes should form a slot nearly the full size of the cross section of the follower, that is, $\frac{13}{16}$ by 3 in. Then chisel out for a tight fit in the jaw and a sliding fit in the leg.

18. Bore a series of holes ½ in. in diameter through the follower in a zigzag pattern about 1 in. apart, as shown.

19. Glue and dowel the follower into the vise jaw, being particular that it is put in square with the jaw.

20. Tighten up the vise, plane off the end of the jaw, and run a bevel on the front side of it.

21. Make the drawer as required by the size of the opening.

22. Cut out a slot in the apron so that the drawer may be opened without using handles.

23. Bore ¾-in. holes in the apron and perhaps one or two in the rear leg where pegs may be placed to support wide boards on edge for planing.

24. Fit an iron bench stop, placing it about 3 in. from the front edge of the bench top and not nearer than 6 in. from the left end.

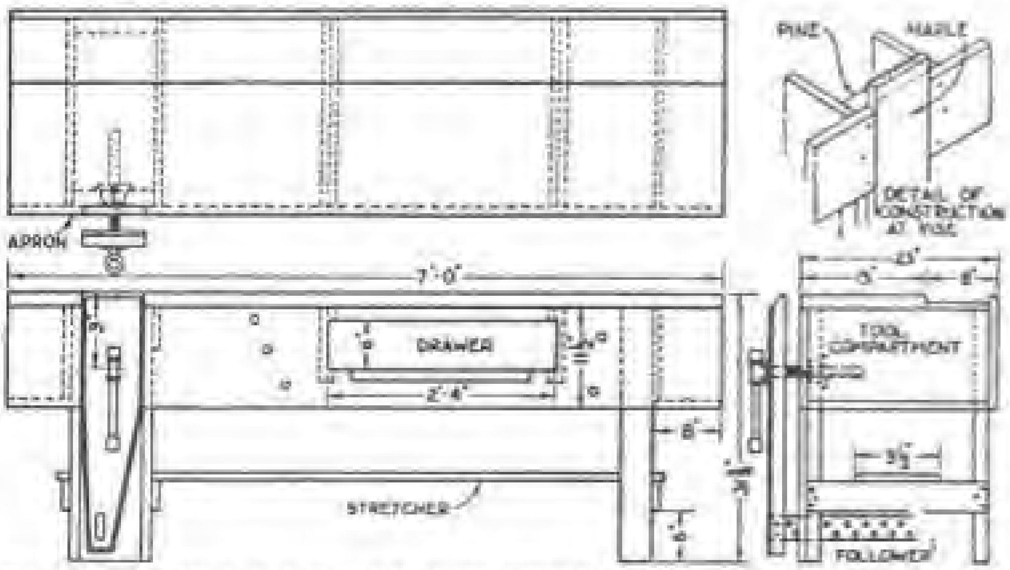


FIG. 18.—Top, front, and end view of the heavy-duty workbench, and a detail of the stationary jaw of the carpenter's vise.

BENCH SAW TABLE

The saw table support illustrated in Figs. 19-21 is designed to overcome some of the ills attendant upon the operation of a bench saw driven by a separate motor. Where such an outfit—now to be found in many home workshops—is mounted on a heavy plank or the like, it is difficult to move the assembly about the shop, to prevent the belt from slipping, and, if the table has the tilting feature, to place the saw so that long stock will clear the bench when cutting angles.

A satisfactory home workshop saw rig requires some means of tightening the belt quickly and effectively without having to loosen the bolts holding either motor or saw frame; a mounting that is absolutely solid and permanently rigid, especially that part which supports the motor (for a firm base will eliminate injurious vibration and add years to its life); and an arrangement of parts that is economical of space.

Any man who owns a bench outfit driven by a separate motor will find a notable improvement in the capacity of his saw if he will take the time to construct a mount after the design shown. The entire cost of the original table,

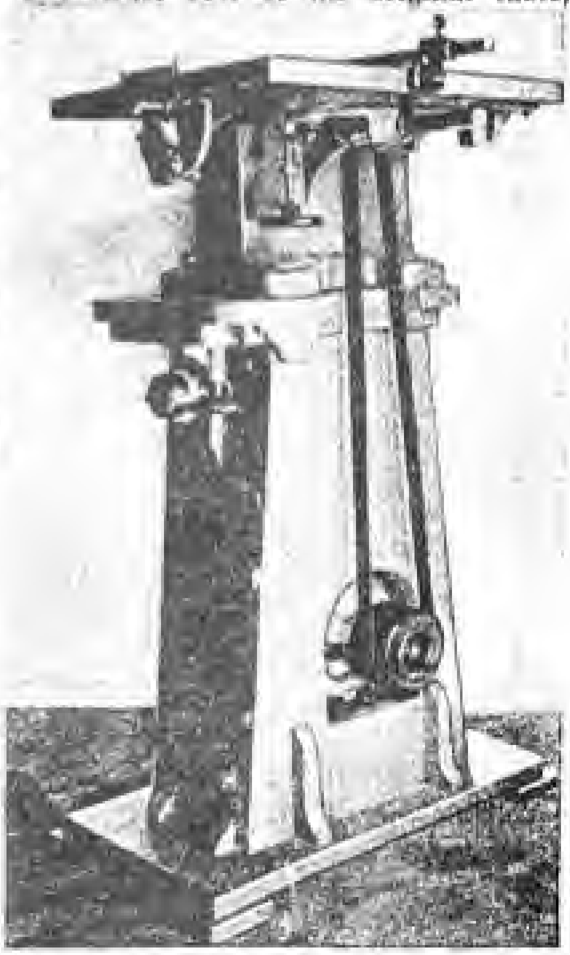


FIG. 19.—The right side and front of the bench saw table. Note the compactness and neatness of construction.

including a high-grade brushing lacquer finish, was found to be slightly less than three dollars.

The motor is fixed permanently on a

MATERIALS FOR HEAVY-DUTY BENCH

What Lumber to Order

Part	No. Pcs.	T.	W.	L.
Top (pine or maple)	1	2	8	14 ft.
Bottom for trough and lower cross rails	1	1	8	16 ft.
Aprons	1	1	12	14 ft.
Shelves, upper cross rails, and stretcher	1	1	12	18 ft.
Drawer	1	1	6	8 ft.
Legs	1	2	4	8 ft.
Legs	1	2	10	6 ft.
Vise jaw (maple)	1	2	8	2 ft. 6 in.
Follower (maple)	1	1	4	2 ft. 6 in.
Back for vise (maple)	1	1	8	2 ft. 8 in.
Strip for tool trough	1	1	1¼	12 ft.
Drawer bottom (3-ply)	1	¼	24	24
Dowels (birch)	1	½ dia.		18 in.

All dimensions are in inches (and all material is hard pine, dressed four sides) except as noted. This lumber, because of the waste in planing, will be less in thickness and width than stated here; 1-in. boards D4S are about 13/16 in. thick, for example.

Hardware

1 lb. eightpenny box nails.
½ lb. sixpenny box nails.
1 screw for vise.
1 bench stop.
1 small machinist's vise (if desired).
1 doz. 2½-in. No. 12 flathead bright screws.

Sizes of Finished Pieces

Part	No. Pcs.	T.	W.	L.
Top	2	1¾	7½	7 ft.
Top	1	13/16	11½	7 ft.
Top	1	13/16	1½	7 ft.
Aprons	2	13/16	11½	7 ft.
Upper cross rails (end rails)	2	13/16	10⅝	21⅝
Upper cross rail	1	13/16	5	21⅝
Lower cross rails (cut from 1 by 8 in. board)	3	13/16	3⅝	21⅝
Drawer rails	2	13/16	2	21⅝
Shelves	2	13/16	8	21⅝
Stretcher (cut after bench is nailed up)	1	13/16	9½	6 ft.
Legs	2	1¾	3⅝	2 ft. 6 in.
Legs for vise end (pine)	2	1¾	9½	2 ft. 6 in.
Backing for vise (maple)	1	13/16	7½	2 ft. 8 in.
Vise jaw (maple; cut top end after fitting vise screw)	1	1¾	7½	2 ft. 5 in.
Follower for vise (maple)	1	13/16	3	2 ft.
Drawer front (pine)	1	13/16	8	2 ft. 4 in.
Drawer sides	2	13/16	6	20
Drawer back	1	13/16	5½	20½
Slats to support drawer	4	13/16	1½	20 in.
Drawer bottom (cut as needed from 3-ply).				

All dimensions are in inches except as noted.

solid, immovable support yet may be removed when desired. The floor space occupied is but 16 by 20 in. The sawdust is delivered through a chute to the back of the machine, where it may be caught in a bag. The outfit is easily moved, as it rests on sliding casters; and, owing to the distribution of the weight, it will not tip either way. Disagreeable vibration is eliminated. Lastly and most important of all, the belt tension is always adjustable, even when the machine is running, by the action of a conveniently located handwheel.

The drawings should be sufficient for any handy man to work from. If any one feature of the construction requires further comment, it is the care necessary in fitting the separate parts. Only simple butt joinery is called for, but unless the surface fits true and tight the strength of the glue is largely lost and the joints are likely to loosen after a time—a possibility to be guarded against when solidity is the main virtue.

A liberal application of glue should be used on all joining surfaces save the 6 by 6 in. piece marked *A* and also the one marked *B* in Fig. 21; these are fastened with screws only as provision must be made for removing the shelf. When in position the support is held rigidly by screws. Flathead 1¾-in. screws are used, the heads being countersunk flush.

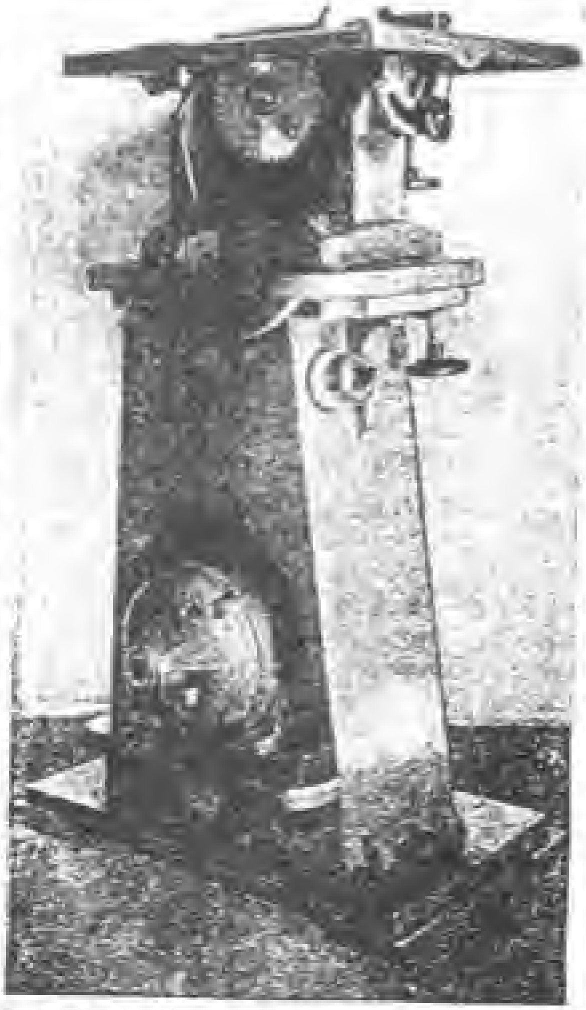


FIG. 20—Another view of the saw table, looking at the left side and front.

The dust chute must be a close fit, secured with glue and screws at a sufficient slant to facilitate the escape of the sawdust and chips from the dado head, if one is used. The dust opening in the platform shown in the drawings should be located to suit the saw and should be smaller than the opening in the fixed portion below, so that a piece of heavy tin neatly tacked in the upper opening will conduct the dust into the chute without allowing it to get between the hinged pieces when the platform is raised.

Attention is called to the center support under the motor shelf, which extends clear through; it should be a good fit and well glued. This thwarts any tendency to spring under the motor's weight and prevents lateral vibration.

Before fastening the sides of the column, it is well to level a place on the floor both ways with the spirit level, place the mount upon it, and level the motor base true with the top which is to support the platform, planing out any discrepancy.

In one of the drawings at the top of Fig. 21—the one showing the handwheel—the dotted line is the apron on the opposite side of the platform. This longer apron is represented in position in the sketch which shows the top raised. These aprons, which fit fairly tight over the fixed piece of the hinged part, are to prevent any side sway when the platform is raised.

Two fairly heavy friction hinges are used. These must be let into both pieces with some care so that when dropped flat the table will be level both ways. Ordinary butt hinges might be used if very carefully fitted, but they will not as effectively overcome the slight vibration resulting from the high-speed operation of the saw.

If the table has the tilting feature, care should be taken not to get the platform so wide as to interfere with the stock when tilted to a full 45 degrees. The dimensions given are arbitrary and should be adapted to the saw table used.

The action of the handwheel is to raise and lower the saw and the upper half of the platform to which it is bolted, thus tightening or slackening the belt at will. In this case the wheel and screw are made of wood, threaded in a ¾-in. screw box. The spindle carrying the thread was turned from a piece of maple with a ½ by ⅝ in. round dowel or tenon left on the end as shown. The wheel was turned and drilled separately, driven on the tenon in glue, and keyed as shown with a 3/16-in. dowel rod. A similar thread was tapped through the fixed section of the platform, after a piece of ⅜-in. maple had been let into the platform to receive the tapped hole. The

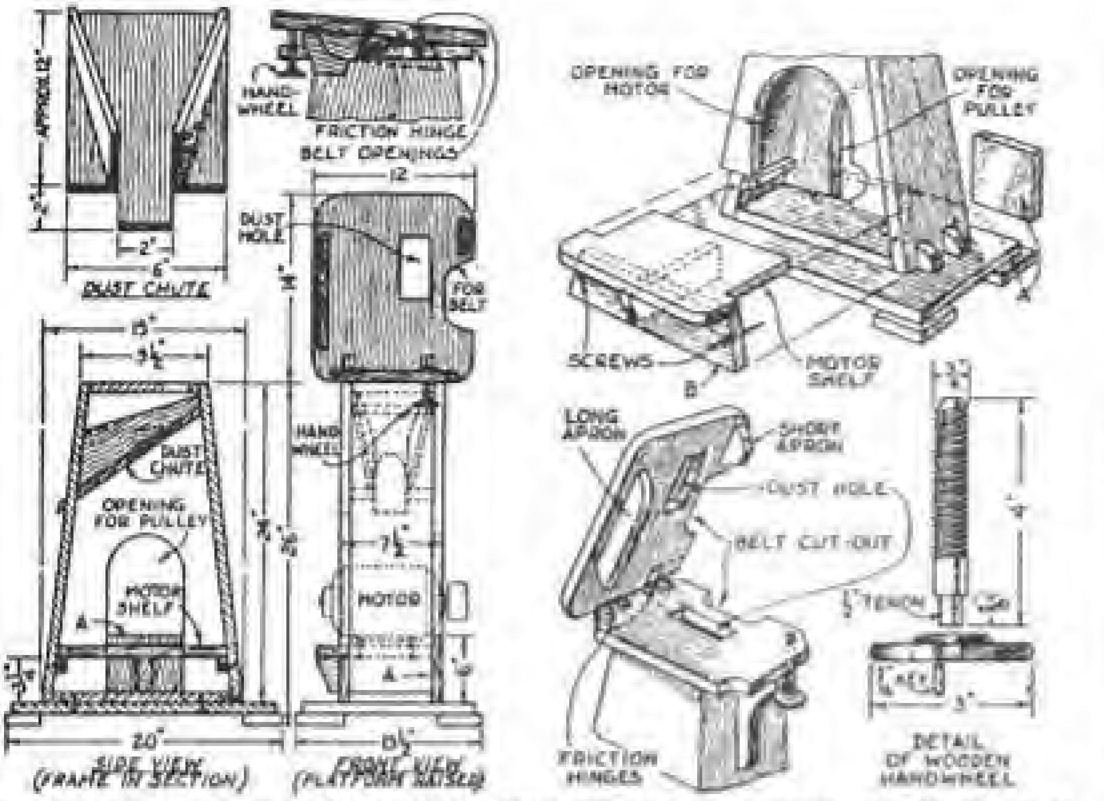


FIG. 21.—Detailed drawings of the bench saw table; how the motor support or shelf is built as a removable unit; and the belt-tightening device.

thread will last indefinitely if greased occasionally.

If the worker does not have a screw box and does not care to invest the very nominal sum required for a good one, it is possible to accomplish the same action with an iron handwheel and nut, the nut being let into the wood and the end of the threaded part bearing against a piece of metal fastened to the lower side of the platform.

With the exception of pine and the other very soft woods, which will not do at all, the selection among the hard and near-hard woods is a matter of choice. Sound gumwood is a good wood because it presents a better than average surface to the glue, holds the screws well, and, when thoroughly sandpapered and given two coats of brushing lacquer over a suitable primer, it presents the nearest appearance to metal that may be had. Two 1 by 12 in. by 12 ft. gum boards, or an equivalent amount, will be ample.

HEAVY-DUTY BENCH SAW TABLE

Some woodworkers may wish a larger and heavier table and one on which other machines than a saw can be mounted when necessary. Such a table is illustrated in Figs. 22-24. Being very easily moved, the table allows a bench saw to be set up in the middle of a small shop to get room for handling long boards, yet the entire floor space of the shop can be cleared when necessary for assembling such work as a screen door, a kiddie coop, or a garden seat.

The table is nothing more nor less than an adaptation, in simple but highly efficient form, of the cam arrangement commonly employed to lift movable typewriter stands and the like. Pushing down the four cam levers lifts the table

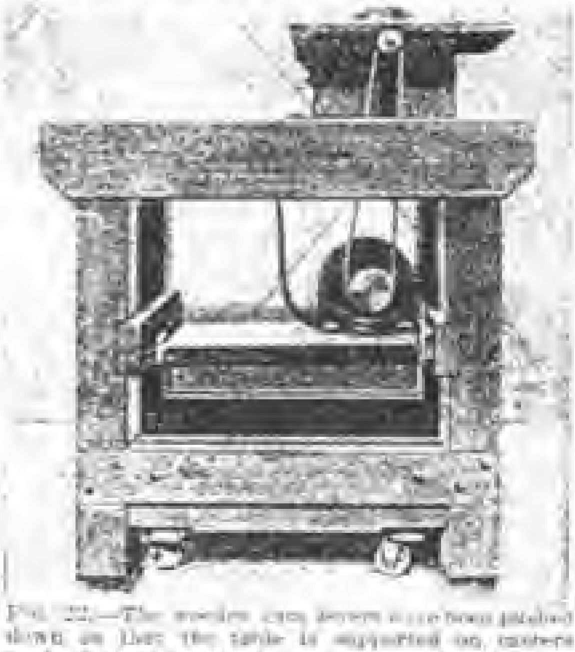


FIG. 22.—The wooden cam levers have been pushed down so that the table is supported on casters ready for moving to the most convenient location for the job in hand. This is of especial advantage to a small shop where every foot of floor space is in use.

onto ball bearing casters, and it can be easily rolled where you wish. When the levers are lifted, the table drops down solidly on its legs—so solidly that it would carry a 4-H.P. outfit, instead of the ¼-H.P. saw it now has.

Obviously, the table would serve as well for mounting a lathe, or any other bench machine, or a combination of machines.

The bill of material lists so-called four by fours for the legs. Actually these are 3½ by 3½ in. nowadays. Legs 3 in. square would be heavy enough, but if you want them, the only way to get them is to buy four by fours and then pay as much more to have them sawed and planed down to 3 in. So with all the material listed; the bill names the common designations, and the drawing shows the actual thickness you will probably get.

The total cost of all the lumber in this bench, which is built of good hard yellow pine, was $1.68; the entire cost

FIG. 23.—The cams are up, and the table is resting on its legs, ready for work as soon as the plug is inserted in an outlet.

amounted to $8.41, including rather expensive brushing lacquer finish.

Pine, either yellow or white, and Douglas fir are satisfactory woods for such a job. Hardwood for the top, maple, birch or oak, is splendid if you wish to go to the extra expense. For a less expensive finish than lacquer, use a good floor paint or varnish.

The top dimensions, 24 by 32 in., were selected because they fit in an out-of-the-way corner of the shop, between a door and a window. They give extra room to mount a small bench band saw on one back corner of the table, and a bench jointer on the other corner, the machines being driven from a countershaft fixed to underside of table.

One point to watch for trouble is the height of the casters. It would be a good idea to get them and screw them to the caster bedplates (pieces of two by four with a tenon 1 in. wide and ¾ in. deep formed on each end). Then measure the actual height and notch the legs to bring the cam rails ⅛ in. higher than this.

Another variable detail is the height of the middle stringers that support the motor shelf. Bench saw outfits usually include an endless belt, and if you want to use the one that comes with your outfit, check up on the center-to-center distance. If you use a laced belt, of course, it can be made to suit the shelf location shown.

Belt slip is a most exasperating trouble with small bench machines. This can be largely overcome by the method of adjustment shown in the front elevation, Fig. 24. The middle screw hole in one leaf of a strap hinge is elongated with a small round file until it will admit a hack saw blade. It is then easy to saw the ⅜ in. wide slot down to the end screw hole, and smooth it up with a file. If the butt hinges on the other end of shelf are of the loose pin type used on doors, removing the two adjuster bolts and pulling these pins will permit the motor and shelf to be taken out.

It is possible to screw the motor and saw temporarily on a heavy plank while making all the saw cuts in building the table. That was done by the amateur mechanic who designed the table and was a striking demonstration of what heavy work a ¼-H.P. outfit will do.

Iron screw clamps are invaluable to hold the parts rigidly together while boring. Use the steel square to check all corners before you bore. Assemble the sides first, with cam rails and aprons; then join the side assemblies with the top and middle stringers across the ends. The motor shelf is next fitted in, and then the top screwed on.

The shape of the cams is very important. On a piece of stiff, smooth cardboard lay out radii spaced at 30 degrees, and from the center lay off the measurements given. This will give you a series of points through which a smooth curve can be drawn. Cut out the cardboard and use it for a pattern. Note particularly that the lowest point of the cam, when the lever is pushed down to the stop (which is simply a stout wire nail put through the cam rails), comes ¼ in. beyond the vertical center line. This makes the cam entirely self-locking.

As shown, the cam consists of a center section with two cheek pieces glued on, the grain crossing at right angles. The purpose in this construction was to guard against splitting. It would be less work and probably safe enough to cut them all in one piece out of oak or other hardwood 1⅞ in. thick, if you can get it. They should be cut on a band saw, and the face smoothed on a sanding disk. It is imperative that the hole should be exactly where indicated and absolutely square in relation to the sides. That means boring in a drill press. It is safest to put through a pilot hole first, on the exact center, with a small drill (say $\frac{3}{32}$ in.) at very high speed. The larger bit will follow this pilot.

It is also important to get the bolt holes through the cam rails accurately located and square. Cams and rails should be painted and dry before assembly. Grease the cam bolt, also the working face of the cam. Then grease the bedplate tenons and their grooves, tilt up one side of the table, and slip the bedplate in place. Do the same on the other side.

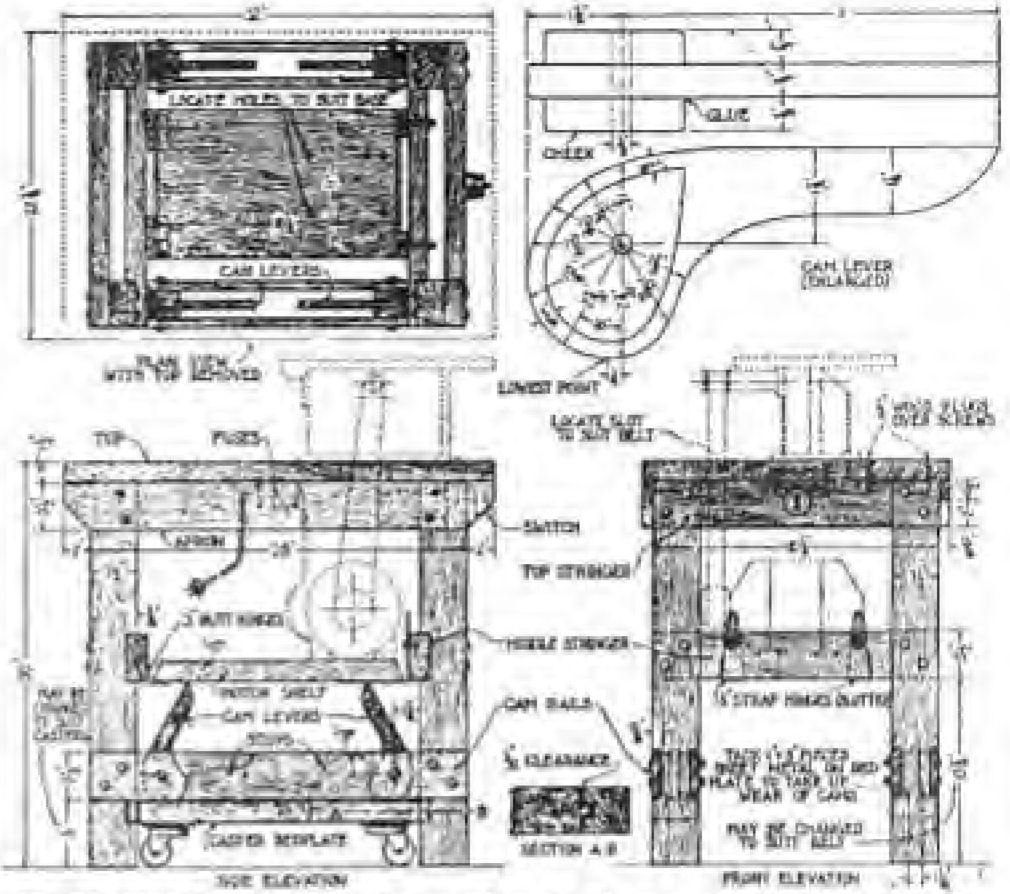


Fig. 24.—Working drawings of the movable saw table. Compare with Figs. 22 and 23. The cam arrangement is amply strong, and provision is made for tightening the belt—an important point on small power saws.

Incidentally, do not forget the ⅛-in. clearance between the bedplate and rails or omit the sheet metal wearing strips.

The electrical work is very simple. Motor wires are run to a porcelain fuse cut-out block screwed to the underside of table, one wire passing through a tumbler switch mounted on the front of bench. The 10-ft. extension cord connects to the fuse block.

The framework is finished in gray and the top, including aprons, in buff. It is well to finish the top of any worktable (if not to be used for very dirty work) in a light color. There is less strain on the eyes, and small objects are more easily seen.

MATERIALS FOR SAW TABLE

Lumber—1 pc. 2 by 4 in. by 12 ft.; 1 pc. 4 by 4 in. by 10 ft.; 1 pc. 2 by 8 in. by 8 ft.; 1 pc. 1 by 4 in. by 16 ft.; 1 pc. 2 by 12 in. by 2 ft.; 1 pc. 4 by ⅝ in. net by 4 ft. (must be hardwood).

Hardware—16 $\frac{5}{16}$-by-4-in. carriage bolts; 8 $\frac{5}{16}$-by-5-in. carriage bolts; 4 ⅜-by-4-in. carriage bolts; 2 ⅜-by-2-in. machine bolts; 12 2½-in. No. 14 flathead screws; 8 1½-in. No. 12 flathead screws; 1 pair 3-in. loose pin butt hinges; 1 pair 5-in. strap hinges; 1 set (4) ball-bearing truck casters, 2½-in. wheels.

Electrical—1 porcelain fuse cut-out block, 2 10-amp. fuses, 1 porcelain base tumbler switch, 5 ft. No. 12 wire. Extension cord and plug, if not included with motor.

Finish—¼ pt. buff and ½ pt. gray brushing lacquer or floor varnish.

BENCH LATHE TABLE

The usual method of driving small lathes seems to involve the use of an overhead countershaft, and this was not desired. As the outfit shown in Figs. 25-28 was intended to be used in a city apartment, compactness and neat appearance were essential; it had to be quiet in operation and all possible parts inclosed. There was also required storage space for lathe attachments, hand tools and miscellaneous small supplies.

The dimensions indicated are suitable for a bench lathe taking work 12 in. long between centers, and driven by a one-quarter-horsepower motor of average size. Needless to say, these dimensions must be checked for other installations.

The table top is of sufficient size to accommodate also a grinding head and a small drill press, which are mounted so as to be easily portable. These are not shown in the photographs.

Any suitable hardwood may be used for the construction. Oak is possibly the best. Yellow pine costs less and will be found somewhat easier to work; it is entirely suitable. Be sure to get well-seasoned lumber. The panels, doors and divisions in the locker space, and the

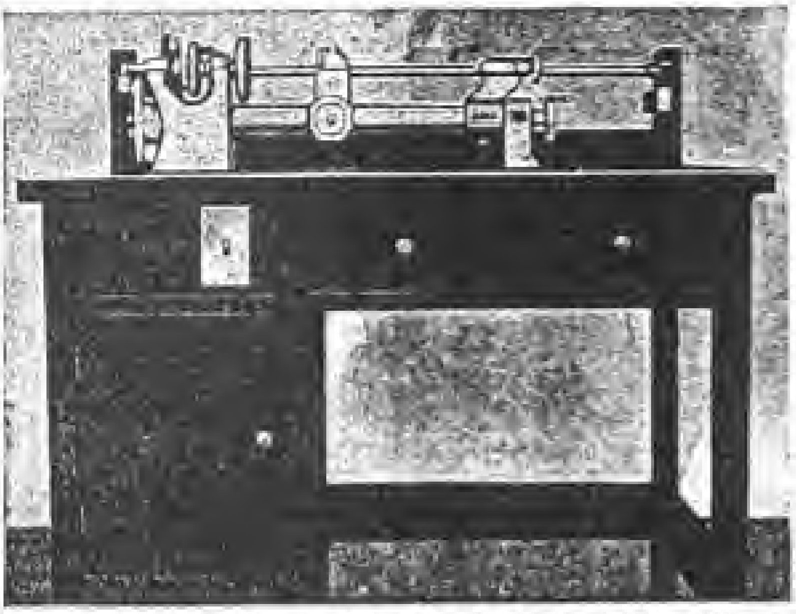


FIG. 25.—The compactness and neatness of this bench lathe table are achieved by eliminating the usual overhead countershaft. There is room at the right end for a small drill or grinder.

FIG. 26.—End view of the completed table. The motor, shaft bearings, and lathe rest on 1/8-in. thick rubber to reduce vibration to the minimum.

drawers (except the fronts) may be of soft wood, such as white pine. The drawer bottoms are of plywood, ¼ in. thick.

The finish of the table is a matter of taste. The writer stained his with walnut oil stain and applied three coats of varnish. The interior parts were given three coats of shellac.

If the dimensions shown do not meet your requirements, it will be necessary to prepare a dimensioned drawing. Then you may order the material from the mill, finished four sides. Many of the pieces may be combined and ordered in long lengths. Be sure to allow for tenons and squaring up. The top, which is 1¼ in. thick, is shown in two pieces with a spline in the joint.

All the principal joints are mortised and tenoned, and fastened with No. 12 wood screws, 1¾ in. long. The screw holes are counterbored to receive the heads of the screws and filled with wood plugs. These joints are easier to make and stronger than concealed fastenings, and in an article of this nature it is immaterial whether or not the plugs show. On a painted job, of course, the plugs would not be seen.

Because the left end of the bench is shown so clearly in Fig. 26, a sectional view through the locker and motor compartment (Fig. 28) is used in the drawings instead of a left-hand elevation. The left end is similar to the right except that the upper rail is 1¼ by 3½ by 18½ in. and there is a dividing piece 1 by 1½ by 18½ in. (1½ in. allowed for tenons) between the upper and lower rail. At the left of this piece is a door ½ by 8 by 17 in., and at the right is a solid panel. There is another door, 11 by 14½ in., at the rear of the motor compartment. The right-hand end of the compartment is paneled. The rails may be laid out first and the tenons cut. Be sure all joints are square and each piece is of correct length. Then square up the legs and lay off and cut the mortises. Fit the tenons to their respective mortises and mark each for identification. Locate the fastenings and bore ½-in. holes about ½ in. deep and then bore for the screws.

After this part of the work is finished, it will be well to sandpaper all pieces. Assemble the two ends first, using a good glue in all the joints. Draw up with the screws and then wipe off the excess glue with a wet rag. The front and back rails come next; then the motor compartment and foundation. After the fastenings are all set up, the holes may be plugged with ½-in. wood bungs.

Now fit the hangers for the intermediate shaft bearings and bore for the bearing bolts. Locate the motor and bore holes for the bolts.

Put in the panels and finish up the locker. Then fit a block for the fuse base. Make the drawers and fit the drawer slides. The doors may be fitted and the hinges located, but do not hang them until after finishing.

Locate the receptacle and switch and fit them in place, also the fuse base and an outlet for the motor and another for the light. The scheme of wiring is shown in one of the drawings. Notice that the switch controls the motor only. Use heavy stranded copper wire well insulated, and solder and tape all joints. The fuses are of ten amperes.

Now you are ready to fit the top, and if this is in one piece, so much the better. Countersink for the screws and drill the holes at a slight angle so as to draw the joints tight when the screws are driven up. Use No. 12 screws 2½ in. long for the top. After planing and sanding the top smooth, fit the hangers for the countershaft bearings.

You can now set the lathe in place and bore holes for fastening it. Locate and cut holes in the top for the belt to pass through. Fasten ¼ in. thick rubber on the bottom end of each bench leg, and put ⅛ in. thick rubber under the motor, all bearings and the lathe. Sandpaper smooth and finish as desired; then hang the doors, put on the drawer pulls, and the plates for the receptacle and switch.

The bearings, four in number, are of the conventional pillow block type. In this instance they were made of Babbitt metal. The shafts are of steel, ⅝ in. in diameter.

The speed of the motor is 1,750 R.P.M. It is fitted with a grooved 2¼-in. pulley. Two pulleys 5 in. in diameter and one

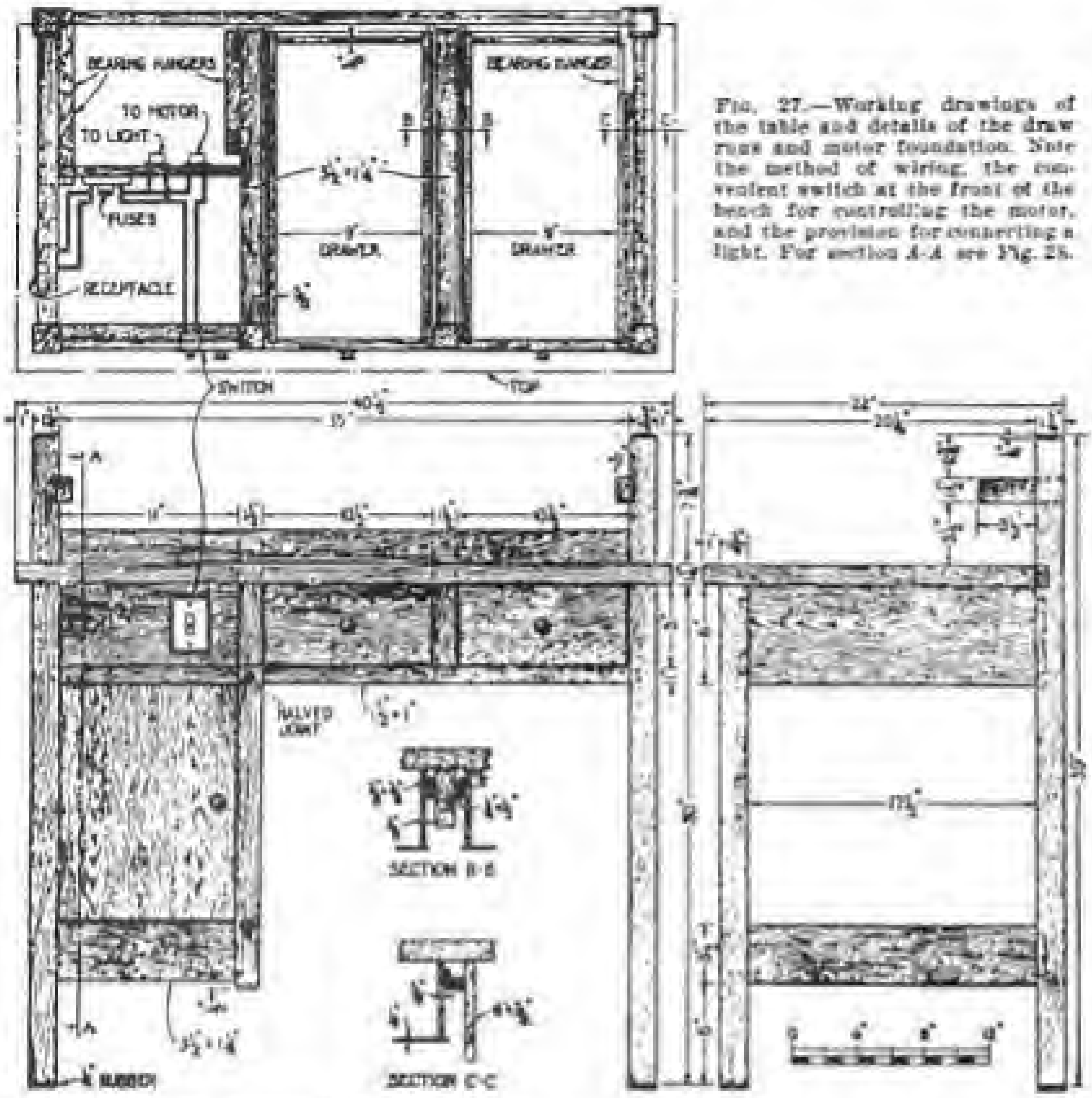


Fig. 27.—Working drawings of the table and details of the draw runs and motor foundation. Note the method of wiring, the convenient switch at the front of the bench for controlling the motor, and the provision for connecting a light. For section A-A see Fig. 28.

2 in. in diameter, grooved for a round belt and bored for a ⅝-in. shaft, were bought and arranged as shown. The countershaft speed is 315 R.P.M. A cone pulley having the same diameters as the lathe cone was fitted

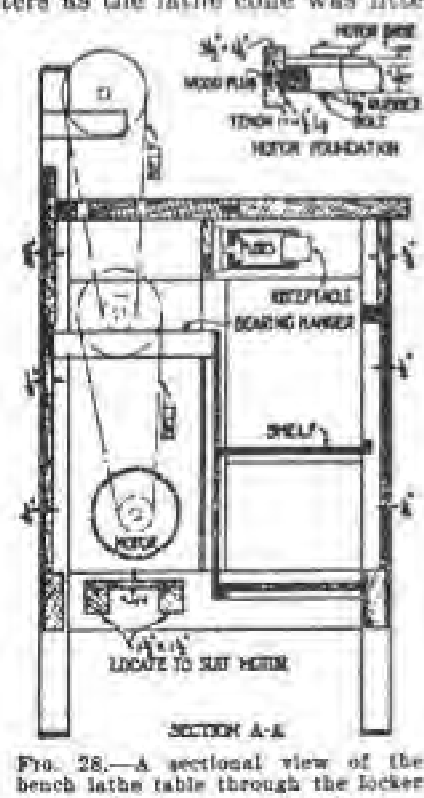


Fig. 28.—A sectional view of the bench lathe table through the locker and motor compartments.

on the countershaft; this arrangement gives the lathe spindle speeds of 160, 315, and 570 R.P.M. without using the black gears. The flexibility and convenience of this arrangement makes model making a pleasure.

TOOL CABINET, BENCH HOOK, AND DOWELING JIG

As the home worker adds to his collection of tools, the problem of keeping them in order and at the same time instantly available for use becomes more pressing. To leave them scattered about the bench is hard on the tools and harder on the temper; yet if they are put away in a box or even in drawers, they are not so accessible. The happy solution is a wall tool cabinet of ample size, and this the home worker can build for himself with little difficulty and with small expense.

The cabinet illustrated in Figs. 29-31 is especially roomy. It will hold a set of at least 50 tools so that any one can be selected without hunting for it. It will, therefore, take care of the equipment of hand tools found in the average home workshop.

The main compartment is 6 by 24 in. by 2 ft. 6 in.; the door compartments are 5 by 12 in. by 2 ft. 6 in. Chestnut or oak is excellent wood for the cabinet, but the builder can use almost any other well-seasoned wood available.

The type of joint illustrated in Fig. 31 is strong and workmanlike; but simpler joints can be used, such as a plain rabbeted joint, or even a butt joint. The corners are greatly strengthened by the use of angles bent up from sheet brass.

Commercial tool clips can be used for supporting the tools, or metal clips may be made, or wooden racks provided in the way shown in the foregoing drawing.

The materials for the tool cabinet are given in the following list. The first number identifies the part as shown in Figs. 30 and 31.

1. Back center, plywood or solid, ⅜ by 24 by 30 in., 1 required.
2. Backs for doors, plywood or solid, ⅜ by 12 by 30 in., 2 required.
3. Ends of cabinet center, ¾ by 5⅝ by 30 in., 2 required.
4. Ends of doors, ¾ by 4⅝ by 30 in., 4 required.
5. Top and bottom center, tongued, ¾ by 5⅝ by 23¼ in., 2 required.
6. Top and bottom doors, tongued, ¾ by 4⅝ by 11½ in., 4 required.
7. Center shelf, ⅝ by 5⅝ by 23 in., 1 required.
8. Door shelves, ⅝ by 4⅝ by 11 in., 2 required.
9. Center drawer front, ⅝ by 3¾ by 22¼ in., 1 required.
10. Drawer fronts for doors, ⅝ by 3¾ by 10¼ in., 2 required.
11. Drawer sides, center, ½ by 3¾ by 5¼ in., 2 required.
12. Drawer back, center, ½ by 3⅛ by 21¾ in., 1 required.
13. Drawer bottom, center, ¼ by 5⅛ by 21¾ in., 1 required.
14. Drawer guides, center, ⅛ by ½ by 5⅛ in., 2 required.
15. Tray sides, ¼ by 1½ by 16½ in., 2 required.
16. Tray ends and divisions, ¼ by 1½ by 4 in., 6 required.
17. Tray bottom, ¼ by 4½ by 16½ in., 1 required.
18. Drawer sides for doors, ½ by 3¾ by 3¼ in., 4 required.
19. Drawer backs for doors, ½ by 3⅛ by 9¾ in., 2 required.
20. Drawer bottoms for doors, ¼ by 3 by 9¾ in., 2 required.
21. Racks for bits, etc., 1⅜ by 2 by 10½ in., 2 required.
22. Rack for chisels, etc., 1⅜ by 1¼ by 22 in., 1 required.
23. Brass hinges, 3 in. long, 6 required.
24. Brass corners for doors, ¹⁄₁₆ by 3½ by 5 in. long, 8 required.
25. Brass corners for centers ¹⁄₁₆ by 3½ by 6 in., 4 required.
26. Brass screw eye and hook, or elbow catch, 2 in., 1 required.
27. Lock, cupboard, 1½ in. to pin, 1 required.
28. Escutcheons, 2 by 1½ in., 1 required.
29. Hooks and clips for tools, as necessary.

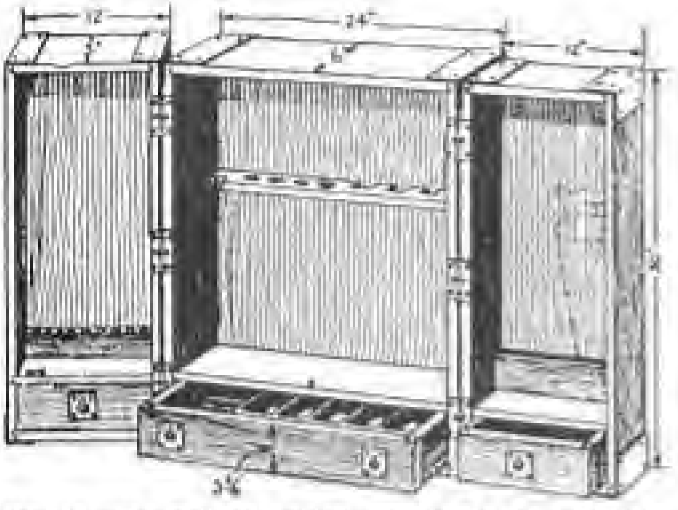


FIG. 29.—The wall tool cabinet open to show the construction. In the large drawer is a removable sliding tray for small tools or screws.

30. Drawer guides (wood), ⅛ by ½ by 3¾ in., 4 required.
31. Tray slides (wood), ½ by ½ by 21½ in., 2 required.
32. Flush ring pulls, 1⅜ by 1⅝ in., 4 required.

Another piece of shop equipment which is well worth making is the combination bench hook, miter block, and plain, miter, and the long-miter shooting board shown in Figs. 32 and 33. This ingenious fixture could well supplement the ordinary bench hook on every home workshop bench. The base, marked No. 1, has fastened to it a top piece, marked No. 2, by means of two hinges let in flush. This top piece carries the usual bench hook headblock, marked No. 3, but the block, instead of being plain, has two miter cuts, which should be most carefully made to insure accuracy and squareness.

A removable miter block (No. 5), triangular in shape, which is cut from a piece 1¾ by 5 by 10 in. in such a way that the grain runs parallel to the long edge, can be fastened to the bench hook when necessary by means of dowels. The dowels are glued in the miter block and fit snugly into holes in the top piece of the bench hook proper. This attachment is for planing the ends of miter cuts such as in making picture frames or preparing moldings to be mitered around cabinet work, as in the sketch in the upper right-hand corner.

There is still another use for the fixture. That is when long miters have to be planed, as sometimes in cabinet work involving long mitered joints. The whole upper part of the bench hook is swung up on the hinges and supported at 45 degrees by means of two triangular braces (No. 7). These blocks have tongues that slip into grooves, as shown. The edges of the stock can then be trued up most accurately by "shooting" them with a fine-set plane.

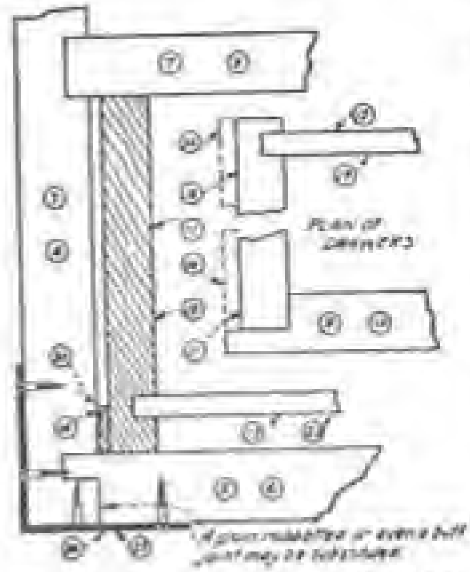
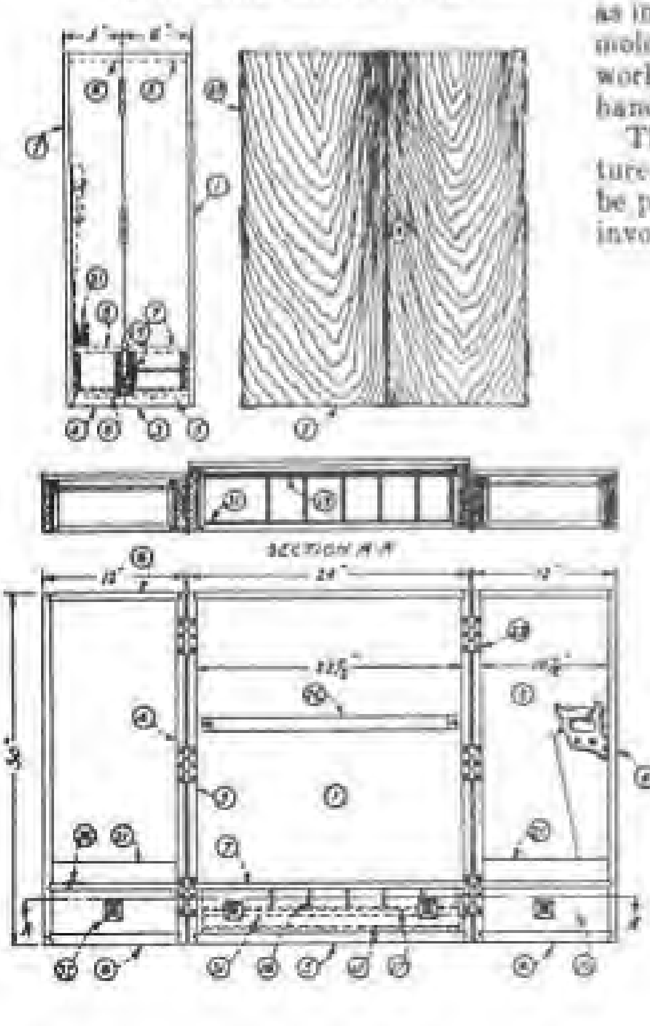


FIG. 31.—How the various parts of the cabinet are fastened together.

FIG. 30.—Dimensioned drawings of the hanging tool cabinet. The numbers refer to the parts listed in the text.



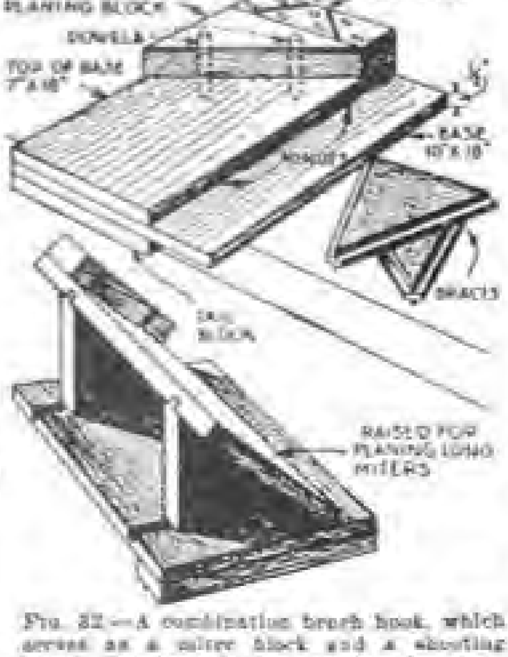


FIG. 32.—A combination bench hook, which serves as a miter block and a shooting board. See Fig. 33 for working drawings.

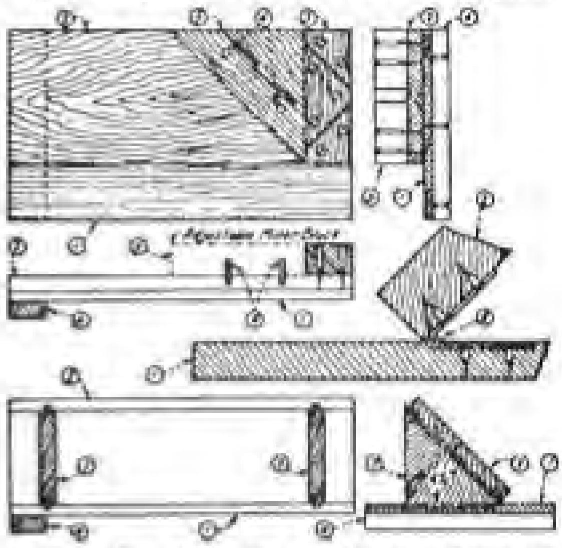


FIG. 33.—Details for the construction of the combination bench hook, miter block, and shooting board shown in Fig. 32.

The parts for the bench hook, which should be made entirely of hardwood such as maple or birch, are given in the following list:

1. Base, ¾ by 10 by 18 in., 1 required.
2. Top of base, ¾ by 7 by 18 in., 1 required.
3. Headblock, 1¾ by 2½ by 7 in., 1 required.
4. Tail block, ¾ by 2 by 7 in., 1 required.
5. Adjustable miter block, 1¾ by 5 by 10 in., 1 required.
6. Dowels, ½ by 1¾ in., 2 required.
7. Long miter braces, ¾ by 8½ by 4 in., 2 required.
8. Broad hinges, 3 in. long, 2 required.
9. Screws, 3 sizes.

Note particularly that at No. 5 the dowels are not glued in No. 2.

Another useful fixture is the guide, gage, or jig shown in Fig. 34. It is for boring holes for dowels or preparatory to cutting mortises. The ordinary wooden gage of this type is difficult to make because the hole through it must be

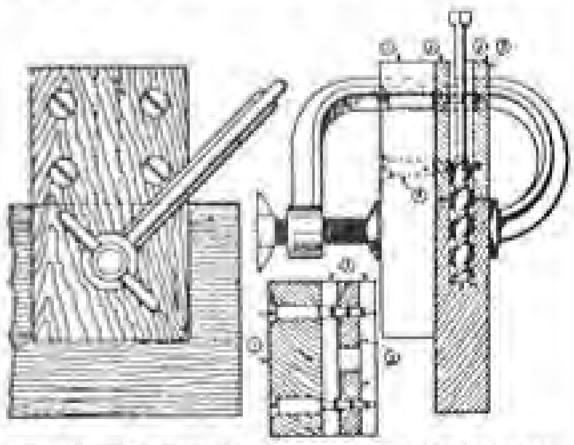


FIG. 34.—Constructional view of a boring gage, which is useful when making holes for dowels or boring for mortises.

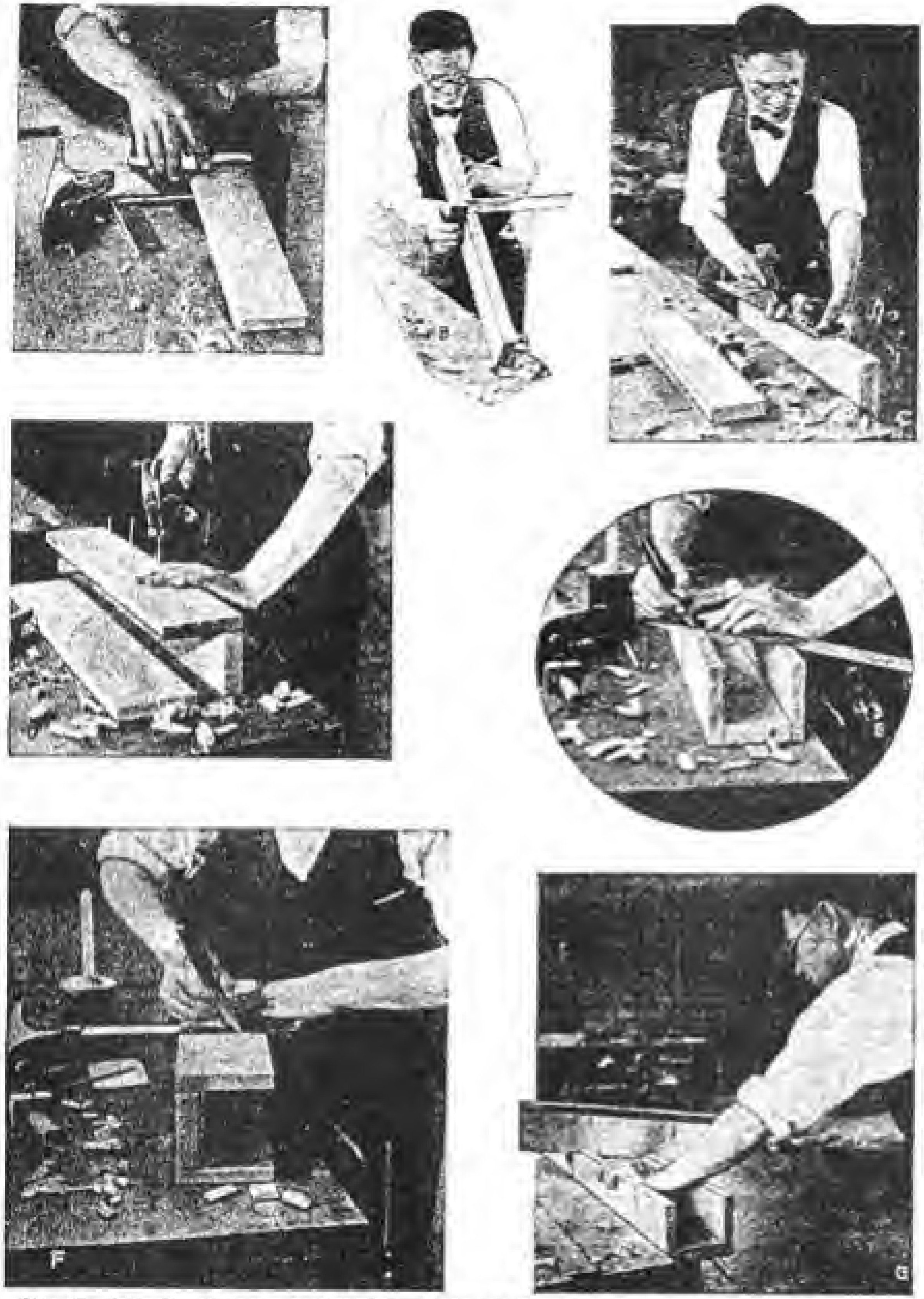


FIG. 35.—Steps in making a miter box of wood. The work must be done with extreme care, and the cuts should be made with the saw which is to be used with the box.

bored with absolute accuracy. There is nothing difficult in making the gage shown, however, for the hole is formed not by boring, but by means of two thin wooden pieces and two spacer blocks that can be planed true and square before assembling. Furthermore, it is a simple matter to change the blocks for use in boring holes of various sizes.

The dimensions suggested as being most generally useful for the boring gage are as follows:

1. Stay block, ⅞ by 2½ by 4⅝ in., hardwood, 1 required.

2. Division strips, ⅝ by 1 1/16 by 2 9/16 in., hardwood, 2 required.

3. Back and front caps, ¼ by 2 9/16 by 2½ in., hardwood, 2 required.

4. Screws, 2 in. long with points cut off, 4 required.

WOODEN MITER BOX

To make a wood miter box, proceed as shown in Fig. 35.

Plane and face mark one side and edge of the 1¼-in. (or thicker) bottom piece; then gage the width with due care as at *A*. Square the edges with extreme accuracy as shown at *B*.

The ¾ in. thick sidepieces, preferably of hardwood, may be held together in the vise for planing to one size as shown at *C*. Gage the sidepieces for width. Assemble so the marked faces of all pieces are turned in. Apply a small quantity of liquid glue to the joints and nail as shown at *D* with eightpenny box nails, or use screws.

Knife mark 45-degree lines with carpenter's square as shown at *E*, placed so that the same readings (as 9 in.) on tongue and blade fall in corresponding positions on the same edge of one side of box. Mark lines down the sides, inside and out, from the extremities of the angular lines as shown at *F*. These are to guide the saw cuts. As in all particular work, it is advisable to make the marks with a bench knife.

Saw both edges at once, as shown at *G*, with the saw that is to be used with the box. An additional square cut at one end is an aid in cutting off squarely stock of small dimensions.

TWO PORTABLE TOOL CASES

Handy men who do a number of repair jobs inside and outside the house, as well as carpenters engaged in framing new buildings and similar work, find it desirable to have a box for carrying around the necessary tools. The one illustrated in Fig. 36 answers this purpose better than most, yet it is of the simplest construction. Among its advantageous features are a separate compartment for saws and steel square, plenty of space for planes, level, bit brace, and other large tools, and two drawers for small tools.

The materials needed are ½- and ¾-in. thick white pine or other soft wood stock, two drawer knobs or pulls, a catch for holding the drawers in place, and a broom handle or other long, round rod of sufficient strength to support the weight.

FIG. 36.—This extremely compact and convenient portable tool box has divisions for saws and planes; also two drawers for chisels and small tools.

The bottom piece is set into a rabbet in the ends, and the front and back pieces also are set in rabbets (Fig. 37). This construction is strong enough to withstand hard usage and even abuse.

Most boxes of this sort, not being stained or painted, soon become grimy.

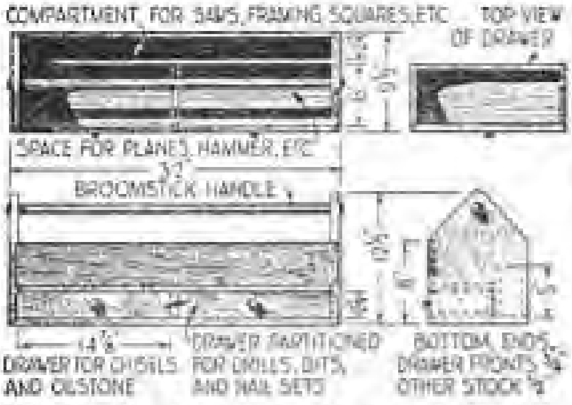


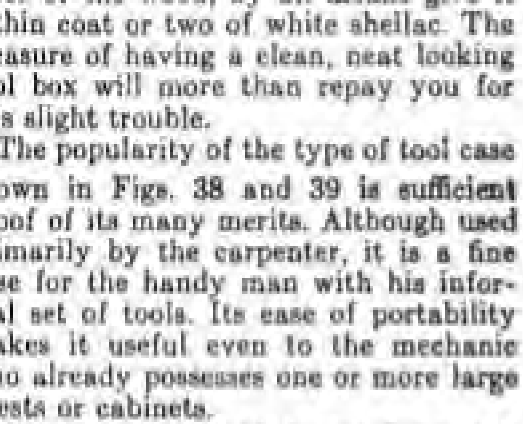
FIG. 37.—The front and end views of the tool-carrying box shown in Fig. 36, and the drawer.

If you wish to keep the box the natural color of the wood, by all means give it a thin coat or two of white shellac. The pleasure of having a clean, neat looking tool box will more than repay you for this slight trouble.

The popularity of the type of tool case shown in Figs. 38 and 39 is sufficient proof of its many merits. Although used primarily by the carpenter, it is a fine case for the handy man with his informal set of tools. Its ease of portability makes it useful even to the mechanic who already possesses one or more large chests or cabinets.

The materials needed are: 1 pc. oak ¾ by 8 in. by 8 ft.; 2 pcs. oak (3 ply) ⅜ by 16 by 30 in.; 1 pc. white pine ⅜ by 6 in. by 6 ft.; 1 tool box lock, 2 tool box clasps, 8 box corners, 3 hinges, 1 leather sample case handle; 42 No. 5—½-in. screws, 40 No. 6—1-in. screws and 28 No. 6—1¼-in. screws, all of the round-headed type; 2 doz. ⅛ by 1 in. machine screws; 1 package twopenny

FIG. 38.—Another type of tool case, which can be carried easily from one job to another. It is one of the most popular designs among mechanics.



brads. All hardware should be of solid brass.

Cut the 16 in. long end pieces from the ¾ by 8 in. piece of oak and the 31½ in. long top and bottom pieces from the same stock. Rabbet the ends of the top and bottom ⅜ by ¾ in. as shown for the joints. Mark the end pieces and the top for the door and saw out with fine saws very carefully. Plane down the other pieces to make up for the saw kerf.

Rabbet the long edges of the top, bottom and end pieces ⅜ by ⅜ in. to receive the ⅜ in. thick side panels flush. Glue up the top, bottom and end pieces and use three screws from both directions, being sure that the case is square. Square one side and the end of the side panels and cut them to size; then glue and screw them in place. One side, of

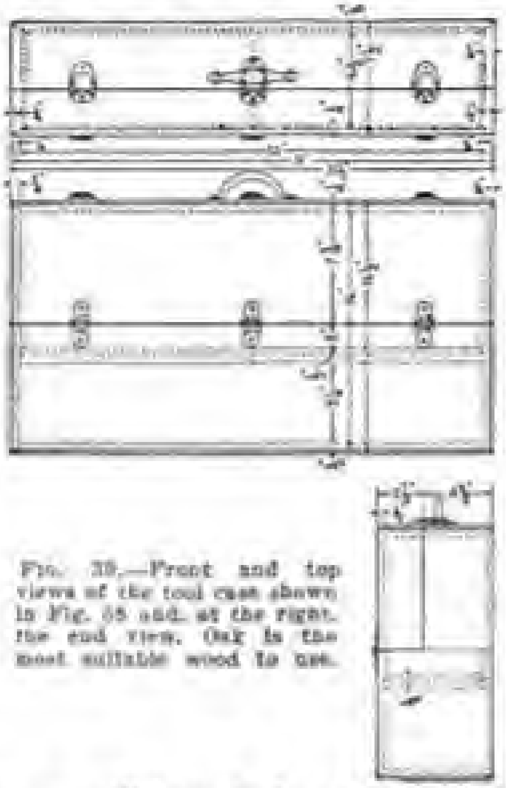


FIG. 39.—Front and top views of the tool case shown in Fig. 38 and, at the right, the end view. Oak is the most suitable wood to use.

course, will have to be cut out for the door.

Perhaps it will be best to leave the tray to the ideas and needs of the individual, but it is made to rest on cleats placed on the ends and at the middle of the box so that its upper edge will be flush with the joint of the door. It should be a little narrower than the inside measurements of the box to allow room for the steel square, which will be kept in the back of the box.

Cleats should be arranged in the door to carry the saws. Hooks and other cleats can be installed for holding other tools.

Stain or merely oil the case with pure boiled linseed oil, as preferred. When the wood is dry, use two coats of shellac, rubbing each down with fine sandpaper. Follow with two coats of varnish (on the outside only); rub the first with fine sandpaper and leave the second as applied or rub it with fine powdered pumice and oil, according to whether a dull or glossy finish is desired. For a finish that can be applied more quickly, use stain, one coat of thin shellac, and two coats of high grade, clear brushing lacquer.

Mark the location of the hardware. Use the ½-in. round-headed screws for the hinges and corner clips and the ⅛ by 1 in. brass machine screws for the locks, snaps and handle. Rivet the inside ends to make it impossible to open the box merely by turning out the screws.

A LARGE TOOL CRIB

Plywood packing cases are an excellent source of material for the home craftsman. The stock seems mainly to be oak, maple, birch, and poplar. While the plywood is not made quite as well as regular cabinet stock of this kind, nevertheless careful selection will produce some really good sides that will

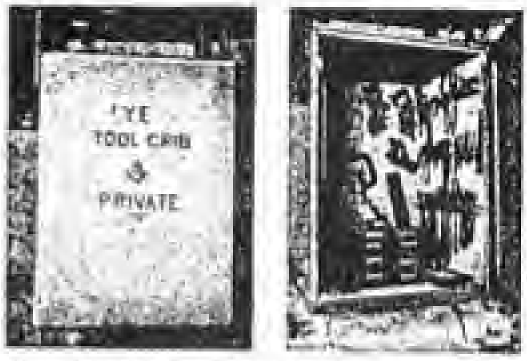


FIG. 40.—This tool cabinet, made from a packing case, is suspended from the first floor beams in the basement.

answer many purposes. One good use for a case is to form a large tool crib as shown in Fig. 40.

It might be added in this connection that when it is necessary to remove the plywood from the frame of a packing case, a fine saw should be used to cut around the frame on the inside. Sacrifice the little plywood left on the frame in order to get out the sheet in good shape. In selecting cases at the store, look for sides which are as free from imperfections as possible and those whose grain markings are most pleasing. Let the light fall slantingly on the side under examination and look for smooth surfaces, free from many waves.

In the construction of particular work, it is best to use regular cabinet plywood for the exposed surfaces that are to receive a fine polished finish. For the backs, drawer bottoms, partitions, and any less conspicuous sections, the cases provide far less expensive plywood.

A few hints on handling plywood: Keep it in a dry place; for although much of it is made with waterproof (casein) glue, it will curve and buckle and the plies may separate if left in a damp place. It is well upon acquiring a plywood case to saw the sides out and lay the sheets flat, one on top of the other, in a warm, dry place, with a few flat boards upon them for weight. Do not attempt to use a warped piece of plywood in a cabinet unless the frame which supports it can be braced to overcome this, which is usually not possible. In sawing plywood place it on a wide, flat surface, like a large, smooth-top box free from nails, and make the start and finish of the cut by cutting into the box as well as the plywood, in such a way as to prevent splintering the plies.

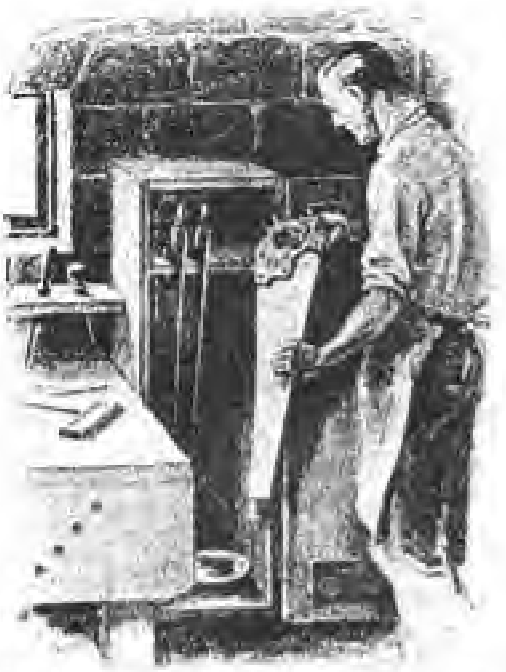


Fig. 41.—The purpose of this cabinet is to protect hand saws from rust and damage.

RUSTPROOF SAW CASE

The case illustrated in Fig. 41 was designed to protect saws from dampness in a basement shop that was none too dry. It is hung on the wall, and a dish of kerosene is kept in the bottom.

Another advantage of a cabinet of this type is that the teeth are not exposed to accidental damage as when the saws are hung on nails in the open shop.

The box can be built of waste lumber ⅞ in. thick. It is 12 in. deep, 14¼ in. wide, and 42 in. high. The saw holder is 12½ by 11 in. with slots 2½ in. apart, running with the grain. There should be a reinforcing cleat 4 by 12½ in. across the underside of the saw holder, at the back. The doors, too, should be well cleated to prevent warping, and hung with three hinges.

Finish the case with stain and varnish, or paint, as preferred.

EQUIPPING A SHOP FOR DECORATIVE METAL WORK

The individual craftsman who takes up decorative metal work will, of course, adapt his shop layout to the space available, be it large or small. He may use benches and other equipment already in his possession provided they are in a good light. If, for example, there is only one window facing north, the best place should be given to the jeweler's or light workbench where one sits down to do the more delicate operations.

A layout such as the one shown in Fig. 42, where the benches are all along one wall, makes for convenience when transferring the work from one bench to another.

Plenty of closet and shelf room is needed. A small case filled with sliding drawers, such as the one shown above the bench for light work, is convenient for storing rivets, screws, drills and the like. Supplies such as lump or powdered pumice, charcoal, pitch, rosin and chemicals are best kept in labeled boxes. It is also a good plan to make a rack of some sort for sheet copper and brass. The high, narrow boxes used for glass by glaziers form excellent racks for flat sheet copper.

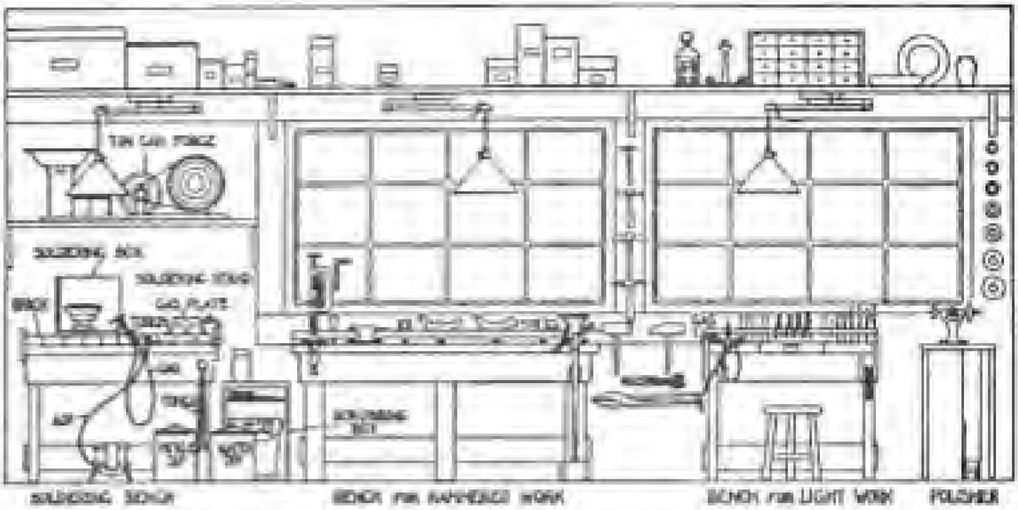


Fig. 42.—An ideal layout for a home shop to be devoted to craft work in metal. The units may be rearranged to suit the floor space, but in any case the small bench should be under a window.

On the extreme left of Fig. 42 will be noted the soldering bench, the top covered with a layer of brick. On this bench stands the soldering box, in which rests the soldering stand or turntable.

Near by is the blowtorch, held by a special hook fastened to the bench. From the blowtorch runs a rubber hose to the foot bellows for the air supply; the other hose goes to a cock on the gas line. A pair of tongs hangs on a nail near the blowtorch for use in handling hot work.

The pickle and water crocks rest on the floor. A small gas plate is available for heating pickle, drying out work for hard soldering, and even for soldering.

The arrangement of this bench would be practically the same if a gasoline blowtorch were used.

One amateur metal worker utilizes an old kitchen stove for a soldering bench, the large flat iron top making an excellent place for soldering operations. The top of a sheet steel oil stove could be used in the same way after the stove had outlived its usefulness in the kitchen.

On a shelf above the soldering bench is a forge for light work. It is set down on the bench for supplementing the heat of the blowtorch when soldering or annealing large work or melting metal.

The bench for hammered work (Fig. 43) should be constructed very solidly. Although suitable dimensions are suggested, the width and length should be made to suit the space available. The height of the top of the bench from the floor should be so planned that when a stake is in the vise you may do hammered work in a natural position.

Generally, the top of the vise jaws should be on a level with the elbow or slightly below it. A bench top from 28 to 30 in. from the floor will usually give this height, depending on the vise mounted on it. As the vise is also used for many filing operations, wire drawing, and many other things, the height of the jaws from the floor should be carefully considered.

The six legs are made of 4 by 4 in. lumber; the rest of the framework may be made of from 1 to 1¼ in. thick boards, 6 or 8 in. wide. If the bench is to be a short one, say 3 or 4 ft. long, four legs will be enough. The top should be of hardwood, beech or maple if possible, and 2 in., or at least 1½ in. thick.

A strong bench will result if it is simply nailed together with heavy spikes; or the frame may be bolted together, the top being held with countersunk lag screws. If you are fond of woodworking you may make the whole affair with mortise and tenon joints, but it is not at all necessary.

Each of the legs is firmly fastened to the floor with angle irons, and the bench should be also held firmly to the wall with angle irons, if possible.

The planks forming the top should be fitted together as tightly as possible and planed smooth. When the bench is finished, the top should be given one or two coats of boiled oil, and the frame-

Fig. 43.—A metal working bench for heavier operations, having a blacksmith's vise.

work painted some attractive color.

The leg of the blacksmith's box vise extends into a hole in a block of wood firmly fastened to the bench leg and floor. The vise should be fastened to the bench top with heavy bolts, the front edge of the bench being notched out, if necessary, to receive a part of the back leg of the vise. A bench drill is a useful tool to have on this bench.

Notice that the shop layout is planned so that there is room between the two benches; one may work at the end of the vise, standing between the two benches, as one often finds it convenient to do when engaged in hammering out bowls and trays.

The advantage of a blacksmith's vise is that it is made of wrought steel and is very strong. Considerable pressure must be put on vise jaws to hold a stake firmly under repeated hammer blows, and the more finely made machinists' vises, while they may be used, will not usually stand up under the work, being made of cast steel or iron. There are many other uses for a heavy vise in the shop as will be noted later on.

Vises are usually sold and listed by the width of the jaws (parallel with the handle). If you buy a vise of the blacksmith's type, get one with at least 4-in. jaws; one with 5-in. jaws is better, and one with 6-in. jaws best of all. This kind of vise, if not sold by your hardware dealer, can be obtained reasonably from any of the large general mail order houses.

Of course, if you already have a machinst's vise of good size, you may use this, or devise some other method of holding the stakes as shown in Fig. 44. At *A* is a tinsmith's bench plate such as you may have seen in a tinner's or coppersmith's shop. This is a heavy slotted iron plate with a number of rectangular holes or slots. It is let into the bench top, and the wood underneath each slot is cut out to correspond with the taper of these slots, so that the tapering ends of the stakes or anvils are held very firmly. This is a very old and satisfactory method of holding stakes. Bench plates of

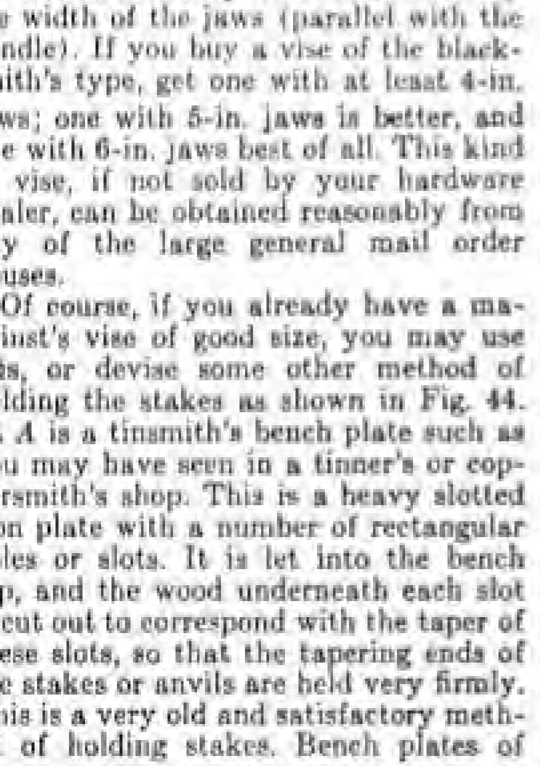


FIG. 44.—Four ways to hold stakes for hammered work. That shown at *B* is the least noisy.

this sort may be obtained from dealers in tinsmiths' supplies. It is well to get the catalog of such a firm, as you will find many stakes, anvils and other special tools for the use of metal workers.

Another method of holding stakes is shown at *B*, Fig. 44. It is perhaps the oldest and best method of all, if you have room for it. A large log or stump of hardwood—maple or beech—is fastened to the floor of the shop with angle irons. In the top of this log, which is about 30 in. up from the floor, is cut one or several tapering slots to fit the tapered ends of the stakes and hold them firmly for hammer work. This is the least noisy and most inexpensive way of holding stakes for making bowls and trays. Many metal workers who live in the country have several of the logs set in the ground in some pleasant location outside the shop, where they work in the summer. Shallow hollows may also be carved in the top of the logs for embossing bowls, forming spoons and so on.

At *C*, Fig. 44, is shown the common method of holding stakes or anvils in a heavy vise. This method has the one advantage of allowing the worker to tip his stakes at various angles to suit the work.

Iron pipe or steel bars of different lengths and diameters may also be held in the vise and used as anvils or stakes. You will find a collection of short lengths of pipe and round or square steel bars obtained from the junk yard extremely useful.

A regular stake holder mounted on the bench top is shown at *D*, Fig. 44. These holders are often sold with sets of stakes. A piece of thin leather slipped between the stake and the holder tends to make the stake hold more firmly and lessens the noise somewhat.

Returning to Fig. 42, you will see a rack for stakes back of the bench for heavy work and just under the window. If the stakes are to be hung on a flat surface, such as in a closet or on a wooden wall, heavy harness hooks form excellent holders, two being used for each stake, just as a hammer is hung on two nails. Another excellent method of holding stakes is to screw a length of old leather or rubber belting, about 1½ in. wide, to the wall so that loops are formed. Metal washers should be placed under each screw head.

On the bench for heavy work is a small bench anvil. An old flatiron with the handle broken off makes an excellent substitute.

Between the benches for heavy and light work, mounted on the wall, is a pair of large bench shears for cutting heavy sheet metal. The end of the lower handle or leg may be set in a slot in the bench top or bench plate or held in the vise. Above the bench shears is a large pair of hand shears or tinner's snips.

Two wooden mallets also will be seen. One is an ordinary wooden mallet of hardwood, one face being flat and the other dome shape or round for embossing or raising. The other mallet, or raising hammer, is square in section and

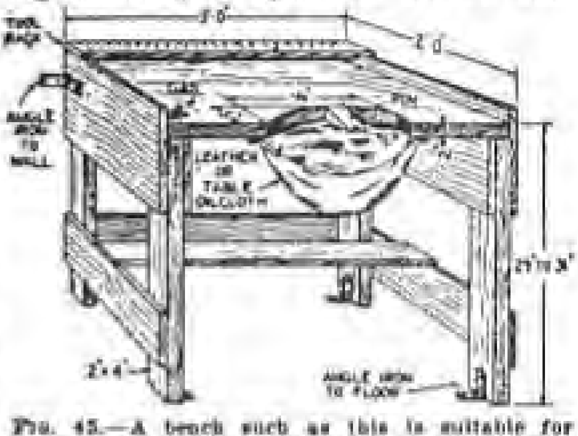


FIG. 45.—A bench such as this is suitable for light work in metals and for making jewelry.

tapered to a blunt point at one end. This form is much used in the preliminary stages of raising certain types of copper bowls and trays.

It is worth remembering that wooden tools are much used by the professional metal worker, as they leave no marks that can not be easily removed or worked out later on.

Above the mallets are mounted special forms of silversmiths' or coppersmiths' hammers for embossed and raised work.

The bench for light work or jewelry making (Fig. 45) should be built solidly, although it is of much lighter construction than the other bench. The size can be varied to suit the shop space. The height from the floor to the bench top is planned to suit the convenience of the worker when seated at the bench—usually between 29 and 31 in.

The four legs may be made of 2 by 4 in. lumber, the other members of the frame being 1 by 6 or 1 by 8 in. boards. The top preferably should be of hardwood such as maple or beech, 2 in. thick. A semicircular piece is usually cut out of the front edge of the bench top, about 5 in. deep and 16 in. long. This allows a bench pin (refer to Fig. 50) to be mounted, as shown, conveniently over a leather apron or "skin," which catches silver or gold filings. Sometimes a zinc-lined drawer is arranged to slide in and out under the bench pin to catch filings, but many jewelry makers prefer the leather skin. This may be of genuine skin or of one of the durable, smooth leather substitutes used for chair or automobile cushions. Small hooks are arranged under the bench so that the skin will hang baglike under the bench pin and yet not interfere with sawing the work.

On top of the bench at the left (Fig. 42) are two gas connections (cocks with rubber hose attachments), one being connected to a Bunsen burner and the other to a mouth or "combined" blowpipe. If you have no gas in your shop, you may use an alcohol chafing dish lamp instead of a Bunsen burner and an alcohol blowtorch in place of the gas blowpipe.

A very small pair of jeweler's snips or shears is hung on the front right leg of the bench. It is a good plan to have a small bench vise of the demountable kind, which may be clamped to the front edge of the bench when needed.

The tool rack at the back of the bench is simply a piece of soft wood 3/4 in. thick, 2 or 3 in. wide and as long as the bench. Slots are made in it for files, and holes are made for the other small tools such as scriber, dividers, pliers, and tweezers. When the bench is finished, the top should be oiled and the underpart painted.

A foot power polishing machine is shown on the extreme right. On the wall back of it are hung the various emery wheels, polishing and buffing wheels, and wire scratch brushes. The polishing machine should have a good working light.

Although not shown, or absolutely necessary, a blacksmith's anvil weighing from 75 to 150 lbs., solidly mounted on a heavy wooden block, is useful. Such anvils are best mounted on a heavy section of a tree trunk, the lower part of which is sunk solidly in the floor, if the floor is of earth as in most blacksmiths' shops. If this is not possible, the anvil block should be held to the floor with heavy angle irons. A skilled metal worker can make almost anything on such an anvil.

If you cannot manage to have a real blacksmith's anvil, you may care to invest a few dollars in one of the very reasonably priced cast steel farm anvils sold by hardware dealers and mail order houses. These cast anvils range from 50 to 100 lbs.

If your shop is a small one, you may get along perfectly well with an improvised flatiron for an anvil, or a small bench anvil and pipe or steel bars held in the vise. If you really want to do a thing badly enough, you will manage it somehow. In metal working or any other craft, the secret is to know just what you want to do and how to do it; then you may improvise many ways of doing it and adapt the tools of one trade to another.

If bowl and tray making are to be a part of your work, locate the shop in the cellar or outside the house. If you are to do the heavier work and the noise proves to be a problem, here is a suggestion worked out by one enthusiastic metal-worker. He simply set each bench leg in a box of sawdust. This deadens the noise transmitted to the floor.

A north light is usually considered the best. Direct sunlight on the bench is very annoying and bad for the eyes. For night work at least two lights are needed, one on the right hand one on the left, so that there are as few shadows as possible. It helps greatly if each of these lights is adjustable.

The soldering apparatus is best located in a rather dark corner, especially if you do any amount of silver soldering. You will be better able to see the glow of the metal and the solder. This is more important than it may sound.

When copper, brass, silver and most other metals are heated much, as for hard soldering or annealing, a scale or oxide forms on the surface of the metal. This must be removed each time the metal is heated. The usual method is to dip the hot metal in "pickle," which is a mixture of water and acid usually kept in an earthen crock near the heating and soldering apparatus. The pickle pot should have a tight cover.

Large pieces are best annealed and soldered (if the blowtorch is used) in a soldering box, which consists of two sides and a bottom as shown in Fig. 46 at *A*. This may be made entirely of fire brick as shown at *B*. The purpose of the soldering box is to conserve and reflect the heat about the work and at the same time confine the flame safely.

Sometimes a pan of cinders, lump pumice stone, broken fire brick, asbestos, or charcoal is placed in the soldering box to hold the work and reflect the heat evenly. It is not a bad plan to cover that part of the bench to be devoted to heating and soldering with fire brick or even common brick.

The soldering box also provides an excellent place for a turntable, as shown at the bottom of Fig. 46. The upper part of the left-hand turntable consists of a shallow pan filled with refractory materials on which the work to be soldered is placed and turned about to best advantage for soldering. Two old machine pulleys that fit the same shaft may be used as a base, the upper pulley turning on a short piece of shaft. A tin pan may be riveted or bolted to the upper pulley.

The automobile junk yard will usually yield plenty of materials for making a turntable. Two brake drums may be arranged, or a wheel hub and a brake drum, as in the right-hand turntable.

You will find many uses for a small polishing head or lathe, driven by either a foot wheel or an electric motor, together with several small polishing and buffing wheels and an emery wheel or two. Hand buffing or polishing sticks also are valuable. These are made by gluing leather to strips of wood and charging the surface with various polishing compounds. They are used like files.

Drilling, grinding and polishing may be quickly done with a small polishing head, if the work is small, as these inexpensive tools are fitted with a drill chuck, a taper polishing spindle for buffing wheels, and nut and collars for a small emery wheel. Do not make the mistake, however, of thinking that you can polish large bowls or other bulky pieces on a small foot-driven machine or that you can use large grinding or polishing wheels on a small head. Polishing takes power, and large work is best polished by hand or on a power driven head.

A small polishing head may be mounted on the base of an old sewing machine and belted to the foot wheel, or it may be fastened on one end of the bench, with the belt passing through the holes in the bench to a foot wheel on the floor. Such foot wheels may be purchased, but it is often possible to pick up a suitable wheel at the junk yard and rig up a treadle for it. The wheel should be quite heavy and well mounted and balanced.

Fig. 46.—Two ways of making a soldering box, and two turntable soldering stands.

While a fairly high speed may be obtained from a polishing head mounted on a sewing machine base, far better work can be done if a countershaft is placed between the foot wheel and the polishing head, as shown in Fig. 47. The writer has such a rig in his shop for small work. The ball-bearing countershaft was made of an old bicycle wheel hub on which were mounted two wooden pulleys. The spoke holes in the flanges on each side of the hub were used for the screws which hold the split pulleys to the hub (Fig. 48). The foot wheel is 18 in., the small wheel on the countershaft 3 in., and the large wheel on the countershaft, which runs to the pulley of the spindle, is 7 in. in diameter. The

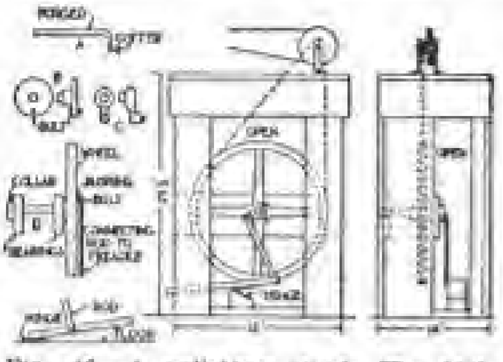


FIG. 47.—A polishing stand. The high spindle speed needed for polishing can be obtained by the use of a ball-bearing countershaft to cut down the friction.

pulley on the spindle is 1¾ in. in diameter, a common size.

If you make up such a rig as this, you will find that the construction of the foot treadle is important. Two suggestions are illustrated. The location of the connecting rod on the side of the treadle has much to do with the ease of operation;

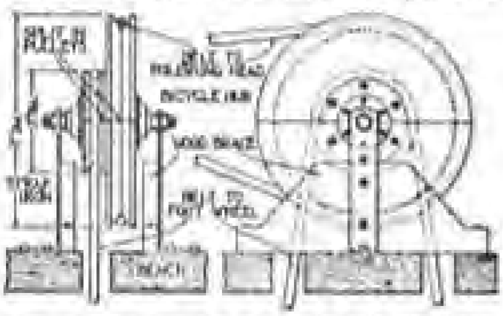


FIG. 48.—A bicycle wheel hub is excellent for the countershaft. The split pulleys are held in place by screws set in spoke holes.

it is best to try several points in relation to the distance from the hinge end of the treadle before finally screwing it in place.

When an old balance wheel is used, some sort of a shaft and crank must be rigged up. One way is to obtain a piece of shafting slightly larger than the hole in the wheel and forge or have forged a crank at the end, and then mount the piece in a lathe and turn down the shaft to fit the wheel (*A*, Fig. 47). Another method is to find or buy a disk crank (*B*) to fit the wheel shaft and drill a hole for a bolt. Two nuts, one on each side of the disk, hold the bolt, while the head of the bolt holds the connecting rod. Perhaps a regular crank-shaped piece may be obtained and held to the shaft with set screws.

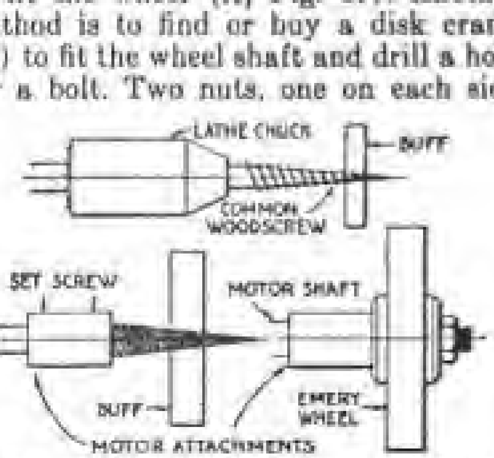


FIG. 49.—Attachments to fit the shaft of the ordinary electric motor allow it to be used as a grinding, buffing, polishing head.

The simplest method probably is to drill a hole on one side of the hub of the wheel (*D*) and tap it for a bolt. A piece of iron pipe is used for a bushing to keep the connecting rod from striking the wheel.

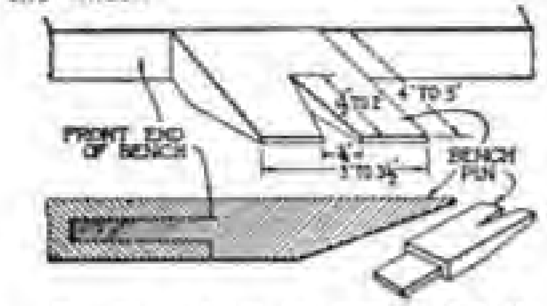


FIG. 50.—A bench pin mortised into the front end of the bench is useful for many jobs. It should be made of hardwood.

The crank and roller bearings sold for mounting grindstones sometimes make an excellent mounting for a foot wheel.

It is quite important not to have too great a throw between the center of the shaft and the crank pin. A large throw will result in an exaggerated foot motion. The distance of the throw of the crank shown in Fig. 47 is 1¾ in., which is ample for an 18-in. wheel.

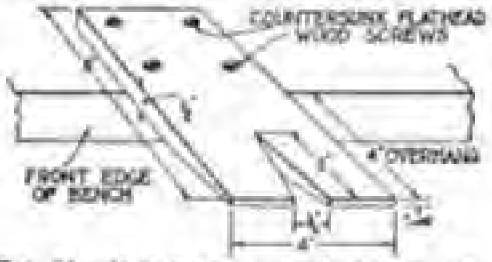


FIG. 51.—If it is not convenient to mount the bench pin by mortising, it can be screwed directly on the bench.

Much work may be done with a ⅛-H.P. polishing motor. Larger work requires a motor of from ¼ to 1 H.P. or more. For very large bowls and trays, you will find that you will need at least a ½-H.P. motor, although much depends on the size of the polishing wheel used and the skill of the operator.

If you already have a small electric motor about the shop, say a ⅛-H.P., you may rig up an excellent little polishing head by mounting the motor and the head on a board or on the bench and connecting them with a suitable length of round sewing machine belt.

When a foot- or power-driven lathe fitted with a drill chuck is available, you may use this as a polishing head, or as a grinder, for that matter. The head may be sawed off a large wood screw and the shank of the screw held in the drill chuck on the lathe; then, using a flat file or a lathe tool, turn off a part of the screw threads in a taper so that just a part of the original thread shows at the point of the screw and the full thread is left at the shank (see Fig. 49). On this you may screw polishing wheels or buffs, and the taper thread will hold them in place as they revolve.

Also, it is quite possible to get attachments which fit on the end of small motor shafts, one for holding emery wheels and another with a taper thread for polishing wheels. These convert a plain motor into a polishing motor at small expense.

If you have gas piped to your shop, you will find it most convenient for a soldering blowtorch driven by a foot bellows, for Bunsen burners, and for a small gas plate. The gas should be piped, if possible, along the soldering bench, with three outlets or cocks for hose connections. At your smaller bench for light work, if you have one, two connections will prove useful, one for a small gas blowpipe and the other for a small Bunsen burner.

If you live in the country, you will find that a plumber's gasoline blowtorch is an excellent source of heat for large work properly set up in the soldering box. For small soldering, you may use an alcohol blowtorch, and for this the current of air is furnished by blowing through a tube.

When fitting up a shop for metal working, you should provide some place for scrubbing your work. Almost all work that is annealed or hard soldered is scrubbed with a brush wet with water

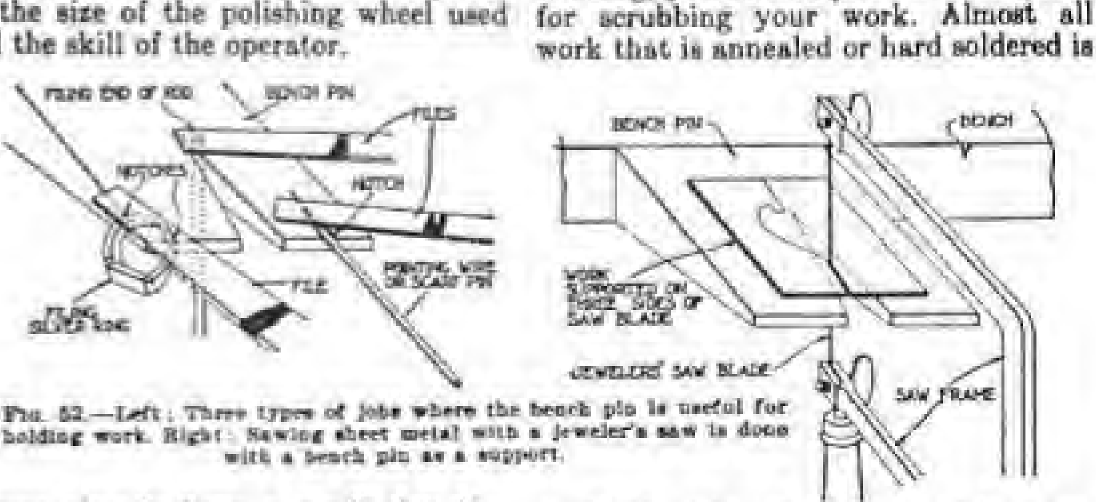


FIG. 52.—Left: Three types of jobs where the bench pin is useful for holding work. Right: Sawing sheet metal with a jeweler's saw is done with a bench pin as a support.

and charged with powdered pumice stone to remove all traces of the pickle and any dirt. A piece of flat board may be laid on the bench and the work scrubbed on it, or a wooden box may be placed near the sink, if you have running water in your shop. The reason a scrubbing board, box or bench is needed is because you must have some place where the spatter from the scrubbing brush will not fly on your tools or work, for wet pumice very quickly rusts steel and stains copper.

The construction of the simple but commonly used bench pin is shown in Fig. 50. This is made of hardwood. It may fit in a mortise in the front of the bench or it may be a single piece of fairly thin hardwood screwed to the bench as shown in Fig. 51. The use of the pin is shown in Fig. 52 and also in Fig. 29 of Chapter VIII (page 199).

INDEX

Chambers' Encyclopaedia 1891

The following feature will be very useful to those who want to become accustomed to the 19th Century terms and technical writing style. In this section will be all of the chemical, herbal and odd goodies from Chambers' with the great bulk of the rest of this fine encyclopaedia like history, biography, etc., left out.

It will be some time and even several subscriptions before the whole selection has been included in THE SURVIVOR. No matter. Each issue will contain some bit of old knowledge you can use.

The difference between this 1891 encyclopaedia and the modern ones is that back then, the layman was considered a potential expert. Science was written so that any literate person could understand it. Nowadays, science is written only for those majoring in a certain subject. It is believed by modern science writers that the intelligent layman should confine his interests to subjects authorized by his teacher, employer, etc. They are so hung up on the belief that a little knowledge is a dangerous thing that they effectively bar the intelligent layman from knowledge not controlled by our corporate system.

In every way possible, Atlan will strive to give the intelligent layman the knowledge he needs to cut loose from the common herd. Nineteenth Century scientific language was the intelligent layman's language. It was the language of opportunity and multiple choice. Today's scientific language is so specialized as to bar the intelligent layman from its mysteries as effectively as Feudalism barred intelligent serfs from opportunity during the Dark Ages.

Chambers' Encyclopaedia was generously donated to Atlan by Bruce Schneiderman.

Absinthe is a spirit flavoured with the pounded leaves and flowering tops of certain species of *Artemisia*, chiefly wormwood (*A. absinthium*), together with angelica-root, sweet flag root, star-anise, and other aromatics. The aromatics are macerated for about eight days in alcohol, and then distilled, the result being a green-coloured liquor. Adulteration is largely practised, usually with the essential oils of other herbs; but even blue vitriol is sometimes found in so-called absinthe. The best absinthe is made in Switzerland, the chief seat of the manufacture being in the canton of Neuchâtel. It is chiefly used in France, but is of late largely exported to the United States. When to be drunk, the greenish liquor is usually mixed with water; whereupon the precipitation of the contained volatile oil causes the mixture to cloud or whiten. The evil effects of drinking absinthe are very apparent; frequent intoxication, or moderate but steady tippling, utterly deranges the digestive system, weakens the frame, induces horrible dreams and hallucinations, and may end in paralysis or in idiocy. Absinthe was first introduced into common use in France through its being prescribed as a febrifuge to the soldiers during the Algerian war (1832-47). See WORMWOOD.

Acetal, $C_2H_4(OC_2H_5)_2$, is a colourless liquid, of an agreeable odour, and a flavour said to resemble that of the hazel-nut. It is one of the products of the slow oxidation of alcohol under the influence of finely divided platinum, or of chlorine, or of dilute sulphuric acid and peroxide of manganese. Its specific gravity is ·821, and it boils at 221° F. (105° C.). It yields various reactions and products of interest in organic chemistry.

Acetic Acid, the sour principle in vinegar, is the most common of the vegetable acids. If alcohol, diluted with water, be mixed with a ferment such as yeast, and exposed to the air at or a little above its ordinary temperature, it is rapidly converted into vinegar or acetic acid. The views held by Liebig regarding the part that wood-shavings, sand, &c. play in condensing oxygen, and transmitting it to the alcohol, are now supplanted by those of Pasteur, who maintains that the true acetifying matter is a very minute mycoderma, a special vegetable organised being. It is impossible to conceive a more simple form of vegetation, consisting of extremely minute spores arranged in chains; each spore having a mean diameter not exceeding 1/30000th of an inch, and the length being about twice as great. The rapidity of the development of the spores, under favourable circumstances, is almost inconceivable; and the power which they possess in fixing the oxygen of the air, and of transmitting it to the alcohol, and of establishing an incomplete combustion of the latter, is no less wonderful. A surface of a square yard covered with this plant, is able, in the course of 24 hours, to fix the oxygen of more than 1000 quarts of air. The temperature of the surface of the fluid at which this slow combustion is proceeding is considerably raised, and often remains for several days at 21° or 25° F. (12° or 14° C.) above that of the surrounding air. The process which has just been described bears a very close analogy to the respiratory process, the oxygen of the air being in one case fixed by minute vegetable cells, and in the other by the blood corpuscles. The change is accompanied by the absorption of oxygen, one atom of which combines with two of hydrogen to form water, aldehyde being left. Further oxidation then takes place, acetic acid being formed thus:

Alcohol.		Aldehyde.		Water.		Aldehyde.		Acetic Acid.
$C_2H_6O + O$	=	C_2H_4O	+	H_2O	;	$C_2H_4O + O$	=	$C_2H_4O_2$

From the mode in which acetic acid combines with bases to form salts, it is evident that one atom of the hydrogen differs from the other atoms in being replaceable by a metal or an alcohol radical (as ethyl, C_2H_5), and on this account acetic acid is called a monatomic acid, and its formula is usually represented as $HC_2H_3O_2$; that of acetate of potash being $KC_2H_3O_2$, and of acetate of ethyl, $C_2H_5C_2H_3O_2$. A striking experiment may be made illustrating the mode in which alcohol is converted into acetic acid. If slightly diluted alcohol be dropped upon *platinum black*, the oxygen condensed in that substance acts with great energy on the spirit, and acetic acid is evolved in vapour. Here the whole office of the platinum is to determine the oxygen of the air and the hydrogen of the alcohol to unite. In the commercial processes for manufacturing vinegar, some vegetable substance containing nitrogen (one of the albuminous principles) takes the place of the platinum-black, and determines the same change. Pure acetic acid is a crystalline solid at ordinary temperatures. It is obtained by distilling dry acetate of potassium and sulphuric acid:

$$2KC_2H_3O_2 + H_2SO_4 = 2HC_2H_3O_2 + K_2SO_4.$$

The anhydride of acetic acid (see ANHYDRIDES) is formed by the action of chloride of acetyl on acetate of potassium. It has the composition $(C_2H_3O)_2O$, and unites with water to form acetic acid. The salts of acetic acid, called ACETATES, are numerous and important in the arts. The most important is acetate or sugar of lead (see LEAD). For the commercial processes of manufacturing acetic acid, see VINEGAR.

Acetones, or KETONES, are the aldehydes of secondary alcohols (see ALCOHOL). Thus secondary propyl alcohol, when oxidised, loses two atoms of hydrogen, and gives dimethyl ketone, ordinarily known as *acetone*.

Secondary Propyl Alcohol.		Acetone.
$CH_3 - CHOH - CH_3 - H_2$	=	$CH_3 - CO - CH_3$

A series of such acetones is known, of which *acetone* is typical. It may be prepared by distilling acetate of calcium. It is a limpid liquid, having a taste like that of peppermint, and is readily soluble in alcohol, ether, and water. Its specific gravity is about ·79, its boiling-point being 130° F. (56° C.). It has recently been used in America for the manufacture of chloroform, which is obtained from it by distillation with bleaching-powder. It is a solvent for gums and resins, as well as for gun-cotton.

Acetyl is an organic radical not yet isolated, but which is supposed to exist in acetic acid and its derivatives; the rational formula for acetic acid being on this hypothesis $(C_2H_3O)OH$. See CHEMICAL TYPES. The reason for assuming the existence of this radical in the acetic compounds is, that the formula to which it leads affords the simplest explanation of the most important reactions of acetic acid. Thus, when acetic acid is treated with a metallic oxide or hydrate, the basic atom of hydrogen is replaced by a metal, and an acetate of the metal, $(C_2H_3O)OM$, is produced. The term *acetyl* was formerly applied to the radical C_4H_3.

Acidimetry is the determination of the percentage of real acid contained in a sample of a hydrated acid, as sulphuric or nitric acid. In most cases, if we know that no foreign body is present, it is possible to determine the percentage by means of the specific gravity, as indicated by the Hydrometer (q.v.). Usually, however, other substances, which alter the specific gravity, may be present, and recourse is then had to one of the following methods:

(1) By volumetric analysis, in the manner described under Alkalimetry (q.v.).

(2) By the gravimetric process. This may be conducted in two ways, which will be best understood by an example of each. Sulphuric acid forms several insoluble salts, the sulphate of barium refusing to dissolve, not only in ordinary fluids, but even in strong acids. When chloride of barium is added to a liquid containing sulphuric acid, the sulphate of barium is precipitated, and after due precautions have been taken to insure its purity and to avoid erroneous conclusions, it may be weighed and the amount of sulphuric acid calculated therefrom.

A more rapid method consists in adding to the sample some carbonate of soda, and noting the amount of carbonic acid disengaged. This is readily accomplished by performing the operation in a weighed flask, and determining the loss of weight after the carbonic acid gas has been liberated. Of course many precautions are essential. See also ANALYSIS.

Acids. An acid is a chemical compound distinguished by the property of combining with bases in definite proportions to form Salts (q.v.). The most striking characteristics of acids are a sour taste, and the property of reddening vegetable blues. They are also mostly oxidised bodies; and at one time oxygen was thought to be essential to an acid, as the name *oxygen* (the acid-producer) indicates. Subsequent experience has extended the definition. There is an important class of undoubted acids that contain no oxygen; and silex, or flint, which, being insoluble, neither tastes sour nor reddens litmus-paper, is held to be an acid because it combines with bases and forms compounds like acknowledged acids. The oxygen acids, which are by far the most numerous class, are formed of elements (sulphur, nitrogen, chromium, &c.) with two or more equivalents of oxygen. The elements that form the strongest acids with oxygen are the non-metallic, and most of them have more than one stage of acid oxidation. Thus sulphur unites with oxygen to form two oxides, SO_2 and SO_3, which, in combination with water, yield respectively sulphurous and sulphuric acid. Similarly, arsenic forms two oxides, As_2O_3 and As_2O_5, corresponding to arsenious and arsenic acids. The higher stage of oxidation forms the stronger and more stable acid. All metals, except arsenic, that form acids with oxygen, have also, at a lower stage of oxidation, one or more oxides. To these inorganic acids containing oxygen must be added the organic acids, composed of carbon, hydrogen, and oxygen. Belonging to this extensive group are oxalic acid, $H_2C_2O_4$; acetic acid, $HC_2H_3O_2$; and formic acid, $HCHO_2$. There are also acids found in animal fluids, or resulting from their decomposition, which contain nitrogen in addition to the three elements above named; such is uric acid, $H_2C_5H_2N_4O_3$. The *hydrogen acids* are formed of hydrogen and a radical, either simple or compound. The most important of these, and the type of its class, is hydrochloric or muriatic acid, HCl; others are hydriodic (HI) and hydrocyanic (HCN) acids. As all acids, however, even oxygen acids, possess acid properties—i.e. combine with bases—only when in combination with water, a new view of the constitution of acids now prevails, which makes hydrogen the real acidifying element in all acids. Thus, instead of considering vitriol as a compound of sulphuric acid and water, $SO_3 + H_2O$, the hydrated acid is held to be the real sulphuric acid, and its rational formula to be H_2SO_4. It thus becomes analogous to hydrochloric acid, HCl. This view has not only the advantage of bringing all acids into one class, but makes the theory of their combination with bases and of their capacity of saturation uniform and simple. Hence has arisen the most general definition of an acid—viz. that 'acids are salts of hydrogen.' A more intelligible definition to ordinary readers is that which is adopted by Frankland, in which an acid is described 'as a compound containing one or more atoms of hydrogen, which become displaced by a metal when the latter is represented to the compound in the form of a hydrate.' Thus nitric acid and sodium hydrate yield nitrate of soda and water:

Nitric Acid.		Sodium Hydrate.		Nitrate of Soda.		Water.
HNO_3	+	NaHO	=	$NaNO_3$	+	H_2O

in which reaction the hydrogen of the nitric acid is replaced by the sodium of the sodium hydrate (or soda), and as only *one* atom of hydrogen is replaced, nitric acid is said to be *monobasic*. When an acid admits of the displacement of two atoms of hydrogen, it is termed *dibasic*—as tartaric, oxalic, and sulphuric acid; and when three atoms can be replaced—as in common phosphoric acid, H_3PO_4, in which H_3 may be replaced by K_3 or Ag_3, the acid is termed *tribasic*. The more important acids are included in the following list:

Acids containing no oxygen: Hydrochloric, HCl; hydrobromic, HBr; hydriodic, HI; hydrocyanic, HCN; hydrosulphuric or sulphuretted hydrogen, H_2S.

Inorganic acids containing oxygen: Boracic, H_3BO_3; carbonic, H_2CO_3; chromic, H_2CrO_4; hypophosphorous, HPH_2O_2; nitric, HNO_3; phosphoric, H_3PO_4; phosphorous, H_2PHO_3; sulphuric, H_2SO_4; sulphurous, H_2SO_3.

Organic acids: Acetic, $HC_2H_3O_2$; benzoic, $HC_7H_5O_2$; citric, $H_3C_6H_5O_7$; gallic, $H_4C_7H_2O_5$; lactic, $HC_3H_5O_3$; salicylic, $HC_7H_5O_3$; tartaric, $H_2C_4H_4O_6$.

The most characteristic inorganic acids (hydrochloric, nitric, phosphoric, sulphuric) are used in medicine in a very dilute condition as tonics and astringents, and to allay thirst in fevers. They corrode the teeth, however, and if long administered tend to disorder digestion; so they must be used with caution. Most of the group have special, some (as hydrocyanic, oxalic) extremely poisonous actions. The stronger acids, when concentrated, are powerful caustics.

Aconite (*Aconitum*), a genus of Ranunculaceæ (q.v.) having five petaloid sepals, of which the upper one is helmet-shaped; and two hammer-headed petals (nectaries) concealed within the helmet-shaped sepal. The fruit consists of 3-5 follicles. *A. napellus*, the common Wolf's-bane or Monk's-hood, often cultivated in flower-gardens for the sake of its erect racemes of blue flowers, is a doubtful native of England, but common in some parts of Europe. The roots are fusiform and clustered. The root and whole plant are very poisonous, containing an alkaloid, called *Aconitin*, (q.v.). An aconite, sometimes called *A. Stoerckianum*, but generally regarded as a variety of *A. Cammarum*, was brought into great repute on the Continent during last century by Dr Stoerck, an Austrian physician, and is still cultivated for medicinal use. The virulent *bikh* poison of India, equally fatal in its effects whether introduced into wounds or taken into the stomach, is prepared from the roots of several species. *A. album*, or white-flowered monk's-hood, a native of the Levant, and *A. lycoctonum*, yellow-flowered monk's-hood, or wolf's-bane, a native of the Alps, are not infrequent in our flower gardens.

Monk's-hood (*Aconitum napellus*): *a*, fruit; *b*, root.

Acon'itin, the active principle of the aconite or monk's-hood, is one of the most potent poisons known, so small a quantity as $\frac{1}{50}$th of a grain of the pure alkaloid having nearly proved fatal. Its recognition in poisoning cases is a matter of difficulty, owing to the small amount necessary for the purpose, but there are tests by which it may readily be recognised. It was the drug employed by Dr Lamson in the murder by poison for which he was executed in April 1882. When applied to the eye in even very dilute solution, it causes a sensation of intolerable heat and tingling, the pupil at the same time contracting. This tingling, associated with numbness, is felt when a piece of aconite root is chewed, and on account of this peculiar property, aconitin, or a preparation of aconite, is extensively used in the treatment of neuralgia, rheumatism, and toothache.

Adipic Acid, $C_4H_8(COOH)_2$, is a dibasic acid of the oxalic series, having the general formula $C_nH_{2n-2}O_4$; and is obtained in the form of white, opaque, hemispherical nodules (which are probably aggregations of small crystals), by the oxidising action of nitric acid on oleic acid, suet, spermaceti, and other fatty bodies. It derives its name from the Latin *adeps*, fat.

Aerated Waters is the name applied to the large class of beverages which are rendered sparkling by dissolving in them carbonic acid under pressure. The term does not include champagne or fermented ginger-beer, or any other carbonated beverage in which the carbonic acid gas is produced by the natural process of fermentation. Carbonic acid dissolves readily in water, that liquid absorbing at the ordinary atmospheric pressure and temperature about its own volume of the gas. Under pressure, however, as when the gas is forced into a strong vessel containing the water, it absorbs many times its own volume; and when the pressure is released, the extra amount of carbonic acid escapes, rendering it sparkling or effervescent. The water does not, however, give off all the extra gas at once; hence the well-known experiment of dropping a piece of cork into a tumblerful of lemonade, when immediate effervescence takes place, and carbonic acid is given off. All agitation, or the presence of particles of dust, favours the disengagement of the gas, and so it is that in drawing lemonade from a *siphon* (see below), the tumbler is filled with froth to an extent not noticed in pouring from a bottle. In this case, the rapidity of discharge through a narrow tube causes immediate liberation of a large volume of the gas, producing the froth referred to. The varying solubility of carbonic acid at different temperatures and pressures explains why siphons or bottles which have been kept in a cold place appear to be deficient in gas, when in reality the gas is only kept in solution by the low temperature of the water.

It would be beyond the scope of this article to describe the various forms of apparatus used in the production on the large scale of aerated water, for in no branch of industry has more ingenuity been expended than in the devising of labour-saving apparatus for aerated water. Essentially, the process consists in the production of Carbonic Acid (q.v.) from whiting or chalk, by the action of sulphuric acid. The refuse, consisting of plaster of Paris, is thrown away, while the gas, after being purified by washing with water, is stored in a copper bell or gasometer. Thence it is pumped along with water into copper or gun-metal vessels lined with pure tin, being made to dissolve in the water either by agitation or by other appliances. When the pressure inside these vessels reaches about 100 lb. per square inch, the water contains about seven times its volume of gas, and is ready to be filled into bottles. The *bottling* is accomplished with great speed, an expert bottler being able to fill from thirty to fifty dozen of corked bottles per hour; while, when patent (i.e. ball-stoppered) bottles are used, from forty to seventy dozen may be filled. Up till comparatively recent years, only corks were used for closing the bottles; but it is computed that between 200 and 300 forms of patent bottles have been recently introduced, which all depend on the internal pressure of the gas forcing a ball of glass, wood, or other material against a rubber ring placed in the neck, and thus sealing the bottle. The *siphon* is a glass bottle, fitted with a metal top, and furnished with a lever or handle, which enables a portion of the contents to be drawn off without difficulty. The head should be of the purest tin, to avoid contamination of the aerated water. Formerly there was risk of lead-poisoning by aerated waters, as they readily dissolve lead, but all manufacturers of any repute now make it a point to use no lead-piping whatever in their machinery, pure tin-pipe being alone admissible.

The better known kinds of aerated waters are: (1) *Potash and Soda waters*, which, when of full medicinal strength, contain fifteen grains of the bicarbonate of potash or soda in each bottle; usually, however, much less is put in, and the amount ranges from one to seven or ten grains; (2) *Aerated water*, which is frequently sold for soda-water, but is a simple solution of carbonic acid, and contains no admixture; (3) *Seltzer water* (better *Selters* water, being named from Selters, in Nassau, where natural mineral water of this composition is obtained), which contains the chlorides of sodium, calcium, and magnesium, along with phosphate and sulphate of sodium; (4) Medicinal waters, containing varying proportions of chemicals, as, for instance, lime, carbonate of iron, citrate of lithia, or bromide of potassium.

The temperance drinks, which include such favourites as lemonade, ginger-beer, ginger-ale, and tonic bitters, are all made by putting the requisite quantity of flavouring syrup into a bottle, and filling up with simple aerated water; and the varying qualities in the market correspond to the variety in the receipts from which they are made.

On the small scale, and for family use, carbonic acid water may be conveniently prepared in the apparatus known as the *gazogène* or *seltzogène*. It usually consists of two globes, one above the

time carbonic acid is given off, and descending the tube into the lower globe, dissolves in the water contained therein. Occasionally, bisulphate of potash is used instead of tartaric acid, to save the greater expense of the latter. *Aerated fruit-beverages* are produced when the water charged with carbonic acid is received in a glass containing about a table-spoonful of any of the fruit-syrups.

A well-known effervescing draught is made from *soda-powders*, composed of bicarbonate of soda and tartaric acid. *Seidlitz-powders* contain tartrate of soda and bicarbonate of soda in one paper, and tartaric acid in the other. Many waters naturally aerated have important medicinal properties; these will be discussed under the title of MINERAL WATERS.

Aga've, a genus of plants of remarkable and beautiful appearance, belonging to the natural order Amaryllideæ (q.v.). There are a number of species, all natives of Mexico and Central America. They are often popularly confounded with Aloes (q.v.); and *Agave americana* is generally known by the name of American Aloe. The agaves have

American Aloe (*Agave americana*).

either no proper stem, or a very short one bearing at its summit a crowded head of large, fleshy leaves, which are spiny at the margin. From the midst of these shoots up the straight, upright scape, 24 to 36 feet high, and at the base often 1 foot in diameter, along which are small, appressed, lanceolate bracteæ, with a terminal panicle, often bearing as many as 4000 flowers. In Mexico, these plants usually flower in the seventh and eighth, sometimes even fifth or sixth year, and even in poor soils or exposed situations seldom later than the twelfth year, but in our hothouses not until they have reached a very advanced age (40-60 years); whence arises the gardeners' fable of their flowering only once in one hundred years. After flowering, the plant always dies down to the ground, but new plants arise from lateral buds. The best known species is *Agave americana*, which was first brought to Spain in 1561, and being easily propagated by cuttings, is employed for fences in Italian Switzerland, and has become naturalised in Naples, Sicily, Greece, and the north of Africa. By maceration of the leaves, which are 5 to 7 feet long, are obtained coarse fibres, which are used under the name of *maguey*, for the manufacture of thread, twine, ropes, hammocks, &c. This fibre is also known as Pita Flax. It is now produced to some extent in the south of Europe. It is not very strong nor durable, and if exposed to moisture it soon decays. The ancient Mexicans employed it for the preparation of a coarse kind of paper, and the Indians use it for oakum. The leaves, cut into slices, are used for feeding cattle. When the young flower-bud has been cut out, the sap continues to flow into the cavity for a considerable time. This is termed *aguamiel*, and contains a considerable amount of sugar. It is collected daily, and after rapid fermentation furnishes the national beverage called *pulque*. This is milky, sour, and ill-smelling, resembling thin buttermilk, and strongly recalling the flavour of rotten eggs; yet even Europeans soon find it agreeable and refreshing. In large quantities it produces a dull intoxication followed by heavy sleep. The strong spirit of the country (*aguardiente*) is also distilled from it. *Agave americana*, *Agave mexicana*, and other species are extensively cultivated for these purposes. The roots of *Agave saponaria* are used in Mexico for washing, being a powerful detergent.

Ag'rimony (*Agrimonia*), a genus of Rosaceæ (q.v.), sub-order Potentilleæ. The Common Agrimony (*Agrimonia eupatoria*) is a native of Britain

Common Agrimony (*Agrimonia eupatoria*).

and other parts of Europe, growing in borders of fields, on waysides, &c. It has an upright habit, attains a height of 2 feet or more, and has interruptedly pinnate leaves, with the leaflets serrate and downy beneath. The flowers are small and yellow, in close racemes. The whole plant has a pleasant, slightly aromatic smell, and is bitter and styptic, and was much valued in domestic medicine; a decoction of it being used as a gargle, the dried leaves as a kind of herb tea, and the root as a vermifuge.—Very similar to this is *A. parviflora*, a native of the United States. It has a very agreeable fragrance. *A. incisa* is common in the Southern Atlantic States.

Ague (*Febris intermittens*) is the common name for an intermittent fever accompanied by paroxysms or fits. Each fit is composed of three stages—the cold, the hot, and the sweating stage. Before a fit, the patient has a sensation of debility and distress about the epigastrium; feels weak and disinclined for exertion; the surface of his body becomes cold, and the bloodless skin shrivels up into the condition termed goose-skin (*cutis anserina*). A cold sensation creeps up the back, and spreads over the body; the patient shivers, his teeth chatter, his knees knock together; his face, lips, ears, and nails turn blue; he has pains in his head, back, and loins. This condition is succeeded by flushes of heat, the coldness gives place to warmth, and the surface regains its natural appearance. The warmth continues to increase, the face becomes red and turgid, the head aches, the breathing is deep and oppressed, the pulse full and strong. The third stage now comes on; the skin becomes soft and moist, the pulse resumes its natural force and frequency, and a copious sweat breaks from the whole body.

These paroxysms recur at regular intervals. The interval between them is called 'an intermission.' When they occur every day, the patient has *quotidian* ague; every second day, *tertian*; and when they are absent for two days, *quartan*. There is a *double quotidian* in which two paroxysms occur daily; in the *double tertian* there is a daily attack, but the paroxysms of successive days differ in some respects, while those of alternate days agree in character. *Quintan*, *sextan*, *heptan*, and *octan* cases are extremely rare. All ages are liable to this disease.

The exciting causes of this disease are unknown, but are thought by some to be effluvia from the surface of the earth (marsh miasmata). Others, again, such as Klebs, Tommasi-Crudelli, Cecchi, Laveran, and Osler, believe that a bacillus of some kind causes the disorder. Their researches show this to be very probable, although absolute proof is still wanting. A certain degree of temperature—higher than 60° F.—seems necessary for the production of the poison. It does not exist within the arctic circle, nor does it appear in the cold seasons of temperate climates, and seldom beyond the 56° of N. lat. (Watson). It also requires moisture. In England, ague is almost exclusively confined to the eastern coast; and the extension of drainage has rendered agues far more rare than before. James I. and Oliver Cromwell died of ague contracted in London. The Pontine Marshes to the south of Rome have long been notorious as a source of aguish fevers. Peat bog, or moss, is not productive of malaria, as is seen in parts of Ireland and Scotland. Neither is ague ever seen among the inhabitants of the Dismal Swamp—a moist tract of 150,000 acres on the frontiers of Virginia and North Carolina in North America.

The treatment of ague must be considered under two heads—during the paroxysm, and in the 'interval.' It is carried out generally as follows: As ague is a specific disease, little can be done during the paroxysm, save by applying external warmth to the body during the cold stage, and by administering restoratives, should collapse occur at the end of the hot stage. During the 'interval,' after purgatives have been administered, quinine must be given with the object of breaking the recurrence of the paroxysm, and thus, if possible, preventing grave degeneration of the organs and malarial cachexia. Arsenic is also sometimes used to attain this object.

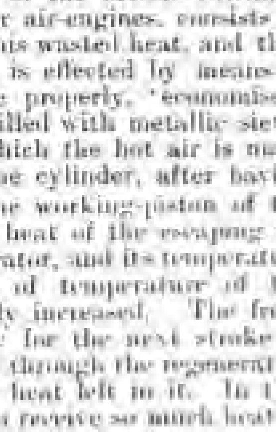
Air-engine, a form of heat-engine in which air is the working substance.

It is a well-known law, applicable to all heat-engines, that (presupposing the merely mechanical part of the machine to be perfect) the heat converted into work bears the same proportion to the total heat given to the working substance as the range of temperature bears to the *absolute* temperature of the source of heat. Thus, supposing an engine to receive steam (and the law is the same for steam, air, or *any other substance whatever*) at the temperature of 275° F., and discharge it at that of 120° F., the fraction of heat which it can convert into work will be $\frac{275 - 120}{275 + 461}$ or about 21 per cent. of the total heat of the fluid. This proportion would be, of course, greatly reduced in practice, owing to imperfections in the machinery; but these being equally likely to occur in all prime movers, we need not consider them here. The *lowest* limit of temperature available being practically constant, fixed either by the temperature of the atmosphere, or that obtainable in a condenser, it follows that greater economy can only be looked for in the direction of increase of initial temperature. In ordinary steam-engines, in which the pressure and temperature increase simultaneously, the latter is limited by the former, which in its turn is kept, by considerations of safety, comparatively low. When, however, *superheated* steam (steam to which additional heat has been imparted without the corresponding addition of pressure) or heated air is used, the temperature is limited only by the power of the metals composing the machine to resist the destructive action of heat, or the chemical action of the fluid at that temperature. Heated air possesses the advantage over superheated steam as a motive power, that with it an explosion, in the usual sense of the word, is rendered almost impossible, and that, if one were to occur, it would be comparatively harmless. It also, of course, enables the boiler to be dispensed with.

Air-engines, in their principal working parts, are very similar to ordinary steam-engines. The heated air is introduced into a cylinder, in which works a tightly fitting piston, which is thus compelled to move up and down, and transfers its motion to a revolving shaft by means of a piston and connecting-rod in the usual manner. The motion of the piston results in all cases from the expansion of the heated air; the air is heated by means of a furnace, is introduced below the piston, raises it, and then is allowed to escape into the atmosphere. Air-engines are almost invariably single-acting; they are sometimes worked simply by heated air, and sometimes with the air which, having passed through the furnace, is mixed with all the gaseous products of combustion. The latter method has the immense advantage that it utilises the heat which would otherwise be rejected into the chimney, and so prevents considerable waste of fuel.

The more heat carried away by the discharged air—the higher its temperature, in other words—the smaller evidently is, *ceteris paribus*, the range of temperature of the machine, and the less, therefore (as already explained), will be its efficiency. The distinctive principle of the Messrs Stirling's air-engine, as of the later air-engines, consists in utilising a great part of this wasted heat, and thus economising fuel. This is effected by means of a 'regenerator,' or, more properly, 'economiser,' consisting of a chamber filled with metallic sieves of wire-gauze, through which the hot air is made to pass *outwards* from the cylinder, after having performed its work on the working-piston of the engine. As much of the heat of the escaping air is taken up by the regenerator, and its temperature thus reduced, the range of temperature of the machine is correspondingly increased. The fresh air entering the cylinder for the next stroke is compelled to pass *inwards* through the regenerator, and abstracts from it the heat left in it. In this way it does not require to receive so much heat in the furnace as would otherwise be the case, and thus economises fuel.

The figure shows one of Stirling's air-engines. E is the plunger which works in the receiver CAB. This receiver is double, the inner lining being pierced with small holes to admit of communication between the annular space and the interior. The regenerator is placed in the space AC. By the motion of the plunger the air is alternately admitted to the upper and under portions of the receiver, passing through the regenerator. The upper portion is always in communication with G, the cylinder, in which the piston H works. At D is placed the 'refrigerator,' a coil of copper tube through which cold water passes. This refrigerator abstracts the heat wasted through imperfect action of the regenerator.



This method of preventing waste of heat was first discovered by the Rev. Dr Stirling, who obtained a patent for it in 1816. In working with air at the ordinary pressure of the atmosphere, however, the engine was found to require to be of large dimensions as compared with a steam-engine of the same power; and in order to obviate this objection, compressed air was used, the idea originating with Mr James Stirling, C.E. Several other difficulties were successfully surmounted by the Messrs Stirling, and eventually two improved engines were constructed, one of which was tested to fully 40 horse-power. This latter engine did all the work of the Dundee Foundry Company regularly for upwards of three years, during which period they employed no other motor. At the end of this period it was laid aside, principally owing to the repeated failure of one of the heating vessels.

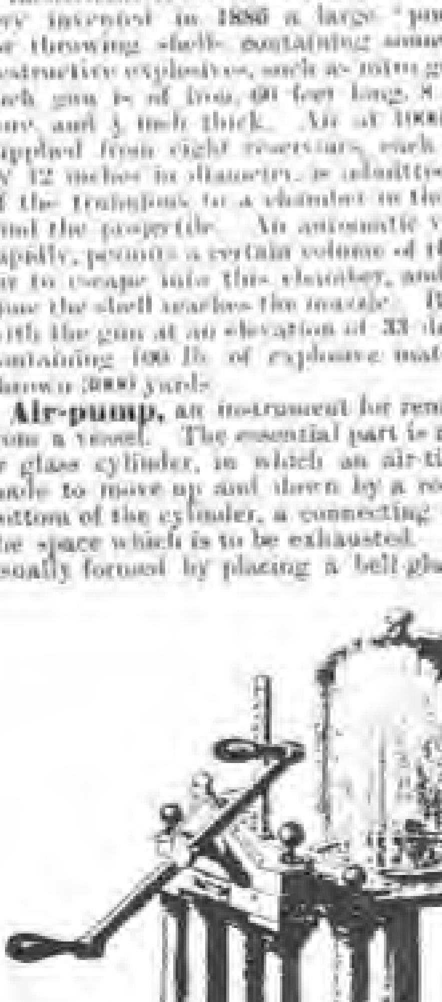
Captain Ericsson, in his attempt to introduce his caloric-engine in the ship which bore his name, experienced precisely the same difficulties and disappointments, and tried nearly the same remedies as the Messrs Stirling. But in the Ericsson engines the regenerator was used in a different way. The temperature of the air working it was changed by passing through the regenerator, while the pressure remained constant. No refrigerator was employed, but the air on its escape passed through the regenerator, to which it imparted much of its heat. The causes of his failure were the burning-up of the heating surfaces, and the insufficiency of their areas. Ericsson has since invented a smaller and very useful air-engine, suitable for light machinery. There are also several other successful inventions of a similar character.

For a very different kind of air-engine, see COMPRESSED-AIR MOTORS.

Air-gun. There are several forms of this weapon, but it is commonly made like a fowling-piece or musket, with lock, stock, and barrel. In one of the simplest kinds there is an air-chamber placed above the barrel, and the two communicate by a valve opening just behind where the bullet is placed. By means of a syringe in the stock, the air is condensed in the chamber. On pulling the trigger the valve opens, and immediately the bullet is projected with considerable force by the elasticity of the compressed air behind it. In air-guns, the reservoir of condensed air is usually very large in proportion to the tube which contains the ball, so that its elastic force is not greatly diminished by expanding through it. These guns commonly propel a bullet to a distance of from 60 to 80 yards. One form of air-gun contains several bullets in a receptacle or channel under the barrel; by the movement of a cock or lever, one of these bullets can readily be shifted into the barrel; and thus several successive discharges can be made after one loading—on a principle somewhat analogous to that of the revolving pistol. Some varieties of air-guns have the condensing syringe detached, by which means greater condensation of air may be produced; this done, the air-chamber is again attached to the barrel. A pressure of as much as 500 atmospheres has been attained with a powerful condenser, but even this is only about half the elastic force of fired gunpowder. Those air-guns which present the external appearance of stout walking-sticks, and are thence called air-canes, have a chamber within the handle for containing condensed air, which can be unscrewed, and subjected to the action of the condensing syringe. The air-gun was known in France more than two centuries ago; but the ancients were acquainted with some kind of apparatus by which air was made to act upon the shorter arm of a lever, while the larger arm impelled a bullet. Among the English patents which have been taken out for peculiar forms of air-guns in comparatively recent years are the following: P. Giffard in 1872; A. Pope (H. M. Quackenbush) in 1874; C. G. Bussey in 1876; and F. Wirth (M. Weber) in 1877. Inventions for using compressed air to fire large shot with pieces of ordnance have been patented by Bessemer (1867) and others.

Lieutenant Zalinski of the United States Artillery invented in 1886 a large 'pneumatic gun' for throwing shells containing some of the very destructive explosives, such as nitro-gelatine. One such gun is of iron, 60 feet long, 8 inches in the bore, and ¾ inch thick. Air at 1000 lb. pressure, supplied from eight reservoirs, each 20 feet long by 12 inches in diameter, is admitted through one of the trunnions to a chamber in the gun just behind the projectile. An automatic valve, opening rapidly, permits a certain volume of the compressed air to escape into this chamber, and closes at the time the shell reaches the muzzle. By this means, with the gun at an elevation of 33 degrees, a shell containing 100 lb. of explosive material has been thrown 3889 yards.

Air-pump, an instrument for removing the air from a vessel. The essential part is a hollow brass or glass cylinder, in which an air-tight piston is made to move up and down by a rod. From the bottom of the cylinder, a connecting tube leads to the space which is to be exhausted. This space is usually formed by placing a bell-glass, called the receiver, with edges ground smooth, and smeared with lard, on a flat, smooth plate or table. When the piston is at the bottom of the barrel, and is then drawn up, it lifts out the air from the barrel, and a portion of the air under the receiver, by its own expansion, passes through the connecting tube, and occupies the space below the piston, which would otherwise be a vacuum. The air in the receiver and barrel is thus *rarefied*. The piston is now forced down, and the effect of this is to close a valve placed at the mouth of the connecting tube, and opening inwards into the barrel. The air in the barrel is thus cut off from returning into the receiver, and, as it becomes condensed, forces up a valve in the piston, which opens outwards, and thus escapes into the atmosphere. When the piston reaches the bottom, and begins to ascend again, this valve closes; and the same process is repeated as at the first ascent. Each stroke thus diminishes the quantity of air in the receiver; but from the nature of the process, it is evident that the exhaustion can never be complete. Even theoretically, there must always be a portion left, though that portion may be rendered less than any assignable quantity; and practically the process is limited by the pressure of the remaining air being no longer sufficient to open the valves. The degree of rarefaction is indicated by a *gauge* on the principle of the barometer. By means of the partial vacuum formed by the air-pump, a great many interesting experiments can be performed, illustrating the effects of atmospheric pressure, and other mechanical properties of gases. The air-pump was invented by Otto Guericke (q.v.), 1654; and though many improvements and varieties of structure have been since devised, the principle of all is the same. Two barrels are generally used, so as to double the effect of one stroke. In some air-pumps, stop-cocks turned by the hand take the place of valves; and in others, the entrance of the connecting tube into the cylinder is so contrived that the valve through the piston is not required.



Air-pump.

Al'cohol (Arab. *al-koh'l*, originally designating a collyrium, a very fine powder of antimony for staining the eyelids; afterwards 'essence,' 'spirits'). Ordinary or *ethyl* alcohol is a limpid, colourless liquid, of a hot pungent taste, and having a slight but agreeable smell. It is the characteristic ingredient of fermented drinks, gives them their intoxicating quality, and is obtained from them by distillation. If we look at the extraordinary consumption of these liquors for various purposes, it is seen to be one of the most important substances produced by art.

Alcohol occurs in nature in several growing plants, and must therefore be regarded as an occasional constituent of plant-juices which have not undergone fermentation. It has been found in the fruit and pedicels of *Heracleum giganteum*, the fruit of the parsnip, and the unripe fruit of *Anthriscus cerefolium*. For practical purposes, there is, however, only one source of alcohol—namely, the fermentation of sugar or other saccharine matter. Sugar is the produce of the vegetable world. Some plants contain free sugar, and still more contain starch, which can be converted into sugar. The best vegetable substances, then, for yielding alcohol are those that contain the greatest abundance of sugar or of starch. See DIASTASE, FERMENTATION, and DISTILLATION.

Owing to the attraction of alcohol for water, it is impossible to procure pure alcohol by distillation alone. Common spirits, such as brandy, whisky, &c. contain 50 or 52 per cent. of alcohol; in other words, they are about half alcohol, half water. *Proof-spirit*, which is the standard by means of which all mixtures of alcohol and water are judged, contains 57·27 per cent. by volume, and 49·50 per cent. by weight of alcohol. The specific gravity of proof-spirit is ·9186; and when a spirit is called *above proof*, it denotes that it contains an excess of alcohol; thus, *spirit of wine*, or rectified spirit, with specific gravity ·838, is 54 to 58 overproof, and requires 54 to 58 per cent. of water to be added to it to bring the strength down to that of proof-spirit; whilst the term *under-proof* has reference to a less strong spirit than the standard (see HYDROMETER). The most primitive method of learning the strength of alcohol was to drench gunpowder with it, set fire to the spirit, and if it inflamed the gunpowder as it died out, then the alcohol stood the test or proof, and was called proof-spirit. The highest concentration possible by distillation gives 90 per cent. of alcohol, still leaving 10 per cent. of water. In order to remove this, fused chloride of calcium, quicklime, or fused carbonate of potash, is added to the alcoholic liquid, the whole allowed to stand for twelve hours, and then the spirit may be distilled off practically free from water. Spirit of wine may also be deprived of its remaining water by suspending it in a bladder in a warm place; the bladder allows much of the water to pass through and evaporate, but little of the alcohol. The latter method is called Sœmmering's process, and depends on the different degrees of rapidity with which the bladder admits of water and alcohol passing through it. Thus, introduce into one bladder eight ounces of water, and into a second eight ounces of alcohol, and allow both bladders to be similarly exposed on a sandbath till all the water has evaporated through the pores of the membrane, which will be accomplished in about four days; and it will then be observed that whilst eight ounces of water have made their exit from the bladder, only one ounce of alcohol has thus evaporated, and seven ounces still remain in the bladder.

Absolute or anhydrous alcohol has a specific gravity of ·793 at the temperature of 60° F. (15·5° C.). It boils at 173° F. (78·4° C.), and has not been frozen by any cold hitherto produced. Reduced to a temperature of −130° F. (−72° C.), alcohol becomes of an oily and greasy consistence; at −146° F. (−81° C.) it assumes the aspect of melted wax; and at −166° F. (−92° C.), it gets still thicker, but does not congeal at the lowest attainable temperature. This property of non-freezing at any degree of cold to which the earth is subjected, has led to the employment of alcohol coloured red by cochineal, in the thermometers sent out to the arctic regions. It is highly inflammable, its combustion yielding only carbonic acid and water. It has a very strong attraction for water, and when mixed with it, much heat is evolved and a contraction in volume takes place. Thus 2 gallons of alcohol and 1 of water measure less than 3 gallons. Its poisonous action when taken internally in large quantity has been referred to this same property, the idea being that it removes water from the tissues, and thus destroys them. The formula of alcohol is C_2H_5OH. In 100 pounds, therefore, of alcohol, about 53 are carbon, 13 hydrogen, and 34 oxygen. Besides the alcohol consumed in wine, beer, and spirits, it is much employed in pharmacy and in the arts. It is a powerful solvent for resins and oils; and hence is employed in the preparation of varnishes. In Germany, a cheap spirit made from potatoes is much used for cooking on a small scale.

During recent years, our knowledge of the properties of ordinary alcohol, and of the general class of bodies to which the term ALCOHOLS is applied, in consequence of their resemblance, in certain chemical reactions, to ordinary alcohol, has been very much enlarged. The alcohols are all compounds of carbon, hydrogen, and oxygen, and are perfectly neutral to test-papers. Many of them are produced along with ordinary alcohol in the process of fermentation, and alter the flavour of the resulting beverage; such are amylic (fusel oil) and butylic alcohol. They are chiefly characterised by yielding, on treatment with acids, neutral bodies called ethers, the formation of water being a part of the reaction. According to the theory of chemical types (see under CHEMISTRY, vol. iii. p. 150), the alcohols are divided into monatomic (comprising the important series of methyl, ethyl, propyl, and other alcohols, which are referred to further below) and polyatomic. According to their behavior on oxidation, they are further divided into primary, secondary, and tertiary.

In a nearly anhydrous state, alcohol has little tendency to oxidation, but when freely diluted, and exposed to the air, it rapidly becomes oxidised into acetic acid. This conversion is, however, not a direct one, an intermediate compound, termed Aldehyde (q.v.), being first formed, which is rapidly oxidised into acetic acid. The oxidation of alcohol into aldehyde is represented by the equation,

$$\underset{\text{Alcohol.}}{CH_3CH_2OH} + O = \underset{\text{Aldehyde.}}{CH_3COH} + \underset{\text{Water.}}{H_2O};$$

and the further oxidation of aldehyde into acetic acid is represented by

$$\underset{\text{Aldehyde.}}{CH_3COH} + O = \underset{\text{Acetic Acid.}}{HC_2H_3O_2}.$$

In the first reaction, alcohol loses two atoms of hydrogen, water being formed; in the second, aldehyde takes up one atom of oxygen.

Every alcohol which like ordinary alcohol yields on oxidation an aldehyde, and on further oxidation an acid having the same number of carbon atoms as the alcohol itself, is termed a primary alcohol. To take another example, primary propyl alcohol, C_3H_7OH, is oxidised first into propyl aldehyde, C_2H_5COH, and then into propionic acid, $HC_3H_5O_2$. Primary alcohols are subdivided into normal and iso-alcohols, but it would lead us too far to explain the meaning of this distinction.

Secondary alcohols on oxidation lose two atoms of hydrogen, and are converted into bodies known as acetones or ketones, which differ from aldehydes inasmuch as they are not converted on oxidation into acids having the same number of carbon atoms, but are split up into acids having a smaller number of carbon atoms. Thus secondary propyl alcohol is oxidised into acetone, and on further oxidation, acetone splits up into formic and acetic acids.

$$\underset{\text{Secondary Propyl Alcohol.}}{(CH_3)_2CH{\cdot}OH} + O = \underset{\text{Acetone.}}{(CH_3)_2CO} + \underset{\text{Water.}}{H_2O};$$

$$\underset{\text{Acetone.}}{(CH_3)_2CO} + O = \underset{\text{Formic Acid.}}{HCHO_2} + \underset{\text{Acetic Acid.}}{HC_2H_3O_2}.$$

It will be observed that propyl alcohol and secondary propyl alcohol, propyl aldehyde and acetone, are respectively isomeric (see ISOMERISM).

Tertiary alcohols on oxidation give neither aldehydes nor ketones, but split up into acids having a smaller number of carbon atoms. Thus tertiary butyl alcohol, $(CH_3)_3COH$, which is isomeric, with primary and with secondary butyl alcohol, splits up on oxidation into acetic and formic acids. Only a comparatively small number of secondary and tertiary alcohols are at present known, and their properties and reactions have not been so thoroughly studied as those of the much more numerous class of primary alcohols. Theoretical considerations, however, lead to the belief that their number will be largely increased.

Ordinary or ethyl alcohol is monatomic—i.e. it may be regarded as being derived from the type HOH, by the substitution of its radical ethyl, C_2H_5, for one atom of hydrogen. This view is expressed by the formula C_2H_5OH.

The *monatomic alcohols* are more abundant than all the polyatomic alcohols put together. There are several series of them, of which the most important are alcohols whose radical is of the formula $C_n H_{2n+1}$ (as methyl, CH_3; ethyl, C_2H_5; propyl, C_3H_7, &c.), and which are represented by the formula $(C_nH_{2n+1})HO$. They are intimately related to the fatty acids, whose general formula is $C_nH_{2n}O_2$, and which may be formed from the alcohols by oxidation, H_2 being replaced by O. The three highest alcohols of this set, cetylic, cerylic, and melissylic alcohols, have the formulæ $C_{16}H_{34}O$, $C_{27}H_{56}O$, and $C_{30}H_{62}O$, and are solid, waxy, or fatty matters.

Of the *polyatomic alcohols*, *diatomic* alcohols belong to the secondary water type, $(H_2O)_2$ or $H_2O_2H_2$. Thus the most important diatomic alcohol, glycol, $C_2H_6O_2$, is represented, according to the theory of types, by the formula $(C_2H_4)''O_2H_2$, its radical, C_2H_4, being marked with two dashes to indicate that it replaces two atoms of hydrogen. So also there are *tri*, *tetra*, and *hexatomic* alcohols corresponding to 3, 4, and 6 molecules of water, examples of which are glycerine, $(C_3H_5)'''O_3H_3$; erythrite (obtained from lichens), $(C_4H_6)''''O_4H_4$; and mannite (from manna), $(C_6H_8)''''''O_6H_6$.

Dry chlorine and absolute alcohol react on each other in a singular manner—the final product being a solid compound of alcohol with a very remarkable colourless oily fluid, called chloral, having a peculiar penetrating and irritating odour, and having the formula C_2Cl_3OH. By treatment with strong sulphuric acid, this chloral is set free, and may be changed into chloroform by warming with an alkali. Dilute alcohol, distilled with chloride of lime (bleaching-powder), yields chloroform; and this is the most economical process for obtaining this invaluable compound. Heated with an excess of sulphuric acid, alcohol loses all its oxygen in the form of water, and is converted into ethylene, the result being shown by the equation,

$$\underset{\text{Alcohol.}}{C_2H_6O} = \underset{\text{Ethylene.}}{C_2H_4} + \underset{\text{Water.}}{H_2O}.$$

A less complete dehydration, under the action of sulphuric acid, converts alcohol into ether. The process is a complicated one, but the final result is expressed by the equation,

$$\underset{\text{Alcohol.}}{2C_2H_6O} = \underset{\text{Ether.}}{(C_2H_5)_2O} + \underset{\text{Water.}}{H_2O}.$$

The best tests for discovering the presence of alcohol are—(1) Its hot pungent taste, its odour, and its great volatility. (2) Absorbed in asbestos, it burns with a pale blue flame, which deposits no carbon on white porcelain; and when burned in the mouth of an inverted test-tube, containing a few drops of solution of baryta, it produces a well-marked deposit of carbonate of baryta—carbonic acid and water being the products of its combustion. (3) When boiled with sulphuric acid, and a few drops of a saturated solution of bichromate of potash, it reduces this salt to green sulphate of chromium. The chromium test, originally discovered by Dr Thomson in 1840, is that on which the French physiologists Lallemand, Perrin, and Duroy relied in their investigations regarding the presence of alcohol in the blood, urine, expired air, &c. (4) The least trace of alcohol in an aqueous solution can be detected by adding a little chloride of benzoyl, and then a little caustic potash; benzoate of ethyl, a liquid having a very characteristic aromatic odour, is at once formed, and enables one thousandth part of alcohol in a teaspoonful of water to be detected.

Alcohol is of a double use to the chemist, inasmuch as it furnishes a cleanly and valuable fuel when used in the spirit lamp, and possesses remarkable solvent powers without in general exerting chemical action on the dissolved substances. It dissolves many of the gases more freely than water, as, for example, nitrous oxide, carbonic acid, phosphuretted hydrogen, cyanogen, and the hydrocarbons, as, for instance, ethylene. Amongst the mineral substances which it dissolves may be mentioned iodine, bromine, boracic acid, the hydrates of potash and soda, the chlorides of calcium, strontium, magnesium, zinc, platinum, and gold, the perchloride of iron, corrosive sublimate, the nitrates of lime, magnesia, &c.; whilst amongst organic matters, it dissolves many organic acids, bases, and neutral bodies, the resins, the soaps, and the fats. The latter dissolve more freely in ether than in alcohol. The alcoholic solutions of substances used in medicine are called *Essences*, *spirits*, and *tinctures*. See BRANDY, WHISKY, FUSEL OIL, AMYL.

ACTIONS AND USES OF ALCOHOL. The only alcohols which require to be taken into consideration are those belonging to the methyl, ethyl, propyl, butyl, and amyl series. It is of interest to observe that these alcohols increase in activity in direct proportion to their rise in atomic weight; amyl alcohol or potato spirit, for instance, is about five times as powerful as ethyl alcohol or spirit of wine.

Aldehyde, CH_3COH, is a volatile fluid produced by the oxidation and destructive distillation of alcohol and other organic compounds. There are many modes of obtaining it; the following is the method described by Liebig: A mixture of 2 lb. of strong alcohol, 2 lb. of water, and 3 lb. of sulphuric acid, is distilled into a receiver kept cool by ice. As soon as the distillate reddens litmus-paper, the operation is stopped. The product in the receiver, weighing about 3 lb., is then twice rectified over chloride of calcium, being reduced by these operations to about 12 oz. This is then mixed with twice its volume of ether, and saturated with ammonia gas. After cooling, crystals of aldehyde ammonia, $C_2H_4ONH_3$, are formed, which are mixed with dilute sulphuric acid, and distilled at a low temperature. The hydrated aldehyde thus obtained is dried with chloride of calcium and again rectified by distillation. The aldehyde thus prepared is a thin, transparent, colourless liquid, very inflammable, burning with a blue flame, and having a spec. gr. of ·800, a boiling-point of about 70° F. (21° C.), and a pungent, suffocating odour. It mixes in all proportions with water, alcohol, and ether, and dissolves sulphur, phosphorus, and iodine. As is shown in the article ALCOHOL, it constitutes an intermediate stage in the oxidation of alcohol into acetic acid. When potassium is gently heated with aldehyde, one atom of H is replaced by one of K, the resulting compound being aldehydate of potash, CH_2COK. Various compounds of this kind may be formed, of which the most important is aldehydate of ammonia, or aldehyde-ammonia, $C_2H_4ONH_3$, which is obtained in transparent shining crystals, and is a compound that has led chemists to the discovery of a large number of very remarkable derivatives.

ALDEHYDES are a class of organic compounds intermediate between primary alcohols and acids. Each aldehyde is derived from the corresponding alcohol by the abstraction of two atoms of hydrogen, and each aldehyde is converted into its corresponding acid by the addition of one atom of oxygen.

Ten aldehydes of the series $C_nH_{2n}O$, corresponding to n = 1, 2, 3, 4, 5, 7, 8, 11, 12, and 16, are at present known, the simplest being formic aldehyde, CH_2O, and the highest being palmitic aldehyde, $C_{16}H_{32}O$.

Amongst aldehydes not connected with the preceding group may be mentioned various organic compounds which have been recently shown to belong to this class—thus, acrolein, C_3H_4O, is acrylic aldehyde; camphor, $C_{10}H_{16}O$, is campholic aldehyde; bitter-almond oil, C_7H_6O, is benzoic aldehyde; oil of cumin, $C_{10}H_{12}O$, is cuminic aldehyde; oil of cinnamon, C_9H_8O, is cinnamic aldehyde. Most of these aldehydes are obtained directly from plants, and either exist in them ready formed, or are given off as volatile oils on distillation with water. Owing to their great tendency to oxidise into their corresponding acids, the aldehydes are powerful reducing agents. They reduce the silver in silver salts to the metallic state. On the other hand, by the action of nascent hydrogen upon the aldehydes, the corresponding alcohols are regenerated. Thus ordinary alcohol may be obtained from ordinary aldehyde.

$$\underset{\text{Acetic Aldehyde}}{C_2H_4O} + H_2 = \underset{\text{Ethyl Alcohol}}{C_2H_6O}.$$

With the acid sulphites of the alkalies the aldehydes form sparingly soluble crystalline compounds. When treated with caustic alkali, many of the aldehydes are converted into the corresponding alcohols, and the potassium salt of the corresponding acid. Thus benzoic aldehyde yields benzyl alcohol and benzoate of potash:

$$2C_7H_6O + KHO = C_7H_8O + KC_7H_5O_2$$

The aldehydes have a great tendency to form polymeric compounds. Thus ordinary aldehyde passes readily into two polymeric modifications (see ISOMERISM): (1) Paraldehyde, a liquid which boils at 255° F. (124° C.); (2) Metaldehyde, a solid body which sublimes at 248° F. (120° C.), and is converted back into ordinary aldehyde by heating to 239° F. (115° C.) for a few hours in a closed vessel.

Algin. On the surface of certain species of seaweed—notably of those belonging to the genus Laminaria—there is sometimes seen a jelly-like material, which is partly formed of a substance called algin, and may be drawn out by the fingers in long tenacious strings. The cell-walls of our common brown seaweeds (Fucus and Laminaria) are, in fact, very mucilaginous, and all contain algin, which has somewhat remarkable properties. This substance was discovered in 1881 by Mr E. C. C. Stanford of Glasgow. If the leaf-like thalli of a Laminaria are immersed in water containing a little carbonate of soda, the whole cellular fabric of the plant becomes broken up in the course of twenty-four hours, forming a thick gelatinous mass containing about 2 per cent. of algin. This mass, after being cautiously heated, is filtered through coarse linen, and the cellulose which is left behind amounts, when dry, to from 10 to 15 per cent. of the air-dried plant. The solution which passes through the filter contains, in addition to the algin in the form of alginate of soda, some mucilage and dextrine. When sulphuric or hydrochloric acid is added, the algin, or, more correctly speaking, the alginic acid, separates in flocks, and is easily washed and pressed in a filter-press. In this condition it forms a compact cake not unlike new cheese. Chemically, it is a nitrogenous organic acid, and is the insoluble form of algin. When required for use in a soluble state, it is redissolved to saturation in solution of carbonate of soda, when alginate of soda is again formed.

The properties of algin in the soluble form are those of a very viscous gum, drying up to a transparent elastic film. As a size or dressing for textile fabrics, experiments have shown that algin goes further and does more work than starch or any of the ordinary gums, and it has the advantage of being easily rendered insoluble in water. Algin makes an excellent thickening for soups, and with the addition of a little gelatine or isinglass, is serviceable for jellies. The insoluble form of algin, in the dry state, resembles horn, and can be turned and polished. Different compounds of algin are now being experimented with for various other purposes in the arts.

Alizarin, the colouring matter used in the dyeing of Turkey red, exists in the madder root as a glucoside, which, when boiled with acids or alkalies, gives glucose and alizarin. But in 1869 Graebe and Liebermann discovered a method of manufacturing it from the coal-tar product anthracene; this synthesis being the first instance of the artificial production of a natural colouring matter. The manufacture of alizarin is now one of the most important branches of the coal-tar colouring industry, and threatens to put an end to the growing of madder root. For the ten years preceding this discovery, the annual imports of madder into Britain averaged over £1,000,000; ten years later, they had sunk to £24,000. The 14,000 tons of alizarin produced in 1880 were reckoned equal in colouring power to 126,000 tons of madder. The value of the former was £1,568,000; that of the madder would have been £5,670,000; that is, the artificial dye costs less than a third of the price of the natural. But the artificial dye is inferior to the natural in permanence. Alizarin is represented by the formula, $C_{14}H_6O_2(OH)_2$. See ANTHRACENE.

Al'kahest, or ALCAHEST, the universal solvent of the alchemists. See ALCHEMY.

Alkalies. The word *alkali* is of Arabic origin, *kali* being the name of the plant from the ashes of which an alkaline substance was first procured. The name now denotes a class of substances having similar properties. The alkalies proper are four in number—potash, soda, lithia, and ammonia. The first three are oxides of metals; the last is a compound of nitrogen, hydrogen, and oxygen, and, being in the form of a gas, is called the volatile alkali. Potash, being largely present in the ashes of plants, is called the vegetable alkali; and soda, predominating in the mineral kingdom, is designated the mineral alkali. The *alkaline earths*, as they are called—lime, magnesia, baryta, and strontia—are distinguished from the former by their carbonates not being soluble in water. The distinguishing property of alkalies is that of turning vegetable blues green, and vegetable yellows reddish brown. Blues reddened by an acid are restored by an alkali. The alkalies have great affinity for acids, and combine with them, forming salts, in which the peculiar qualities of both alkali and acid are generally destroyed; hence they are said to neutralise one another. In a pure state, alkalies are extremely caustic, and act as corrosive poisons. Combined with carbonic acid, especially as bicarbonates, they are used to correct acidity in the stomach; but the injudicious and continued use of them is attended with great evil. The alkalies and some of their salts (e.g. citrates, tartrates) are also used to increase the secretion of urine, and (ammonia excepted) to diminish its acidity. Ammonia in small doses is a powerful stimulant. An account of the several alkalies will be found under the heads of POTASH, SODA, LITHIA, and AMMONIA; and of the alkaline earths, under LIME, MAGNESIA, BARYTA, and STRONTIA.

Alkalim'etry. Commercial potash and soda always contain greater or less quantities of foreign substances, such as sulphate of potash, common salt, silicates, oxide of iron, water, &c. which diminish the percentage of real alkali in a given weight. It is important, then, for the manufacturer to have some simple and ready means of determining the proportion of pure carbonate of potash or soda contained in any sample, that he may be able to judge of its value. Ordinary chemical analysis takes too much time. The alkalimeter serves this purpose. It consists of a graduated glass tube, filled with diluted sulphuric acid, and containing as much absolute sulphuric acid as would neutralise a given weight, say 100 grains, of carbonate of potash. 100 grains of the article to be judged of is then dissolved in water, and as much acid is gradually added to it from the tube as to neutralise the solution, that is, take up all the alkali. The purer the article, the more of the acid will be required; and if the tube, which is divided into 100 degrees, has been emptied to the 80°, the impure article contains 80 per cent. of pure carbonate of potash. The point at which neutralisation is complete is determined by means of coloured tests. Formerly, the two vegetable colours, litmus and turmeric, were alone used for this purpose, addition of an alkali rendering litmus blue and turmeric reddish brown; while under the influence of acids the former changes to a red, the latter to a yellow (red in the case of boracic acid). It is not, however, always easy to recognise the neutral point, and other *indicators* (as these colouring matters are called) have come into use. The chief of these are methyl-orange and phenolphthalein. A mixture of the alcoholic solutions of these substances imparts a pale yellow colour to strictly neutral liquids, which is changed to deep red by the least trace of alkali, and to pink by a trace of acid.

This method of determining the strength of alkalies is called the *alkalimetric process*; but the alkalimeter is not confined in its use to the estimation of the strength of alkaline substances. It is likewise employed in the determination of the strength of acids, such as sulphuric acid, hydrochloric acid, nitric acid, and acetic acid (vinegar). For this end, the graduated instrument is charged with a solution of an alkali of known strength, such as a given weight of crystallised carbonate of soda (washing soda), dissolved in water, and according to the number of divisions of the liquid poured from the alkalimeter, the strength of the acid into which the alkaline liquid has been decanted is calculated. The latter application of this instrument is called *acidimetry*. Again, the same graduated glass tube has been recently employed in many other ways, such as the determination of the strength of a solution of silver, by charging the instrument with a known or standard solution of common salt; and for this purpose it is used largely by the assayers to the Royal Mint, and other metallurgic chemists. This mode of analysis is every day becoming of more and more importance, and, in fact, has given rise to a new department of analytical chemistry, which has been designated *volumetric analysis*.

Alkaloids form an important class of substances discovered by modern chemistry. They are divided into two classes—namely, *natural* and *artificial*. The natural alkaloids are found in plants and animals, and are often designated *organic bases*. Those obtained from plants are frequently their *active principles*; but it must not therefore be assumed that when a plant contains an alkaloid it is of necessity the active principle, which may rather be a resin, glucoside, volatile oil, or vegetable acid. Most of the natural alkaloids consist of carbon, hydrogen, nitrogen, and oxygen, and are solid bodies at the ordinary temperature. A few, however, only contain carbon, hydrogen, and nitrogen, and these are for the most part liquids which can be distilled without decomposition. The more important of this class are coniine and nicotine. The alkaloids have generally an energetic action on the animal system, and hence are every day employed in small doses as medicine; whilst in comparatively large doses they are powerful poisons.

Many of them have an alkaline reaction on vegetable colours, and are hence termed *vegetable alkalies*; but in the greater number this property is only possessed in a very faint degree, and it is by analogies, based on other properties, that they are all classed under one title. There is only one property common to all alkaloids, natural and artificial—namely, that they combine directly with acids to form more or less stable salts, capable of undergoing double decomposition; as, for example, sulphate of quinine, muriate of morphine, &c. Most of the alkaloids have an acrid, bitter taste, and are sparingly soluble in water, more freely so in alcohol. To describe the methods of obtaining alkaloids from plants or animal matters would be beyond the scope of this article; but, in general, it may be stated that they are precipitated from solutions by tannin, and the double iodides of potassium and mercury, or cadmium and bismuth; and by treating these precipitates with an alkali, the bases may be obtained. The following list contains the names of the chief alkaloids, with the plants from which they are obtained:

Alkaloids.	Source.	Alkaloids.	Source.
Aconitine	Aconite.	Hyoscyamine	Henbane.
Angosturine	Cusparia.	Jervine	Hellebore.
Atropine, Belladonnine	Belladonna.	Lupuline	Hops.
Bebeerine	Bebeeru Tree.	Morphine, Codeine, Narcotine	Opium.
Berberine	Barberry, Calumba.	Nicotine	Tobacco.
Cocaine	Coca Leaf.	Pilocarpine	Jaborandi.
Coniine	Hemlock.	Piperine	Black Pepper.
Curarine	Arrow Poison.	Quinine, Cinchonine, Cinchonidine	Cinchona.
Cytisin, Laburnine	Broom.	Sinapine	Mustard.
Daturine	Stramonium.	Strychnine, Brucine	Nux Vomica.
Delphinine	Stavesacre.	Veratrine	Cevadilla.
Ergotinine	Ergot.		
Eserine or Physostigmatine	Calabar Bean.		

The number of animal alkaloids which has been examined is small, the better-known ones being urea, found in the urine of the mammalia, and kreatine and kreatinine, two of the constituents of the juice of flesh. Besides these, however, there are many substances, answering to the alkaloidal tests, which are found in flesh, both in the fresh and putrefied state, and which are classed under the title *Ptomaines* (q.v.).

The artificial alkaloids are those organic bases which are not found in any known plant or animal, but of which the later researches of chemists have contrived to form a large number. As the artificial alkaloids do not differ from the natural alkaloids in composition, structure, or properties, it is confidently believed that the day is not far distant when all of the alkaloids will be prepared artificially; indeed, recently, several of the natural alkaloids have been manufactured on the small scale without the intervention of the living plant or animal. For instance, urea can be formed by heating carbonate of ammonia to 284° F. (140° C.) in a sealed tube, while coniine, the alkaloid of hemlock, has been prepared artificially by a German chemist. Hitherto, the more important alkaloids—quinine, morphine, &c.—have defied all attempts at artificial production.

The following remarks on the artificial alkaloids refer (1) to the classification of organic bases, and (2) to their formation.

(1) From the fact that nearly all artificial organic bases are (as will be afterwards shown) actually constructed from ammonia, and that, whether artificially or naturally formed, they exhibit the property of basicity, which is a leading characteristic of ammonia, chemists have been led to refer organic bases generally to the typical body ammonia, and to regard them as being constructed upon or derived from the simple type NH_3. Berzelius believed that all the alkaloids actually contained ammonia as an ingredient of their composition, a view which is now untenable; and it is to Liebig that we are indebted for the idea that they are derivatives of ammonia, or, in other words, amidogen bases or ammonia in which an equivalent of hydrogen is replaced by an organic radical. These bases are classified under the general term *amines*—the word *amines* being applied to all organic bases that are derived from ammonia (NH_3). The amines may be (1) *monamines*, (2) *diamines*, (3) *triamines*, (4) *tetramines*, or (5) *pentamines*, according as they are constructed upon a single, double, treble, quadruple, or quintuple atom of NH_3. We shall confine our illustrations of the meaning of these terms to the monamines, both because they form the most important group, and because they are much more readily elucidated than the other groups, which are extremely complicated in their composition. *Monamines* are constructed upon the simple type of ammonia, H_3N. In *primary monamines* one of the atoms of hydrogen is replaced by an organic radical, R; and hence their general formula is RH_2N. Ethyl-amine $(C_2H_5)H_2N$, or C_2H_7N, is an example. In *secondary monamines* two of the atoms of hydrogen are replaced by two atoms of either the same or of different radicals. Hence their general formula is $RR'HN$, where R and R' may be the same or different radicals. $(C_2H_5)_2HN$, diethyl-amine, and $(CH_3)(C_2H_5)HN$, are examples of these. In *tertiary monamines* the three atoms of hydrogen are replaced by three atoms of the same or different radicals; their formula therefore is $RR'R''N$, when R, R', R'' may or may not differ from one another. Trimethyl-amine$(CH_3)_3N$, and methyl-ethyl-phenyl-amine $(CH_3)(C_2H_5)(C_6H_5)N$, afford examples of the radicals being all the same, and of their being all different.

(2) Although all attempts at forming in the laboratory those alkaloids that naturally exist in plants, such as morphia, quinia, and strychnia, have hitherto failed, a large number of organic bases have been prepared by artificial means, such as: *a*. By the destructive distillation of organic bodies containing nitrogen. Thus, in the preparation of coal-gas, four at least of these compounds are obtained—viz., aniline, picoline, leukol (or quinoline), and pyridine. *b*. By the distillation of certain nitrogenous compounds with caustic potash. In this way aniline is obtained from indigo. *c*. By the combination of ammonia with the aldehydes and with certain volatile oils which possess the properties of aldehydes. Thus acetic aldehyde yields dimethyl-amine, and oil of mustard yields thyosinamine. *d*. By the substitution (by the action of strong nitric acid) of *one* molecule of nitrous acid, NO_2, for one atom of hydrogen in certain hydrocarbons. *e*. By the processes of fermentation and putrefaction. Thus wheaten flour yields by putrefaction trimethyl-amine, ethyl-amine, and amyl-amine.

Al'kanet (*Anchusa tinctoria*, to which the name Alkanet or Alkanna—Arabic *Al-chenneh*—more strictly belongs) is a native of the Levant and of the south of Europe, extending as far north as Hungary. The root is sold under the name of alkanet or alkanna-root, and is imported from the Levant. It appears in commerce in brittle pieces of the thickness of a quill or of the finger, the rind blackish externally, but internally dark red. It is sometimes adulterated with dyed roots of common alkanet (*Anchusa officinalis*). The root of *Lawsonia inermis*, a Lythraceous plant, was formerly often imported under the same name. Alkanet-root contains a resinous red colouring-matter, called *Alkanna Red* (*Alkannin* or *Anchusin*). The colour which it yields is very beautiful, but not very durable. It is readily soluble in oils and alcohol, and is therefore in very general use amongst perfumers for colouring oils, soaps, pomades, lip-salves, &c., and in the composition of stains and varnishes. The name of alkanet is also extended to the whole genus Anchusa, of which three species are common in Britain.

Almond (*Amygdalus*), a genus of the natural order Rosaceæ (q.v.), sub-order Amygdaleæ or Drupaceæ, consisting of trees or shrubs, distinguished by the coarsely furrowed and wrinkled shell (*endocarp* or *putamen*) of the drupe, and by

The Almond:
a, flower; *b*, fruit.

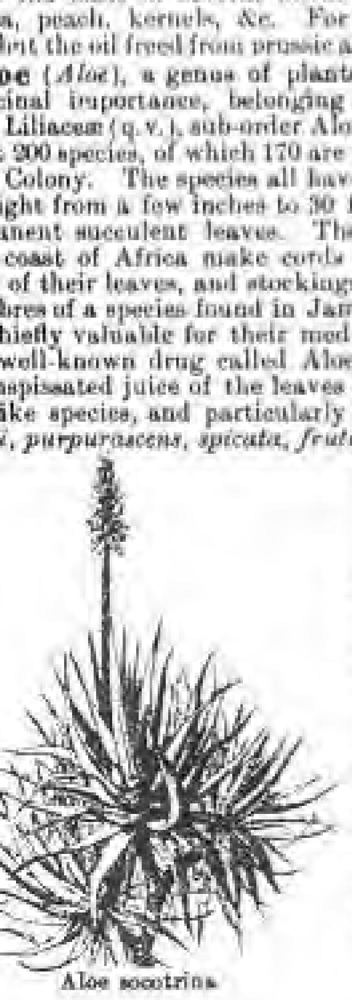
the young leaves being conduplicate, or having their sides folded together. According to the greater number of botanists, it includes the Peach (q.v.), constituted by some into a distinct genus, Persica, in which the drupe has a fleshy covering (*sarcocarp*), whereas, in the species to which the name almond is commonly given, this part is a dry fibrous husk, which shrivels as the fruit ripens, and finally opens of its own accord. The almond-tree (*Amygdalus communis*) is very similar to the peach-tree, and is about 20–30 feet high, a native of the East and of Africa, but has now become completely wild in the whole south of Europe. Even in the more northern parts of Germany and of Britain it is planted for the sake of its beautiful flowers, which are produced in great abundance, and resemble those of the peach in form and often in colour, although generally paler and sometimes white. The blossoms appear before the leaves, and are very ornamental in shrubberies in March and April. The wood of the almond-tree is hard, and of a reddish colour, and is used by cabinet-makers. But it is chiefly valued on account of the kernel of its fruit, which forms an important article of commerce. The almond-tree is often referred to in the Old Testament, and the word translated *hazel* is supposed to be another name for the almond. The tree flowers in Palestine in January. The rod of Aaron, mentioned in Numbers xvii., was taken from an almond-tree, and it is yet customary with the Jews to carry rods of almond-blossom to the synagogue on festival days. It seems to have been very early introduced into England, and is named in the *Durham Glossary* (11th century) the 'Easterne Nutte-Beam.' Its great beauty has made it a favourite with every one wherever it can be successfully grown. Gerard, in Shakespeare's days, says the trees were 'in our London gardens in great plenty;' but Spenser had sung of its beauty before that time. It is only in the most favoured situations in the south of England that it ever produces good fruit.—Almonds are either sweet or bitter. The bitter appear to be the original kind, and the sweet to be an accidental variety, perpetuated and improved by cultivation. Sweet almonds contain a large quantity of a very bland, fixed oil, emulsin, gum, and mucilage sugar, are of a very agreeable taste, and very nutritious, and are used in the dessert, in confectionery, and medicinally in an emulsion, which forms a pleasant, cooling, diluent drink. Bitter almonds contain the same substances, and, in addition, a substance called *Amygdalin* (q.v.), from which is obtained a peculiar volatile oil. (For the almond *oils*, see the following articles.)—The muddy water of the Nile is clarified by rubbing bitter almonds on the sides of the water-vessels, in the same way in which the nuts of the *Strychnos potatorum* (see CLEARING NUT) are used in India. The principal varieties of almond in cultivation are—the common *sweet* almond, with thick hard shell; the *brittle-shelled*, with a very thin, almost leathery brittle shell and sweet kernels; the *bitter* almond, with thick hard shell (sometimes also with a brittle shell) and bitter kernels; the *large-fruited*, with large flowers of a whitish rose-colour, and very large, sweet fruit; the *small-fruited*, with very small sweet fruit; and the *peach* almond, with a slightly succulent blackish *sarcocarp* (see above), yellow shell, and sweet kernels. In commerce, the long almonds of Malaga, known as Jordan almonds, and the broad almonds of Valencia, are most valued. Large quantities of almonds are annually imported into Britain and America from France, Spain, Italy, and the Levant; and California produces annually about 2,000,000 lb. Bitter almonds are brought to Britain chiefly from Mogadore.—The DWARF ALMOND (*A. nana*) is very similar to the common almond, except that it is a low shrub, seldom more than two or three feet in height. Its fruit is also similar, but much smaller. It is common in the plains of the south of Russia, and is frequently planted as an ornamental shrub in Britain, flowering freely in March and April, but not producing fruit.

Almonds, FIXED OIL OF.—When almonds are subjected to pressure, a fixed greasy oil exudes. Either bitter or sweet almonds may be employed; but the former are generally used, as they are cheaper than the sweet almonds, and the expressed cake is valuable in the preparation of the *essential oil*. 1 cwt. of the almonds generally yields 48 to 52 lb. of the fixed oil. When first obtained, it possesses a turbid or milky appearance; but when allowed to stand at rest, the impurities settle, and a clear, light, yellow oil remains above. It has the specific gravity of ·920, and does not solidify till it is cooled to between + 14° and − 5° F. (− 10° and − 20° C.). When fresh it has a mild nutty taste, but soon becomes rancid by exposure to the air;

it is not, however, one of the drying oils. It consists almost wholly of *triolein*, a compound of glycerine with oleic acid. The fixed oil of almonds possesses a mild laxative property, and is beneficial also in allaying troublesome coughs.

Almonds, VOLATILE OIL or ESSENTIAL OIL OF. The cake which is left after the expression of the fixed oil from bitter almonds, contains, among other matters, a portion of two substances called, respectively, amygdalin, and emulsin or synaptase. When the cake is bruised and made into a paste with water, the synaptase acts as a *ferment* upon the amygdalin, splitting it up into the volatile oil of almonds, hydrocyanic (prussic) acid, grape-sugar, ammonia, formic acid, and water. The oil is not originally present in the bitter almonds; in fact, the latter do not contain a trace of the oil ready formed, so that the oil is purely the product of the fermentation of amygdalin, 100 parts of which yield 47 of crude oil. This action takes place very rapidly, and is complete within 24 hours. The paste having been placed in a retort, heat is very cautiously applied, to prevent the lumping and frothing to which the almond infusion is liable. In the distillation, the hydrocyanic acid and the volatile oil unite into an unstable compound, which passes over into the receiver, along with much water. The crude oil thus obtained decomposes gradually, the prussic acid being set free, and on this account it is very poisonous, many fatal cases having occurred from its wilful, accidental, or careless use. The crude oil is purified and freed from prussic acid by means of sulphate of iron and lime. On redistillation, it has a specific gravity of 1·049, as compared with 1·064 in the crude state, and must be carefully freed from water by being shaken with fused chloride of calcium. The yield of crude essential oil is very variable, ranging from 4 to 9½ lb. from 1000 lb. of bitter almonds, and this again is reduced by about 10 per cent. during its purification from prussic acid. The volatile oil (C_6H_5COH) is the aldehyde of benzoic acid (C_6H_5COOH), into which substance it rapidly changes when exposed to the air in a moist state. It has an agreeable odour, an acrid, bitter taste, and burns with a smoky white flame. It is soluble to the extent of 1 part in 30 parts of water, and is very soluble in alcohol and ether. Heated to 356° F. (180° C.), it boils, and distils over unaltered. In medicine, the crude oil used to be employed in place of prussic acid, but its variability in strength has led to its disuse for this purpose. The cook and confectioner employ the oil for flavouring custards, &c., and it forms the basis of several flavouring essences, as ratafia, peach, kernels, &c. For these purposes, none but the oil freed from prussic acid must be used.

Aloe (*Aloë*), a genus of plants of considerable medicinal importance, belonging to the natural order Liliaceæ (q.v.), sub-order Aloineæ. There are about 200 species, of which 170 are indigenous to the Cape Colony. The species all have stems, but vary in height from a few inches to 30 feet. They have permanent succulent leaves. The negroes of the west coast of Africa make cords and nets of the fibres of their leaves, and stockings are woven from the fibres of a species found in Jamaica. But aloes are chiefly valuable for their medicinal properties. The well-known drug called Aloes (see below) is the inspissated juice of the leaves of several almost tree-like species, and particularly of *A. socotrina*, *perryi*, *purpurascens*, *spicata*, *fruticosa*, and *indica*. *A. vulgaris* is found in the East and West Indies, in Italy, and in some of the islands of the Mediterranean, being the only species which can be reckoned European, although it also is probably an introduced plant. The *American Aloe* is a totally different plant (see AGAVE). The *aloes* of the Bible was the wood of a tree (see next article).—The juice of aloes was anciently used in embalming, to preserve dead bodies from putrefaction. In the East Indies, it is employed as a varnish to prevent the attacks of insects. A beautiful violet colour is obtained from the leaves of the Socotrine aloe, which also affords a fine transparent colour for miniature painting.



Aloe socotrina

ALOES is a drug of great antiquity, for we find it mentioned by Dioscorides (50 A.D.). Till modern times, the source of the drug was the island of Socotra, but at present it is imported from various parts of the world. The chief varieties are distinguished by colour, smell, and fracture, and in the London market are: *Socotrine aloes*—derived from the *Aloe perryi*, not from the *Aloe socotrina*, which was till recently believed to be the source of the drug; *Barbadoes aloes*; *Cape aloes*; and *Natal aloes*.

These various forms of the drug are derived from several species of aloe, but they all agree in possessing a bitter taste, and having powerful purgative properties. Active principles, similar in nature but differing in composition, are found in the three chief varieties. These are Socaloin, $C_{15}H_{16}O_7$, found in Socotrine aloes; Nataloin, $C_{16}H_{18}O_7$, found in Natal aloes; Barbaloin, $C_{17}H_{20}O_7$, found in Barbadoes aloes.

When employed in small doses as extract, tincture, pills, or otherwise, aloes exerts a tonic, and in larger doses, a cathartic action.

Aloes Wood (sometimes called also Eagle Wood, Calambac, Paradise Wood, or Agallochum) is the heart-wood of *Aquilaria ovata* and *A. Agallochum*, trees of the order Aquilariaceæ, natives of the tropical parts of Asia, and supposed to be the aloes or lign-aloes of the Bible. They are large spreading trees. Aloes wood contains a dark-coloured, fragrant, resinous substance, and is much prized in the East as a medicine, and for the pleasant odour which it diffuses in burning. The resinous substance is found only in the inner part of the trunk and branches; the younger wood is white, and almost scentless; hence the pure aloes wood is sometimes obtained by burying the stems, when the sap-wood decays away, leaving the resinous core intact. A similar substance, still more esteemed, is obtained in the south-eastern parts of Asia and the adjacent islands, from the central part of the trunk of *Aloexylon Agallochum*, of the natural order Leguminosæ, sub-order Cæsalpineæ. This tree is found in Cochin-China and the Moluccas, where a character of sacredness is attached to it. Its fragrant wood is not only much prized in the East as a perfume, but many medicinal virtues are ascribed to it. The ancients ascribed to it similar virtues, and so valued it for these and its fragrance, that Herodotus says it once sold for more than its weight in gold. As it admits of a high polish, and exhibits a beautiful graining, precious gems were set in it; and it was cut into fantastic forms and worn in head-dresses, &c. It was early used to perfume apartments, and Napoleon I. used it as a perfume in his palaces. The fragrance continues undiminished for years. *Lign Aloes* is a corruption of *Lignum Aloes* (aloes wood).

Alum, a white, saline substance, with a sweetish, astringent taste, is, properly speaking, a double salt, being composed of sulphate of potash and sulphate of alumina, which, uniting together along with a certain proportion of water, crystallise in octahedrons or in cubes. Its formula is $K_2SO_4Al_23SO_424H_2O$. Alum is soluble in eighteen times its weight of cold water, and in its own weight of hot water. The solution thus obtained is strongly acid to coloured test-papers. When heated, the crystals melt in their water of crystallisation; and when the water is completely driven off by heat, there is left a spongy white mass, called burnt alum or anhydrous alum. Alum is much used as a mordant in dyeing. This property it owes to the alumina in it, which has a strong attraction for textile tissues, and also for colouring matters; the alumina thus becomes the means of fixing the colour in the cloth. The manufacture of the colours or paints called lakes depends on this property of alumina to attach to itself certain colouring matters. Thus, if a solution of alum is coloured with cochineal or madder, and ammonia or carbonate of soda is added, the alumina of the alum is precipitated with the colour attached to it, and the liquid is left colourless. Alumina, the basis of pure clay—which is a silicate of alumina—derives its name from being first extracted from alum. Alum is also used in the preparation of leather from skins, and, in medicine, as a powerful astringent for arresting bleeding and mucous discharges. Its use to impart whiteness to bread made from poor flour is highly objectionable.

Alum rarely occurs in nature, except in a few springs and in some extinct volcanoes, where it appears to be formed from the action of sulphurous acid vapours upon felspathic rocks. In this country it is prepared artificially from alum-shale, obtained from coal-mines at Hurlet and Campsie, near Glasgow; and from alum-slate, which occurs at Whitby, in Yorkshire. The alum-slate, shale, or schist consists mainly of clay (silicate of alumina), iron pyrites (bisulphuret of iron), and coaly or bituminous matter. When the shale is exposed to the air—as it is in the old *coal-wastes* or mines from which the coal has been extracted—the oxygen of the air, assisted by moisture, effects a decided change upon it. The original hard stony substance begins to split up into thin leaves, and becomes studded over and interspersed with crystals. The latter are the result of the oxidation of the sulpour of the pyrites into sulphuric acid, and the iron into oxide of iron, both of which in part combine to form sulphate of iron, whilst the excess of the sulphuric acid unites with the alumina of the clay, and produces sulphate of alumina. When the alum-shale thus weathered is digested in water, there dissolve out the sulphate of alumina, Al_23SO_4, and sulphate of iron, $FeSO_4$; this solution is treated with chloride of potassium, KCl, which decomposes the sulphate of iron, forming sulphate of potash, K_2SO_4, and protochloride of iron, $FeCl_2$. When this liquid is evaporated to concentration, and allowed to cool, crystals of alum, leaving the composition above described, separate out, and the protochloride of iron is left in the solution or *mother-liquor*. The crystals of alum obtained from the first crystallisation are not free from iron, and hence require to be redissolved in water, reconcentrated, and recrystallised. This operation is generally repeated a third time before the alum is obtained pure.—As the preliminary weathering of the shale takes some years to complete, a more expeditious method is now largely resorted to. The shale is broken in fragments, and piled up over brushwood in long ridges shaped like huge potato-pits, and the brushwood being set fire to, the coaly matter of the shale begins to burn, and the whole ridge undergoes the process of roasting; the results of which are the same as that of the weathering operation—namely, the oxidation of the sulphur and iron, and the formation of sulphate of alumina and sulphate of iron. This material is afterwards worked up as previously described. The roasting operation is so much more expeditious than the weathering process, that months suffice instead of years. The alum made at Tolfa, near Civita Vecchia, is extracted from alum-stone, a mineral containing sulphate of potash and sulphate of alumina, but united in such a form as to render them insoluble. When the mineral is calcined, the sulphates become soluble, and are extracted by lixiviation. The alum thus manufactured crystallises in opaque cubes, having a reddish tint, due to the presence of iron, and goes by the name of *Roman alum*. The potash in alum can be replaced partly or altogether by soda or ammonia; the alumina by oxide of chromium or sesquioxide of manganese; or the sulphuric acid by chromic acid, or peroxide of iron, without altering the form of the crystals. There are thus soda, ammonia, chrome, iron, &c. alums, forming a genus of salts of which common alum (potash alum) is only one of the species. The more important members of the class, expressed in symbols, are:

$K_2SO_4,Al_23SO_4,24H_2O$, potash alum.
$Na_2SO_4,Al_23SO_4,24H_2O$, soda alum.
$(NH_4)_2SO_4,Al_23SO_4,24H_2O$, ammonia alum.
$K_2SO_4,Cr_23SO_4,24H_2O$, chrome potash alum.
$FeSO_4,Al_23SO_4,24H_2O$, iron alum.

Alu'mina, the most abundant of the Earths (q.v.), is the oxide of the metal Aluminium (q.v.), the formula being Al_2O_3. It occurs in nature abundantly in combination with silica, associated with other bases. The most familiar of its native compounds is felspar, a silicate of alumina and potash, $K_2O,Al_2O_3,6SiO_2$. This is one of the constituents of granite, and of several other igneous rocks. Certain varieties of these, by exposure to the atmosphere, become completely disintegrated, passing from the state of hard, solid rock, such as we are accustomed to see in building-granite, into soft, crumbling, earthy masses. It is the felspar which undergoes the change; and it appears to be owing to the action of rain-water charged with carbonic acid, which dissolves the potash and some of the silica of the felspar, leaving the excess of silica and the alumina still united. It is not known, however, why certain specimens of granite are rapidly corroded and crumbled down, whilst others have resisted for ages the same causes of decay. By such a process of disintegration as we have described, the clays of our arable soils are produced. Clay consists of silica and alumina in a state of chemical combination. It never is pure alumina, but the quantity of silica united to the latter is variable. When it is pure, clay is quite white, as we see in the porcelain clay of Devonshire and Cornwall, which is derived from colourless felspar. More frequently, clay is red, owing to the presence of oxide of iron; or black, from the diffusion through it of vegetable matter.

From alum, alumina is prepared by adding to a solution of the *former*, water of ammonia, as long as it occasions a precipitate. The alumina appears as a voluminous, white, gelatinous substance, consisting of the oxide of the metal combined with water. When alumina is precipitated from a solution containing colouring matter, such as logwood, &c., it carries down the colour chemically united to the flocculent precipitate; in this way are formed the coloured earths called *Lakes* (q.v.). Alumina in the state of precipitate, after being gently dried, is readily soluble in acids and in alkalies; but if strongly heated, at a certain temperature it presents an appearance of sudden incandescence, it loses the associated water, contracts greatly in bulk, and now forms a white, soft powder, not at all gritty, and with difficulty soluble in alkalies and acids. Alumina, as generally prepared, whether hydrated or anhydrous, is insoluble in water, possesses no taste, and does not alter colouring matters; but it has also been obtained in an allotropic hydrated form, which, in the presence of a very small proportion of acetic acid, is largely soluble in water, from which a minute trace of sulphuric acid precipitates it. It is quite different, therefore, in properties from the alkaline earths, and is a much weaker base. In the anhydrous state it absorbs water with great readiness without combining with it, so that it adheres to the tongue, and is felt to parch it. Clay retains this property; and the ends of tobacco-pipes are often glazed, to prevent adhesion to the lips or tongue. Alumina is not fusible by a forge or furnace heat, but it melts before the oxyhydrogen blowpipe into a clear globule, possessing great hardness. It occurs in nature in a similar state. The more coarsely crystallised specimens form the emery which is used for polishing; the transparent crystals, when of a blue colour, owing to a trace of metallic oxide, constitute the precious gem the sapphire, and, when red, the ruby. Alumina, in common with other sesquioxides, is a feeble base. The salts it forms with the acids have almost all a sour taste, and an acid action on colouring matter.

Alumin'ium—sym. Al, eq. 27·4—is one of the metals present in clay, felspar, slate, and many more rocks and minerals. It was discovered by Wöhler in 1828, and was re-examined by him in 1846, when he obtained the metal in minute globules or beads, by heating a mixture of chloride of aluminium and sodium. In 1855, the French chemist Deville showed, as the result of a series of experiments, that aluminium could be prepared on a large scale and in a compact form without much difficulty. The mineral cryolite found in Greenland, which is a double fluoride of aluminium and sodium, was the ore first used for its manufacture; but bauxite, a mineral found in France, and consisting chiefly of alumina or oxide of aluminium, and oxide of iron, has more recently been employed as a convenient source of the metal. An aluminate of soda is first obtained by heating the bauxite with soda ash in a furnace, and separating it (the aluminate) from the insoluble portions by lixiviation. When carbonic acid is passed through the solution, pure alumina is thrown down. The alumina is then formed into balls with common salt and charcoal, which are heated in an earthenware retort through which chlorine gas is passed. In this part of the process, the charcoal combines with the oxygen, and the chlorine with the aluminium; the latter sublimes over with the common salt (chloride of sodium), and is collected as a double chloride of aluminium and sodium. When this double chloride is heated in a reverberatory furnace with fluxes and metallic sodium, the latter seizes the chlorine combined with the aluminium, which is then set free, and falls to the bottom ready to be cast into ingots for use. The manufacture of aluminium was started in 1860 near Newcastle, by Mr (afterwards Sir) I. L. Bell; but owing to the restricted demand for the metal, the works were stopped. Recently, however, works have been again started in England by the Aluminium Crown Metal Company, at Hollywood, near Birmingham. Here the metal is made from alum. In 1885 the Cowles process was established, and is carried on by the Cowles Electric Smelting and Aluminium Company, at Lockport, N.Y. Its chief products are aluminium alloys (aluminium bronze and ferro-aluminium), of which it produced in 1889, 171,759 pounds. Aluminium is also extracted by dynamo electricity, by the Pittsburg Reduction Company, at Pittsburg, Pa., whose product in 1889 was 19,200 pounds. A process for the production of sodium, invented by H. Y. Castner of New York, was made public in 1887. The sodium is obtained from caustic soda by heating this substance along with carbon and iron in crucibles.

The properties of aluminium are, that it is a white metal, somewhat resembling silver, but possessing a bluish hue, which reminds one of zinc.

This bluish colour can be whitened by hydrofluoric and phosphoric acids, and also by a heated solution of potash. It is very malleable and ductile, in tenacity it approaches iron, and it takes a high polish. It fuses at about 1292° F. (700 C.), and can then be cast in moulds into ingots. Exposed to dry or moist air, it is unalterable, and does not oxidise or tarnish like most common metals. Neither cold nor hot water has any action upon it. Sulphuretted hydrogen, the gas which so readily tarnishes the silver in households, does not act on aluminium, which is found to preserve its appearance under all ordinary circumstances as perfectly as gold does. When cast into moulds, it is a soft metal like pure silver, and has a density of 2·56; but when hammered or rolled, it becomes as hard as iron, and its density increases to 2·67. It is therefore a very light metal, being lighter than glass, and only one-fourth as heavy as silver. Aluminium is very sonorous, a bar of it when struck giving out a very sweet clear ringing sound. It is a good conductor of heat and electricity. Considerable difficulty was long experienced in working the metal, for want of a suitable solder. That generally used consists of aluminium, 6 per cent.; copper, 4 per cent.; and zinc, 90 per cent.

Aluminium is still rather more than one-half of the price of silver, and has not the beautiful colour of the latter. These reasons seem to prevail against its extensive use in the arts. On the other hand, it is hard to understand how a metal with such remarkable properties is not in greater demand. During the last thirty years, such articles as coins, medals, statuettes, personal ornaments, keys, helmets, sabre sheaths, mounts for furniture, culinary vessels, and many other things, for which its strength and lightness render it particularly suitable, have all been tried, and have failed to take the market. It is now chiefly used for optical, surgical, and chemical instruments or pieces of apparatus. Aluminium leaf and wire may be employed with great advantage in place of silver leaf for decoration, or silver wire for embroidery.

Aluminium Bronze.—Aluminium forms, with copper, several light, very hard, white alloys; also a yellow alloy, which, though much lighter than gold, is very similar to it in colour. This gold-like alloy, which is ordinary aluminium bronze, contains from 5 to 10 per cent. of aluminium, and is very strong, was discovered by Dr Percy of London. For many years it has been manufactured into watch chains, pencil-cases, and other small ornamental articles. More lately it has been made on a limited scale into such articles as table-plate and carriage mountings, which have an attractive appearance. This bronze, which can be made with a tensile strength equal to steel, has certain advantages for field-guns. Its anti-friction and wearing qualities make it well adapted for bearings of shafts; but its price, namely 1s. 6d. per lb., being considerably in excess of ordinary bronze, somewhat hinders its use on a large scale for objects of utility.

An alloy of aluminium and tin is used for optical instruments, and from another of aluminium and silver called 'Tiers Argent,' excellent spoons and forks are made. See J. W. Richards, *Aluminium; its History* (1887).

Alum Root. This name is given in the United States to two plants, natives of that country, very different from one another, but agreeing in the remarkable astringency of their roots, which are medicinally used. One of these plants is *Geranium maculatum* (see GERANIUM). The root contains more tannin than Kino (q.v.) does. The property of astringency belongs, in an inferior degree, to some other species of Geranium, and of the kindred genera, Erodium and Pelargonium.—The other American plant to which the name alum root is given is *Heuchera americana*, a plant of the natural order Saxifragaceæ (q.v.), an order in which also astringency is a prevalent property. The root is a powerful styptic, and is used to form a wash for wounds and obstinate ulcers.

Amal'gam is the term applied to that class of Alloys (q.v.) in which one of the combining metals is mercury. On the nature of the union, it has been observed that 'on adding successive small quantities of silver to mercury, a great variety of fluid amalgams are apparently produced; but in reality, the chief, if not the sole compound, is a solid amalgam, which is merely diffused throughout the fluid mass.' The fluidity of an amalgam would thus seem to depend on there being an excess of mercury above what is necessary to form a definite compound. Mercury unites readily with gold and silver at the usual temperature. It has no disposition to unite with iron even when hot. A solid amalgam of tin is used to silver looking-glasses.

Amalgamation is employed on a small scale in some processes of gilding, the silver or other metal being overlaid with a film of gold amalgam, and the mercury being then driven off by heat. But its most extensive use is in separating gold, and especially silver, from certain of their ores. The mercury dissolves the particles of the metal, and leaves the earthy particles; it is then easily separated from the gold or silver. This process, discovered in Mexico in 1557 by Bartolomé de Medina, is still used in Mexico, and was introduced with great success into the Californian and Australian gold-fields. The mode of application is to crush the quartz rock which serves as the matrix in which the small particles of gold are imbedded; place the fragments in a barrel or revolving drum with mercury, and agitate for some time. The mercury attaches all the gold particles to itself; and in the apparatus, when fully agitated, there is found a semi-fluid mass, which is the mercury, appearing half-congealed, and containing all the gold. It is only necessary to place this amalgam in a retort and apply heat, when the mercury sublimes over—and can be re-employed for further amalgamation—and leaves the gold in the body of the retort.

Several amalgams may be regarded as definite chemical compounds. Thus, when gold-leaf is placed in mercury, and the amalgam so produced filtered by being squeezed in a chamois-leather bag, the uncombined mercury oozes through the skin, but a definite amalgam of 2 of gold and 1 of mercury remains behind in the leather filter. Tin amalgam is employed in silvering looking-glasses, and is formed by laying a sheet of tinfoil on a table, covering it with mercury, and then placing, by a sliding movement, the sheet of glass over it. This amalgam contains 3 of mercury and 1 of tin; glass balls are silvered with an amalgam of 10 mercury, 1 tin, 1 lead, and 2 bismuth, best prepared by melting together the last three metals, and then adding the mercury.

A silver amalgam, containing about 26 per cent. of metallic silver—and, from the clusters of crystals somewhat resembling a tree, called *Arbor Dianæ*, or Tree of Diana—is prepared by placing about half a teaspoonful of mercury in a small phial, and filling the bottle with a solution of nitrate of silver of the strength of 25 grains to the ounce. In the course of a few days the arborescent appearance presents itself. The amalgam used for frictional electric machines is made from 1 tin, 1 zinc, and 3 mercury, to which sand is afterwards added.

Amani'ta, a genus of Hymenomycete Fungi, nearly allied to the mushrooms (*Agaricus*). Several of the species are edible, notably the delicious Orange (*A. cæsarea*), but the majority are poisonous. *A. muscaria*, which is pretty common in woods, especially of fir and beech, in Britain, is one of the most dangerous fungi. It is sometimes called Fly Agaric, being used in Sweden and other countries to kill flies and bugs, for which

Amanita muscaria, young.

Amanita muscaria, full-grown, more reduced.

purpose it is steeped in milk. The pileus or cap is of an orange-red colour, with white warts, the gills white, and the stem bulbous. It grows to a considerable size. It contains a bitter and narcotic principle, resembling in its physiological action that of Indian hemp (*hashish*), and is used by the Kamchadales to produce intoxication. The intoxicating principle passes off in the urine of those who swallow it, a circumstance of which they or others often avail themselves, when abundance of the fungus is not at hand.

Am'aranth (*Amaranthus*), the leading genus of Amaranthaceæ, an order differing from Chenopodiaceæ (q.v.), in the possession of a crowded bracteate inflorescence and membranous perianth. *A. caudatus* (Love-lies-bleeding), *A. speciosus*, *A. hypochondriacus* (Prince's Feather), and other species, are common annuals in our flower-gardens. *A. tricolor*, from China, is cultivated in the Southern United States, and is popularly known as Joseph's Coat. The spikes of *A. caudatus* are sometimes several feet in length. The dry red bracts which surround the flower retain their freshness for a long time after being gathered; for which reason the plant has been employed from early times as an emblem of immortality.—The Globe Amaranth (*Gomphrena globosa*) and the Cockscomb (q.v.), well-known tender annuals, belong to the same natural order. The Globe Amaranth is much cultivated in Portugal and other Roman Catholic countries for adorning churches in winter. Its flowers, which are of a shining purple, retain their beauty and freshness for several years. No species of the order can be regarded as a true native of Britain, although *A. blitum* is now found in waste places near London and elsewhere. *A. blitum*, *A. oleraceus*, and other species, are used as pot-herbs, but rarely in Britain. Wholesome mucilaginous qualities are very generally found in the leaves throughout the order. The seeds of

Love-lies-bleeding (*Amaranthus caudatus*).

A. frumentaceus (called Kiery) and of *A. anardhana* are gathered as corn-crops in India. —Medicinal properties are ascribed to some species of the order, particularly to *Gomphrena officinalis* and *macrocephala*, which have a high and probably exaggerated reputation in Brazil, as the popular names, '*para todo*,' &c., indicate, as cures for many diseases.

Amaryllid'eæ, or AMARYLLIDACEÆ, a natural order of petaloid Monocotyledons, essentially distinguished from Liliaceæ by their inferior ovary, and including many species distinguished by the beauty of their flowers. They are herbaceous plants, or when, as in the genera Agave and Fourcroya, they form woody stems, they have still the character of gigantic herbs rather than of shrubs. The greater part are bulbous-rooted. There are about 400 known species, natives of tropical or sub-tropical, and more sparingly of temperate regions, but particularly abundant at the Cape of Good Hope. A few species only are European. Many of them are much-prized ornaments of our gardens and hothouses. Amongst these are different species of Narcissus, Amaryllis, Alstrœmeria, Pancratium, &c. (q.v.). To this order belong the Snowdrop and Snowflake, and it includes also the American Aloe (*Agave*). *Sternbergia lutea* is said to be the lily of the field referred to in the Sermon on the Mount. The properties of the Amaryllideæ are rarely very distinct; the Agave (q.v.), however, yields its juice, the bulbs of snowdrop and daffodil are emetic, and the juice of *Hæmanthus toxicarius* is used by the Hottentots as an arrow-poison.

Am'ides was the name originally applied to a group of organic compounds, derived from ammonia, NH_3, or NHHH, by the exchange of one or more atoms of hydrogen for a corresponding number of atoms of a metal or a compound radical. At present, the term *amide* is restricted to the case in which one or more atoms of hydrogen are replaced by an *acid* radical, and the amides are called primary, secondary, or tertiary, according as one, two, or all three of the atoms of hydrogen are replaced by the acid radical. The primary amides may be obtained in various ways, of which we shall mention two: (1) If we heat an ammoniacal salt, two atoms of water are given off, and the amide corresponding to the acid is left; thus, acetate of ammonia ($NH_4OC_2H_3O$) - water (H_2O) = acetamide ($C_2H_3ONH_2$). (2) If an anhydride is submitted to the action of ammonia, there are simultaneously formed an amide and an ammoniacal salt. Thus valerianic or valeric anhydride $(C_5H_9O)_2O$ + ammonia $(NH_3)_2$ = valerate of ammonia ($NH_4OC_5H_9O$) + valeramide ($C_5H_9ONH_2$). The amides are, for the most part, capable of being obtained in a crystalline form, and are fusible volatile bodies. If, in place of an *acid radical*, a *base radical* replaces one or more atoms of hydrogen in ammonia, a class of compounds termed *amines* is formed. See ALKALOIDS.

Amid'ogen, or DIAMIDE, $NH_2 - NH_2$, was till lately looked upon as a hypothetical body, to which the formula NH_2 was assigned. Curtius has, however, recently produced the sulphate of amidogen, from which amidogen itself is obtained by the action of an alkali. It is a gas, possessing (when concentrated) a peculiar odour somewhat similar to that of ammonia, and when inhaled it strongly affects the nose and fauces. It possesses an alkaline reaction, and unites with acids to form salts. Research shows that its formula must be $NH_2 - NH_2$, and not NH_2. See ALKALOIDS.

Ammonia, HARTSHORN, or the VOLATILE ALKALI, was one of the few substances known to the chemistry of the ancients; being referred to by Pliny under the name of *vehement odour*, which he evolved by mixing lime with nitrum (probably sal ammoniac). It derives its name ammonia from its being obtained from sal ammoniac, which was first procured by heating camels' dung in Libya, near the temple of Jupiter Ammon. The atmosphere contains a minute quantity of ammonia, amounting to 210 to 247 parts in 10,000,000,000 parts of air, which is equal to 1 volume of ammonia in 28,000,000 of air. It is likewise present in rain-water in variable proportion. The supply of ammonia to the atmosphere is due to its evolution during the putrefaction of animal and vegetable substances, during the vinous fermentation, and the combustion of coal. It is likewise present in respired air, and is therefore a product of the daily wear and tear of the animal system. The principal source of ammonia at the present time is the destructive distillation of coal, as in gas-making. Blast-furnaces and paraffin works also produce large quantities. The materials which pass over from the retort are partly uncondensable and truly gaseous, and these are carried to our gas-jets, and burned; but in other parts they are condensable, and are received during the purification of the gas, as a mixed tarry and watery liquid. On allowing this liquid to settle, the watery portion, containing ammonia, can be separated, and, hydrochloric acid being added to it, there is formed a compound of ammonia and hydrochloric acid, called chloride of ammonium, which can be obtained dry, by evaporating the solution down in shallow vessels. Pure ammonia is manufactured from this impure chloride of ammonium by mixing it with its own weight of slaked lime in a retort, and applying a gentle heat, when the ammonia as a gas passes over, and is received in a vessel containing water. The solubility of ammonia in water is very great, 1 volume of water at 32° F. (0° C.) dissolving 1050 volumes of ammoniacal gas.

The *liquor ammoniæ* of the chemists, or *hartshorn* of the shops, contains about 32 per cent. by weight of the gas, and it is lighter than water, its density being ·891. The solution of ammonia is transparent, colourless and strongly alkaline. In taste it is acrid caustic, and in odour very pungent. Applied to the skin in a concentrated form, it blisters. Exposed to the air, the ammonia escapes, and the solution thus gets weaker, and, reduced to - 40° F. (- 40° C.), it freezes. As generally obtained, even in the gaseous condition, it is in combination with water, and may be represented by the formula NH_4HO or NH_3H_2O. Dry ammonia can be procured by passing the vapour of ammonia, as ordinarily obtained, over fused chloride of calcium, when the water is abstracted, and true gaseous ammonia is left, having the composition of one atom of nitrogen and three of hydrogen, NH_3. Gaseous ammonia can be liquefied under pressure and cold, and then yields a colourless, clear, mobile liquid, with the characteristic odour and other properties of ammonia much intensified. Ammonia combines with acids to form a class of salts which are of considerable importance. Thus, the crystallised sulphate of ammonia, $(NH_4)_2SO_4$, is very extensively used as a top-dressing by farmers, and is also mixed with manures where an increase of ammoniacal matter is desirable. The chloride of ammonium is also employed in agriculture; likewise largely by the Russian peasantry, in place of common salt, as a condiment for flavouring food.

In medicine, the gaseous ammonia has been rarely used. The solution of ammonia is employed as a means of rousing the respiratory and vascular systems; and of the speedy alleviation of spasm. It is also used as a local irritant and antacid. It is serviceable in dyspeptic complaints with preternatural acidity of stomach and flatulence; to produce local irritation or destruction of certain parts, and to render comparatively harmless the bites of poisonous animals, such as serpents and insects.

Ammonium is the term applied to the group of atoms represented by the formula NH_4. As this group enters into the composition of many salts, exactly in the same way that potassium, sodium, and other metals do, the term *hypothetical metal* has been applied to it, although no one has ever succeeded in isolating it. Ammonium may be prepared by acting on an amalgam of sodium and mercury with a solution of chloride of ammonium. A portion of mercury is slightly heated in a porcelain vessel, and pieces of sodium introduced, when the sodium and mercury combine, and form an amalgam of sodium and mercury, which is a semi-solid substance, and scarcely occupies more space than the bulk of the mercury employed. If this be introduced into a vessel containing a strong or saturated solution of chloride of ammonium, NH_4Cl, the chlorine combines with the sodium, Na, of the amalgam, forming chloride of sodium, NaCl, and the ammonium unites with the mercury, forming the amalgam of ammonium and mercury. As the change referred to proceeds, the amalgam increases in size many times, and forms a spongy mass of the consistence of butter, which rises through the saline solution and floats on the surface. The amalgam of ammonium and mercury very readily decomposes, and hence the difficulty of determining its exact composition.

Ammoni'acum, or AMMO'NIAC, a gum resin, used in medicine on account of its stimulant and expectorant qualities, is obtained from *Dorema Ammoniacum*, a plant of the natural order Umbelliferæ, a native of Persia—a perennial about seven feet high, with large doubly pinnate leaves. The leaves are about two feet long. The whole plant is abundantly pervaded by a milky juice, which oozes out upon the slightest puncture, and which hardens, and becomes ammoniacum. The ammoniacum exudes from punctures made by a beetle, which appears in great numbers at the time when the plant has attained perfection. It occurs in commerce either in tears, or in masses formed of them, but mixed with impurities. It is whitish, becoming yellow by exposure to the atmosphere, is softened by the heat of the hand, and has a peculiar heavy unpleasant smell, and a nauseous taste, at first mucilaginous and bitter, afterwards acrid. It is not fusible, but burns with white crepitating flame, little smoke, and strong smell.

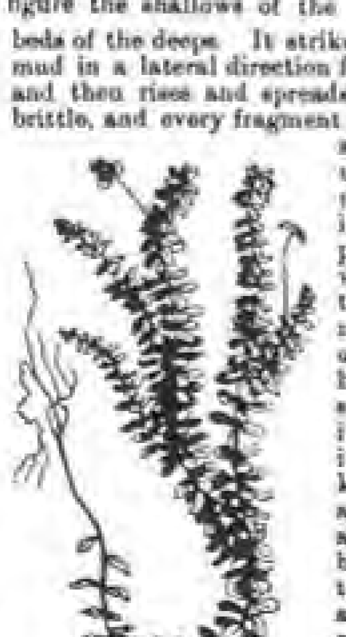
Amyg'dalin, $C_{20}H_{27}NO_{11}3H_2O$, is a crystalline principle existing in the kernel of bitter almonds, the leaves of the *Prunus lauro-cerasus*, and various other plants, which, by distillation, yield hydrocyanic acid. It is obtained, by extraction with boiling alcohol, from the paste or cake of bitter almonds, which remains after the fixed oil has been separated by pressure. When obtained pure, it has a sweetish, somewhat bitter taste, and is not poisonous, and when treated with alkaline solvents, ammonia is expelled, and amygdalic acid, $C_{20}H_{28}O_{14}$, is produced. Its most remarkable change is, however, that which is noticed in the article Volatile Oil of Almonds (q.v.), and which may be thus briefly stated. When the bruised almond kernel, or almond paste, is brought in contact with water, the peculiar odour of bitter almonds is almost immediately evolved; and in twenty-four hours all traces of amygdalin will have disappeared, its place being taken by essential oil of almonds, hydrocyanic acid, sugar, and formic acid. This transformation is due to the presence of a peculiar nitrogenous matter called Emulsin (q.v.), or synaptase, which sets up a kind of fermentation.

Am'yl, C_5H_{11}, is the fifth in the series of alcohol radicals whose general formula is C_nH_{2n+1}, and of which methyl and ethyl are the first two members. It is obtained by heating amyl-iodide with an amalgam of zinc in a closed tube at a temperature of about 350° F. (177° C.), and is one of the natural products of the distillation of coal. As thus obtained, it represents two molecules of the radical united together, and usually goes by the name *diamyl*, $(C_5H_{11})_2$. The single molecule, C_5H_{11}, has not been produced. Diamyl is a colourless liquid, with a specific gravity of ·770 at 52° F. (11° C.), and a boiling-point of about 316° F. (158° C.). It has an agreeable smell and burning taste. It enters into a large number of chemical compounds, most of which—as, for instance, bromide, chloride, iodide, &c.—are derived from amylic alcohol, which bears precisely the same relation to amyl that ordinary alcohol bears to ethyl, C_2H_5. Amylic alcohol is sufficiently described in the article FUSEL OIL, which is the name given to the crude alcohol. It seems invariably to accompany ordinary alcohol when the latter is prepared by fermentation, and apparently occurs in largest quantity in those liquids which remain most alkaline during fermentation.

AMYL, NITRITE OF, $C_5H_{11}NO_2$, a valuable drug which must not be confounded with *Nitrate* of Amyl, may be prepared by the action of nitric acid on fusel oil (amylic alcohol). It is a pale yellowish liquid, with an ethereal fruity odour, the vapour of which, when inhaled, even in very small quantity, causes violent flushing of the face and a feeling as if the head would burst. It is a very powerful remedy in all convulsive diseases, and is of special value in angina pectoris, as well as in asthma. Owing to its volatile nature it is usually kept in small glass globes containing from two to five drops, one of which, when crushed in the handkerchief, and the vapour breathed, will often give immediate relief.

Am'yloid (Lat. *amylum*, 'starch') is a term used in Chemistry and Botany, and generally equivalent to 'starchy.' Amyloids are substances like starch, dextrine, sugar, gum, &c., which consist of carbon, hydrogen, and oxygen, the latter two being always in the proportion in which they occur in water, H_2O. The animal body, chemically considered, is a mixture of Proteids (q.v.), amyloids or carbohydrates, and Fats (q.v.), plus water and mineral constituents, and the normal food always contains these constituents. Of the three items, proteids are, however, absolutely essential, amyloids and fats only desirable accessories. In the human body the most important carbohydrates are glycogen, $C_6H_{10}O_5$; grape-sugar or dextrose, $C_6H_{12}O_6$; maltose, $C_{12}H_{22}O_{11}$; and milk-sugar, $C_{12}H_{22}O_{11}$. See ANIMAL CHEMISTRY. A compound radical called *amyl* is formed by the decomposition of starch in a peculiar fermentation—the *amylic fermentation*—but to it the term amylaceous has no reference.

Ana'charis, a genus of plants of the natural order Hydrocharideæ, of which a species, *Anacharis alsinastrum* (*Elodea canadensis*), has become naturalised in Britain. It is a native of North America, growing in ponds and slow streams; and is a dark-green, much-branched perennial, entirely floating under water. The male flowers are seldom observed, and British specimens are exclusively female, the male plant happily not having been introduced. The plant was first found in Britain in 1842, by the late Dr Johnston, in the lake of Duns Castle; and again in 1847 by Miss Kirby, in the reservoirs of a canal in Leicestershire. It is now very abundant and troublesome in the Trent, Derwent, and other rivers; in fact much more so than in America. Its rapidity of growth is extraordinary. Immense masses disfigure the shallows of the Trent, and cover the beds of the deeps. It strikes its shoots under the mud in a lateral direction for six inches or a foot, and then rises and spreads. The stems are very brittle, and every fragment is capable of growing, so that the means usually adopted to get rid of it serve rather for its propagation. It appears that water-fowl are very fond of it; and by them, probably, its seeds may be conveyed from one river to another. It has been found that swans may be fed upon it with advantage, and its excessive growth kept down more effectually in this way than in any other. It seems to be an impediment to the progress of salmon ascending the rivers in which it occurs; but for some kinds of fish it probably affords both food and shelter. The manner of its introduction into Britain is unknown, although it has been conjectured that it may have escaped from some garden-pond—a conjecture the more doubtful, from the distance between the localities in which it was first found; but its rapid increase is of great scientific interest, in connection with the important subject of the distribution of species. As being calculated to block up water-courses, the plant involves some serious economic considerations. It is remarkable that in North America, its native land, it never grows so as to block the rivers. The plant is also of interest to vegetable physiologists, since exhibiting peculiarly well, under moderate power of the microscope, the phenomenon of circulation of the protoplasm within the cells.



Anacharis alsinastrum.

Anæsthe'sia (Gr., 'lack of sensation') is a term used to express a loss of sensibility to external impressions, which may involve a part or the whole surface of the body. It may occur naturally as the result of disease, or may be produced artificially by the administration of *anæsthetics*. In some diseased conditions of the nervous centres, a part of the body may become totally insensible to pain, while in another part sensation may be unnaturally acute, constituting a state of hyperæsthesia. When a nerve is divided, there is no feeling of touch or pain referred to the parts which it supplies, because these are cut off from communication with the brain; and in some diseases, as the *elephantiasis græcorum*, a loss of sensation in patches of the skin is an early and characteristic symptom. Insensibility to external impressions may be either *general*—i.e. affecting the whole body, or *local*, where only that part is affected to which the anæsthetic agent is applied.

In ancient writers, we read of insensibility or indifference to pain being obtained by means of Indian hemp (*Cannabis indica*), either smoked or taken into the stomach. The Chinese, more than 1500 years ago, used a preparation of hemp, or *ma-yo*, to annul pain. The Greeks and Romans used mandragora for a similar purpose (*poiein anaisthēsian*); and as late as the 13th century, the vapour from a sponge filled with mandragora, opium, and other sedatives was used. The mandragora, however, occasionally induced convulsions, with other alarming symptoms; and though Bullein, an English physician (died 1579), mentions the possibility of putting patients who were to be operated upon into 'a trance or a deepe terrible dreame' by its use, it gradually became obsolete, and was banished from the pharmacopœia. John Baptista Porta, of Naples, in his work on Natural Magic (1597), speaks of a quintessence extracted from medicines by somniferous *menstrua*. This was kept in leaden vessels, hermetically closed, lest the *aura* should escape. 'When it is used, the cover being removed, it is applied to the nostrils of the sleeper, who draws in the most subtile power of the vapour by smelling, and so blocks up the fortress of the senses, that he is plunged into the most profound sleep, and cannot be roused without the greatest effort. . . . These things are plain to the skilful physician, but unintelligible to the wicked.' In 1784, Dr Moore, of London, used compression on the nerves of a limb requiring amputation, but this method was in itself productive of much pain. In 1800, Sir Humphry Davy, experimenting with the nitrous oxide or *laughing-gas*, suggested its usefulness as an anæsthetic; and in 1828, Dr Hickman suggested carbonic acid gas.

As early as 1795, Dr Pearson had used the vapour of sulphuric ether for the relief of spasmodic affections of the respiration. The fact that sulphuric ether could produce insensibility was shown by the American physicians, Godwin (1822), Mitchell (1832), Jackson (1833), Wood and Bache (1834); but it was first used to prevent the pain of an operation in 1846, by Dr Morton, a dentist of Boston. The news of his success reached England on 17th December 1846; on the 22d, Mr Robinson, a dentist, and Mr Liston, the eminent surgeon, operated on patients rendered insensible by the inhalation of sulphuric ether. This material was extensively used for a year, when Sir J. Y. Simpson, of Edinburgh, discovered the anæsthetic powers of *Chloroform* (q.v.), and introduced the use of it into his special department, midwifery. Since that time, chloroform has been the anæsthetic in general use in Europe, but ether is preferred in America. It is now the opinion of most medical men that chloroform should not be given where there is weak action of the heart from disease. Other substances have been used by inhalation, such as nitrous oxide gas, which is the best and safest anæsthetic for operations that last only one or two minutes, as in the extraction of teeth; bichloride of methylene and tetrachloride of carbon have also been employed, but are not so reliable as those above mentioned.

The employment of general anæsthetics in surgery has greatly increased the scope of the surgeon's usefulness, and has been a great boon to suffering humanity. It is, however, fraught with a certain amount of danger. However much care may be taken in its administration, an occasional fatal accident occurs from the action of the anesthetics employed. In these cases, there is generally disease of the heart, or a hypersensitive nervous system, predisposing to sudden sinking, or to shock.

Local anæsthesia, artificially produced, is of great value in minor operations, and in painful affections of limited areas of the body. It depends upon a paralysis of the sensory nerves of the part, and may be induced by the application of *cold*, or of medicinal agents. An ether spray thrown on the part, produces such intense cold by its evaporation, that the part is completely numbed, and a layer of ice forms on its surface. The after effects, however, when reaction sets in, are very painful, and there is danger that in weak constitutions sloughing and ulceration may follow. Of medicinal agents, the best is *cocaine*, prepared from the coca shrub of Peru (*Erythroxylon coca*). In the form of a five to ten per cent. watery solution, this drug is introduced into the tissues by a hypodermic needle, and produces complete anæsthesia of the part thus treated in from three to fifteen minutes. Rarely it produces giddiness, but has no unpleasant local after effects. Thymol, menthol, aconite, belladonna, chloroform (the last three as the well-known A B C liniment), phenol, chloral, and Indian hemp, have also a local anæsthetic action if rubbed on the skin, or applied to abraded surfaces.

Angel'ica, a genus of plants of the natural order Umbelliferæ (q.v.), by some botanists divided into two, *Angelica* and *Archangelica*. The species are mostly herbaceous and perennial, natives of the temperate and colder regions of the northern hemisphere. Wild Angelica (*A. sylvestris*) is a common plant in moist meadows, by the sides of brooks, and in woods in Britain and throughout many parts of Europe and Asia. The Garden Angelica (*A. archangelica* or *Archangelica officinalis*) is a biennial plant, becoming perennial when not allowed to

Angelica archangelica.

ripen its seeds. The whole plant, and especially the root, is aromatic and bitter, with a pleasant, somewhat musky odour, and contains much resin and essential oil. The root was greatly valued in the middle ages as a specific against poisons, pestilential diseases, witchcraft, and enchantments, and was long employed as an aromatic stimulant and tonic, and in nervous and digestive ailments, but is now very little used in Britain. The root of *A. sylvestris*, sometimes substituted for it, is much weaker. The Garden Angelica was at one time also much cultivated for the blanched stalks, which were used as celery now is. The tender stalks and midribs of the leaves, candied, are still, however, a well-known article of confectionary, and an agreeable stomachic; the roots and seeds are employed in the preparation of gin and of 'bitters.' The plant is a very doubtful native of Britain, but is common in many parts of Europe, and even in Lapland and Iceland. Linnæus describes the use of the dried root in Lapland as tobacco, and of the stem as a vegetable. The roots are occasionally ground and made into bread in Norway, and the Icelanders eat the stem and roots raw with butter. *A. sylvestris* has been used in tanning, and also as a yellow dye. Several species of angelica are natives of North America. The plant was called 'Angelic Herb' because of its repute as a defence against poison and pestilence.

Anglo-Israelite Theory, an opinion as to the historical origin of the English people held by a considerable number of persons in Britain and America. They contend that the English are descended from the Israelites who were carried into captivity by the Assyrians under Sargon in 721 B.C. The Israelites were carried into Media, where they are identified with the Sacæ or Scythians, who appeared as a conquering horde there about the same time. They next swarmed westwards into Northern Europe, and became the progenitors in particular of the Saxon invaders of England. Unfortunately for the conclusion, the premises must both be questioned; and we have not yet been presented with any satisfactory proof either that the Anglo-Saxons are the Sacæ, or that the Sacæ are the Israelites. And it must not be forgotten that Scythia is much more a geographical than an ethnological term. Moreover, the so-called 'identifications,' on examination, prove to be little more than verbal quibblings on the English letter, depending for their success on the reader's ignorance of Hebrew exegesis. Thus one of the strongest is that according to prophecy, lost Israel's location must be 'the isles.' The applicability of this to England is at once obvious. But unfortunately for the argument, the word rendered 'island' or 'isle,' is applied in the Hebrew text indifferently to any district on the sea-coast separated from Palestine by water—the shores around the Mediterranean, and the coasts of Greece and Asia Minor, as well as islands proper. Much is made of 'Jacob's stone' in the coronation chair at Westminster Abbey; of the fact that the Irish, or Canaanites, still trouble us according to prophecy; that in public worship we still pray towards the east, as if the posture was peculiar to English Christians; &c. On such feeble arguments as these, we are gravely asked to believe that prophecies which apply to all Israel relate to ten tribes only, to the complete exclusion of the two tribes represented by the Jews throughout the world at the present day. These prophecies, which have no meaning at all if not national and spiritual, are interpreted as if mundane and political, and referring to a portion only of Israel. We are told, moreover, that the well-marked physical features of the Jews are the special effect of the curse of God upon them; and when we ask for any survivals among the English of such peculiar and persistent customs as circumcision, seventh-day observance, legal uncleanness, and the like, we are told that the identity was to be lost, and that our ignorance is the best proof of the theory's being true. Of course, all evidence goes to show the impossibility of such peculiar customs and the language of a nation being so completely forgotten; and it is hardly enough for the opponents of a theory that sets at defiance all ethnological and linguistic evidence to be assured that nevertheless it is proved by a particular interpretation of Scripture assumed to be as infallible as its own authority.

The 'lost tribes of Israel' have been sought for in almost every quarter of the globe, and as one nation answered the conditions of the theory about as well as another, 'the remnants of the ten tribes were found marauding in the Afghan passes, wandering with the reindeer in Lapland, chasing buffaloes on the American prairies, or slaughtering human victims on the teocallis of Mexico.' But the enthusiasm of Rudbeck, Garcia, and Adair had at least one good result: it caused evidence about the facts of manners and customs—afterwards to be, in the hands of scientific students, of great value for the history of civilisation—to be preserved before it was lost before advancing European influences. The ten tribes delusion has now, however, sunk to a lower level than when Lord Kingsborough spent his fortune in publishing the Mexican pictures and chronicles. In spite of all the new real knowledge as to races, it has even now more votaries than ever. 'There is indeed no doubt,' says Dr Tylor, 'that this abject nonsense has a far larger circulation than all the rational ethnology published in England.'

Angostura Bark, or CUSPARIA BARK, is the aromatic bitter bark of the *Galipea cusparia*, a native of Venezuela and other tropical countries. It derives its name from the town of Angostura, where it is a considerable article of commerce. It was first brought to England in 1788, although it had been in use in Spain since the year 1759. The *Galipea cusparia* is a small tree belonging to the natural order Rutaceæ, 12 to 15 feet high, with a trunk 3 to 5 inches in diameter. It flourishes at an elevation of 600 to 1000 feet above the sea, and its elegant white blossoms, which appear in great profusion in August, add greatly to the beauty of the scenery.

Angostura Bark is a valuable tonic in dysentery, chronic diarrhœa, and dyspepsia, but it is falling into disuse. It owes its virtues to a volatile oil, and a bitter principle, the nature of which is uncertain, to which the name Cusparin has been given. Under the name of Angostura Bitters, an essence containing angostura, canella, cinchona, lemon peel, and other aromatics, came into extensive use as a tonic; but much of what is sold is devoid of angostura, and consists mainly of cheretta or other simple tonic. Angostura contains an alkaloid called Angosturia. In the year 1804, a quantity of bark of a highly poisonous nature reached Europe, and being mistaken for Angostura Bark, gave rise to several accidents, and in consequence the use of Angostura Bark was prohibited in some countries. This spurious bark, now known as *False Angostura Bark*, is obtained from the Strychnos Nux Vomica, the source of strychnine, and it is readily distinguished from Angostura Bark by the following simple tests: It has no smell, has a resinous fracture, cannot be split up into small laminæ, has a pure bitter taste, without aromatic pungency, and when touched with nitric acid, develops on its inner surface a deep red spot, and on its outer an emerald green. Under this test the genuine bark becomes of a dull red colour on either surface.

Anhydrides is the term now commonly given to the compounds formerly known as anhydrous acids, which was a very unsatisfactory name, seeing that these bodies do not present any of the ordinary properties of acids. In some cases they are the result of the dehydration of acids, and in all cases they represent in their composition the acid *minus* water. Thus, in the following equation, we give an example of the formation of an anhydride:

Nitric Acid.				Nitric Anhydride.
$2HNO_3$	$-$	H_2O	$=$	N_2O_5.

The anhydrides of the monobasic acids are formed in various ways; thus, hypochlorous anhydride is formed by the action of chlorine on oxide of mercury; nitric anhydride is formed by the action of chlorine on nitrate of silver, &c. The anhydrides of tribasic acids are often formed by the mere action of heat on the acids, as is the case with lactic and tartaric acids.

The anhydrides present no uniformity of appearance; for example, carbonic anhydride (commonly known as carbonic acid, which in reality is CO_3H_2O) is a gas; phosphoric anhydride is a white powder; nitric anhydride occurs in crystals; sulphuric anhydride is a ductile wax-like substance; while the anhydrides of the organic acids are oily bodies heavier than water.

The most important property of this class is their conversion into the corresponding acids, under the influence of water.

Anhydrous is the term applied to a chemical substance free from water. Thus, ordinary limeshell as it comes from the kiln is simply lime, CaO, without any water, and is called *anhydrous* lime;

but when water is thrown upon the lime-shell, the liquid disappears by combination with the lime, which very much increases in volume and becomes *hydrated* lime, $CaOH_2O$. Again, ordinary stucco, before being used by the modeller, contains only lime and sulphuric acid, $CaSO_4$, with no water, and is therefore anhydrous; but when water is added, and the stucco sets into its mould, it combines with two equivalents of water, and becomes hydrated stucco, $CaSO_4,2H_2O$. Examples of anhydrous substances are also found amongst liquids; thus, alcohol free from water is called anhydrous alcohol; and in like manner we speak of anhydrous acetic acid, anhydrous nitric acid, &c.

Aniline, or AMIDO-BENZENE, was discovered in 1826, as a product of the dry distillation of indigo; hence the name, derived from *anil*, the Portuguese for indigo. This source has now ceased to be of importance, for, practically, all the aniline now manufactured is obtained from coal-tar. When coal is heated in the manufacture of illuminating gas, a large number of substances are produced, and are obtained as a tarry matter of varying composition. Only a few of these bodies are of commercial importance, the chief being ammonia, carbolic acid, anthracene, naphthalene, pitch, and benzene. It is this last-named substance that yields aniline. If it is treated with strong nitric acid, an intermediate compound, nitro-benzene, $C_6H_5NO_2$, is formed, which, when mixed with acetic acid and iron-filings, yields acetate of aniline. Aniline may also be prepared by passing a mixture of benzene and ammonia through a red-hot tube, after the following reaction:

Benzene.		Ammonia.		Aniline.		
C_6H_6	+	NH_3	=	$C_6H_5NH_2$	+	H_2

Aniline may be regarded either as benzene in which one atom of hydrogen has been replaced by the group amidogen, NH_2, or as ammonia, NH_3, in which one atom of hydrogen has been replaced by the radical phenyl, C_6H_5; and according as the one or other view is held, it is called amido-benzene or phenylamine (see AMINES).

The pure article is a colourless oily fluid, slightly soluble in water, but readily dissolving in alcohol and ether. It refracts light strongly, and possesses a weak aromatic taste. It boils at 360° F. (182° C.), and when pure, has a specific gravity of 1·020. It is a well-marked *Base* (q.v.), producing numerous crystalline salts, although it has no alkaline action on vegetable colours. It is a powerful narcotic poison, its fumes causing giddiness, and subsequently insensibility, while the body becomes of a livid leaden-blue colour. Taken internally, it soon causes death; and even when respired in small quantity, as by the workmen engaged in its manufacture, it causes severe headaches, nausea, and vomiting.

It is, however, as being the source of the numerous aniline dyes, that this body has become of leading importance.

Aniline unites with acids, forming salts, but these do not constitute the *aniline dyes*. These consist of various bases obtained by the oxidation of aniline by means of nitric acid, chlorine, arsenic, or other agents. In many instances these bases are quite colourless, and only develop their tints when formed into salts. They may be regarded as Amines (q.v.)—i.e. ammonia in which hydrogen has been replaced by one or more radicals. Thus we have diphenylamine, $NH(C_6H_5)_2$; dimethyl aniline, $N(C_6H_5)(CH_3)_2$; methyl ethyl aniline, $N(C_6H_5)(CH_3)(C_2H_5)$; and so on. To refer at length to the various aniline dyes would be impossible, as these now number some hundreds, and we can only indicate the leading varieties. The colours produced by these dyes include every shade and tint, and the list of red or violet compounds would alone exhaust our available space. *Fuchsine*, which may be taken as typical of the red dyes, is formed when aniline is treated with strong nitric acid; but, in practice, many other chemicals may be substituted for the acid. *Blue dyes* are produced when aqueous aniline salts are treated with chlorate of potash and hydrochloric acid. *Mauveine*, a powerful violet dye, was discovered by Perkin in 1856, and this led the way in the manufacture of aniline colours. Perkin produced it by acting on aniline with bichromate of potash. We must pass over the various green, brown, yellow, and gray dyes, merely mentioning that the so-called aniline blacks are usually either very intense greens or blues, appearing black through concentration.

The aniline dyes are noted for their intense colouring power, one part of a rosaniline salt in a million parts of water still possessing a deep crimson colour, and instantly dyeing a skein of silk moistened with vinegar. Even in so dilute a solution as one grain dissolved in 1500 gallons of water, it is capable of dyeing a silk thread immersed in it for twenty-four hours.

Many of the dyes exhibit complementary colours (see LIGHT) when looked at by reflected and transmitted light; thus, the strong solution of the salt above referred to looks a purple red by transmitted, and a brilliant green by reflected light; a fact familiar to the users of an aniline red ink, or an ink for any of the familiar 'graph' copying processes. Here the pen assumes a green shining appearance, quite different from the colour of the ink. Aniline dyes are used as lacquers for cheap toys, being readily soluble in spirit varnish, the well-known 'bronzing liquid' being an example of this. Mixed with gelatin or collodion, and allowed to dry in thin sheets, they furnish the thin transparencies so much used for producing stained glass imitations. They have been also used for colouring wines and sweetmeats, but as arsenic was formerly or is still employed in the manufacture of the red varieties, this practice is not unattended with risk. The use of arsenic has of late been largely abandoned; or, when used, makers take care to eliminate the arsenic at the end of the process, so that the final product is innocuous. Numerous cases of skin-eruptions have been traced to the wearing of red flannel or red stockings dyed by aniline dyes. The readiness with which any housewife can dye articles of clothing or household ornaments has made them great favourites. The chief drawback lies in the fugitive nature of many varieties, but notwithstanding there is a wide field still open to them. The aniline colours are as a whole disapproved from the artistic point of view. Some of them are especially objectionable when used in the same textile fabric along with natural dyes. Notwithstanding this, the introduction of aniline dyes is said to have closed half the dyers' shops in India. A few years ago the Shah of Persia prohibited the importation of these colours into that country. Further details about aniline dyes are given under the head of DYEING. Although England and France were first in the field, Germany took up the manufacture with so much zeal and scientific skill that it soon surpassed its competitors, producing superior shades of colour.

Animal Chemistry. The objects of animal or physiological chemistry are, to investigate the composition and properties of protoplasm and its various modifications which form the tissues and organs of living beings, and to ascertain the precise nature of the constructive and destructive changes which take place in those tissues and organs during the performance of their functions.

Protoplasm is always found to contain much albuminous or proteid matter, together with smaller quantities of amyloids and fats, and its molecule is conjectured to include representatives of all these three classes. Much water is also present, together with small quantities of numerous products of functional activity. We may briefly refer to these.

Proteids (q.v.) are at present classified as follows: (1) Native Albumens (egg, serum, &c.); (2) Derived Albumens (acid and alkali albumens, casein); (3) Globulins (globulin, myosin, vitellin, &c.); (4) Fibrin; (5) Coagulated Proteids; (6) Peptones; (7) Lardacein. Certain nitrogenous bodies allied to proteids are mucin, chondrin, gelatin, keratin, nuclein, &c., which form the principal components of mucus, cartilage-matrix, connective tissue, epidermic structures, and cell nuclei respectively.

The *Amyloids*, or carbo-hydrates, from their far less complex structure, are much better understood. The most important of these are grape-sugar (glucose, dextrose, diabetic sugar), $C_6H_{12}O_6 + H_2O$; milk-sugar (lactose), $C_{12}H_{22}O_{11} + H_2O$; muscle-sugar (inosite), $C_6H_{12}O_6 + 2H_2O$; glycogen or animal starch, $C_6H_{10}O_5$; and dextrine, $C_6H_{10}O_5$.

The fats, with their derivatives and allies, form very complete series, acid, neutral, and nitrogenous, of which the composition is tolerably well known. The acetic acid series, $C_nH_{2n}O_2$, is best represented, including formic (in blood and many tissues, also secreted by ants, &c.); acetic (in stomach during fermentation of food, in diabetic urine, &c.); propionic (in sweat, &c.); butyric (in milk; also sweat, urine); valerianic (in fæces); caproic, caprylic, and capric (in butter); lauro-stearic and myristic (in spermaceti, &c.); palmitic and stearic acid (in human fat). Of the oleic series, $H(C_nH_{2n-3})O_2$, many members are known. Human fat is a mixture of oleic, palmitic, and stearic acids in combination with glycerine. The glycolic acid series is represented by lactic acid, the oxalic series supplying oxalic and succinic acids. Cholesterin is abundant in nervous tissue and in bile, &c. The complex nitrogenous fats are lecithin, neurin, cerebrin, &c.

The most important product of nitrogenous waste in mammalia is urea, $(NH_2)_2CO$, which forms the chief solid constituent of urine, and occurs in traces in blood and most tissues, except muscle, which, however, contains intermediate products of decomposition. Little is yet known of its relations to the proteids, from which it arises; but Schutzenberger has succeeded in decomposing albumen into carbonic anhydride and ammonia in the same ratio as urea, and therefore concludes that the molecule of albumen is a complex ureide. Uric acid, $C_5H_4N_4O_3$, predominates in the urine of birds and reptiles, but it is also present in small quantities in that of mammals, and its salts form gouty and urinary concretions. Kreatin, kreatinin, and sarkin occur constantly in muscle; xanthin, guanin, &c. in urine; glycocoll and taurin in combination in the bile acids, &c.; leucin and tyrosin, as products of pancreatic digestion.

Most of the preceding substances, though seldom constant, appear to be of exceedingly wide distribution throughout the animal kingdom. A few substances, including several of the more important proteids, grape-sugar, muscle-sugar, peptic and diastatic ferments, are also of frequent occurrence in the vegetable kingdom; while some of the most important and characteristic vegetable compounds also occur incidentally among animals—e.g. cellulose, chlorophyll, and starch. The whole progress of research tends to show the fundamental unity, not only of the composition of animal and vegetable protoplasm, but also of most of the processes of waste and repair in animals and plants alike. Thus, for instance, it has been proved by analysis that allantoin, a body analogous to urea, and known as an important waste product of the vertebrate embryo, is also found in quantity in opening buds in spring. Cholesterin, too, has been prepared from carrots, while pepsin can be obtained alike from the stomach, from the plasmodium of a myxomycete, or from the digestive secretion of an insectivorous plant.

Annatto, or ANATTA, also known in commerce as *Arnotto*, *Roucou*, and *Orleana*, is the reddish pulp surrounding the seeds of the *Bixa orellana*, a medium-sized tree growing in Guiana and other parts of South America. The fruit having been bruised and macerated with water, the juice is allowed to stand till the colouring matter subsides to the bottom (an operation hastened by the addition of vinegar), when it is strained and the residue dried. Sometimes fermentation is allowed to take place, when an article superior for dyeing purposes, but having a disagreeable odour, is produced. Annatto is used in the dyeing of cloth, to which it imparts a bright orange tint, of slight permanence, however; and it also enters into some bright-coloured varnishes. It is in the manufacture of butter and cheese that it finds its widest application, although its value in this respect is purely a sentimental one, depending on the taste for a high-coloured article. As met with in this country, it contains flour, chalk, and other foreign substances, which, however, can hardly be regarded as adulterants, being necessary to adapt the crude article to its various uses.

Annealing. When a slab of glass or metal is allowed to cool down rapidly from its melted state, the constituent particles near the surface become differently arranged from those in the interior. The molecules next the skin are in a different state of tension from those inside. Annealing is a process of slow cooling of a body from a high temperature, by which there is secured a more or less uniform arrangement of the particles or molecules throughout its mass. Glass is in this way made strong and able to resist changes of temperature. The mere dropping of a small angular fragment of some hard substance, such as flint, into a glass vessel before it is annealed, usually makes it fly to pieces. A still more striking example of the unstable nature of unannealed glass is seen in Prince Rupert's drops. These are drops of glass which have fallen in a melted state into cold water, and have assumed a tadpole-like shape. If the point of the tail of one of these be nipped off with the fingers, the whole of it will fall into dust with a loud explosion. This shows that whenever the skin is broken, the particles beneath it are acted on by a repellent force, and fly away from one another.

An annealing kiln or oven is usually of some length, and the glass vessels or sheets placed in it are raised to near their melting-points at its hottest portion, and then moved away at intervals to cooler and cooler parts of the chamber. It takes twelve hours to anneal wine-glasses, but much longer for large objects. Plate-glass requires to be two weeks in the kiln before it is properly annealed. Badly annealed glass shows itself in numerous ways. A basin of thick glass left in an ordinary room will sometimes break spontaneously during a cold night. Plates of glass placed, on account of their apparent strength, in floors to admit light to cellars, have occasionally cracked to pieces during sharp frost. Hot water, as is well known, often breaks tumblers.

Metals under various circumstances require to be annealed. Hollow ware (q.v.) of cast-iron, before it can be turned bright for tinning, must be softened by the annealing process. The old way of doing this was a rough and ready one. Large and strong iron pots which contained the ware were placed on gratings in the open air, and the whole covered over with coke, all interstices both within and without the pots being filled up with coal-dust, to prevent as far as possible the access of air. The coke was then fired and kept at a red heat for about twenty-four hours, after which the pile was allowed to cool. For many years, however, hollow ware has been annealed in an oven not much unlike that used for glass. Large iron-castings are kept covered up in their moulds, to prolong the time of cooling—sometimes with hot cinders—for a month or more. Like thick glass, these occasionally break spontaneously.

What are called malleable iron castings are articles usually of limited size, made of cast-iron, which are afterwards annealed. They are covered over with powdered hæmatite ore, and subjected to various degrees of heat for about ten days, when they become quite malleable.

Metals, when undergoing the process of rolling, hammering, or stamping, require annealing. In the manufacture of sheet-brass, the rolling, by which it is gradually reduced in thickness, makes it so hard that it has to be annealed several times during the operation. But in this case the annealing is conducted in a reverberatory furnace, and lasts only a few minutes. The sheet-brass is simply raised to a blood-red heat and then withdrawn, this being sufficient to restore the ductility of the metal. Articles made of brass and other metals by stamping, and particularly such articles as require many blows of the stamp to bring them into shape, are repeatedly annealed during the process. In the case of coins, as they receive only one blow of the coining-press, the metal blanks are annealed before they are stamped. A steel matrix, from which die-punches are impressed, being usually a work of much labour, is put through the annealing process after every few blows in the die-press. German silver, which is composed of three kinds of metal, is difficult to anneal from its tendency to crack in the process.

Annealing is also used in gold-beating, in wire-drawing, in nail-making, and many other arts. Tin, lead, and zinc are annealed by the use of boiling water, and steel tools by immersion in hot oil, both liquids being allowed to cool slowly. Many experiments have shown that steel boiler-plates and ship-plates are made stronger by annealing them in oil, or in melted lead, or by simply heating them to redness in a slow furnace, and afterwards covering them up with sand or ashes to prevent them cooling rapidly or unequally. Tempering (q.v.) has been called the inverse process of annealing.

Antacids are drugs used for the purpose of neutralising or diminishing excessive acidity of the digestive system, or of the different excretions. Substances which act upon the former are termed direct, and upon the latter, remote antacids. Many drugs act in both ways, such as potash, soda, lithia, lime, and magnesia, as well as their combinations with carbonic acid. Some substances—as for instance, ammonia and its carbonate—are only direct antacids, being converted into acids in the body, and thus increasing the acidity of the urine. Others—like the acetates, tartrates, and citrates of the alkalies—are not direct antacids, inasmuch as they are neutral salts, but, being converted into carbonates in their passage through the body, they act as remote antacids, and reduce the acidity of the urine. The direct antacids are required when digestion is followed by the generation of too much acid. When this is confined to the stomach, potash is to be preferred, as being more readily absorbed, or in the case of aged or feeble individuals, ammonia, as being at once a stimulant and an antacid. If the acidity exists in the bowels, soda, lime, or magnesia is to be given, as being less readily absorbed than potash, and more likely therefore to reach the situation of the acidity. The remote antacids are required in all cases where the blood contains uric acid, and the urine is excessively acid. In such cases, potash or lithia must be chosen, as forming much more soluble urates than soda.

Antichlor was the name formerly applied to commercial sulphite of soda by paper-makers, but now usually restricted to hyposulphite of soda. When the rags are reduced to a pulp, they are bleached by chloride of lime (bleaching-powder), which thoroughly soaks the pulp, and is very difficult to wash out. The traces of chlorine thus left in the pulp pass into the manufactured paper, and tend to bleach the writing-ink which may be traced thereon. To free the pulp from the residue of the chlorine, some hyposulphite of soda is employed, and hence the name antichlor, which literally signifies 'against (*anti*) chlorine.'

Antifebrin, or ACETANILID, introduced in 1886 as a febrifuge, the cheapness of which, combined with its rapidity of action and its non-poisonous nature, have brought it rapidly into favour as a substitute for quinine. A white colourless powder, with burning taste, it is almost insoluble in cold water, though readily soluble in alcohol. It is derived from anilin, to which it is closely allied, its chemical formula being $C_6H_5NHC_2H_3O$.

Antimony—symb. Sb (Lat. *stibium*); equiv. 120—is a brittle metal of a flaky, crystalline texture, and a bluish-white colour. It is readily reduced to powder by ordinary pulverisation; when heated to 842° F. (450° C.), it fuses, and thereafter being allowed to cool, it solidifies in rhombohedral crystals, which are isomorphous with those of arsenic. Heated in a retort, where the oxygen of the air is excluded, as in an atmosphere of hydrogen, antimony volatilises as the vapour of the pure metal. When raised in temperature in contact with the air, it burns with a white light—combining with the oxygen of the atmosphere, and forming copious white fumes of the sesquioxide of antimony, or 'flowers of antimony.' The metal is a bad conductor of heat and electricity, but may be used, in conjunction with bismuth, in the construction of thermo-electric piles. Exposed to the air at ordinary temperatures, antimony does not tarnish or rust; and this property, combined with the hardness of the metal and of its compounds, renders antimony of essential service in the useful arts, in the construction of alloys, such as Britannia metal, type metal, pewter, and white or anti-friction metal. Precipitated powder of antimony, called *antimony black*, is used for giving an iron-like appearance to casts.

Stibnite, or gray antimony ore, the impure sesquisulphide of antimony, Sb_2S_3, is the principal source of the metal. This substance has long been employed in the East for darkening the eyebrows. Native antimony is found, but rather sparingly, associated with a few other metals. Antimony is smelted in France, where ore is found abundantly, in Germany, and in England, which receives its supply of ore from Singapore and Borneo. But stibnite has formerly been mined at several places in Great Britain. Although the extraction of antimony from its ore is a simple matter, there are several processes employed. Sometimes 'crude antimony,' or purified sulphide of antimony, is produced by liquation as a first stage in the operation. From this there are two or three ways of obtaining the impure metal, called 'regulus of antimony.' This raw antimony, whether obtained from the purified sulphide or direct from the ore, requires a calcination to separate such impurities as arsenic, iron, lead, copper, and sulphur. In the English process of getting it direct, the ore is smelted along with some alkaline slag and old scrap-iron in crucibles. When the mixture is completely fused, it is poured into conical moulds, and the contents of these, after cooling, consist of impure antimony and a slag of sulphide of iron. There are several methods in use for purifying the raw antimony (regulus). One of the simplest is to charge each of a number of crucibles with this regulus along with some soda, common salt, and pure oxidised antimonial ore. When heat is applied, the foreign metals become oxidised and scorified, and nearly pure antimony or star metal is obtained.

The compounds of antimony are numerous: with oxygen it forms (1) the *sesquioxide* of antimony, or *white antimony ore*, Sb_2O_3, which enters into the composition of tartar emetic; (2) *antimonious acid*, Sb_2O_4, which forms one of the components of Dr James's powders; (3) *antimonic acid*, Sb_2O_5, a very insoluble compound, obtained by acting upon the metal with concentrated nitric acid. With sulphur, antimony forms the *subsulphide*, Sb_2S_3, already referred to as a natural ore of the metal, and which when roasted at a temperature sufficient to fuse it, passes into the mixed-sesquioxide and subsulphide of antimony known commercially as the *glass of antimony*, used for colouring glass and porcelain yellow. A native oxysulphide, of a pretty red colour, is called *red antimony ore*. When the ordinary sulphide of antimony is boiled with potash, or the carbonate of potash, it dissolves; and thereafter, on boiling, deposits a reddish-brown substance, known as *mineral kermes*. The liquid from which the deposit has fallen, if treated with hydrochloric acid, throws down an orange precipitate of *golden sulphide* of antimony.

There is also a chloride of antimony, $SbCl_3$, prepared by heating sulphide of antimony and hydrochloric acid together, and which has the common name of *butter of antimony*. It is generally obtained as an oily liquid, of the consistence of melted butter, and of a golden-yellow colour. Mixed with olive oil, it is used by gunmakers as *bronzing salt*, to impart a yellow colour to gun-barrels.

Various compounds of antimony are used as medicinal agents, both in human and veterinary practice, especially the *tartar emetic*, a double tartrate of antimony and potash, $(KSbOT)_2H_2O$, which is the active ingredient in antimonial wine, sherry constituting the bulk of the compound. Several cases have occurred where tartar emetic has been used criminally as a poison.

Basil Valentine, in his *Triumphant Chariot of Antimony*, says, 'the shortness of life makes it impossible for one man thoroughly to learn antimony, in which every day something of new is discovered.'

Antiperiodics are drugs which relieve or cure certain diseases (particularly ague, and some forms of neuralgia and headache) whose attacks occur at regular intervals. The most important are cinchona bark and its alkaloids, especially quinine, and arsenic.

Antiphlogis'tic (Gr. *anti*, 'against,' and *phlogizo*, 'I burn'), a term applied to remedies and to regimen opposed to inflammation, such as blood-letting, purgatives, low diet, &c.

Antipyrin is one of the most serious rivals to quinine yet artificially produced. It is obtained from coal-tar products by a process of great complexity, its chemical composition being $C_{11}H_{12}N_2O$. It is a white crystalline powder, tasteless, colourless, and soluble in water. Given in doses of 15 to 30 grains, it reduces the temperature 2° to 3° in about an hour, without the discomfort of profuse perspiration, and is therefore of great value as a febrifuge. It is not an antiperiodic, however, and therefore cannot replace quinine in cases of ague or intermittent fevers.

Antiseptics (Gr. *anti*, 'against,' *sēptikos*, 'causing putrefaction') are substances which prevent or arrest putrefaction and analogous fermentive changes. It has been proved that Putrefaction (q.v.), fermentation of grape-juice (*vinous fermentation*), of milk (*lactic fermentation*), and many, though probably not all other fermentations, depend upon the presence of microscopic vegetable organisms (see GERM THEORY). To prevent these processes, then, it is necessary either (1) to exclude these organisms altogether; (2) to interfere with conditions which permit of their development; or (3) to destroy their vitality.

(1) These organisms, or their germs, are present in ordinary air; but it has been shown by Pasteur, Tyndall, Lister, Roberts, and others, that if air be filtered through cotton wool, or (if moving slowly) through a fine bent tube, it may be allowed to come in contact with putrescible substances, if these themselves contain no living organisms or germs, without causing putrefaction. This method, however, has had no important applications except in scientific research.

(2) Their growth may be arrested (*a*) by a low temperature. Thus large quantities of fresh meat are imported from America, and even Australia and New Zealand, in chambers cooled to near the freezing-point. Carcasses of the long-extinct mammoth, with the flesh still present, have been found in the ice-cliffs of Siberia. The longer time that meat, milk, &c. keep in cold than in hot weather is familiar. (*b*) By absence of moisture. Thus, if the contents of an egg be thrown out on a plate, and thoroughly dried in an oven, the whole becomes of a hard, horny consistence, and may be kept in this state for years. If soaked in water, it will soon begin to putrefy. In the same way meat may be kept fresh by thoroughly drying it. (The preservation of fruits, &c. in strong syrup is an example of a somewhat similar action.)

(3) The vitality of these organisms may be destroyed (*a*) by heat—e.g. meat and other eatables can be preserved for an indefinite time if they are boiled and hermetically sealed, while still hot, in tin vessels (see PRESERVES); (*b*) by various chemical substances. Some of the most important are common salt and saltpetre, used in curing fish, pickling meat, &c.; alcohol, in preserving zoological specimens, vegetable essences, fruits, &c.; sulphurous acid, boracic acid, and arsenious acid; many salts, as chloride of zinc (Burnett's solution, q.v.), permanganate of potash (Condy's fluid, see under MANGANESE), sulphate of copper (blue vitriol), corrosive sublimate, nitrate of silver; chlorine (given off by chloride of lime), iodine, iodoform (CHI_3), glycerine, boroglyceride, eucalyptus oil, thymol, creasote, carbolic acid, salicylic acid, tannic acid, quinine, the patent preparation 'sanitas,' charcoal (both vegetable and animal), dry mould, used in the earth-closet system (see SEWAGE). All these substances act directly or indirectly as poisons to the organisms which produce putrefaction, &c.; most of them are either poisonous or very unpalatable to man, and cannot therefore be used in preserving food. Many of them are, however, used in the arts to arrest the decomposition of putrescible substances—e.g. in the manufacture of size for writing-paper from scraps of hides, sulphite of soda, containing sulphurous acid, is added; hides are preserved by salt, or, when tanned, by tannin, a compound of tannic acid; and timber is found less liable to decay if charged with an antiseptic, such as sulphate of copper, chloride of zinc, corrosive sublimate, or creasote. The timber is placed in a steam-box, so that the air contained in its pores is displaced by steam; the whole casing is then closed tight, and allowed to cool; the steam condenses and leaves a vacuum in and around the wood. If one of these substances is then introduced, it finds its way into the innermost pores of the timber (see WOOD-PRESERVING).

Several of the above-named antiseptics are largely used in the preservation of food. Salicylic acid is used for preserving beer, butter, fruits, and meat; and to such an extent is this the case, that the French authorities have forbidden the sale of anything containing this preservative, on the ground that when taken continuously, even in small doses, it is injurious to health. The opposite view is held by many in this country, and the question is still *sub judice*. Boracic acid, either alone or mixed with borax or glycerine, is a very powerful preservative, and experience indicates that the amount necessary to preserve food is perfectly harmless. Large quantities of butter (Swedish, &c.) are now sent into this country, which have only sufficient salt added to impart flavour, and which owe their keeping properties to boracic acid. It is also coming into use for preserving fresh fish, and a bright future is opening up to fishermen in secluded waters, who hope thereby to be able to get a wider market for their harvest. Milk and meat are readily kept sweet for some time when treated with this acid.

Next to the preservation of food, the most important purposes for which antiseptic methods and substances are used, are the *prevention of infectious diseases*, and the *treatment of wounds*. The properties of the infectious matter of infectious diseases are closely analogous to those of the organisms that lead to putrefaction, &c.; and even in cases where its organic nature has not been pro ed (see GERM THEORY), it can be rendered inert by a proper use of antiseptics, or by exposure to a high temperature. Thus, anything that has come near the patient suffering from an infectious disease, and discharges from his person, are made harmless by carbolic acid, chloride of zinc, or some other antiseptic; his bedding is roasted in an oven at a temperature of 212° F. (100° C.), or more; the room where he has been treated is fumigated with chlorine or sulphurous acid; and so the disease is prevented from spreading. This is, in fact, one of the chief aims of medical practice at the present day (see DISINFECTANTS).

Many of the evil effects which follow wounds and surgical operations are due to the presence of organisms (see PYÆMIA); and the effects of their antiseptic treatment, introduced by Sir Joseph Lister, have been marvellous.

Antiseptic Surgery, or LISTERISM, is the system of treating surgical wounds introduced by Sir Joseph Lister (q.v.), based on his clear recognition of the fact that putrefactive processes (*sepsis*) are the chief danger which the surgeon has to combat in dealing with accidental and operation wounds. The system consists essentially in excluding, by the use of germicide substances, those microbes by which fermentative processes are induced, or in eradicating them from wounds to which they have gained access. In this way pyæmia, septicæmia, erysipelas, and gangrene, once the scourge of surgical hospitals, have in a short period of years become diseases of rare occurrence, and the reduction in hospital mortality has been very great. Carbolic acid dissolved in various menstrua, in the form of a steam spray, or impregnated in gauze or cotton-wool, was till recently the favourite antiseptic in surgical practice. Thymol, eucalyptus oil, boric and salicylic acids, and iodoform, are also in frequent use for the same purposes. In 1881 Professor Koch of Berlin drew attention to the much greater potency of perchloride of mercury (corrosive sublimate) as compared with other antiseptics, and his suggestion of its employment in a one *pro mille* aqueous solution has now been universally adopted with satisfactory results. Along with carbolic acid, which is still preferred for some parts of the method, this antiseptic is employed in destroying the infective particles or *germs* in the immediate neighbourhood of the wound. The wound itself is only treated with the germicide solution when the presence of germs within it is suspected, otherwise it is kept free from the irritative action of the lotion; but all objects approaching it must be rigorously purified if the danger of infection is to be safely avoided.

Method of Operating and of Dressing Operation-wounds.—The skin of the part, the hands of the operator and his assistants, and the instruments, are carefully purified with a watery solution (1 in 1000) of corrosive sublimate. Sponges, Ligatures, and Drainage-tubes (q.v.) are kept in carbolic acid solutions. The operation is conducted in an atmosphere impregnated with carbolic acid by means of a fine spray, usually produced by steam generated in a small boiler, or the wound and its neighbourhood are constantly irrigated by the corrosive sublimate solution during the continuance of the operation. When the operation is completed and the wound closed, it is covered with a layer of specially prepared oil-silk (protective), to prevent constant irritation by the antiseptic in the dressing. This consists of muslin impregnated with a mixture of carbolic acid, resin, and paraffin; it retains the carbolic acid at ordinary temperatures, but gives it off slowly at the temperature of the body, so that the dressing remains in an actively antiseptic condition for some days, till all its carbolic acid has evaporated. The first layer is wetted in carbolic acid solution (1 to 40) to destroy any germs adhering to its surface, and render it actively antiseptic at once. The remainder is applied dry, in order to soak up the discharge as it flows from the wound. This dressing may be in part or wholly replaced by fine cotton wadding impregnated with corrosive sublimate, or with salicylic acid, its elasticity rendering it a more comfortable application, and permitting its close adaptation to the contour of the body. The whole is fixed by bandages. The dressing is in general not changed till discharge becomes visible through it. When it is changed, similar precautions with regard to spray, purification of hands, &c. must be observed.

Treatment of Wounds not inflicted by the Surgeon.—They are washed out with a searching antiseptic solution, as watery solution of corrosive sublimate (1 in 500) or carbolic acid (1 in 20), and are thus at once thoroughly disinfected. They are then treated like operation-wounds. After 48 hours at furthest, it is not generally possible to eradicate the causes of putrefaction thoroughly.

Results.—If this treatment is thoroughly carried out: (1) no bacteria and no putrid smell are present in the discharge; (2) no pyæmia, septicæmia, hospital gangrene, or erysipelas results; and in general (3) no formation of pus takes place; (4) no pain is felt in the wound; (5) no fever follows.

Some of the most striking effects of this method on surgical practice are: (1) In many cases of injury, especially compound fractures and dislocations, a limb may now be preserved where amputation was formerly considered necessary. (2) Many operations are now fearlessly and safely performed, which formerly were either not attempted, or were frequently followed by disastrous results; especially operations on bones and joints, and opening of Chronic Abscesses, and Serous Membranes (q.v.). (3) Mortality from injuries and operations has been greatly diminished—e.g. the death-rate after major amputations (in 1864 and 1866) fell from 45 per cent. to 15 per cent. (1867-69) in Lister's wards in Glasgow after he introduced his method, and to about 12 per cent. (in 1871-77) in Edinburgh, when he had further developed it. Volkman of Halle was on the point of closing his wards in consequence of the prevalence of pyæmia and septicæmia. He tried Lister's method, and during the next five years the total mortality in his wards was less than 6 per cent.

Aperients are substances which are employed to cause intestinal evacuations. Many articles of food, such as oatmeal, brown bread, and bran biscuits, and fruits such as figs, prunes, and strawberries, are used for this purpose; but the term is usually applied to denote certain medicines which act upon the intestines and cause them to expel their contents. Although considerable progress has been made in recent years in the investigation of the action of various drugs upon the intestines, we are as yet unable to give a final classification to them. For practical purposes, however, we may classify aperients as follows: (1) laxatives and (2) purgatives—(*a*) cathartic and (*b*) drastic. (1) Laxatives are substances which only slightly increase intestinal action. They act without causing any irritation or griping. The chief examples of this class are manna, magnesia, olive oil, sulphur, and castor oil in small doses. (2) Purgatives—(*a*) Cathartics are substances which quicken or increase the evacuations from the intestines, and in their action may cause griping. Examples of this class are aloes, castor oil in large doses, rhubarb, senna, and various species of rhamnus; (*b*) drastics are substances which are prompt, powerful, and effective in operation. Colocynth, croton oil, elaterium, gamboge, jalap, podophyllin, and scammony belong to this class. Besides the substances already enumerated, we must mention the saline aperients—e.g. sulphates of potassium, sodium, and magnesium, tartrates of potassium and sodium, phosphate of sodium, and citrate of magnesium. Of the above drugs, bitartrate of potassium, elaterium, and gamboge act as hydragogues (Gr. *hudōr*, 'water,' and *ago*, 'I drive away'), as they tend to remove water from the system; and aloes, euonymin, iridin, mercurial preparations (blue pill, calomel), podophyllin, and rhubarb, act as cholagogues (Gr. *cholē*, 'bile'), as they increase the evacuation of bile. Purgatives may be said to act in three ways—(1) by increasing the peristaltic action of the intestines; (2) by causing an increase of the secretion from the intestinal mucous membrane; and (3) by preventing the absorption of the fluids of the intestines. Purgatives have various uses, for they not only remove the contents of the intestines, but also prevent the accumulation of fæces in them, and the irritation such accumulation causes. They are useful in cases of dropsy, to remove excessive fluids from the body. In fever they lower the temperature, and they are of use in lowering the blood pressure in certain diseases. Lastly, in cases of hernia, aneurism, and some other disorders, they are beneficial in preventing difficulty in the act of defæcation. Although the use of aperients is of undoubted benefit, yet their abuse is much to be deprecated, as to employ them habitually or promiscuously may produce serious results. There are also used as aperients many Mineral Waters (q.v.).

Apomor'phia is an alkaloid prepared from morphia by heating with hydrochloric acid. It is a rapid and powerful emetic, but its effects quickly pass off; and it causes very little depression. Its chief value depends upon the ease with which it can be administered by hypodermic Injection (q.v.), as vomiting can thus be induced even when swallowing is difficult or impossible—e.g. in cases of poisoning.

Aqua Fortis (literally 'strong water') was the term used by the alchemists to denote nitric acid, and is still the commercial name of that acid.

Aqua Regi'næ (literally 'queen's water') is a mixture of concentrated sulphuric acid (oil of vitriol) and nitric acid, or of sulphuric acid and nitre. Either mixture evolves fumes largely, and may be used as a disinfectant.

Aqua Regis, or REGIA (literally 'royal water'), is the common name applied to a mixture of 1 part of nitric acid, and 2, 3, or 4 parts of hydrochloric acid. The general proportion is 1 to 2. The term aqua regia was given to the mixture from the power it possesses of dissolving gold, which is the *king of the metals*.

Aquatic Plants. The presence of water is not only essential to the active life of all organisms, but is peculiarly necessary for plants which are for the most part dependent for food-supply on matter dissolved in water, as well as on the carbonic anhydride mingled with the surrounding medium. Numerous plants are, moreover, in the strict sense of the word aquatic, having never acquired or having lost all direct connection with the soil. The simplest plants or Algæ are almost all aquatic, though many occur in damp situations on land, or on other organisms, while others remain for long periods quiescent in comparative dryness. Many Algæ are absolutely isolated in the water, while others are more or less intimately fixed to some solid substratum. Fungi are very seldom found in water, and lichens are also emphatically terrestrial. Some Liverworts, again, occur floating in lakes, but the majority grow in very damp places, and mark the transition to the generally terrestrial life of mosses and ferns. Some Rhizocarps, such as Salvinia, are aquatic, with leaves rising to the surface, while others are land or marsh plants, like the higher horse-tails and club-mosses.

Among the flowering plants or phanerogams, a return to aquatic life is exhibited by numerous, though exceptional cases, while a very large number grow in moist situations, and have a semi-aquatic habit. The simple Monocotyledons known as Helobiæ (q.v.) or marsh-lilies are more or less strictly water-plants. The Arrow-head, q.v. (*Sagittaria*), and other Alismaceæ; the *Butomus* of the marshes; *Hydrocharis*, with floating kidney-shaped leaves; the water-soldier (*Stratiotes*), with narrow submerged leaves; and the Canadian pond-weed (*Anacharis*, q.v.), which, though entirely flowerless in Europe, threatens to choke some canals and lakes, are familiar representatives. The little duck-weed (*Lemna*) floating on the surface of stagnant pools is one of the commonest aquatic Monocotyledons; and the pond-weeds (*Potameæ*) found both in fresh and salt water; the lattice-plant (*Ouvirandra*, see fig. 1), with its skeleton leaves; various estuarine and fresh-water Naiadaceous plants—e.g. *Zostera* and *Naias*, are also common instances, while those growing in marshy ground are much too numerous to mention. Among Dicotyledons, the white water buttercup (*Ranunculus aquatilis*), with its slightly divided floating, and much dissected submerged leaves; the yellow and white water-lilies (*Nymphæa*); the sacred lotus-flower of the Ganges and Nile (*Nelumbium*); the gigantic *Victoria regia* of tropical South America; and the insectivorous bladderwort or *Utricularia*, are among the most familiar aquatic forms.

Numerous modifications have naturally resulted in adaptation to aquatic life. The roots growing out in a relatively frictionless medium may become, as in *Hydrocharis* and *Pontederia* (see ROOT), long and delicate, covered with numerous and uniform root-hairs, which thus expose a large absorbing surface. In *Utricularia*, on the other hand, where the whole plant is submerged with the exception of the flower-stalk, root-structures are not developed at all. The leaf-stalks of a *Pontederia* growing in the water, show, when contrasted

Fig. 1.

A, Madagascar Lattice-leaf (*Ouvirandra fenestralis*), showing open fenestrated leaves in adult state, with young leaves at first entire, and showing, as they develop, the progressive rupture of parenchyma between the fibro-vascular bundles ('veins').
B, Leaf of Pond-weed (*Aponogeton*), to show floating type (entire) with same venation as *Ouvirandra*.

with those of another growing on land, an enormous development of air-spaces, which serve to buoy up the floating plant. Submersion seems to increase the surface of leaves at the expense of their thickness, and this in Monocotyledons usually

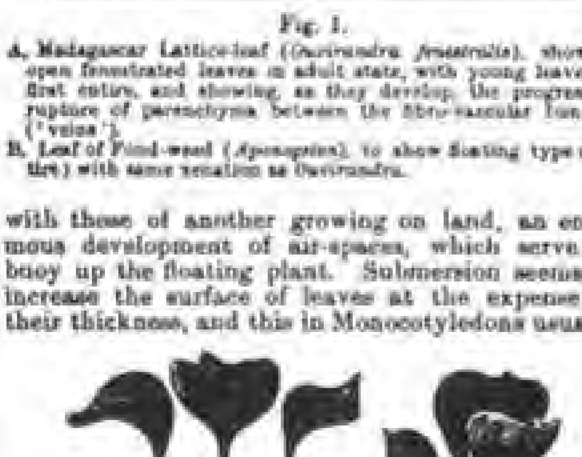


Fig. 2.

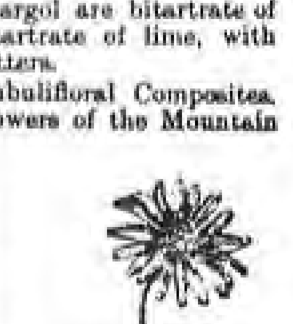
A, *Pontederia crassipes* of Amazons: ordinary floating form with air-spaces in leaf-stalks, and branched roots.
B, a runner which has taken root on land, and accordingly reverted to the ordinary form of root and leaf-stalk.

results in elongation in one direction (*Sagittaria*, *Vallisneria*, &c.), and in Dicotyledons, in the development of numerous capillary divisions, as in *Ranunculus aquatilis* and *Myriophyllum*. The change may sometimes be experimentally demonstrated by artificial change of environment, while the foliage of *Sagittaria*, *Alisma*, *Nuphar*, &c. is very different, according as the leaves are submerged, floating, or aerial. In aquatic plants, the Stomata (q.v.) are usually absent or scarce on the lower surface of the floating leaves, and on both sides of the submerged: and many more intimate changes, such as the disappearance of hairs, the occurrence of chlorophyll in the epidermis, and so on, have been repeatedly observed to follow change to an aquatic medium. Some plants, such as *Zostera*, even flower under water, but an exposure and relative drying at the surface has been shown to be in some cases essential to the germination of the seeds. The fruits of the water-lily keep afloat by means of large air-spaces, and those of the arrow-head are protected by a thick oily rind. The whole subject of the adaptive modifications of aquatic plants is obviously a special case of the general problem of the relation between organism and environment, and for further details reference must be made to the separate articles on some of the plants cited as instances.

Aqua Vitæ (Lat., 'water of life') is a common term applied to ardent spirits; especially, in commerce, spirits of the first distillation, or unrectified. During the alchemical epoch, brandy or distilled spirits was much used as a medicine, was considered a cure for all disorders, and even got the credit of prolonging life. French *eau de vie* (brandy) has the same meaning, as well as our words *whisky* and *usquebaugh*; the former a Scotch, the latter an Irish form, from a common Gaelic and Irish, *uisge bheatha*.

Ar'gol is a crude variety of cream of tartar which forms a crust in the interior of wine-vats and wine-bottles. Originally, it exists in the juice of the grape, and is soluble therein; but during the fermentation of the juice, and as it passes into wine, much alcohol is developed, which remaining in the fermenting liquor, causes the precipitation of the argol; the latter being very sparingly soluble in an alcoholic liquid. Some wines, when they are bottled, are not fully ripe, and more alcohol being thereafter developed, a further precipitation of argol takes place as a crust in the bottles, and hence the meaning of the term *crusted port*. Argol is generally of a reddish tinge, obtained from the colour of the grapes, but sometimes is of a grayish-white colour, when it has been deposited during the fermentation of the juice of colourless grapes. The red or white argol is denominated in commerce *crude tartar*, and its principal uses are in the preparation of Cream of Tartar and Tartaric Acid (q.v.). The constituents of argol are bitartrate of potash (cream of tartar), tartrate of lime, with colouring and extractive matters.

Ar'nica, a genus of Tubulifloral Compositæ. The rhizome, leaves, and flowers of the Mountain Arnica (*A. montana*), sometimes called Mountain Tobacco, formerly enjoyed much repute in medicine as a stimulant in paralytic affections, low fevers, &c. The flowers are still employed to yield a tincture which is of service as an external application to wounds and bruises. The plant yields a considerable quantity of tannin, resin, volatile oil, and a peculiar alkaloid (arnicin). The rhizome is perennial and crooked, the stem about two feet high, simple or little branched, with few leaves, bearing on the summit a head of flowers of a dark golden yellow, often two inches in breadth. It flowers from June to August, forms an ornament of mountain meadows in Germany and Switzerland, and is found upon the Continent as far south as Portugal, and as far north as Lapland, but is not a native of Britain. There are a few North American species.



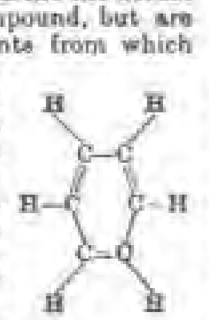
Arnica.

Aromatics constitute a class of medicines which owe their properties to the essential oils, to benzoic and cinnamic acids, to volatile products of distillation, or to odorous glandular secretions. The plants that contribute to this class of medicines are those which yield essences, camphor, or odorous resins, and amongst the families which yield the most important aromatics are the Labiatæ, Umbelliferæ, Lauraceæ, Myrtaceæ, Aurantiaceæ, Coniferæ, Scitamineæ, Orchideæ, &c. In some cases, the aromatic matter is diffused throughout all parts of the plant, but it is usually condensed in particular organs, such as the root, in the case of ginger and galanga; or the bark, in the case of cinnamon, canella, and cascarilla; or the flowers, as in the case of cloves; or the fruit, as in the case of anise and vanilla; or the wood, as in the case of sandal-wood and aloes-wood; or the leaves, as in the case of most of the Labiatæ, Umbelliferæ, &c.

Aromatics may be arranged in the following subclasses: (1) Those in which the active principle is an essential oil, as the oil of thyme, lavender, cajeput, neroli, fennel, &c. (2) Those containing camphor, or an allied body, such as artificial camphor obtained from turpentine. (3) Bitter aromatics, in which there is a mixture of a bitter principle and an essential oil, as chamomile, tansy, wormwood, &c. These are tonics and vermifuges. (4) Those of which musk is the type, such as civet and ambergris; and certain plants with a musk-like odour, such as *Malva moschata*, *Mimulus moschatus*, and *Hibiscus abelmoschus*. (5) Those containing a fragrant resin, as benzoin, myrrh, olibanum, storax, and the balsams of Peru and Tolu, which possess stimulant properties. (6) Lastly, those which are artificially produced by destructive distillation, as tar, creosote, benzol, or the various empyreumatic oils.

As a general rule, these substances act as diffusible stimulants of more or less power, and as antispasmodics, while those in which a bitter principle is present act as vermifuges and tonics. The whole class were formerly regarded as possessing disinfectant and antiseptic properties, and there is no doubt that some, as coal-tar, creosote, &c. strongly possess this property. In this country we usually associate aromatics with other medicines; but in France aromatic infusion, lotions, baths, &c. are prescribed. The composition of aromatic infusion may be given as an illustration: Take equal parts of the leaves of sage, ordinary and lemon thyme, hyssop, origanum, wormwood, and mint; and infuse 50 parts of these leaves in 100 parts of boiling water.

Aromatic Series. This term is applied to a large group of organic chemical compounds, many of which occur in balsams, essential oils, and other substances having an aromatic odour. It was originally limited to the compounds of the benzoic group, but it has now been extended so as to include other series homologous with them, and ranging round the group of hydrocarbons, C_nH_{2n-6}. The simplest of these hydrocarbons is Benzene (q.v.), in which there are six atoms of carbon, the formula being C_6H_6. Now, such a body is an unsaturated one (see ATOMIC THEORY), and is capable of uniting with monatomic elements such as chlorine to form chlorides, containing from one to six atoms of chlorine. To account for this, Kekulé has devised a structural formula for benzene, which assists one in understanding the complex relations of the aromatic series; but it must be borne in mind that such formulæ do not profess to represent the actual positions of the atoms in the compound, but are only used as convenient stand-points from which to regard them. In Kekulé's formula, the double lines, uniting the atoms of carbon, indicate that each of these atoms can still unite with an atom of hydrogen. From this peculiar construction, it is evident that the compounds of the aromatic series must have distinctive properties, and the number of these compounds be very large. Thus, referring to chlorine, we see that we may either *replace hydrogen by chlorine*, or add chlorine to benzene, the resulting bodies having the composition C_6Cl_6 and $C_6H_6Cl_6$, when the full amount of chlorine has been taken up. So also oxygen may enter into the compound, giving us a series of bodies called *phenols*, which are monatomic, diatomic, or tetratomic, according to the number of atoms introduced. The phenols correspond to the alcohols of the fatty series (see ALCOHOLS), ordinary phenol having the formula C_6H_5OH, that of common alcohol being C_2H_5OH. Hydrogen may also be replaced by amidogen, NH_2, giving rise to *Amines* (see ALKALOIDS), the best known of which is Phenylamine, or Aniline (q.v.), $C_6H_5NH_2$. The *nitro compounds*, in which hydrogen is replaced by the group NO_2, include nitrobenzene, or artificial oil of bitter almonds (not to be confounded with the true Oil, q.v.), the formula of which is $C_6H_5NO_2$.



When carbon enters the benzene group, C_6H_6, it forms many new compounds. Thus hydrogen may be replaced by radicals such as methyl and ethyl, CH_3 and C_2H_5, giving rise to such compounds as

Methyl benzene.............. $C_6H_5CH_3$;
Ethyl benzene.............. $C_6H_5C_2H_5$;

or, again, more than one molecule of these radicals may be introduced, as in

Dimethyl benzene.............. $C_6H_4(CH_3)_2$;
Methyl-ethyl benzene.............. $C_6H_4CH_3C_2H_5$.

From these again are derived aldehydes, alcohols, and acids, of which we can only give a single example:

Methyl benzene, or toluene.. $C_6H_5CH_3$;
Benzyl alcohol.............. $C_6H_5CH_2OH$;
Benzyl aldehyde.............. C_6H_5COH;
Benzoic acid.............. C_6H_5COOH.

All of which, in their composition and properties, show close analogies to the corresponding fatty compounds. An account of the aromatic series would be incomplete without reference to the *isomerism* which exists among its members. A reference to the formula for benzene will show that when only one atom of chlorine has been introduced into the molecule, there can only be one monochlor benzene. When two, however, are present, or when one atom of chlorine and one of bromine have replaced hydrogen, as in chloro-bromo benzene, the case is different:

Benzene. 1·2 1·3 1·4
Chlorobromo benzene.

Here we see that the atoms of hydrogen replaced may be either contiguous (1·2), separated by one group of CH (1·3), or by two groups (1·4); and that this is not a mere distinction on paper is borne out by experiment, which has succeeded in producing three chlorobromo benzenes, differing in properties, but identical in percentage composition. There are many other isomeric bodies known, but for further information the reader must refer to the article on ISOMERISM, or to a practical treatise on the subject.

Aromatic Vinegar differs from ordinary vinegar (which is acetic acid diluted with water) in containing certain essential oils which impart an agreeable fragrance. It is generally prepared by adding the oils of cloves, lavender, rosemary, bergamot, neroli, and cinnamon to the strongest acetic acid. Aromatic vinegar is a very pleasant and powerful perfume; it is very volatile, and when snuffed up by the nostrils, is a powerful excitant, and hence is serviceable in fainting, languor, headache, and nervous debility. Aromatic vinegar is generally placed on a sponge in a smelling-bottle or in a *vinaigrette*; it can also be purchased as a liquid in phials; and a drop or two allowed to evaporate into a sick-room, overpowers, but does not destroy any unpleasant odour. The liquid must, however, be cautiously dealt with, as it is very corrosive.

Arrack, or RACK, is an East Indian name (derived from the Arabic) for all sorts of distilled spirituous liquors, but chiefly to that procured from *toddy* or the fermented juice of the cocoa and other palms, as well as from rice and the kind of brown sugar called *jaggery*. The palms in other tropical countries furnish a fermented beverage similar to the toddy of India, and in a few instances also it is distilled, but arrack essentially belongs to India and the adjacent countries. The cocoa-nut palm (*Cocos nucifera*) is a chief source of toddy or palm wine, which is obtained from trees ranging from twelve to sixteen years old, or in fact at the period when they begin to show the first indication of flowering. After the flowering shoot or spadix enveloped in its spathe is pretty well advanced, and the latter is about to open, the toddy-man climbs the tree and cuts off the tip of the flower-shoot; he next ties a ligature round the stalk at the base of the spadix, and with a small cudgel he beats the flower-shoot and bruises it. This he does daily for a fortnight, and if the tree is in good condition, a considerable quantity of a saccharine juice flows from the cut apex of the flower-shoot, and is caught in a pot fixed conveniently for the purpose, and emptied every day. It flows freely for fifteen or sixteen days, and less freely day by day for another month or more; a slice has to be removed from the top of the shoot very frequently. The juice rapidly ferments, and in four days is usually sour: previous to that it is a favourite drink known in some parts of India as callu, and to the Europeans as toddy. When turning sour, it is distilled and converted into arrack. It is largely manufactured in Goa, Batavia, Ceylon, and Siam. A similar spirit is made pretty largely from the magnificent fan-leaved palm, *Borassus flabelliformis*, and also from the so-called date-sugar palm, *Arenga saccharifera*. The name is also given to a spirit obtained from rice and sugar fermented with cocoa-nut sap. An imitation arrack may be prepared by dissolving 10 grains of benzoic acid in a pint of rum.

Ar'senic and its Compounds. Arsenic (through Lat. from Gr. *arsenikon*, 'arsenic,' a word meaning literally 'male,' *arsēn*, from the notion of the old alchemists that metals were of different sexes) is the name applied in popular language to a well-known poisonous substance, arsenious acid, but, strictly speaking, the term is restricted to the metal, of which the symbol is As and the atomic weight is 75. The metal arsenic is rarely found free in nature, but in a state of combination it occurs largely. The most important of all arsenical minerals, because of their use as ores of arsenic, for the preparation of white arsenic, or arsenious acid, are those in which arsenic is combined with nickel and cobalt. The chief of these are arsenical pyrites, or leucopyrite, nickeline, cobaltine, and smaltine, which are found in Cornwall and the continent of Europe, as well as in other parts of the world. The last-named two are used for the preparation of blue colours for porcelain or stoneware. The presence of arsenic in a mineral may commonly be detected by the alliaceous odour which it emits before the blowpipe.

The metal is generally prepared from arsenious acid, As_2O_3, by mixing it with its own weight of charcoal, placing the mixture in a well-covered crucible, and subjecting the whole to heat, when the metal set free by the charcoal rises, and condenses in the upper part or cover of the crucible. Metallic arsenic is very brittle, can easily be reduced to powder by hammering, or even pounding in a mortar; and when a freshly cut surface is examined, it presents a brilliant dark steel-gray lustre, which, however, readily tarnishes on exposure to the air. The metal, as such, is not considered poisonous, but when introduced into the animal system, it is there faintly acted upon by the juices, and in part dissolved, at the same time, exhibiting poisonous properties. When heated in the open air, it burns with a peculiar bluish flame, and emits a characteristic alliaceous odour. The only use to which the metal arsenic is applied in the arts is in the manufacture of leaden shot of the various sizes, when its presence in small quantity in the lead renders the latter much more brittle than it ordinarily is. Of all the compounds of arsenic the most important is the one already alluded to—namely, arsenious acid, which is an oxide of arsenic. With sulphur, arsenic forms two important compounds: *Realgar*, As_2S_2, a red, transparent, and brittle substance, which is employed in the manufacture of the signal-light called *White Indian Fire*; and *Orpiment*, As_2S_3, or *King's Yellow*, a cheap pigment of a yellow colour.

With hydrogen, arsenic forms arseniuretted hydrogen, AsH_3, a very poisonous gas, and one which has been fatal to several chemists.

ARSENIOUS ACID is the arsenical compound most familiarly known. It is obtained principally during the roasting of the arsenical nickel ores in Germany in furnaces communicating with flues. When the arsenic of the ore burns, it passes into the condition of arsenious acid, As_2O_3, and rising as vapour into the somewhat cool flue, is there deposited as a grayish powder, known by the names of *Smelting-house Smoke*, *Flowers of Arsenic*, *Poison-flour*, or *Rough Arsenious Acid*. In this condition, the arsenious acid is contaminated with some impurities, from which it may be separated by introducing the gray powder into an egg-shaped vessel, and applying heat at the lower end, when the arsenious acid rises in vapour, and condenses in the cool end as a transparent glassy or vitreous substance. Ordinary arsenious acid of the shops (which is what is popularly known as *arsenic*) is a white crystalline powder, which feels decidedly gritty, like fine sand, when placed between the teeth, and has no well-marked taste. It is very heavy, so much so as at once to be noticeable when a paper or bottle containing it is lifted by the hand. It is soluble in about 10 parts of boiling water, or 100 parts of cold water. As ordinarily sold in quantities under 10 lb. in weight, the arsenious acid is required by law to be coloured with $\frac{1}{32}$ of its weight of indigo, or $\frac{1}{16}$ of its weight of soot; the object of the admixture being to render any liquid to which the arsenious acid might be added, with a murderous intent, of a black or bluish-black hue, and thus indicate the presence of something unusual. In packages of 10 lb. and upwards, arsenious acid is allowed to be sold in the pure white crystalline form without coloration. When placed in a spoon, or other vessel, and heated, the arsenious acid volatilises, and condenses in crystals on any cool vessel held above. Again, when arsenious acid is placed on a red-hot cinder, the strong alliaceous odour characteristic of arsenic is given off. When thrown upon water, instead of at once descending through the water like sand, arsenious acid, notwithstanding its great density (specific gravity 3·70), partially floats on the surface, as wheat-flour does; and that portion which sinks in the water rolls itself into little round pellets, which are wetted only on the outside, and contain much dry arsenious acid within. The solution of arsenious acid in water is recognised by three tests:

(1) Hydrosulphuric acid and hydrochloric acid produce a *yellow precipitate* of sulphide of arsenic, As_2S_3, soluble in ammonia.

(2) Ammonio-sulphate of copper, an *apple-green precipitate* of arsenite of copper, $CuHAsO_3$.

(3) Ammonio-nitrate of silver, a *yellow precipitate* of arsenite of silver, Ag_3AsO_3.

In many cases, arsenious acid is used as a means of destroying animal life, but, happily, the processes for the detection of the poison in organic mixtures and in the animal tissues are unerring and trustworthy.

For the isolation and recognition of arsenious acid in organic mixtures, such as the contents of a stomach, the method generally pursued is called Reinsch's process, from the name of its discoverer. The manner of its application is to treat the organic mixture with water sufficient to render it thin, then add hydrochloric acid to the extent of one-eighth of the volume of the liquid; apply heat, and when the whole has been raised to near the boiling-point, introduce clean, newly burnished pieces of copper in the form of wire, gauze, or foil. If arsenious acid be present in the mixture, a steel-gray coating of metallic arsenic will form on the surface of the copper. This apparent tarnishing of the copper may take place when no arsenious acid is in the mixture, and may be produced by salts of mercury, antimony, &c., as well as by sulphur compounds, and even occasionally by fatty matters. To distinguish between the coating formed by arsenious acid and that produced by other substances, the copper is taken out of the mixture, washed with water, to remove acid; immersed in ether, to dissolve off any adherent fatty matter; dried between folds of blotting-paper; introduced into the lower end of a dry glass test-tube, and there cautiously heated. The metallic arsenic, As, is driven off by the heat from the surface of the copper, rises in vapour into the upper portions of the test-tube; there meets the oxygen of the air, with which it combines, forming arsenious acid, As_2O_3, and thereafter deposits itself on the inner surface of the cool part of the tube in little glistening crystals. On allowing the tube to cool, adding water thereto, and applying heat, the water dissolves the crystals of arsenious acid, yielding a solution, to separate portions of which the liquid tests mentioned above may be successfully applied.

Arsenious acid forms compounds (salts) with alkalies and other bases, which are called arsenites. Some of these are employed in commerce and medicine. Arsenious acid, boiled with a solution of potash, or carbonate of potash, forms an arsenite of potash, used in medicine, and known as *Fowler's Solution* or *liquor arsenicalis*. Many sheep-dipping mixtures are composed of arsenious acid, soda, sulphur, and soap, which, when used, are dissolved in a large quantity of water, and thus constitute essentially dilute solutions of arsenite of soda. A compound of arsenious acid and the oxide of copper, called the Arsenite of copper, or *Scheele's Green*, is a pigment largely used by painters as a pretty and cheap green paint. The same substance is, or was formerly, extensively employed in the manufacture of common green paper-hangings for the walls of rooms; and it seems certain that rooms covered with paper coated with this green arsenite of copper are detrimental to the health of human beings residing therein, from the readiness with which minute particles of the poisonous pigment are detached from the walls by the slightest friction, are diffused through the room, and ultimately pass into the animal system. Another green pigment is named *Schweinfurth Green*, and contains arsenious acid, oxide of copper, and acetic acid, and is a double arsenite and acetate of copper.

Arsenic has long been used as a medicine. When taken into the stomach, it is soon absorbed into the blood, acting powerfully in such skin diseases as Psoriasis, Lepra, Eczema (q.v.), &c. As a tonic alterative it holds a high place, and it is much used in ague, remittent fever, and St Vitus's dance. The usual method of administering arsenic is in small doses (from three to five drops) of the liquor arsenicalis, largely diluted with water, twice or thrice in the day.

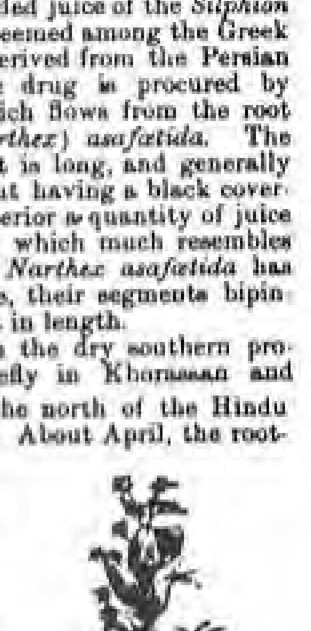
When given in the doses above mentioned, for eight or ten days, symptoms of poisoning begin to appear, the skin becoming hot, the pulse quick, the eyelids hot and itchy; the tongue has a silvery appearance; the throat is dry and sore, the gums swollen and tender; and if the treatment is persisted in, salivation ensues, and then come nausea, vomiting, diarrhœa, nervous depression, and faintness. The quantity necessary to destroy life, of course, varies, but under circumstances favourable for its operation the fatal dose for an adult is from *two* to *three grains*. Death from a poisonous dose of arsenic may occur in a few hours, or after the lapse of days. Arsenic has been used frequently as a slow poison, the symptoms being attributed to inflammation of the bowels from natural causes. Fortunately, in most cases its detection is easy.

In some countries, especially in Austria (though the practice is not unknown in England), arsenic is given to cattle and horses to render the skin bright and glossy. In Styria, arsenic is taken by the peasant girls to increase their personal attractions; and it has been definitely ascertained that over a considerable area in the south-west of Austria, including Styria, Carinthia, Salzburg, Tyrol, Lower Austria, and the Erzgebirge, arsenic eating is largely practised by men, who nevertheless attain a healthy old age. Arsenic eaters, who generally begin the use of the drug secretly, say that it improves the complexion, increases the digestive powers, and so strengthens the respiratory organs as to enable the bearers of heavy burdens to climb mountains with ease. At first a dose may be taken once a week, afterwards daily; and there are authenticated cases of men who consume six grains—enough to poison three men—at one dose without inconvenience. Once the habit is established, it is impossible to give up arsenic eating. Terrible heart-gnawings following any attempt gradually to stop the practice; and sudden cessation causes death. That arsenic can be taken habitually for any length of time with impunity was formerly regarded as a physiological impossibility; and yet the fact is established on unquestionable evidence.

No effective chemical *antidote* for arsenic has yet been discovered. In case of an overdose, or of intentional poisoning, the following treatment is recommended: Evacuate the stomach by the stomach-pump, using lime-water; administer large draughts of tepid sugar and water, chalk and water, or lime-water; avoid the use of alkalies, but administer charcoal and hydrated sesquioxide of iron; bleed freely; take a tepid bath, and use narcotics. If the fatal symptoms be averted, let the patient for a long time subsist wholly on farinaceous food, milk, and demulcents.

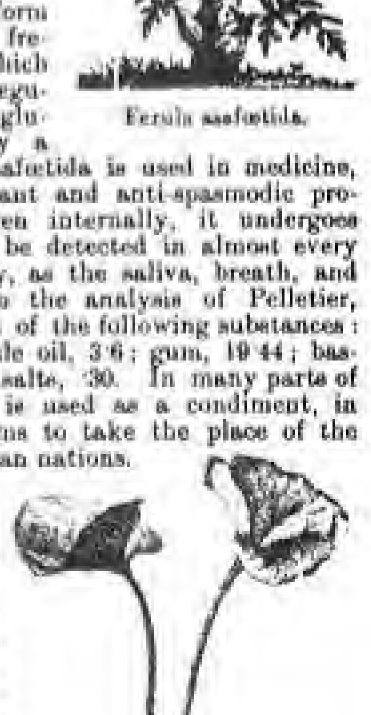
Asafœ'tida, or ASSAFŒTIDA (i.e. Fetid Asa or Assa), is a gum-resin, which has been supposed to be identical with the exuded juice of the *Silphion* of Dioscorides, so highly esteemed among the Greek physicians. Its name is derived from the Persian word *aza*, 'mastic.' The drug is procured by drying the milky juice which flows from the root of the plant *Ferula* (*Narthex*) *asafœtida*. The root of the asafœtida plant is long, and generally undivided; white inside, but having a black covering; and contains in its interior a quantity of juice of an overpowering odour, which much resembles that of garlic. *Ferula* or *Narthex asafœtida* has its radical leaves tripartite, their segments bipinnatifid, and nearly two feet in length.

Asafœtida is prepared in the dry southern provinces of Persia, but chiefly in Khorassan and Afghanistan, and also to the north of the Hindu Kush range of mountains. About April, the root-leaves are taken away, and the root itself is more or less exposed by removal of the soil from about it. After a lapse of six weeks, a slice is cut horizontally from its summit, this operation being repeated at intervals of a few days till the root is exhausted, and a thick white juice exudes, the smell of which even exceeds in strength that of the drug when dry. The drug is sometimes met with in the market in the form of tears, but more frequently in lumps, which are made up of irregularly shaped tears, agglutinated together by a softer substance. Asafœtida is used in medicine, and possesses stimulant and anti-spasmodic properties. When taken internally, it undergoes absorption, and may be detected in almost every secretion of the body, as the saliva, breath, and urine. According to the analysis of Pelletier, asafœtida is composed of the following substances: resin, 65 parts; volatile oil, 3·6; gum, 19·44; bassorin, 11·66; various salts, ·30. In many parts of the East, this drug is used as a condiment, in which respect it seems to take the place of the garlic of some European nations.



Ferula asafœtida.

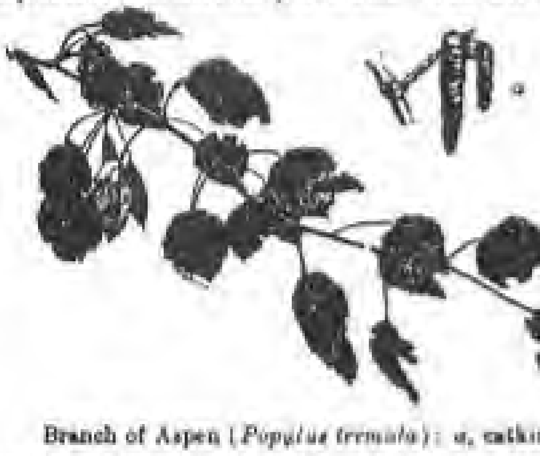
Asarabac'ca (*Asarum europæum*), a plant of the natural order Aristolochiaceæ (see ARISTOLOCHIA), a native of Europe, growing in woods; but rare in Britain. The whole plant has acrid properties; the roots and leaves are aromatic, purgative, and emetic, and were formerly considerably used in medicine, especially in the preparation of snuffs used in the treatment of catarrh, &c.—A nearly allied species.



Asarabacca (*Asarum europæum*).

A. canadense, a native of Canada, is stimulant and diaphoretic, and is used, under the name of Canada Snakeroot, instead of *Aristolochia serpentaria*. It is also called Wild Ginger, and used as a spice, being of a warm aromatic quality, and not acrid, like its European congener.

Aspen, or TREMULOUS POPLAR (*Populus tremula*; see POPLAR), a tree which grows plentifully in Europe and in Siberia. It is a native of Britain, and is frequently found in Scotland, where it is met with even at an elevation of 1500 feet above the sea. It has received the specific name *tremula*, from the readiness with which its leaves are thrown into a tremulous motion by the slightest breath of wind—a property for which, indeed, the aspen-leaf has become proverbial. The leaves are



Branch of Aspen (*Populus tremula*): *a*, catkin.

nearly orbicular, but broadly toothed, so as almost to exhibit angles. The footstalks are long, slender, and compressed, which favours the readiness of motion. It grows quickly, with a straight stem, reaching to a height of from 60 to 80, or even 100 feet. The wood is soft, porous, light, white, and smooth; it does not make good fuel, but is very fit for the turning-lathe, and especially for being made into troughs, trays, and pails; whilst in France it is used for sabots. If the stem be peeled and allowed to dry before it be cut down, the wood becomes harder, and is then capable of being used as timber for the interior of houses; and on this account the tree is of great importance in many districts, and the more so as it succeeds in any soil, although it prefers one which is moist and gravelly. The bark contains a great quantity of a bitter alkaloid, *Salicin*. The charcoal made from this tree can be used in the manufacture of gunpowder. The peculiar quivering of the leaves of the aspen has given origin to a wealth of legendary and literary associations with the tree. The old legend that it supplied the wood of the Cross, and has never since ceased to tremble, is even yet quoted as the cause of its ceaseless quivering. It appears to have been highly valued as a timber tree in the time of Henry V., particularly for the making of arrows. An act of parliament was passed in that reign preventing the consumption of the *aspe* for any other purpose, under a penalty of a hundred shillings. This act was only repealed in the reign of James I.—*Populus tremuloides*, a very similar species, a native of North America, is called the American aspen. It is regarded by some as a mere variety. Very similar, also, is another North American species, *P. grandidentata*.

Asphalt, ASPHALTUM, or MINERAL PITCH, is the name given to a compact form of bitumen, which is usually black or dark brown in colour. When free from earthy impurities, it has a conchoidal fracture and resinous lustre. Asphalt is generally found wherever rock-oil occurs, and in such localities it is clearly produced by the drying up of the petroleum. In some places, however, it occurs in beds forming a compact rock. The Dead Sea, the district near Babylon, some of the West Indian Islands, notably the *Pitch Lake* in Trinidad, and one or two places in France, Switzerland, and Dalmatia, are the best-known localities for this substance; but it is found, more or less, in a great many countries. Asphalt was employed by the ancient Egyptians for embalming their dead, and it was used in Babylon as mortar. Its modern applications are numerous. It is an ingredient in Japan varnish, and is used along with other materials to make waterproof roofing and flooring, linings for cisterns, and along with pasteboard material in the construction of water-pipes. It is much used to form what are called 'damp courses' in walls of buildings—that is, a layer of it, from ½ inch to ¾ inch thick, is spread over the thickness of a wall near the ground-level, to prevent the ascent of damp. Frequently nowadays the whole internal area of a house is covered with a layer of asphalt. In cases where the wall of a house comes against a bank of earth, the whole surface is protected from damp by a lining of this material. One or two kinds, such as those found at Seyssel in the east of France, and at Val-de-Travers in Switzerland, though called asphalts, are really bituminous limestones. The latter is known all over the world as a material for pavement. This Val-de-Travers asphalt is prepared by reducing the natural rock, which contains from 7 to 20 per cent. of bitumen, to powder, and then putting it with a small quantity of melted bitumen into a caldron. After it is fused and stirred for some time, it is run into moulds to form blocks of about 1 cwt. each. These blocks are called 'asphaltic mastic,' and the finest kinds contain 87 per cent. of carbonate of lime and 13 of bitumen. This mastic should not melt below 168° F. It has, especially since 1854, been very extensively employed in the construction of pavements. When this material is used, there is, of course, far less noise produced by the traffic on the streets than with stone. For paving purposes, the 'asphaltic mastic' is heated in portable boilers, into which, at a certain stage of the preparation, there is poured about 25 per cent. of thoroughly dried sand, gravel, or powdered limestone, which is well mixed with the liquid asphalt. The mixture is then spread on the spot prepared for it, and when cool forms a hard kind of pavement. In Paris, both for carriage-ways and foot-pavements, it has been largely employed for more than thirty years, having been introduced by Napoleon III. with a view, it is said, to prevent the erection of barricades with paving-stones. In more recent times it has been extensively used in Berlin, and many other continental towns, for the same purposes. In London and other parts of Great Britain, foot-pavements are still frequently made of it, but it has been but very partially used for carriage-ways. For this last purpose the moist climate of our island probably renders it more slippery than on the Continent. Pavements formed of an artificial or coal-tar asphalt have long been, to a limited extent, in use; but this material is not so suitable for them as the natural asphalts (see GAS-TAR). It is well to state, however, that artificial asphalt is more used for 'damp courses' than the asphalts from bituminous limestones, although the latter are much better. Of late years, an asphalt made of coal-tar pitch and a cheap mineral oil called creosote oil, has been much used for the joints of wood-pavement and causeway stones, and does very well. The pigment known as asphaltum is sometimes prepared from natural asphalt, but more frequently from the residue of distilled bituminous substances. Unfortunately, its fine transparent brown colour has tempted some distinguished modern artists to use it largely. Through its property of not drying thoroughly and free of cracks, a number of fine pictures painted some years ago by Horace Vernet, Sir George Harvey, and others, are now mere wrecks. For the synonyms of asphalt, see BITUMEN.

Aspira'tor is the name of an apparatus employed to draw air or other gases through bottles or other vessels. It is of great use in the examination of gases by the analytical chemist. The simplest form of the apparatus is that represented in fig. 1, where A is a large vessel capable of being filled with water, having a tube with stop-cock at B, a second tube with stopcock at C, and a thermometer introduced at D. In working, the apparatus is filled with water; the tube C is attached to the

Fig. 1.

vessels through which the gas is to be drawn; and the stopcocks at C and B being opened, the weight of the water escaping at B acts as suction, and draws in the gas from the tube C and the attached bottles or other vessels. The thermometer at D denotes the temperature of the water, and subsequently gas, contained in the reservoir, while the upright turn of the tube B keeps any air from entering the reservoir by that route. Another form of aspirator is represented in fig. 2. A is connected with a supply of water under pressure. As the jet of water is forced into the contracted neck at D, it draws the air from B along with it down the outlet pipe C. This form of aspirator is much used in the chemical laboratory for filtering purposes. Into the neck of the funnel is placed a small cone of platinum foil, and thereafter the filtering-paper is carefully fitted, taking care to avoid any creases. The funnel is then passed through an india-rubber cork, fitted to a strong flask, and provided with a tube connecting it with the aspirator. On opening the stopcock B, a partial vacuum is formed in the flask, and the liquid in the filter rapidly passes through. For this purpose a simpler form of aspirator, or filter-pump (as it is also called), is used, represented in the second diagram. A connects with a supply of water under pressure, while B leads to the filtering flask. On forcing water through A, the jet as it passes into the contracted neck at D draws the air from B in along with it, and carries it down the outlet pipe C, thus producing the required vacuum.

Fig. 2.

Assaying is the art of determining the proportion of any specified metal in a given metallic ore or in an alloy. The various methods of estimating the amounts of base metals present could not, however, be usefully set forth within the limits of the present article, and the reader who requires technical information in regard to them must be referred to the special works enumerated at the end: we shall here limit our attention to the methods commonly adopted for ascertaining the amount of gold or silver present in an ore or alloy. Although the actual process adopted for assaying an ore is the same as for an alloy, the former has to be subjected to certain preliminary treatment in order to bring the metal present into a convenient form. This consists of 'scorification' or 'fusion,' with or without a previous 'roasting,' in case carbonaceous or other oxidisable substances are present, as happens with jewellers' 'sweep,' &c. Such roasting is conducted in an open dish with free access of air, as in a muffle furnace. The process of scorification is conducted also in a muffle furnace, in a non-porous fireclay dish or 'scorifier' heated to bright redness. One part by weight of a carefully taken sample of the ore in a fine state of division is mixed in the scorifier with from ten to twenty times its weight of granulated lead, and one-tenth its weight of borax, and the whole left in the muffle for about half an hour. On withdrawing the scorifier, its contents are poured into a cup-shaped iron mould, and when cold, the slag can be detached from the lead button, which contains all the gold and silver originally present in the ore, and only requires to be cupelled as explained below. When the 'fusion' or 'crucible' method is adopted, the prepared ore is mixed with red lead, charcoal powder, carbonate of soda, and borax, in proportions depending on the nature of the ore, and placed in a crucible which is heated in an ordinary furnace for about a quarter of an hour, when the whole may be poured into a mould, and a lead button, containing the precious metals, obtained as in the scorification process.

The 'cupellation' method of assaying gold and silver is of the highest antiquity. It depends essentially on the fact that molten litharge, monoxide of lead, PbO, is capable of holding in solution oxides of other metals with which it may be brought in contact, and thus separating them from unoxidisable metals. If, for example, gold, silver, copper, and lead are brought into a state of fusion in a current of air, the lead on becoming oxidised will take up the oxidised copper; the gold and silver, however, being unoxidisable, will not be so absorbed, and it only becomes necessary to provide a means of removing the oxides in order to obtain the precious metals which have thus been isolated. This is readily effected by using a 'cupel,' formed of compressed bone-ash, of some such form as is shown in fig. 1; being porous, it absorbs the oxides, while the molten gold and silver remain on its surface like a bead of mercury. One or more of these cupels, according to the number of assays to be made, are arranged on the floor of a muffle or oven of fireclay, provided with orifices at the sides and ends to produce the requisite draught, as indicated in fig. 2, and heated externally by anthracite, coke, charcoal, or gas. The operations comprised in the assay of an alloy containing silver by cupellation may be thus briefly described. A clean piece of the alloy, say 12 grains in weight, is accurately weighed on an assay balance. It may then conveniently be wrapped up in the whole or a portion of the

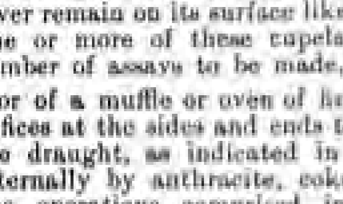


Fig. 1.

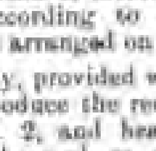


Fig. 2.

lead required for cupellation in the form of foil. The amount of lead taken, being dependent on the proportion of oxidisable metal present in the alloy, will, of course, depend on the composition as approximately judged from the colour, appearance of cut, &c.: three times the weight of the assay-piece for fine, or nearly fine, silver, six times for English standard (92·5 per cent.), and a still greater proportion for coarser varieties. The muffle having been raised to a red, but not bright-red, heat, the assay parcel is charged into a cupel, and the temperature maintained uniform. After a lapse of from twenty minutes to half an hour, it will be found that all the lead has been converted into litharge, and either volatilised or absorbed by the cupel, the completion of the operation being preceded by the passage of brilliant iridescent colours over the surface of the button, and, as soon as these cease, by an instantaneous increase in its brilliancy, known as *flashing* or *brightening*. The muffle is now closely shut up, and the temperature allowed to gradually fall until the button is set. It is then removed, hammered to detach adhering bone-ash, and weighed.

If there is reason to suspect the presence of small quantities of gold, it will only be necessary to dissolve the silver button, after weighing, in nitric acid (equal parts pure acid and water), collect the black deposit (the gold) that remains undissolved, and wash, ignite, and weigh it.

In many cases it is possible to ascertain the amount of silver present in an alloy without resort to cupellation. For this, the *humid*, or Gay Lussac's method, it is essential that the composition be previously known within comparatively close limits. Knowing this, it is easy to calculate what weight of the alloy contains 1 gramme of pure silver, by simply dividing the estimated percentage composition into 1000. This amount having been dissolved in nitric acid (equal parts pure acid and water), a measured volume of solution of common salt, standardised so as to precipitate exactly 1 gramme of silver, is added. By vigorously shaking the bottle for a few minutes, the white precipitated chloride will agglomerate, leaving a clear solution above; and on adding a small quantity of salt solution, the production of a further precipitate will indicate the presence of silver still in solution. Measured quantities being thus added, and the bottle shaken after each addition, a point will be reached at which no further precipitation occurs, and the total quantity of salt solution employed affords a means of ascertaining how much silver was actually present in the portion of alloy taken for assay. If W be the weight of silver alloy taken in grains, A its assay, M the volume in c.cs. of standard salt solution (of which 100 c.c. will precipitate 1 gramme of silver) required to saturate it, then $A = \frac{10\,M}{W}$.

The method of assaying gold alloys remains to be considered. This is always effected by cupellation, and, in the rare event of silver being *known* to be entirely absent, a simple cupellation with lead, as in the case of silver, will suffice, a gold button being obtained and weighed. If, however, even a trace of silver is present, the process involves several additional operations to effect its complete removal. The *inquartation* method adopted derives its name from the fact that the gold present is associated with about three times its weight of silver previous to cupellation, the object being to obtain a button in which the gold is distributed like a sponge so as to facilitate the subsequent removal of the silver by solution in nitric acid. The amount of lead varies, as in the case of silver, with the composition. With gold, from pure down to 22 carat, about six times its weight; from this point to 15 carat, eight times; and for lower qualities, ten times its weight will generally suffice. It is generally safer to take a weight of silver equal to two and a half times the weight of gold estimated to be present. The assay-piece, which may weigh half a gramme, having been very accurately weighed, is wrapped, together with the requisite silver, in the lead, and charged into a cupel in the muffle, the temperature of which may be appreciably higher than when cupelling silver. The phenomena observed are similar to those already described, and, on its removal from the cupel, the button, having the form shown at *a* in fig. 3, is brushed, flatted (*b*) on an anvil, annealed at a red heat, and drawn out into a *fillet* (*c*) in a

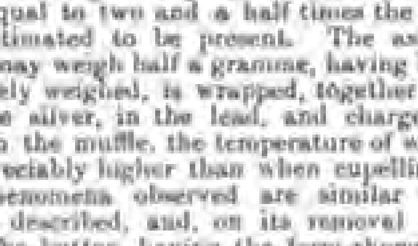


Fig. 3.

small rolling-mill to about the thickness of a calling-card, in order to still further facilitate the removal of silver. After being again annealed this is coiled into a *cornet* (*d*) between the finger and thumb. The precise manner in which the boiling in nitric acid is effected depends on the number of assays that are made. In large assay offices, as in that of the Royal Mint, a platinum boiling apparatus is now generally employed; but this is expensive, and, for smaller numbers of assays, the older method of boiling separately in 'parting' flasks is available. When adopting the former method, each cornet is placed in a small perforated platinum cup, a number of these being ranged on a tray of the same metal, which is introduced into the acid (specific gravity 1·2) contained in a boiler also of platinum. After remaining for about twenty-five minutes, the tray is removed, washed in hot distilled water, and transferred to acid of specific gravity 1·3 in a second boiler, and kept at the boiling-point for a similar period. On again being removed, the tray is washed, and raised to a red heat in the muffle, which causes the dull-red fragile cornets to cohere, assume the yellow colour of gold, and shrink in about the proportion of *d* to *e* (fig. 3). The cornets are then weighed.

In parting in a flask, the cornet is boiled for ten minutes in 2 or 3 fluid ounces of the first acid, the flask nearly filled with hot distilled water, and decanted. A similar quantity of the second acid having been added, the boiling is continued for fifteen minutes, and water again added. After decanting, and once or twice washing, the cornet is transferred to a small porous crucible, in which it is annealed at a red heat, when it is weighed.

The old method of assaying gold by the *touch-stone* is still occasionally resorted to when an approximate estimate of the composition is desired without damaging the object. This consists in comparing the appearance of a streak made with the metal on a hard basaltic stone of dark colour, with those produced by certain *touch-needles*, the composition of which is known, after all the streaks have been subjected to the action of nitric acid. The touch-needle whose streak most nearly corresponds with that of the unknown sample is selected as corresponding with it in composition. Another convenient mode of estimating the assay of a gold-copper alloy, without in the slightest degree damaging it, is to accurately determine its density by any of the well-known methods. From this density the amount of gold present is approximately calculated as follows: Let D be the density thus obtained; W, the weight of the object; w, the weight of gold in the object; w_1, the weight of copper; d, the density of gold = 19·3; d_1, the density of copper = 8·6. Then

$$\frac{W}{D} = \frac{w}{d} + \frac{w_1}{d_1};$$

whence we obtain for w, the gold present,

$$w = \frac{W\,(Dd - dd_1)}{D\,(d - d_1)},$$

and assay required $= \frac{w}{W} = \frac{19{\cdot}3\,D - 166}{10{\cdot}7\,D}$.

A few words must be added as to ascertaining both the silver and gold contained in an alloy. It becomes necessary either to perform separate assays, or to subject one assay-piece to cupellation twice. The assay is first conducted without adding silver, and the resulting button weighed as though it were a silver assay. After adding silver and lead, the button is again cupelled and treated as a gold assay. The weight of gold finally obtained is deducted from that of the first button, and the difference gives the weight of silver present. Some experience is necessary in order to accurately estimate this latter metal.

The reader who requires more detailed information in regard to the above, or other assay methods, is referred to the following works: Mitchell's *Manual of Practical Assaying*; Percy's *Metallurgy*; Makins' *Manual of Metallurgy*; Balling's *Manuel de l'Essayeur*.

Atropia, or ATROPINE, $C_{17}H_{23}NO_3$, is an alkaloid existing in all parts of the deadly nightshade (*Atropa belladonna*). The seeds of the thorn-apple (*Datura stramonium*) also contain an alkaloid, Daturine, which for long was believed to be identical with atropia. Recent researches seem to indicate that it is, however, only isomeric, and that it is only half as poisonous as atropia. It may be prepared from the juice of belladonna by heating it to 194° F. (90° C.), filtering, and after addition of potash, shaking with chloroform. The crude alkaloid obtained after evaporation of the chloroform is purified by crystallisation from hot alcohol. The crystals occur in colourless silky needles, united in tufts. It is very poisonous, $\frac{1}{10}$th of a grain causing dryness of the throat; but it is nevertheless used internally or by injection in cases of hooping-cough and ptyalism. It is also used as an antidote in cases of opium poisoning. A solution of sulphate of atropia in water dropped into the eye is now generally preferred to belladonna lotions or ointments for eye diseases. It produces dilatation of the pupil and paralysis of the accommodation, which do not completely pass away for some days; and also a sedative and curative effect in many inflamed conditions. A solution of about four grains to the ounce is most often employed; but a single drop of a very much weaker solution affects the pupil.

Balm (*Melissa officinalis*), a fragrant perennial herb belonging to the order Labiatæ, a native of the south of

Europe and Western Asia; and naturalised in a few places in England, has long been cultivated in gardens. The stems and leaves are still occasionally used in medicine as a gentle stimulant and tonic, and were formerly in high repute. The taste is somewhat austere, and slightly aromatic. The quantity of essential oil, on which its whole qualities depend, is not more than sufficient to communicate a pleasant flavour to the infusion

Common Balm (*Melissa officinalis*).

Balsam, a name formerly comprehending medicines compounded of resins and oils, as well as many resinous substances and oils, to which important medicinal virtues were ascribed. When the term balsam is now used without addition, the balsams of Peru and Tolu are generally intended.—These two balsams are very similar in all their more important properties, and are both produced by trees of the genus Myroxylon, of the natural order Leguminosæ, sub-order Papilionaceæ, natives of the tropical parts of America. *M. pereiræ*, the source of balsam of Peru, is a tree found in the state of San Salvador, in the district called Balsam Coast. *M. toluifera*, a native of Venezuela, Ecuador, and Brazil, furnishes balsam of Tolu. After being bruised and charred, the bark of the former falls off, and balsam begins to exude. It is received on rags, which, when saturated, are boiled in water, the separated balsam falling to the bottom. It is a liquid, having the appearance of treacle, but rather less viscid. Balsam of Tolu is generally soft and tenacious when first imported, becoming hard by age. Both balsams have a very fragrant odour. They are used in confectionery, to impart a flavour like that of vanilla; also in perfumery, and for pastilles, &c. In medicine, they are administered as gentle stimulants and tonics, and particularly in chronic bronchial affections. *Tolu lozenges* are a popular and pleasant remedy for troublesome coughs. These balsams are also used for cleansing ulcers.—They contain cinnamic acid, and a peculiar oily substance which has been called *cinnameine*, and is also known as Oil of Balsam of Peru. The name *White Balsam of Peru* is sometimes given to a balsamic substance which flows from the *Liquidambar styraciflua*. See LIQUIDAMBAR.

Balsam or **Balm of Gilead** is a liquid resinous substance, which has long enjoyed a very high reputation in the East for its fragrance and medicinal virtues. It is the subject of several allusions in the Old Testament, and is celebrated by Strabo, Pliny, Diodorus Siculus, and other ancient writers, almost as a cure for every disease. It is generally believed to be derived from a species of Balsamodendron (q.v.). The finest balsam, called Opobalsam, or Balm of Mecca, is of a golden yellow colour, and of a consistence like honey. Balm of Gilead is irritating when applied to the skin. Other substances sometimes designated balsams, and possessing a somewhat similar fragrance, are produced by different species of Amyridaceæ (q.v.). Among them is one called American Balm of Gilead, the produce of a tree called *Icica Carana*.—Balsamic substances are furnished also by a number of species of Clusiaceæ.—Balsam of Umiri, a fragrant yellow fluid, by *Humirium floribundum*, a South American tree, of the natural order Humiriaceæ.—Canada Balsam (q.v.) is a kind of turpentine obtained from the Balm of Gilead Fir (*Abies balsamea*); Hungarian Balsam, from the Mugho or Mountain Pine (*Pinus pumilio* or *Mughus*); and Carpathian Balsam, from the Stone Pine (*Pinus pinea*). See FIR and PINE.—Balsam of Copaiva (q.v.) is the produce of different species of Copaifera.

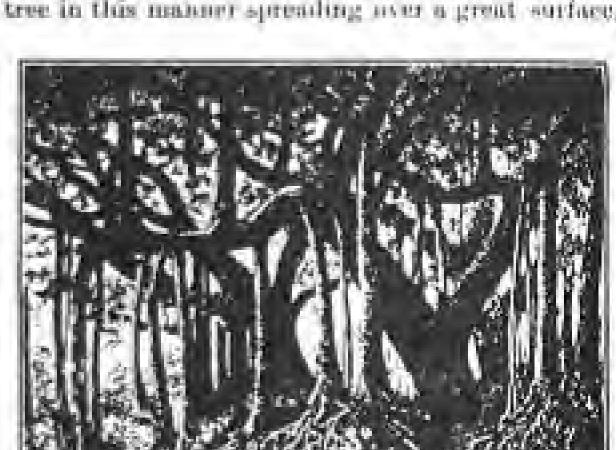
Bamboo' (*Bambusa*), a genus of grasses, of which most of the species attain a great size, many of them 20 or 30 feet, some 70 or 100 feet in height. The species are numerous, and are found in tropical and subtropical regions, both of the eastern and western hemispheres. Some of the species grow to the height of only a few feet; and almost all of them are slender in proportion to their height, although *B. guadua* has often a trunk 16 inches in diameter. All of them have a jointed subterranean root-stock (rhizome), which throws

Bambusa falcata:
a, upper portion of the stem, with foliage; *b*, root-stem; *c*, section of stem.

up 10-100 stems. These are generally straight and erect; although one large species (*B. agrestis*), common in dry mountainous situations in the south-east of Asia, has crooked, and sometimes creeping stems. The stems grow to their full height unbranched, but afterwards throw out straight horizontal branches, especially in their upper parts, forming a dense thicket; some of the smaller kinds are often planted as hedges. The stems are jointed like those of other grasses, very hard, but light, elastic, and hollow, containing only a light spongy pith, except at the joints or nodes, where they are divided by strong partitions. The stems of different species vary also very much in the thickness of the woody part, and so in their adaptation to different purposes. In China and Japan is found a bamboo the stem of which, instead of being cylindrical like that of other bamboos and all grasses, is square. At three years old, this stem is one inch in section each way.

The *hairy* bamboo is one of the most useful in China. The external covering of the stem is, in all the species, remarkably siliceous; the stem of *B. tabacaria* is so hard that it strikes fire when the hatchet is applied. There is perhaps scarcely any plant that serves such a variety of domestic and economical purposes. It would be difficult to point out an object in which strength and elasticity are required, and for which lightness is no objection, to which the stems of the different species are not applied. In the whole of the East, particularly in India, China, and Japan, in Jamaica and other parts of the West Indies, and some parts of South America, it forms almost the sole material of which the houses of the poor are built. It is employed for water-pipes, for which purpose its hollow stems (after the partitions at the joints are removed) render it eminently well fitted. It is used in the building of bridges, in the manufacture of furniture, ladders, masts for boats, rails, fences, spear-shafts, domestic utensils, and agricultural implements. The stems are also split up finely and worked into mats, and ropes, and even into the sails of boats. From both the external and internal pellicles of the stems an excellent paper is made by bruising and steeping it in water till it becomes a paste. Large quantities of bamboo cane are imported to Europe for various purposes, such as the making of walking-sticks, stakes for flowers and the training of fruit-trees in nurseries, and the manufacture of wicker-work. The leaves of some kinds are used as thatch in the making of hats and mats; those mats seen enfolding chests of tea being made of the leaves of one species cultivated by the Chinese for that purpose. The shoots, when young and tender, are eaten in the same way as asparagus, or boiled with milk, or made into broth with the addition of animal food, spices, and salt; also along with the young root-stocks they are pickled in vinegar wherever they abound in the East, and are imported into Europe as an eastern condiment under the name *Achiar* or *Achar*. The pith of some species is sugary, and at certain seasons a saccharine juice exudes from it at the joints, which becomes concrete on exposure to sun and air, and is used for domestic and economic purposes in India. This substance is called *Indian Honey*, and is erroneously also sometimes named *Tabasris* or *Tabasheer*, a name which properly belongs to another and very remarkable substance produced in the hollow internodes of the stems of some of the species (see TABASHEER). The seeds of some species are used as rice, and for making a kind of beer. Bamboos are generally of very rapid growth, and they are often found in arid situations, which would otherwise be destitute of vegetation. *B. guadua* and *B. latifolia*, both natives of South America, have the internodes of the stems filled with clear fluid of an agreeable taste, which, though containing slight traces of sulphates and chlorides, can scarcely be distinguished from pure spring-water.

Banyan, or BANIAN (*Ficus indica*), an Indian tree, remarkable for its vast rooting branches. It is a species of Fig (q.v.); has ovate, heart-shaped entire leaves, about 5 or 6 inches long; and produces a fig of a rich scarlet colour, not larger than a cherry, growing in pairs from the axils of the leaves. The branches develop pendulous adventitious roots, which soon become new stems, the tree in this manner spreading over a great surface,



Banyan Tree.

in fact almost developing into a wood, and enduring for many ages, although the original central trunk decays. One has been described as having no fewer than 350 stems equal to large oaks, and more than 3000 smaller ones, covering a space sufficient to contain 7000 persons. The tree is inhabited by great numbers of birds, fruit-bats, and monkeys, which latter consume the leaves as well as the fruit. The seeds are often deposited by birds in the crowns of palms, and send down roots which become stems and eventually replace the palm altogether. The wood of the banyan is light, porous, and of no value; but the tree furnishes lac and caoutchouc, and the bark and milky juice are sometimes employed in Hindu native medicine. By the Brahmins the banyan is held in special reverence, as is its congener the Sacred Fig, also called Peepul and Bo-tree (*F. religiosa*) by the Buddhists, so that it is said that the sites of temples can be readily distinguished as Brahmin or Buddhist by the presence of one or other tree.

Barilla, an impure carbonate of soda, procured from plants which grow in salt-marshes or other places near the sea; it forms a considerable article of commerce, being used in the manufacture of soap and of glass, and for other purposes in the arts. The greatest quantities of barilla are produced in Spain and the Balearic Islands; but the Canary Islands, Italy, and France also contribute a part. It is procured by burning the plants, much in the same way that seaweeds once were largely burned on the coasts of Scotland for kelp. The Spanish barilla is most esteemed, especially that produced near Alicante, where it is chiefly obtained from the *Salsola sativa*, a plant of the natural order Chenopodiaceæ. This plant is cultivated in grounds close by the sea, embanked on the side nearest it, and furnished with floodgates, through which the salt water is occasionally admitted. It is cut in September, dried in small heaps, and then burned in a hole in the ground. Other species of *Salsola* (Salt-wort), as *S. tragus* and *S. kali* (the latter, a common native of the shores of Britain), are also burned for barilla, although they yield it in smaller quantity than *S. sativa*. Barilla is made in France from *Salicornia herbacea* or *annua* (Glass-wort), another of the Chenopodiaceæ, plentiful also in salt-marshes on the shores of Britain and other parts of Europe. The manufacture of barilla has greatly declined, from the fact that soda can now be made artificially from common salt. See SALT-WORT.

Barium (sym. Ba, eq. 137) is the metal present in heavy spar (sulphate of baryta) and baryta. It was regarded as a white metal, until the researches of Dr Matthiessen demonstrated that it possesses a yellow colour. As yet, the metal barium has not been obtained in mass, but only as a powder. It decomposes water readily at ordinary temperatures, and exposed to the air, quickly combines with oxygen, forming the *oxide of barium*, BaO, or Baryta (q.v.), an earth resembling ordinary caustic lime. The *sulphide of barium*, BaS, is obtained when the sulphate of baryta, $BaSO_4$, in powder is mixed with finely pulverised coal, and the whole being placed in a crucible, is raised to a red-heat in a furnace. The result is, that 4 atoms of the carbon, C, of the coal carry off the 4 atoms of oxygen in the sulphate of baryta as carbonic oxide, CO, whilst the barium united solely with sulphur is left behind as the sulphide of barium, BaS. The *chloride of barium* is prepared by adding hydrochloric acid, HCl, to a solution of the sulphide of barium, BaS, when sulphuretted hydrogen, H_2S, escapes, and chloride of barium remains behind, and on evaporation of the liquid, is obtained in crystals.

Barker's Mill (*Fr. Roue à réaction*, Ger. *Segner's Wasserrad*), a water-wheel invented by a Dr Barker towards the middle of the 18th century. It is represented in its simplest or typical form in fig. 1. A is a wide metal pipe, resting at its lower end, by the steel spindle T, on a metal block B, and kept in a vertical position by the spindle S, at its upper end, which passes through the frame of the machine. Near its lower end, two smaller pipes or arms C, C, are inserted, which project horizontally from it, and these have each, at the outer extremity, a hole cut horizontally in them, opening towards opposite sides. The water is supplied by the pipe P. The reaction caused by the water gushing from the arms, forces them backwards, and gives to the whole machine a rotatory motion. Suppose that the arms were closed all round, the pressure of the water against the sides would be proportional to the height of the water in the pipe A, and the pressure against any particular surface of the side would produce no motion of the arm, because an equal pressure is exerted in a contrary direction upon a corresponding surface opposite to it. Now, if one of these surfaces be cut out, the pressure against the other being uncounteracted, forces the arm in the opposite direction to that of the side in which the hole is made. This being done to both arms on opposite sides, two equal pressures are produced, which conspire in generating the same motion of rotation. As soon as motion ensues, centrifugal force comes into play, which, throwing the water out towards the ends of the arms, increases the rapidity of its discharge, and therefore increases the reaction.

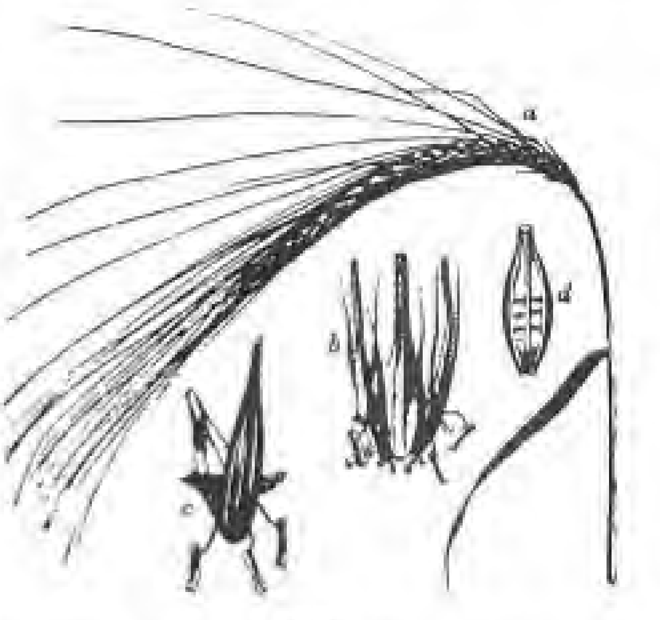
The power is manifestly increased by heightening the water-column, or by lengthening the arms—the former increasing the pressure of the water, and the latter increasing the leverage. In the mill shown in the figure, the column in A cannot be advantageously heightened, for the higher it rises, the greater must be the weight which the conical spindle, T, has to sustain, and the greater, consequently, becomes the friction. Hence, in the reaction-wheels now in use, the original Barker's Mill has been so modified as to allow of the water being conducted from the reservoir below the arms instead of above. The power of these machines may be also increased by using curved (fig. 2) instead of straight arms. See WATER-POWER.


Fig. 1.


Fig. 2

Barley (*Hordeum*), a cereal or grass crop. In ordinary cultivation it is annual, but some hardy varieties are sown in autumn, and except in severe winters, survive and ripen the second year, or if frequently cut green and not allowed to mature seed, may continue to grow for several years. The cultivation of it extends from Italy northwards in Europe. It is better adapted than any other grain to the most northern regions of the grain-growing belt. Some of its varieties are cultivated with advantage where the climate is too cold, or the summer too short, for any other cereal crop. It extends over a wider climatic range than any of the other grains. Barley-meal is used for bread in the north of Europe, but in other parts it is used as a horse-corn, or converted into malt for the making of beer, or deprived of its outer husky covering, and so used as an article of human food called *pot-barley*, or when well rounded and polished in the mill, *pearl-barley*; this is sometimes ground into a fine quality of barley-meal.

By botanists cultivated barley in England is divided into three species. *H. vulgare* (Scotch Bere or Bigg) is distinguished by having the grains in four rows; *H. hexastichum* in six rows; and *H. distichum* in two rows. But the lower part of the spike in the varieties ranked under *H. vulgare* is often six-rowed, and only the upper part four-rowed; and in rich soils, a tendency to resume the six-rowed form is otherwise manifest. A kind with naked seeds, called *Siberian Barley* (*H. celeste* of some writers), is cultivated in some parts of Europe, but it is liable to loss in harvest through the grain, which is slightly attached to the straw, shaking off; its straw is regarded as richer food for cattle than that of most other kinds. The *Nepaul* or *Himalaya Barley*, another variety with naked seeds, has been recommended as particularly adapted for cold mountainous regions, yielding good crops in the Himalaya at an elevation of 14,000 feet above the sea.—Of the two-rowed barley there are many varieties, of which the Common or *Early English*, *Golden Drop*, *Big Ben*, *Hallett's Pedigree*, and the *Chevalier* are among the most esteemed, the latter being in particular demand for brewing. The *Sprat* or *Battledore Barley* (*H. zeocriton*) is also two-rowed, but is distinguished by the grains standing out from the spike, their awns spreading very widely. It is sometimes called *German Rice*, as it swells by boiling in the way that rice does, and for some purposes forms a good substitute for it. It is scarcely cultivated in Britain, but is in much esteem in Germany, and succeeds well in the Alps at an elevation of 3300 feet.



Barley:
a, a spike in fruit; b, a cluster of three spikelets in flower, with awns removed; c, a flower with palea; d, a grain (outer side).

H. pratense and *H. murinum* are barley grasses seen in natural British pastures, but are of no practical value.

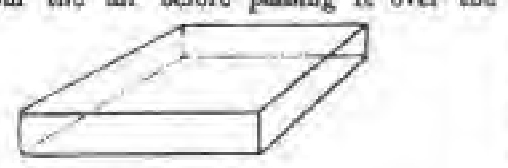
Barley is most productive where the climate is moderately dry and warm. No country seems to possess a soil and climate better suited to its growth than many parts of Britain. In former times, this grain was largely employed in the British Islands as human food; and is still used in some parts of Ireland, and in the Highlands of Scotland. Fine malting barley always commands a ready demand in the London market, as well as a high price.

Barley occupies a prominent place in the rotation of the lighter class of arable lands, such as in Suffolk and Norfolk. Fine malting qualities are grown on the turnip soils of these counties, as well as throughout the south-eastern counties, where the four-course rotation is adopted. In this rotation, the barley follows the turnip-crop. The ground is worked into a fine tilling condition on the surface, and the seed is either broadcast or drilled in February or March, depending on the weather and the condition of the soil, at the rate of two, three, or four bushels to the acre. On strong land or on very rich soils, the barley-crop is sown after a grain crop, say wheat, as it is found to give a better quality, though not such a heavy crop. In the south of England, barley is allowed to stand till the grain is fully ripe, when it is either cut with the scythe or most commonly now with the reaping-machine. In some parts, where the straw is very short and the bulk small, it is not bound up into sheaves, but remains in the swath for a few days, when it is afterwards carted, and stored in barns or oblong stacks. The produce is more influenced by the seasons than that of wheat, as it is liable to suffer from droughts in the early part of the year, and when sown late in very dry seasons, it sometimes remains for weeks and months without germinating, and never comes to a crop. This is all the more striking when it is remembered that if sown under favourable conditions, barley germinates more quickly than any other grain crop, being up within three or four days. On well-farmed land, from 48 to 60 bushels and upwards are got to the acre. In the peaty soils of the fens of Lincolnshire, barley is not raised, as it is too liable to lodge with the rain; neither is it a favourite crop in the moist climate of the west of England.

Barley has long been grown in Scotland. The level parts of the Lothians and other counties in the east of Scotland, with Moray, Inverness, and Ross in the north, are the districts in which the finest crops are raised. In these districts barley is commonly sown after a portion only of the turnip-break. Moray-shire barley has long been famous for its fine sample, and is in great demand with English brewers. On the other hand, in the less genial climate of the western counties, and also of the upper parts of Aberdeenshire, Banffshire, and Perthshire, less barley is sown, and oats frequently succeed the green-crops. In these parts the variety known as bere, or bigg, is preferred to any other, as it is not so liable to lodge, and it withstands wet weather better, and comes earlier to maturity. Here is the variety which is cultivated by many of the small cotters in the Highlands and islands. Instead of a rotation in which green-crops find a place, a succession of corn-crops is taken, and an occasional rest is given to the soil. The crop, when ripe, is cut by sickle, scythe, or reaping-machine; bound up at once, and put into stooks, to defend it from the weather till ready to cart, and to be built up in neat round stacks. The grain is invariably thrashed out by machinery.

On good turnip-soils the land is enriched by the droppings of the sheep, frequently fed on cake and corn along with the roots, and manure is not often directly applied to the barley-crop. When the turnip-crop is drawn from the land, unless the soil is very rich, the barley should have a dressing of some phosphatic manure, say 3 cwt. or 4 cwt. per acre of superphosphate bone-meal, or fish-guano, at the time of sowing, and 1 cwt. of nitrate of soda after the plant is well up, and the roots spreading through the soil.

Bary'ta, or BARYTES, or Oxide of Barium (q.v.)—symbol BaO—is the earth present in the minerals *witherite* (carbonate of barium) and *heavy spar* (sulphate of barium). It may be prepared in several ways: (1) By acting upon the carbonate of baryta, $BaCO_3$, by nitric acid, HNO_3, which causes the disengagement of the carbonic acid, CO_2, and the nitric acid combining with the baryta forms the nitrate of barium, $Ba2NO_3$. On evaporating the latter substance to dryness, and igniting the residue, the nitric acid volatilises, and leaves the baryta, BaO. (2) Another mode of preparing the same substance is to act upon a solution of sulphide of barium, BaS, by the black oxide of copper, CuO, when an interchange of elements occurs, the sulphur uniting with the copper, producing sulphide of copper, Cu_2S, and the oxygen with the barium, forming baryta, BaO, which remains dissolved in the water, and, on evaporation, deposits crystals in the hydrated condition, $BaH_2O_2,8H_2O$. Baryta belongs to the group of alkaline earths, and has the property of acting like an Alkali (q.v.) on colouring matters. It has a very harsh taste, is highly caustic, and is very poisonous. The presence of carbonic acid gas may be detected by exposing a solution of baryta to the air, when carbonic acid combines with the baryta and forms a film of white carbonate of barium, $BaCO_3$. Baryta exposed to air or oxygen absorbs oxygen, forming peroxide of barium. On this being heated, oxygen is liberated and baryta again produced. Till lately it was found impossible to procure oxygen by this simple method, as the action became weak when the process was repeated. But recently it has been found that by carefully removing all carbonic acid gas and water from the air before passing it over the



Crystal of Sulphate of Baryta.

barium, the difficulty is removed, and oxygen is thus economically produced. The *sulphate of baryta*, $BaSO_4$, otherwise called *ponderous* or *heavy spar*, is found in fissures or cracks in other rocks. It is crystalline, and is sometimes found pure and white, but generally presents a flesh-red colour, from the red oxide of iron (rust) incorporated in it. The rust can be got quit of by reducing the sulphate of baryta to a fine powder under rollers or travelling-wheels, and subjecting the pulverised material to the action of dilute sulphuric acid, which dissolves the oxide of iron, and leaves the sulphate of baryta as a white dense powder. The principal use of *heavy spar* is as a pigment under the name of *permanent white*; but having little opacity, it cannot be employed by itself, but only when mixed with ordinary white-lead. When added to the latter, however, it must be regarded as an adulteration, for the little opacity it possesses renders it of service only as an increaser of the bulk of the white-lead. Several mixtures of sulphate of baryta and white-lead are manufactured, and are known in commerce. *Venice White* contains 1 part sulphate of baryta and 1 part white-lead. *Hamburg White* contains 2 parts sulphate of baryta and 1 part white-lead. *Dutch White* contains 3 parts sulphate of baryta and 1 part white-lead. The native sulphate of baryta has been employed by the celebrated potter Wedgwood in the manufacture of jasper ware, and for the formation of white figures, &c. on coloured jars and vessels. The *carbonate of baryta* found native as *witherite*, and the *nitrate of baryta*, have been previously referred to in this article and that on BARIUM.

Base, in Chemistry, is a term applied to a compound body, generally consisting of a metal united with oxygen. Thus, the metal potassium, K, when it combines with oxygen, O, forms the oxide K_2O, which unites with water, yielding the base potash, or caustic potash, KOH; and similarly lead, Pb, and oxygen, yield the base oxide of lead, or litharge, PbO. A distinguishing feature of a base is that it is capable of entering into double decomposition with an acid, more or less neutralising its acid properties, and forming a Salt (q.v.) and water. Thus, the base potash combines with sulphuric acid to form the salt, sulphate of potash, and water, as represented by the following equation:

Potash.	Sulphuric Acid.		Sulphate of Potassium.		Water.
K_2O	$+ \; H_2SO_4$	$=$	K_2SO_4	$+$	H_2O.

So also potash and nitric acid, HNO_3, yield the salt nitrate of potassium, or nitre, KNO_3. Occasionally sulphur replaces the oxygen in a base. Thus, the metal potassium, K, unites with sulphur, S, to form the *sulphur base*, sulphide of potassium, K_2S, which can unite with a sulphur acid like sulpharsenious acid or orpiment, As_2S_3, to make the salt sulpharsenite of potash, K_2S,As_2S_3. The metal half of a base need not be a simple element, but may be a compound body which, for the time, plays the part of a simple substance. Thus, the compound ethyl, C_2H_5, can combine with oxygen to form ordinary ether, $\left.\begin{matrix}C_2H_5\\C_2H_5\end{matrix}\right\}O$; and the base thus produced can, in its turn, combine with acids to form salts. A base may be soluble or insoluble in water. Thus, the bases potash, K_2O, soda, Na_2O, ammonia, NH_4HO, baryta, BaO, strontia, SrO, lime, CaO, and magnesia, MgO, are more or less soluble in water; whilst the oxide of iron or rust, Fe_2O_3, and the red oxide of mercury, HgO, are insoluble in water, but soluble in acids. For *organic* bases, &c., see ALKALIES, ALKALOIDS, and AMINES.

Bas'il (*Ocymum*), a mainly tropical or subtropical genus of Labiatæ (q.v.), characterised by a pleasant aromatic smell and taste, and reckoned among *sweet herbs*.—SWEET BASIL (*O. basilicum*) is an Indian annual which has long been cultivated in Europe for seasoning purposes. It was formerly also of some medicinal repute, and is doubtless a gentle carminative. Many superstitions attach to it. The ancients asserted that the plant had the power of propagating scorpions, even in the brains of men. The belief that it thrives especially on the brains of murdered men occurs in the *Decameron*, and is rendered familiar by Holman Hunt's picture. —BUSH BASIL (*O. minimum*) is of similar origin and uses. The seed of both species should be sown on a hotbed, and subsequently planted out.—WILD BASIL (*Calamintha clinopodium*) and BASIL THYME (*C. Acinos*) are natives of Britain, and are similarly fragrant and aromatic.—Basil Vinegar is made in the same manner as Mint Vinegar, by steeping the leaves in vinegar. It is used for seasoning, in winter, when the fresh plant cannot be obtained.

Bay, a name given to a number of trees and shrubs more or less resembling the Laurel or Victor's Laurel (*Laurus nobilis*), which is also called Sweet Bay (see LAUREL); the name *Bay* (Fr. *baie*, from Lat. *baccæ*, 'berries'), which was once exclusively applied to the fruit, having been extended to the whole plant. The larger-leaved hardy evergreen common in shrubberies, the Common Laurel or Cherry Laurel (*Prunus Laurocerasus*), is sometimes called Bay Laurel. The true bay-leaves are frequently used for flavouring puddings,

Sweet Bay (*Laurus nobilis*).

&c.; but those of the laurel are sometimes substituted. The fumes of prussic acid given off by the latter when bruised are used by entomologists in killing butterflies and moths. Bay-rum, used by perfumers, is an aromatic liquid obtained by distilling rum in which bay-leaves have been steeped.—The RED BAY of the Southern States of America is *Laurus Carolinensis* (see LAUREL).—The WHITE BAY of America is *Magnolia glauca* (see MAGNOLIA), and the LOBLOLLY BAY of the same country is *Gordonia Lasianthus*.

Bedstraw (*Galium*), a genus of Rubiaceæ (q.v.). The species are very numerous, natives chiefly of the colder parts of the northern hemisphere, or of mountainous regions within or near

A, Common Great Bedstraw (*Galium elatum*);
B, Yellow Bedstraw (*Galium verum*).
(*a*, flower; *b*, fruit.)

the tropics. About eleven species are found in Britain, some of them very common weeds. Amongst these is the Ladies' Bedstraw, or Yellow Bedstraw (*G. verum*)—sometimes called Cheese Rennet, because it has the property of curdling milk, and has been long used for that purpose (whence the generic name from Gr. *gala*, 'milk')—a small plant with linear deflexed leaves and dense panicles of bright yellow flowers, very abundant on dry banks. The flowering tops, boiled in alum, furnish the Icelanders with a bright yellow dye; while the Highlanders used to employ the root-stock for dyeing yarn red. Their colour being essentially that of the allied madder, the cultivation of the plant was attempted many years ago. Certain North American species, especially *G. tinctorium* and *G. septentrionale*, have been used in the same way. Like madder, they possess the property of imparting a red colour to the bones and milk of animals which feed upon them. Medicinal virtues were ascribed to some of the species, as *G. rigidum* and *G. mollugo*. The roasted seeds of some, as *G. aparine*, the troublesome Goosegrass, or Cleavers, of our hedges—remarkable for the hooked prickles of its stem, leaves, and fruit—have been recommended as a substitute for coffee; but it does not appear that they contain any principle analogous to caffeine. Its expressed juice is in some countries a popular remedy for cutaneous disorders, and is used as a safe and efficient diuretic. The roots of *G. tuberosum* are farinaceous, and it is cultivated in China for food. The name *bedstraw* is due to the old legendary name of one of the species, 'Our Lady's Bedstraw,' analogous to 'Our Lady's Garters, Mantle, Slippers,' &c.

Beef-tea is a light and pleasant article of diet, obtained from the flesh of the ox. It is best made as follows: A pound of lean beef is cut into small pieces and placed in a closed jar with a pint of cold water; after an hour the jar is allowed to stand for another hour in a pan of gently boiling water; the contents are then strained through a coarse sieve. A much more concentrated beef-tea may be made by placing the meat in a jar without water and simmering it as above for two or three hours. Salt is then added according to taste. Either of these processes removes from the meat almost all its salts and extractive matters, with a proportion of its albumen and gelatine.

Beef-tea is popularly supposed to contain all the nourishment of the meat from which it is made. This is a great mistake; for though the substances which give the beef its flavour are extracted, far the larger part of the nutritious albumen and gelatine remain in the tasteless and hardly digestible residue; more complex processes are required to obtain highly nutritious extracts from meat. It is, however, of great value in the treatment of invalids, for the nutritious elements which it does contain are, so far as they go, in a digestible form; it is, moreover, a pleasant stimulant, a relish which may enable a sick person with poor appetite to eat other food with enjoyment, and a suitable vehicle for the administration of more nutritious material, for example, some of the easily absorbed 'peptones' or 'infants' foods' in the market. It must always be borne in mind that beef-tea alone has not a high value as a food, and that the increased sense of strength and well-being often following its administration is due to a stimulating more than to a nourishing effect, and is therefore transient and sometimes harmful. Moreover, in some diseases, particularly gout and kidney-disease, it is usually injurious. Mutton, treated in a similar manner, yields a broth or tea which is not so easily digested, and is hurtful to persons of weak stomach, especially if the fat be not skimmed off from the liquid. A knuckle of veal affords a similar broth or tea; but it is not so light as beef-tea, and, moreover, gelatinises on cooling. A broth or tea prepared from a young chicken is, of all decoctions of animal matter, the most readily digested, and is specially suitable for invalids, where great irritability of the stomach exists.

Belladonna, DWALE, or DEADLY NIGHTSHADE (*Atropa belladonna*; *Belladonna*, Ital. 'fair lady,' see below; *atropa*, Gr. *Atropos*, one of the Fates; *dwale*, from A.S., connected with *dull*, from its stupefying effects), a plant of the natural order Solanaceæ (q.v.); a herbaceous perennial, growing up every year as a bush, from 2 to 4 feet high, with ovate entire leaves, and bell-shaped flowers of a lurid purple colour, which are fully larger than those of the common harebell, stalked and solitary in the axils of the leaves. It produces berries of the size of a middle-sized cherry, and which, when ripe, are of a shining black colour, and of a sweetish and not nauseous taste, although the whole plant has a disagreeable heavy smell. It is a native of the southern and middle parts of Europe, and is not uncommon in Britain, in the neighbourhood of towns and of ruins, and flowers from June to November. All parts of the plant are narcotic and poisonous, and fatal consequences not unfrequently follow from the eating of its berries, which have an inviting appearance. Its roots have sometimes been mistaken for parsnips. It owes its poisonous properties to the presence of the alkaloid Atropia (q.v.), which is found in all parts of the plant. Large doses either of belladonna or atropia produce dryness of the mouth and throat, dilatation of the pupils, dimness of vision, bright redness or an

Belladonna (*Atropa belladonna*):
a, flower; b, fruit.

actual rash on the skin, quickening of the pulse and respiration, talkative delirium, sometimes convulsions; at a later stage complete paralysis, stupor, and death. The treatment in cases of poisoning consists in the prompt use of emetics; and thereafter in the administration of stimulants, especially strong coffee; vegetable astringents, as tannin; and Calabar bean. In medicinal doses belladonna and atropia are used to relieve spasm, as in colic, whooping-cough; to check excessive secretions—e.g. of sweat, milk, saliva; as an antidote in poisoning by opium, Calabar bean, and prussic acid; and for many other purposes. Local application, in the form of liniment, ointment, or plaster, is often more efficacious, especially in the relief of pain, than internal administration. Belladonna has been recommended as a preventive of scarlet fever, apparently on the ground of its tendency, when administered in frequent small doses, to produce an eruption and an affection of the throat somewhat similar to those characteristic of that disease; but the evidence of its utility for this purpose is not sufficient to warrant confidence. But perhaps the most important medicinal use of belladonna, and especially its alkaloid, is in the treatment of diseases of the eye (see EYE, DISEASES OF), in many of which its action is invaluable. Its power of enlarging the pupil and giving a bright, glistening appearance to the eyes, has long been in use to enhance the charms of female beauty; hence the name Belladonna. For the Woody Nightshade, see BITTERSWEET.

Ben, OIL OF, a fluid fixed oil, obtained from the seeds of a tree found in India and Arabia, and known as the Horse-radish Tree (*Moringa pterygosperma*). The seeds are called Ben Nuts, and are roundish, with three membranous wings. The oil has several properties which make it of special value to perfumers and watchmakers. When exposed to cold, it deposits a white flaky matter; and when it is removed, an oil is left which is most suitable for watches owing to its non-liability to freeze. Oil of ben is also used to extract the odorous principles from flowers; and as it is not liable to turn rancid, it is much prized in the manufacture of perfumes, although its frequent adulteration with other oils has tended to restrict its use.

Benzene, a compound of carbon and hydrogen, C_6H_6, discovered by Faraday in 1825, in a tarry liquid resulting from the distillation of oil. It must not be confounded with Benzine or Benzoyl, which names have at different times been used for benzene. *Benzine* is the name given to a distillate from American petroleum, which is much used as a substitute for turpentine, and for dissolving oils and fats. *Benzoyl* is the commercial name applied to a mixture of substances, including benzene and its homologues. *Benzol* is synonymous with benzene, while *benzoline* is a name applied to benzine and impure benzene indiscriminately. Benzene is found amongst the products of the destructive distillation of a great many organic bodies. The most abundant source of benzene is coal-tar (see GAS, COAL). On distilling coal-tar, the more volatile liquid hydrocarbons pass over first, mixed with acid and basic compounds, and constitute what is known as light oil or coal naphtha. When the crude naphtha is purified by redistillation and subsequent agitation, first with sulphuric acid, and then with caustic soda, an oil is obtained which consists mainly of benzene and its homologues. By submitting this oil to a process of fractional distillation, a portion is obtained, boiling at 176°-212° (80° C.-100° C.), from which benzene crystallises out on cooling the liquid to 32° (0° C.). The benzene is freed by pressure from the substances remaining liquid at this temperature. Commercial benzene is, however, always impure. Pure benzene is most readily obtained by cautiously distilling a mixture of one part benzoic acid with three parts of slaked lime. The mixture of benzene and water which passes over is shaken up with a little potash, the benzene decanted, treated with calcium chloride to take up the water, and the dried benzene thus obtained is rectified on the water-bath. At ordinary temperatures benzene is a thin, limpid, colourless liquid, evolving a characteristic and pleasant odour. At 32° (0° C.) it crystallises in beautiful fern-like forms, which liquefy at 40° (4°·5 C.); and at 176° (80° C.) it boils, evolving a gas which is very inflammable, burning with a smoky flame. It readily dissolves in alcohol, ether, turpentine, and wood-spirit, but is insoluble in water. It is valuable to the chemist from the great power it possesses of dissolving caoutchouc, gutta-percha, wax, camphor, and fatty substances. Impure benzene is thus much used in removing grease-stains from woollen or silken articles of clothing. When heated, benzene also dissolves sulphur, phosphorus, and iodine. Although commercially of importance, from the chemical point of view benzene is a compound of surpassing interest. It consists of 12 parts of carbon by weight, with 1 part of hydrogen, and might therefore be represented by the formula CH; but it has been found that the molecule weighs six times as much as this, and requires the formula C_6H_6. The manner in which the atoms are arranged in the molecule has already been referred to in the article on the AROMATIC SERIES, and it will be seen by a reference to the graphic formula there given, that the number of compounds derivable from benzene is practically unlimited. The so-called coal-tar colours are all derivations of benzene (see DYE-STUFFS, and ANILINE).

Benzoic Acid, or the *Flowers of Benzoin*, has been known since the beginning of the 17th century, and occurs naturally in many balsamiferous plants, and especially in benzoin gum, from which it may be readily obtained by several processes. The simplest is as follows: The coarsely-powdered resin is gently heated in a shallow iron pot, the mouth of which is closed by a diaphragm of coarse filter-paper. Over this is tied a covering of thick paper somewhat like a hat. The porous filter-paper allows the vapours of benzoic acid to pass through it, but keeps back the empyreumatic products. At the end of the operation, the hat-like cover is found lined with a crystalline sublimate of benzoic acid which is nearly pure, being mixed only with traces of a volatile oil, which gives it a pleasant smell, like vanilla. The benzoic acid thus prepared is the best for pharmaceutical purposes. Benzoic acid is also prepared from the urine of graminivorous animals. The urine is allowed to putrefy, then mixed with milk of lime and filtered. The filtrate, concentrated by evaporation, gives with hydrochloric acid a precipitate of benzoic acid. Benzoic acid thus prepared is cheaper, but always smells of urine. By subliming it with a small quantity of benzoin gum, the pleasant vanilla-like smell may, however, be imparted to it also. Benzoic acid is always in the form of snow-white, glistening, feathery crystals, with a fairy aspect of lightness, having a warm, acrid, and acidulous taste. It is readily dissolved by alcohol and ether, but sparingly soluble in water, which, however, dissolves it readily on the addition of borax or phosphate of soda. Benzoic acid is one of the materials present in *Tinctura Camphoræ Composita*, and has been administered in chronic bronchial affections, its value being due to its locally stimulating properties. It has also been used largely in genito-urinary diseases. Benzoic acid taken into the stomach increases within three or four hours the quantity of hippuric acid in the urine. It forms a numerous class of compounds with the oxides of the metals, lime, &c., called benzoates. The chemical formula for crystallised benzoic acid is C_6H_5COOH. Oil of bitter almonds (hydride of benzoyl) is the aldehyde of benzoic acid (see ALDEHYDES), and the corresponding alcohol, benzoic or benzylic alcohol, is also known.

Benzoin, BENJAMIN, or BENZOIC GUM, a fragrant resinous substance, formed by the drying of the milky juice of the Benzoin or Benjamin Tree (*Styrax*, or *Lithocarpus benzoin*), a tree of the natural order Styraceæ, and a congener of that which produces Storax (q.v.), a native of Siam, and of Sumatra and other islands of the Indian Archipelago. Benzoin is first mentioned by Batuta in 1350 A.D. as Java Frankincense (Arabic *Luban Jawi*), corrupted into Banjawi, Benjoin, Benzoe, &c. Benzoin comes to us in reddish yellow transparent pieces. Different varieties, said to depend upon the age of the trees, are of very different price; the whitest, said to be the produce of the youngest trees, being the best. Amygdaloidal benzoin contains whitish almond-like tears diffused through its substance. Benzoin is obtained by making longitudinal or oblique incisions in the stem of the tree; the liquid which exudes soon hardens by exposure to the sun and air. Benzoin contains about 14 to 18 per cent. of Benzoic Acid (q.v.), although in some varieties this is either entirely wanting or replaced by 11 per cent. of cinnamic acid.

A very fragrant oil, *styrol*, is present in small proportion (a few drops from a pound), the bulk of the gum consisting of resin. Benzoin is used in perfumery, in pastilles, and for incense, being very fragrant and aromatic, and yielding a pleasant odour when burned. Its compound tincture is prepared by macerating benzoin, along with storax, tolu, and aloes, in rectified spirit for seven days, and subsequent straining, when the Compound Tincture of Benjamin (called variously Wound Balsam, Friar's Balsam, the Commander's Balsam, or Jesuit's Drops) is obtained. It is frequently applied to wounds directly; or is used as an exterior varnish over a bandage. In the preparation of court-plaster, sarcenet (generally coloured black) is brushed over with a solution of isinglass, and then with a coating of the alcoholic solution of benzoin. The tincture is likewise used in the preparation of soaps and washes. Benzoin possesses stimulant properties, and was formerly much used in medicine, particularly in chronic pulmonary affections. The name *Asa dulcis* (q.v.) was given to it in the 16th century.—The milky juice of *Terminalia benzoin*, a tree of the natural order of Combretaceæ, becomes, on drying, a fragrant resinous substance resembling benzoin, which is used as incense in the churches of the Mauritius. It was at one time erroneously supposed that benzoin was the produce of *Benzoin odoriferum*, formerly *Laurus benzoin*, a deciduous shrub of the natural order Lauraceæ, a native of Virginia, about 10 to 12 feet high, which still bears in America the name of Benzoin, or Benjamin Tree, and is also called Spicewood or Fever-bush. It has a highly aromatic bark, which is stimulant and tonic, and is much used in North America in intermittent fevers. The berries are also aromatic and stimulant.

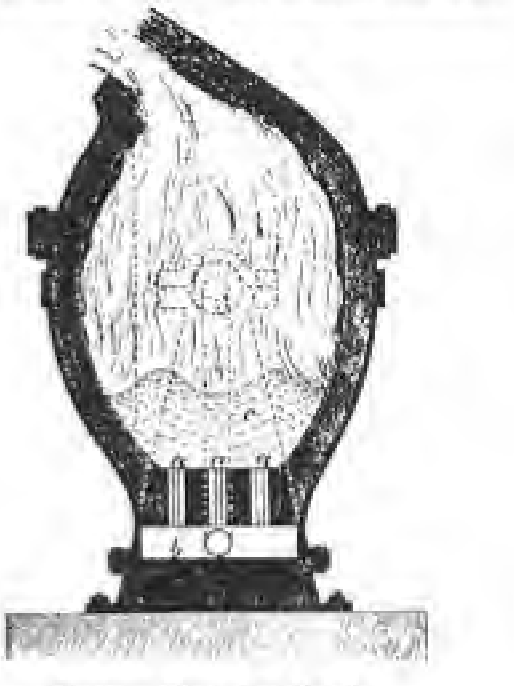
Benzoyl, the radical of the benzoic series, represented by the formula C_7H_5O, is a hypothetical substance supposed to exist in benzoic acid and many other bodies. Thus, benzoic acid, from this point of view, is regarded as hydrate of benzoyl, C_7H_5OOH, and the oil of bitter almonds as the hydride of benzoyl, C_7H_5OH. As further examples of this group of bodies, we may mention benzoyl chloride, C_7H_5OCl, and benzoyl cyanide, C_7H_5OCN. *Dibenzoyl* $(C_7H_5O)_2$, or benzoyl, as it is sometimes called, may be looked on as the above-mentioned radical in the free state, and is prepared by the action of sodium amalgam on benzoyl chloride, in small colourless prisms, soluble in alcohol and ether.

HYDRIDE OF BENZOYL is the volatile or essential oil belonging to the benzoic series. It is represented by the formula C_7H_5OH, and has been already considered under ALMONDS, VOLATILE OIL or ESSENTIAL OIL OF (q.v.).

Bergamot is also the name of a species or variety of the genus Citrus (q.v.), also called the BERGAMOT ORANGE, or MELLAROSA; by some botanists regarded as a variety of the orange (*C. Aurantium*); by others, as a variety of the lime (*C. limetta*); and elevated by Risso to the rank of a distinct species, under the name of *C. bergamia*. The name comes from Bergama (q.v.), a city in Asia Minor, the ancient Pergamus. It is now cultivated in the south of Europe; and from the rind of its fruit, the well-known Oil of Bergamot is obtained, which is extensively used in making pomades, fragrant essences, eau de Cologne, liqueurs, &c. The fruit is pear-shaped, smooth, of a pale golden colour, and has a green, subacid, firm, and fragrant pulp. The essential oil is obtained by distillation, or by grating down the rinds, and then subjecting them to pressure, which is the better method. The oil is also obtained from other varieties or species of the same genus. It is of a pale yellow colour or almost colourless. One hundred Bergamot oranges are said to yield about 2½ ounces of oil. Oil of Bergamot is frequently employed for diluting or adulterating the very expensive blue volatile oil of Chamomile (q.v.).—BERGAMOT is also applied to certain fragrant Labiatæ, notably *Mentha citrata* or *odorata*, as also to species of Monarda (*M. fistulosa*, &c.).

Bessemer, SIR HENRY, inventor, born in 1813, at Charlton, Herts, was the son of an artist, and was to a great extent self-taught. He has been a prolific inventor, as the volumes issued by the Patent Office show. It has been said, indeed, that he has paid in patent stamp-duties alone as much as £10,000. The working-out of many of his inventions, however, resulted in a loss to himself and to others. His first pecuniary success was obtained by his invention of machinery for the manufacture of Bessemer gold and bronze powders, which was not patented, but whose nature was long kept secret. His process for the manufacture of steel, noticed below, raised the annual production of steel in England from 50,000 tons by the older processes to as many as 1,600,000 tons in some years. Bessemer steel is also largely made abroad. This steel averages £10 per ton, while the price of steel before the introduction of his process averaged not less than £50 per ton; but the latter was of a much finer kind. Bessemer was knighted in 1879, and has received many gold medals from scientific institutions. In addition he has, to use his own words, received in the form of royalties 1,057,748 of the beautiful little gold medals issued by Her Majesty's Mint.

BESSEMER STEEL.—Sir Henry Bessemer's process for making steel, which is now so largely practised in England, on the continent of Europe, and in America, was patented in 1856. It was first applied to the making of malleable iron, but this has never been successfully made by the Bessemer method. For the manufacture of a cheap but highly serviceable steel, however, its success has been so splendid that no other metallurgical process has given its inventor so great a renown. Although the apparatus actually used is somewhat costly and elaborate, yet the principle of the operation is very simple. A large converting vessel (see annexed figure), with openings called tuyeres in its bottom, is partially filled up with from 5 to 10 tons of molten pig-iron, and a blast of air, at a pressure of from 18 to 20 lb. per square inch, is forced through this metal by a blowing engine. Pig-iron contains from 3 to 5 per cent. of carbon, and, if it has been smelted with charcoal from a pure ore, as is the case with Swedish iron, the blast is continued till only from ·25 to 1 per cent. of the carbon is left in the metal, that is to say, steel is produced. Sometimes, however, the minimum quantity of carbon is even less than ·25 per cent. In England, where a less pure but still expensive cast-iron—viz. hæmatite pig—is used for the production of steel in the ordinary Bessemer converter,



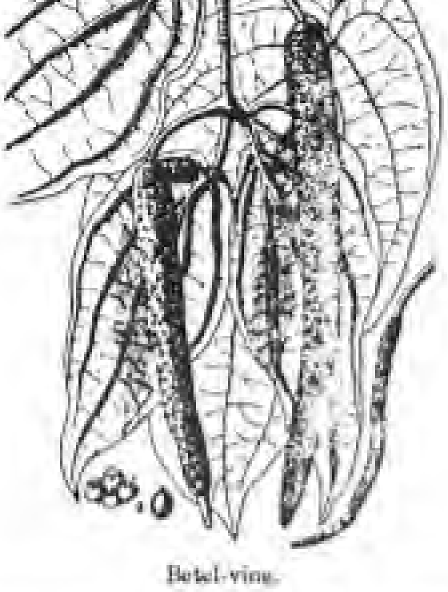
Bessemer Converting Vessel:
a, a, a, tuyeres; *b*, air-space; *c*, melted metal.

the process differs slightly. In this case the whole of the carbon is oxidised by the blast of air, and the requisite quantity of this element is afterwards restored to the metal by pouring into the converter a small quantity of a peculiar kind of cast-iron, called *spiegeleisen*, which contains a known quantity of carbon. But small quantities of manganese and silicon are also present in Bessemer steel. The 'blow' lasts from 20 to 30 minutes. Steel made from whatever kind of pig-iron, either by this or by the 'basic' process, presently to be described, is not sufficiently dense, at least for most purposes, and it is accordingly manipulated under the steam-hammer and rolled into a variety of forms. Bessemer steel is employed for heavy objects, as rails, tires, rollers, boiler plates, ship plates, and for many other purposes for which malleable iron was formerly used.

Basic Steel.—This kind of steel is now largely made from inferior pig-iron, such as the Cleveland, by the Thomas-Gilchrist process patented in 1878. It is, however, only a modification of the Bessemer process to the extent of substituting for the siliceous or 'acid' lining generally used, a lime or 'basic' lining for the converter. Limestone, preferably a magnesian limestone in some form, is commonly employed for the lining. By the use of a basic lining, phosphorus is eliminated towards the end of the 'blow.' Phosphorus is a very deleterious substance in steel, and is present, sometimes to the extent of 2 per cent., in pig-iron smelted from impure ore.

Betel, properly the leaf of the betel-vine, a plant (*Chavica betle*, *C. siraboa*, &c.) of the natural order Piperaceæ, indigenous to the East Indian Archipelago, and cultivated also in continental India, Ceylon, and several of the Indo-Chinese countries (Burmah, Siam, &c.), but more or less as an exotic according as the necessary conditions of humidity and heat have to be artificially increased. The name betel (a Malayalam and Tamil word for 'leaf') is frequently applied to the bolus of areca-nut and shell-lime (*chunam*) wrapped round with betel-leaf, employed as a masticatory throughout a large part of the farther East, especially by the Malay and Hindu races. As early as Fryer (1673) betel begins to be used erroneously as a synonym for the nut of the Areca (q.v.) palm. Betel-leaf (Hindustani, *pān* or *pawn*; Persian, *tambol*; Malay, *sirih*) is described in glowing terms in the *Hitopadesa*, book iii., fable 9. The ancient Hindu writers recommend it to be taken early in the morning after meals, and at bedtime. Pills against phlegm are rubbed into an emulsion with the juice; and the leaves are applied to remove headache, reduce swollen glands, or check the secretion of milk. The use of the masticatory has become a matter of etiquette, and the betel-box plays as important a part as the snuff-box did in England in the 18th century. In

India the offering of *pawn* by the host intimates the termination of a visit. Among the Malays of the Archipelago to offer *sirih* is accepted as a legal sign of apology for a serious offence. Europeans seldom take kindly to the habit of chewing betel,



Betel-vine.

partly because it blackens the teeth and causes the lips to appear as if covered with blood. Sir James Emerson Tennent (*Ceylon*) considers that it supplies the antacid, the tonic, and the carminative required by a people who usually eat no flesh. In former days the betel-leaf was a monopoly of the East India Company. The cultivation of the plant is in many districts a highly important industry, and requires considerable capital. In Bombay, betel-vines are put down in October, 3600 to 5000 per acre. They are sheltered from drought by plantains grown along with them, and by bamboo stages covered with grass. These are afterwards replaced by stronger and taller trellis-work up which the plants climb luxuriantly. In Tenasserim, again, the Karens train the vines to forest-trees from which all but the topmost boughs have been lopped off. See Marsden's *History of Sumatra*; Curtis's *Botanical Magazine* (vol. vi. new series); Miguel, *Systema Piperacearum*; Hunter's *Gazetteer of India*.

Bicarbonates differ from carbonates in containing twice as much carbonic acid. Bicarburets, bisulphurets, and bitartrates are words formed on the same plan; but in recent chemical nomenclature, the prefix *bi-* has been superseded by *di-*.

Bile is a fluid secreted from the blood by the liver. One part of it is destined to serve in the process of digestion; the other to be eliminated from the system. It is coloured yellow in man, and in carnivorous and omnivorous animals; it is green in vegetable feeders. The primary cells of the liver (the hepatic cells) separate the bile from the blood of the portal vein, and discharge it into small ducts, which unite to form larger ones, and eventually the right and left hepatic ducts. The latter unite to form the common hepatic duct, which is soon joined by that of the gall-bladder (the cystic duct). This junction forms the common bile duct, which pierces the second part of the duodenum, and running obliquely in its wall for a short distance, opens on its mucous surface.

Bile is constantly being secreted, more copiously after food; while the duodenum is empty, most of it passes up the cystic duct into the gall-bladder where it is stored. But when the contents of the stomach are carried past the opening of the common bile duct, a copious flow of bile takes place into the duodenum, where it is mixed with the food, in order to aid the further processes of digestion.

The composition of human bile is on the average of

Water	about	86	per cent.
Bile-salts	"	9	"
Mucin	"	3	"
Other organic substances	"	3	"
Inorganic substances (ash)	"	0·8	"

The *bile-salts* (glycocholate and taurocholate of soda) are the most important constituents. If an animal membrane be wetted with a solution of these salts, it allows fatty substances to filter through it much more readily than if pure water or a solution of an inorganic salt be used; and this property aids in the absorption of fatty foods by the intestine. The bile-salts also assist in the emulsification, and to a certain extent, in the solution of fats. The *mucin* gives bile its viscid consistence. The other organic constituents include *fats* and *soaps*; *cholesterin*, chemically an alcohol, a crystallisable substance which is usually the chief constituent of biliary calculi or gall-stones (see CALCULUS); and the *bile-pigments*. The ash contains a considerable proportion of iron, derived, like the bile-pigments, from disintegrated red blood corpuscles (see BLOOD).

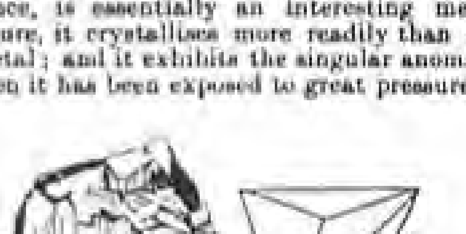
Human bile has the specific gravity of about 1026 (water = 1000), is of a ropy consistence, with usually a yellowish-brown colour; does not readily mix with water, but sinks therein, and only after repeated agitation becomes diffused through the water, which then assumes a frothy appearance resembling soap-suds. Bile has a bitter taste and a faint musky odour. Besides aiding in the digestion of fats, bile stimulates the various muscular fibres of the intestine, and thus aids both the absorption and the propulsion of its contents; while the mucus it contains acts as a lubricant. It has also an antiseptic action, diminishing the putrefactive changes of the intestinal contents. Should, from any cause, the elements of the bile be in excess in the blood, or should the liver suspend the function of secreting it, not only is digestion imperfectly performed, but the general health suffers from the impure condition of the blood, and the patient is said to be *bilious*. On the other hand, the bile may be secreted, but its escape interfered with, and then its reabsorption will produce Jaundice (q.v.). See also the articles LIVER and DIGESTION.

BILIOUS ATTACK.—When the functions of the liver are temporarily interfered with, and particularly the secretion of bile diminished, most often in consequence of imprudence in eating or drinking, a *bilious attack* results. The liver, however, is rarely if ever affected alone, the stomach and intestines being also disordered; in most cases the stomach is probably the first to suffer. There are pain and discomfort in the abdomen, usually headache, and a yellowish discoloration of the skin and whites of the eyes; the tongue is furred and the appetite impaired, and the temper often becomes very irritable. Vomiting and diarrhoea often occur, and are in such a case salutary processes. The administration of a purgative is beneficial; and the food taken, if any, must be small in amount, simple, and readily digestible—e.g. milk with potash water, toast, biscuits, &c.

Binary Theory, in Chemistry, takes cognisance of the mode of construction of salts. It assumes that all salts contain merely two substances, which either are both simple, or of which one is simple and the other a compound playing the part of a simple body. The best and most familiar illustration of the binary theory is common salt or chloride of sodium, NaCl, which is constructed of the metal sodium, Na, and the non-metal chlorine, Cl, and is at a glance seen to be a *binary compound* (a compound of two). In like manner, fluor-spar, or the fluoride of calcium, CaF_2, consists of the metal calcium, Ca, and the non-metal fluorine, F; and iodide of potassium, KI, largely employed in photography, of potassium, K, and iodine, I. Although this theory attracted much attention from 1837 to 1855, and was adopted by Liebig and other chemists, it never met with general acceptance, and has now been quite superseded.

Birdlime is a viscid and adhesive substance, which is placed on twigs of trees or wire-netting, for the purpose of catching the birds which may alight thereon. A common practice is to place a decoy or tame bird in a cage near where the birdlime is spread; the wild birds, attracted to the spot by the song of the tame bird, get entangled with the birdlime. It is also extensively used for catching mice, and even rats, in houses, where poison is objectionable. The birdlime is spread on a board, some toasted cheese placed in the centre, and the trap laid on the floor. The mice in endeavouring to reach the cheese, are held fast by the feet, and may be destroyed. The substance is generally prepared from the middle bark of the holly, mistletoe, or distaff-thistle, by chopping up the bark, treating it with water, boiling for several hours, straining, and lastly exposing it to fermentation for several weeks, when a gelatinous mucilage is obtained, consisting mainly of a substance to which the name *viscin* has been applied. A second mode of preparing birdlime is to employ ordinary wheat-flour; place it in a piece of cotton cloth; tie up the ends, so as to form a bag; immerse the whole in a basin of water, or allow a stream of water to flow upon it; and repeatedly squeeze the bag and its contents. The result is, that the starch of the wheat-flour is pressed out of the cloth bag, and an adhesive substance named *gluten* is left on the cloth. This substance resembles that prepared by the previous process in its properties; but the former mode of preparing birdlime is a much cheaper plan, and is that generally followed.

Bismuth (sym. Bi, eq. 210) is a brittle metal of a crystalline texture, and of a white colour tinged with a faint red hue. It is found native in Cornwall, France, Germany, Peru, Siberia, &c., but it is from Saxony that the largest proportion is obtained. It exists also in combination with oxygen, carbonic acid, lead, tellurium, &c., but the native impure metal is the ore usually resorted to in obtaining the metal. The process of separating it from the rock with which it is associated is extremely simple. The ore is placed in inclined iron tubes, and heat applied, when the metal melting and partly volatilising, runs down to the receivers, and when transferred to moulds, solidifies with a crystalline texture. Bismuth, although not of great technical importance, is essentially an interesting metal. When pure, it crystallises more readily than any other metal; and it exhibits the singular anomaly, that when it has been exposed to great pressure its

a  *b*

Bismuth:
a, example of native bismuth from Redruth, in Cornwall; *b*, crystal of bismuth.

density becomes less. It may be distilled at a high temperature, and repels a magnet more than any other metal. Heated in the air, it burns with a blue flame, forming yellow fumes of oxide. Bismuth unites readily with other metals, forming Alloys (q.v.). The most remarkable of these is called fusible metal, consisting of 2 of bismuth, 1 of lead, and 1 of tin, the melting-point of which is 200·75° F. (93·75° C.), or 12° below the boiling-point of water. Spoons made of this alloy, therefore, readily melt when placed in boiling water; a favourite trick with amateur conjurers. A still more fusible metal is obtained by the addition of mercury, and this is used in forming moulds for toilet-soaps or in taking casts. Bismuth has a specific gravity of 9·83, and melts at 507° F. (264° C.).

Bismuth forms several compounds of service in the arts and in medicine; it combines with oxygen to form several oxides, of which the trioxide, Bi_2O_3, is the most important. It may be prepared by boiling together a solution of the subnitrate of bismuth, $BiONO_3$, and caustic soda, NaHO, when the oxide, in combination with water, is thrown down, and nitrate of soda remains in solution. It is employed in the porcelain manufacture as an agent for fixing the gilding, and for increasing the fusibility of fluxes, at the same time neutralising the colours which are often communicated by them. The ternitrate of bismuth is prepared by acting upon the metal bismuth with a mixture of one part of commercial nitric acid and one part of water, and applying heat. The subnitrate or basic nitrate of bismuth receives the names of *Pearl White*, *Pearl Powder*, *Blanc de Fard*, and *Blanc d'Espagne*. It is used as a cosmetic, but is apt to become gray in tint, and even brown or black, when sulphuretted hydrogen, often evolved from sewers, cesspools, and drains, comes in contact with it. The subnitrate and subcarbonate of bismuth are used in medicine as very soothing, feebly astringent sedatives when applied to irritated mucous membranes, and are of great value in various forms of stomachic disease; while externally they are used as an application to scrofulous sores. The citrate of bismuth in combination with ammonia being very soluble, is more rapid and irritant in its action than the soluble salts last mentioned, but is of special use in cases of relaxation with excessive discharge. Bismuth salts sometimes contain arsenic, and must be used with caution. The 'bismuth breath' is a peculiar garlicky odour often felt in the breath of those who have taken bismuth preparations for some time. The cause of this is not clearly known, although at various times the presence of arsenic or tellurium as impurities has been blamed for it; but it would seem that it may be produced even when these are absent.

Bittern, BITTER LIQUID, or SALT OIL, is an oily liquid obtained during the preparation of common Salt (q.v.). When the mother-liquor of the evaporating pans ceases to deposit crystals of common salt, there is left behind in the boilers the material called bittern. It consists principally of a strong solution of common salt, along with the chlorides of magnesium and calcium, to which the bitter taste is due; but it also contains the bromides of sodium and calcium, which are valuable sources of the element Bromine (q.v.). The bittern obtained from the salt-works at Epsom was at one time the source of the sulphate of magnesium (hence called Epsom salts), but at present this salt is obtained in other ways.

Bitters are prepared from an infusion of herbs containing bitter principles. Formerly the name was limited to a favourite household remedy prepared from the Garden Angelica (see ANGELICA). The roots or seeds, or both, were placed in water, and allowed to simmer for several days, when the bitter infusion was strained off for use. Coincident with the disuse of these bitters, the term assumed a wider significance, embracing all bitter infusions, and having distinctive names attached to it, indicating the origin of the bitter, as Angostura, Quassia, Gentian, or Orange Bitters. An aerated beverage, called tonic bitters, flavoured with chiretta, calumba, quassia, or gentian, is esteemed by many. The medicinal properties of bitters are mainly those of a mild tonic and pungent aromatic stimulant, and hence they are serviceable as a stomachic in cases of weakness of the digestive organs. When taken in excess, the more powerful of them are apt to do more harm than good, the tone of the stomach being undermined by the excessive stimulation. The most widely used bitter is that of the hop, to which, in part at least, are due the tonic properties of beer. The medicines known as hop bitters must not, however, be supposed to derive any virtues they possess from the hop, their nature being rather that of a purgative.

Bittersweet, or WOODY NIGHTSHADE (*Solanum dulcamara*), a plant found in hedges and thickets in Britain, and throughout the palæarctic region, also introduced into North America. The root is perennial and creeping; the annual stems climbing and trailing, 4 to 6 feet in length; the leaves acuminate with 2 lateral pinnæ, the upper halbert-shaped; the flowers purple, in drooping corymbs, much resembling those of its congener, the potato, but much smaller, followed by ovate red berries of tempting appearance, which, although by no means approaching in poisonousness to those of the true nightshade (see BELLADONNA), contain an apparently variable quantity of alkaloid, and seem sometimes to have been the cause of accidents, particularly to children; although some physiologists have administered it without bad effects. The twigs, collected in autumn after the leaves are fallen, are still occasionally used in medicine, a decoction being given in rheumatic or cutaneous affections. It is in the stems rather than in the fruit that the peculiar succession of tastes, to which the plant owes its name, is best observed.

Bittersweet (*Solanum dulcamara*): *a*, a flower; *b*, fruit.

Bitter Vetch. See OROBUS.

Bitterwood, a name given to certain species of Xylopia, a genus of *Anonaceæ*, trees and shrubs remarkable for the bitterness of their wood, particularly the West Indian *X. glabra*. Furniture made of this wood is safe from the attacks of insects. —The fruit of some of the species, particularly *X. sericea*, is highly aromatic and pungent like pepper. *X. sericea* is a large tree, a native of Brazil; its bast tissue is used for making cordage, which is excellent.

Bitterwood is also the name of *Picræna excelsa* (formerly *Quassia excelsa*), a tree of the natural order Simarubaceæ (q.v.), a native of Jamaica, the wood of which is now alone used in medicine, as Quassia (q.v.), owing to the scarcity of the *Quassia amara*, to which the name was first given. It is, botanically, very nearly allied to the true quassia, and possesses very similar properties, containing the crystallisable bitter principle called Quassite or Quassin. The wood, which is intensely bitter, is a very useful stomachic and tonic; an infusion of it is a well-known and useful fly-poison; and it appears to act as a powerful narcotic on many quadrupeds.

Bitu'men, a mineral substance, remarkable for its inflammability and its strong peculiar odour; generally, however, supposed to be of vegetable origin. The name, which was in use among the ancient Romans, is variously employed, sometimes to include a number of the substances called Mineral Resins (see RESINS), particularly the liquid mineral substances called Naphtha (q.v.) and Petroleum (q.v.) or Mineral Oil, and the solid ones called Mineral Pitch, Asphalt (q.v.), Mineral Caoutchouc, &c.; sometimes in a more restricted sense it is applied by mineralogists only to some of these, and by some mineralogists to the solid, by others to the liquid ones. All these substances are, however, closely allied to each other. Naphtha and petroleum consist essentially of carbon and hydrogen alone, 84 to 88 per cent. being carbon; the others contain also a little oxygen, which is particularly the case in asphalt, the degree of their solidity appearing to depend upon the proportion of oxygen which they contain, which amounts in some specimens of asphalt to 10 per cent. Asphalt also contains a little nitrogen. It seldom occurs quite pure, but is usually mixed with sand or other inorganic ingredients. Not unfrequently it is found impregnating sandstone, limestone, shales, clay-slates, &c. Such is the character of the so-called fetid sandstones and limestones. From certain shales, marls, and slates, mineral oil is distilled in large quantities (see SHALE and MARL). Asphalt occurs plentifully on the shores and floating on the surface of the Dead Sea. It is met with in mass in many other places, as in Trinidad, at Limmer in Hanover, at Lobsan in Alsace, at Val de Travers in Switzerland, &c. Now and again it occurs also, in small quantities, in mineral veins or lodes, where it is often mistaken for anthracite. Closely related to asphalt are the pitch-like minerals called Grahamite and Albertite, which occur in fissures in the Carboniferous system of North America. The latter mineral has likewise been met with in Scotland. Some authorities also include the well-known Boghead Coal (q.v.) under the general head of Bitumen.

One of the most interesting of the bituminous minerals is that called Mineral Caoutchouc or Elastic Bitumen, and for which the new name of Elaterite has been devised, as if to support the dignity of its exaltation to the rank of a distinct mineral species. It is a very rare mineral, only a few localities being known for it in the world—among which are the Odin lead-mine in Derbyshire, and a coal-mine at Montrelais, near Angers, in France. A similar material has been found at Woodbury, Conn. It is elastic and flexible like caoutchouc, and may be used, like it, for effacing pencil-marks. It is easily cut with a knife. Its colour is blackish, reddish, or yellowish-brown; and its specific gravity is sometimes a little less, and sometimes a little more than that of water. It has a strong bituminous odour, and burns with a sooty flame, its composition being CH_2. Several substances occur in nature with a similar composition. Of these the best known is the mineral called Ozokerite. It is brownish, yellowish, or greenish in colour, streaked or spotted, and occurs in rudely fibrous masses, as at Slanik and Boryslaw in Galicia. It dissolves with difficulty in alcohol and ether. Various other natural products have been described as Ozokerite, to which they closely approach in chemical composition, and from which they seem to differ chiefly in their ready solubility in ether.

Black Flux is prepared by heating in a covered crucible ordinary or crude cream of tartar, the bitartrate of potash, $KHC_4H_4O_6$, when the tartaric acid, $H_2C_4H_4O_6$, is decomposed, and charred, forming carbonic acid, CO_2, which remains in combination with the potash as carbonate of potash, K_2CO_3, accompanied by much free carbon. This very intimate mixture of carbonate of potash and carbon, otherwise called black flux, is a fine black powder of great service in the fluxing of metallic ores, as of Lead (q.v.), and the separation of the metal therefrom. In the preparation of black flux it is usual to add to the cream of tartar half its weight of nitre, while *white flux* is produced when twice its weight of nitre is used. The black flux is likewise employed as the raw material from which, on the application of heat in iron vessels, the metal potassium can be obtained.

Blacking is the material employed for producing a black glazed shining surface on leather. The main ingredient in the various kinds of blacking is Bone-black (q.v.), which is mixed with an oil, some sugar, and a little sulphuric acid. The materials in Day & Martin's blacking are finely powdered bone-black ground with sperm-oil, raw sugar or molasses, a little vinegar, and some concentrated sulphuric acid (specific gravity 1843). The substances are incorporated together one by one in the order in which they are stated, and the action of the sulphuric acid is to convert much of the lime in the bone-black into sulphate of lime, which causes a thickening of the mixture, and a tenacious paste results. This paste, diluted with weak vinegar, is put, whilst warm, in stoneware bottles, and is then ready for the market. For harness the blacking consists mainly of beeswax, softened with turpentine, and mixed with ivory-black, Prussian blue, and copal varnish.

Black Lead (or BLACKLEAD), GRAPHITE, or PLUMBAGO, a mineral consisting chiefly of carbon, but containing also more or less of alumina, silica, lime, iron, &c., to the extent of 1 to 47 per cent., apparently mixed rather than chemically combined. Black lead is the popular name, and that by which it is generally known in the arts, though no lead enters into the composition of the mineral; graphite is that generally preferred by mineralogists. It sometimes occurs crystallised in flat hexagonal tables; but generally massive, and more or less radiated, foliated, scaly, or compact. It is of a grayish-black colour, with a somewhat metallic lustre, and a black and shining streak, and is perfectly opaque. It is greasy to the touch, and is a perfect conductor of electricity. It occurs in beds and masses, laminæ or scales in the schistose rocks (gneiss, mica-schist, clay-slate, &c.), and is sometimes in such abundance as to give its name to the schist (graphite-schist) in which it appears. It occurs also now and again in fissures in granite, or in scattered scales in various other igneous rocks, as in syenite in Norway, in porphyry in the Harz, &c. Thick vein-like masses of black lead are met with in Siberia, Spain, Canada, New Brunswick, United States (mines at Ticonderoga, N.Y., supplying almost the whole output), Ceylon, and elsewhere; the once extensive supplies of Borrowdale in Cumberland are now exhausted. It is far more incombustible than even anthracite (or *blind-coal*), burning with much difficulty even before the blowpipe, on which account it is much used for the manufacture of crucibles or 'melting-pots,' which withstand a great heat. These are not, however, made of mere black lead, but of black lead in powder, mixed with half its weight of clay. Black lead is employed for making Pencils (q.v.). It is also extensively employed to give a black gloss to iron grates, railings, &c., and to diminish the friction of belts, machinery, and rifle cartridges.

Bladder-nut (*staphylea*), a very widely distributed genus of deciduous shrubs or small trees of rather elegant appearance, usually referred to the order Celastraceæ (see SPINDLE-TREE). The Common Bladder-nut (*S. pinnata*) is frequently planted in shrubberies, as is also the North American *S. trifoliata*. The wood of both is firm and white, well suited for the purposes of the turner. The seeds yield a good oil, and may be eaten, but act as a mild aperient. The flower-buds are capsule, and the hard bony *testa* of the seed. The name *Staphylea* is from the Gr. *staphylē*, 'a bunch of grapes,' and has reference to the racemed flowers.

a, a flower; b, fruit.

Blowpipe, a small instrument used in the arts for glass-blowing and soldering metals, and in analytical chemistry and mineralogy, for determining the nature of substances by the action of an intense and continuous heat. Its utility depends on the fact, that when a jet of air or oxygen is thrown into a flame, the rapidity of combustion is increased, while the effects are concentrated by diminishing the extent or space originally occupied by the flame.

The blowpipe generally consists of a conical tube of metal, about 8 inches long (see fig.), closed at the wider or lower end, but open at the narrow or upper end, which latter constitutes the mouthpiece, and is turned over to admit of the lips closing perfectly round it. Near the lower end, a small tube, fitted with a finely perforated nozzle, *a*, is inserted in the large tube—the space below being intended as a chamber for condensing the moisture of the breath, and through this nozzle, a fine current of air can be projected against the flame experimented with.

Blowpipe.

The use of the mouth blowpipe, so as to sustain a prolonged steady blast, requires some skill, and is at first very fatiguing to the learner. In breathing, the manipulator involuntarily closes the back of the mouth, retaining in the expanded cheeks sufficient air to last till the lungs have been replenished through the nose. Where high temperatures are required mechanical blowpipes are resorted to.

When a current of air from the blowpipe is directed against a candle or gas-jet, the flame almost entirely loses its luminosity, owing to the perfect combustion of the gases evolved from the source of heat, and is projected in a lateral direction, as a long pointed cone, consisting of three distinct parts. The first or central cone is of a dark-blue colour, and there the combustion is complete from the excess of air thrown in from the small nozzle. The second cone, or that immediately surrounding the first, is somewhat luminous; and here the oxygen being insufficient for the combustion of the carbon, any metallic oxide subjected to the action of this portion of the flame is deprived of its oxygen, and reduced to the condition of metal; for this reason the luminous cone is generally termed the *reducing flame* of the blowpipe. Beyond the second cone, or where the flame comes freely in contact with the atmosphere, and abundance of oxygen is present to effect complete combustion of the gases, is a third, or pale yellow envelope, containing excess of atmospheric air at a very high temperature, so that a portion of metal, such as lead or copper, placed at this point, becomes rapidly converted into its oxide; this outer part of the flame is on this account called the *oxidising flame* of the blowpipe.

Substances under examination before the blowpipe are generally supported either on wood-charcoal or platinum—the latter in the condition of wire or foil. In applying the blowpipe test, the body to be examined is either heated alone, or along with some flux or fusible substance; this being added, in some cases, for the purpose of assisting in the reduction of metals from their ores and other compounds; in others, for the production of a transparent glassy bead, in which different colours can be readily observed. When heated alone, a loop of platinum wire, or a piece of charcoal, is generally employed as a support; the former when the colour of the flame is to be regarded as the characteristic reaction, the latter when such effects as the oxidation or reduction of metallic substances are to be observed.

The following are examples of the difference in colour communicated to the flame by different substances: Salts of potash colour the flame *violet*; soda, *yellow*; lithia, *purplish red*; baryta, *yellowish green*; strontia, *carmine*; lime, *brick red*; compounds of phosphoric acid, boracic acid, and copper, *green*. The commonly occurring metallic oxides reducible by heating on charcoal alone in the inner flame of the blowpipe are the oxides of zinc, silver, lead, copper, bismuth, and antimony; the principal ones not so reducible are the alkalies and alkaline earths, as also the oxides of iron, manganese, and chromium. The fluxes generally used in blowpipe experiments are either carbonate of soda, borax (biborate of soda), or the ammonia-phosphate of soda, otherwise called *Microcosmic Salt* (q.v.). The carbonate of soda, when heated on platinum-wire in the oxidising flame, forms with silica a *colourless glass*; with oxide of antimony, a *white bead*, &c. The following metals are reduced from their compounds when heated with carbonate of soda on charcoal in the inner flame of the blowpipe: viz. nickel, cobalt, iron, molybdenum, tungsten, copper, tin, silver, gold, and platinum. When compounds of zinc, lead, bismuth, arsenic, antimony, tellurium, and cadmium are similarly treated, these metals are also formed, but being volatile, pass off in vapour at the high temperature to which they are exposed.

Borax, as a flux, is generally mixed with the substance under examination, and placed on platinum-wire. When thus heated in either of the flames, baryta, strontia, lime, magnesia, alumina, and silica, yield *colourless beads*; cobalt gives a *fine blue colour*; copper, a *green*, &c. With microcosmic salt, the results obtained are generally similar to those with borax, and need not be specially mentioned, as the test is applied in the same way. The blowpipe has been long used by goldsmiths and jewellers for soldering metals, and by glass-blowers in fusing and sealing glass tubes, &c.; it has also been applied in qualitative analysis for many years, but more recently chemists (especially Plattner) have devoted their attention to its use, and have even employed it with great success in *quantitative* chemical analysis; the advantages being that only a very small quantity of material is required to be operated upon, whilst the results may be obtained with great rapidity and considerable accuracy.

The *oxyhydrogen blowpipe* is an arrangement by which a jet of oxygen and hydrogen, in the proportions to form water, is ignited and directed against any object. The most intense heat is produced, most of the metals being volatilised when placed in it, and even the diamond changes into ordinary carbon, and is burned when exposed to its flame. When a cylinder of quicklime is heated by it, a most dazzling light is produced, rivalling the electric light in brilliancy, and known as the Drummond Light (q.v.).

Blowpipe, a kind of weapon much used by some of the Indian tribes of South America, both in war and for killing game. It consists of a long straight tube, in which a small poisoned arrow is placed, and forcibly expelled by the breath. The tube or blowpipe, called *gravatana*, *pucuna*, &c., is 8 to 12 feet long, the bore not generally large enough to admit the little-finger. It is made of reed or of the stem of a small palm. Near Para, it is in general very ingeniously and nicely made of two stems of a palm (*Iriartea setigera*) of different diameters, the one fitted into the other. In some places the inner tube is formed of the thin stem of a reed, protected by an outer one of this palm. A *sight* is affixed to it near the end. The arrows used in that district are 15 to 18 inches long, made of the spines of another palm, sharply pointed, notched so as to break off in the wound, and their points covered with *Curari* (q.v.) poison. A little soft down of the silk-cotton tree is twisted round each arrow, so as exactly to fit the tube. In Peru, arrows of only 1½ to 2 inches long are used, and a different kind of poison seems to be employed. An accidental wound from one of these poisoned arrows not infrequently proves fatal. In the hand of a practised Indian, the blowpipe is a very deadly weapon, and particularly when directed against birds sitting in the tops of high trees. As his weapon makes no noise, the hunter often empties his quiver before he gathers up the game, and does more execution than an English sportsman could with his double-barrelled fowling-piece. In Borneo, the Dyaks have a similar blowpipe called a *sumpitan*. It, however, has an iron spear-head tied on the end so that it can be used as a spear. It is employed both in war and hunting. Small arrows, which have on their end a piece of pith adapted to the bore of the tube, are used. These are pointed with sharp fish-teeth and poisoned with upas. They are blown with great accuracy; and if the upas-juice is fresh, a wound from an arrow, fired at a distance of 40 yards, proves fatal to man.

Blue Pill (*Pilula hydrargyri*) is the most simple form in which mercury can be administered internally. It consists merely of *two* parts of mercury rubbed up with three parts of conserve of roses, till globules of mercury can no longer be detected; to this is added one part of powdered liquorice-root, so that a pill of three grains contains one grain of mercury. In cases of torpid condition of the liver or inflammation of that organ, blue pill is much used as a purgative, either alone or combined with some other drug, such as rhubarb. When it is given with the view of bringing the system under the influence of mercury (Salivation, q.v.), small doses of opium should be added to counteract its purgative tendency, and the state of the gums watched carefully from day to day, so that the first symptoms of salivation may be noticed, and the medicine omitted. As a purgative, the common dose of blue bill is one or two pills of five grains each, followed by a purgative draught. When the system is to be saturated with it, or salivated, one pill may be given morning and evening, or one every night combined with ¼ of a grain of opium, repeated till the gums become sore. But the sensibility to the action of mercury varies with the individual; some may take large quantities before it exhibits its physiological effects, and, on the other hand, three blue pills, one taken on each of three successive nights, have brought on a fatal salivation. When taking blue pills, all sudden changes of temperature should be avoided; and, indeed, though they are found in every domestic medicine-chest, neither they nor any other form of mercury should be given without good cause and without the greatest caution.

Bog Iron-ore, a mineral of very variable composition, but regarded as consisting essentially of peroxide of iron and water; the peroxide of iron often amounts to about 60 per cent., the water to about 20. Phosphoric acid is usually present in quantities varying from 2 to 13 per cent. Silicic acid, alumina, oxide of manganese, and other substances, which seem accidentally present, make up the rest. Bog iron-ore occurs chiefly in alluvial soils, in bogs, meadows, lakes, &c. It is of a brown, yellowish-brown, or blackish-brown colour. Some of its varieties are earthy and friable, formed of dull dusty particles; some are in masses of an earthy fracture, often vesicular; and some more compact, with conchoidal fracture. It is abundant in some of the northern and western islands of Scotland, and in the northern countries of Europe generally; also in North America. When smelted it yields good iron (see IRON, ORES OF). Bog iron-ore owes its origin to the chemical action of organic acids arising from the decomposition of plants. These acids attack and dissolve the salts of iron which they meet with in the rocks and soils. The solutions thus formed, when they are exposed to the air, become oxidised, and iron is thus precipitated in the form of hydrous ferric oxide, which, along with the various impurities mentioned above, forms bog iron-ore. This mineral occurs frequently in boggy or badly-drained land, forming the hard ferruginous crust known in Scotland as 'moorland-pan.' Considerable accumulations of bog iron-ore or lake-ore occur in the bottoms of lakes in Sweden and Norway, forming with comparative rapidity on the shallower slopes where reeds grow more or less abundantly. According to Ehrenberg, the bog iron-ore in the marshes about Berlin owes its origin largely to diatoms, which separate iron from the water and deposit it as hydrous ferric oxide within their siliceous frustules.

Bog Myrtle, GALE, or SWEET GALE (*Myrica Gale*), an aromatic and resinous shrub, with small lanceolate and serrate gland-dotted leaves, the only genus of the amentaceous sub-order Myricaceæ. It covers large areas of bog and of wet moorland in northern regions, and was formerly put to many domestic uses. Its twigs were used to make beds, and to keep away moths and other insects, while its shoots and leaves served as a substitute for hops, its leaves were mixed with tobacco, and wax was obtained from its berries. See CANDLEBERRY.

Bog Myrtle:
a, male catkin; b, female catkin.

Bog-plants. The extensive areas, especially in the colder regions of the northern hemisphere, which are covered by bogs and marshes, have a highly characteristic flora which is distinct from the fully Aquatic Plants (q.v.) on the one hand, and from the ordinary terrestrial flora on the other. The most important and widely distributed of bog-plants are the bog-mosses (Sphagnum), of which the steady upward growth has formed the bulk of our peat-mosses; but higher cryptogamic plants also occur, notably the horsetails (Equisetum), and occasionally also rarer forms like Pilularia and Marsilea. Many sedges and rushes, reeds and grasses, are also highly characteristic, most of all perhaps the curious cotton-grass (Eriophorum), while heaths constantly struggle for possession of the drier and denser spots. The Bog-myrtle, q.v. (*Myrica Gale*) often overspreads vast areas with its low, scanty brushwood, above which rise only occasional tufts of willow, or at most here and there an alder. The insectivorous plants are perhaps the most characteristic minor denizens, sundews (Drosera) and butterworts (Pinguicula) being thickly strewn, while the rarer blossoms of the bladderwort (Utricularia) rise golden from their stagnant pools. The margins of these are fringed by the beautiful bog-bean (Menyanthes) and the smaller and less spreading forget-me-nots (Myosotis), or in spring are gay with marsh-marigolds (Caltha) and ranunculuses, while the brown blossoms of the marsh-potentilla (*P. Comarum*), the purplish-pink lousewort (Pedicularis), and the curious yellow-rattle (Rhinanthus) make their appearance later in summer.

The progress of agriculture completely destroys this flora, hardly a single bog-plant, save the versatile *Polygonum amphibium*, being able to survive thorough drainage. Many beautiful bog-plants can, however, be easily cultivated where a supply of standing water renders possible an artificial re-establishment of their natural conditions, or at anyrate, the continual soaking of their garden border, which should, of course, contain a large proportion of peat. For the geological agency of bog-plants, see PEAT.

Bone-ash, or BONE-EARTH, is obtained by the complete combustion of bones in an open furnace, when the oxygen of the air burns away the organic matter or gelatin, and leaves the earthy constituents as a white friable mass, the size of the original bone, but readily reducible to the condition of coarse powder which is bone-ash. A very large quantity of bone-ash is exported from South America to other countries, especially Britain. The used-up bone-black of the sugar-refiner is also employed as a source of bone-ash, by being heated in a furnace exposed to the air. Bone-ash of good quality contains about 80 per cent. of phosphate of lime, and 20 per cent. of carbonate of lime, phosphate of magnesia, soda, and chloride of sodium (common salt); but it is occasionally found mixed with sand, especially that procured from South America. Bone-ash is employed to some extent as a source of Phosphorus (q.v.), and in the making of cupels for the process of Assaying (q.v.); but the most extensive use is in the manufacture of artificial manures, such as dissolved bones (see BONE MANURES) and superphosphates.

Bone-black, the product of the carbonisation of bones, used as a pigment (see BLACK) and as a deodoriser. See CHARCOAL.

Bone Manures are applied to crops on account of the nitrogen—equivalent to 4 or 5 per cent. of ammonia—and the phosphate of lime which they contain—the latter amounting to nearly half their weight. Their value has only recently been discovered. The first crude bone-crushing machines were used in England in 1814. In Scotland, when bones began to be employed as manure, about 1825, they were roughly broken into large splinters with hammers by the farm-servants during wet weather, and 30 bushels applied per acre, at a cost of half-a-crown a bushel. Five hundredweight per acre is now considered a good dressing. Bones are not applied in good practice in a larger size than that of *meal* or *flour*—in other words, ground into a fine state of division.—*Rough Bones*, as quarter-inch size and larger, are rarely used, as these lock up capital in the soil by taking too much time to decay, and do not give a remunerative return in comparison with manures that act quickly. Bones are sometimes fermented to induce decay. They are piled in heaps, and water or urine poured over them. When the heat resulting from the fermentation goes down, they should be turned and watered again, and this kept up for a few months. Bones in an altered form are also used in making up concentrated manure, and are either ground or acted upon by sulphuric acid—for example:

(1) *Steamed Bone*, or degelatinised bone, results when bone is made friable and more easy of assimilation by plants through the action of superheated steam (at 270°—280° F.) removing the fatty and gelatinous matter; but there is a loss of nitrogen in the process, as there is also in the preparation of ash and char.

(2) *Bone-ash* is the residue from bones burnt as fuel used in the 'rendering' of the fat of cattle in South America.

(3) *Bone-char* is made by heating in a close retort, and used largely for refining sugar before it goes for manure.

(4) *Vitriolised Bone* is a material only partially acted upon by acid—the result of a most wasteful practice deserving of condemnation, as destroying microbes which bring about nitrification in the soil.

(5) *Dissolved Bone* is bone broken into half-inch size, and then acted upon by sulphuric acid, so as to change a portion (about half) of the insoluble tribasic phosphate of lime into the soluble monobasic phosphate and the sulphate of lime; thus, $Ca_3P_2O_8 + 2H_2SO_4 = CaO,2H_2O,P_2O_5 + 2CaSO_4$. Sulphuric acid is peculiarly suitable for this purpose as compared with say hydrochloric acid, as by the formation of sulphate of lime—or in common language, plaster of Paris—a part of the moisture is absorbed, and the resulting material is left in a dry condition, which is essential for its proper distribution on the land. The object—extraordinary minuteness of division—is obtained, although the soluble condition disappears soon after its application to the soil. The dissolving of bones is now held to be wasteful because soluble phosphate of lime is procurable from many other cheaper sources. It is also unsatisfactory on account of the acid destroying the microbes of nitrification, so useful to the soil, which exist in large quantities in bones and all sorts of decaying animal matter. Liebig was the originator of the method in 1839, and during the next few years it was taken up by leading farmers in England and carried out as a farm operation. Now the work has fallen into the hands of manufacturers who can make it cheaper and, if they choose, better. Much adulteration has been practised in this trade at the expense of farmers. This was made possible owing to their ignorance and prejudices against learning anything scientific. Much manure sold as 'dissolved bone' is merely a mixture of soluble phosphate and some such nitrogenous material as nitrate of soda and sulphate of ammonia—the valuable substances being in the proportions present in bone. Soluble phosphate of lime, from whatever source, has a more beneficial influence on the turnip-crop than upon any other crop, because the turnip roots are not so able as the roots of other plants, such as wheat, to make use of the natural supply of phosphates

existing in the soil in the insoluble form, even when this is abundant. Should the stock of phosphoric acid in the soil be reduced too far, the crop produce is reduced accordingly; it is necessary, therefore, to apply at least sufficient of this ingredient to make up for the loss resulting from the removal of the sale produce of a farm. The famous example of the deterioration of the Cheshire pastures on the rich soils of the new red sandstone by the yearly drain of phosphates through the sale of dairy produce, is now a matter of history. It is recorded that by the application of bones to these soils the value was doubled. Bone meal or flour is the most valuable form for application to thin, light, or hungry soils, as it decays in time to feed the growing crop, and is not liable to be washed out. In heavy land, ground bones are of little or no value—they get imbedded in the clay, and are preserved so that they cannot yield their substance to act as manure. On such soils the phosphate of lime should be used in the soluble form.

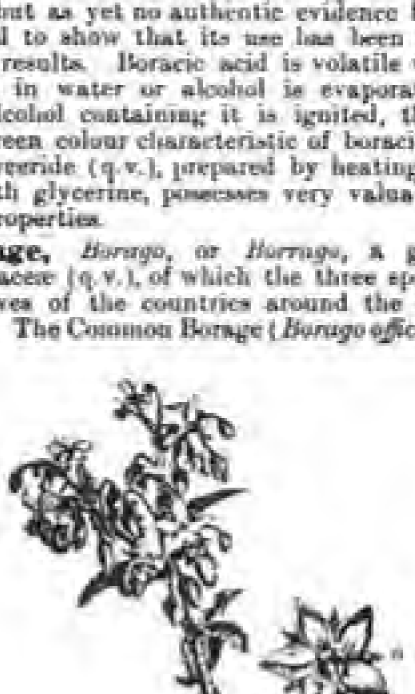
Boracic Acid, or BORIC ACID, is found native (1) in the steam or vapour which rises from certain volcanic rocks in Tuscany, (2) as the mineral Sassolite, occurring largely in California, and (3) as a saline incrustation in the crater of a mountain in the island Volcano, in the Lipari group, 12 miles N. of Sicily. Boracic acid also occurs in combination in Borax, Datholite (q.v.), Boracite, Ulexite, and other minerals, and to a very minute extent in trap rocks generally. The plan of collection pursued in Tuscany is to form a series of caldrons—100 to 1000 feet in diameter, and 7 to 20 feet deep—partly by excavation, and partly by building, in the side of the volcanic mountain where the steam and boracic acid vapours are issuing from fissures, and divert the course of a mountain stream, so that at pleasure the caldrons or *lagoons* may be supplied with water. As the volcanic vapours gurgle through the water contained in the lagoons, the boracic acid is arrested by the water, which becomes impregnated with it. The liquid is passed from one lagoon to another, then on to settling vats and flat-bottomed evaporating pans, till it becomes so concentrated that on cooling, impure crystals of boracic acid separate. In this condition it is exported.

The production of boracic acid from ulexite, a native borate of lime and soda found in California, has of recent years assumed importance. Ulexite is found as rounded concretions, white in colour, varying in size from ½ inch to 12 inches in diameter, and is locally known as 'cotton balls.' After being broken down, it is heated to 200° F. (93·3° C.) along with three times its weight of water, and sulphurous acid gas is forced in till saturation takes place. The whole is allowed to settle, and the clear solution of boracic acid run off and crystallised. So prepared, it contains about 4 per cent. of impurities. In this process there are produced in addition to boracic acid the sulphates of lime and soda, as well as sulphuretted hydrogen. Native boracic acid is employed as a source of Borax (q.v.), and contains about three-fourths of its weight of true boracic acid, accompanied by one-fourth of water and impurities. In a pure condition boracic acid may be prepared by dissolving forty parts of borax, $Na_2B_4O_7$, in one hundred of water, and acting thereon by twenty-five parts of hydrochloric acid, HCl, which removes the soda, forming chloride of sodium, NaCl, and water, H_2O, and on cooling the mixture, the boracic acid, HBO_2, crystallises out. On re-solution in water and re-crystallisation, it is obtained in pure white feathery crystals. These crystals have the composition of HBO_2H_2O, and on heating lose the whole of the water they contain, yielding boracic anhydride, B_2O_3, thus:

$$\underset{\text{Boracic Acid.}}{2HBO_2H_2O} = \underset{\text{Boracic Anhydride.}}{B_2O_3} + \underset{\text{Water.}}{2H_2O}.$$

Boracic acid is used in the arts as a flux, as an ingredient in the glaze employed in pottery; and the wicks of stearine and composite candles are treated with it, so that when the candle is burning, the end of the wick, when it gets long, may fuse and fall to the side, where it can be burned away. As an antiseptic and preservative of food, boracic acid is extensively employed either alone or along with borax. An ointment, called 'Lister's Ointment,' of great antiseptic power, is prepared from boracic acid, wax, and paraffin. In the preservation of butter, milk, wine, beer, meat, and fish, it is probably used to a greater extent than any other antiseptic. There is still much discussion as to the desirability of preserving food by this means, but as yet no authentic evidence has been produced to show that its use has been followed by evil results. Boracic acid is volatile when its solution in water or alcohol is evaporated, and when alcohol containing it is ignited, the flame has a green colour characteristic of boracic acid.—Boro-glyceride (q.v.), prepared by heating boracic acid with glycerine, possesses very valuable antiseptic properties.

Borage, *Borago*, or *Borrago*, a genus of Boraginaceæ (q.v.), of which the three species are all natives of the countries around the Mediterranean. The Common Borage (*Borago officinalis*) is



Common Borage (*Borago officinalis*): a, a flower.

found in waste places in many parts of Europe, and is pretty frequent—no doubt naturalised—in Britain. It is a herb of somewhat stout and coarse appearance, but is easily recognised by its scorpioid cymes of few large (¾ in.) beautiful blue flowers with purple-black anthers, spurred at the back. Borage was formerly much cultivated and highly esteemed, being reckoned amongst the *cordial* flowers, and supposed to possess exhilarating qualities, for which it no longer receives credit. The belief in its virtues was at one time extremely prevalent in England, its very name being, according to some, a corruption of *corage*, and its use correspondingly universal. The flowers were put into salads, Gerard tells us (1597), 'to make the mind glad;' and he adds: 'There be also many things made of them, used everywhere for the comfort of the heart, for the driving away of sorrow, and increasing the joy of the mind.' It was also frequently put in wine, and although it has no sensible properties, its traditional virtues still retain for its leaves a place in the preparation of claret-cup. The young leaves and tender tops are pickled, and occasionally boiled for the table, and are still used in salads in Germany.

Borax, or BIBORATE OF SODA, is found native as a saline incrustation on the shores of certain lakes in Persia, Tibet, Nevada, and California, but it also occurs widely scattered over the world. It has been long known, but it was not till 1732 that its chemical nature was ascertained. At first, and till comparatively recent years, the main source was the crude article brought from Tibet in skins, and going by the name of *tincal*. As so obtained, the crystals were coated with a greasy matter, said to be derived from the skins, and this had to be first removed by means of soda before the borax could be refined. In 1856 the Californian sources of borax were discovered, the bottom of a lake being found to be covered to a depth of about 18 inches with a mud impregnated with borax, and containing large crystals of it. From this mud, by treatment with hot water and crystallisation, there is first obtained *concentrated* borax, and by further treatment this yields the *refined* borax. In other places in California the borax is found mixed with sand in a light granular form, containing about $\frac{1}{5}$th of the pure salt, while large crystalline masses of it occur below the surface of the ground. In all these cases a similar method of purification is adopted. In Europe, large quantities of *artificial* borax are prepared from the Boracic Acid (q.v.) of Tuscany. This, mixed with carbonate of soda, is heated in a furnace, carbonic acid being liberated, and the crude salt is then dissolved in water to free it from impurities, and crystallised. The changes which take place in this operation are represented by the following equation:

$$\underset{\text{Boracic Acid.}}{2B_2O_3 3H_2O} + \underset{\text{Carbonate of Soda.}}{Na_2CO_3} = \underset{\text{Borax.}}{Na_2B_4O_7} + \underset{\text{Carbonic Acid.}}{CO_2} + \underset{\text{Water.}}{3H_2O}.$$

The common variety of borax contains ten equivalents of water, $Na_2B_4O_7 + 10H_2O$, and forms prismatic crystals; but another variety exists, known as *octahedral* borax, and containing only five molecules of water. Borax is soluble in twelve times its weight of cold water, and in half its weight of boiling water, yielding a clear solution with a slightly sweetish taste. It is of great use in the chemical arts owing to its properties of dissolving metallic oxides, and of forming a flux when heated with other substances. On this account it is much used in connection with the Blowpipe (q.v.), before which it yields different coloured glasses corresponding to the metals present. It is also employed in the manufacture of enamel, and for glazing or coating vessels in pottery, as also in the formation of the paste for artificial gems. To the metallurgist it is an aid in the readiness with which it promotes the fusion of metallic mixtures, and the separation of the metals; and to the solderer it is of service in forming a thin glassy coating over the edges of the metals, which prevents their oxidation at the time they are being joined together. It is used as a mordant in calico-printing, while as an adjunct to, or substitute for, soap in washing, it gives satisfactory results in the proportion of ½ lb. to 10 gallons of water. For the toilet, borax in solution is invaluable, making in itself an admirable shampoo, while its utility for cleaning brush and comb are well known. A varnish prepared by boiling together one part of borax and five of shellac with water is used for stiffening hats; and as an insecticide it is very powerful, being specially destructive to cockroaches. For preserving meat, fish, butter, and milk, either alone, or along with Boracic Acid (q.v.), borax has a wide application, no less than 20,000 lb. having been supplied to the Chicago canning works in one year for the preserving of meat alone. Besides these technical uses, borax is much used in medicine as an antiseptic, being applied either in powder or as lotion. For ulcerating surfaces, and in the treatment of the infantile disease thrush, it is extensively applied; while throat lozenges, designed to relieve the hoarseness of public speakers, generally contain this valuable salt as a constituent.

Boroglyceride, a compound prepared by heating together 62 parts of boracic acid and 92 parts of glycerine. It is extensively used as a preservative of food, and also in antiseptic surgery, combining, as it does, the valuable properties of the above-mentioned substances.

Boron (sym. B, eq. 11) is a non-metallic element present in boracic acid and Borax (q.v.). It was discovered in 1808 by Gay-Lussac and Thenard in France, and Davy in England. In some respects boron resembles carbon, existing like it in the so-called amorphous, graphitoid, and diamond forms. In the amorphous or pure state, prepared by heating boric anhydride with sodium, it is an olive-green powder, very slightly soluble in water, and unaltered by exposure to moist air. When heated in air, it takes fire, uniting with oxygen to form boric anhydride, B_2O_3 (see BORACIC ACID). The graphitoid and diamond boron are not pure forms of the element, but contain a definite proportion of Aluminium (q.v.). The diamond boron is obtained by heating the amorphous form to a high temperature, along with aluminium, when boron is left as minute crystals interspersed through the earth alumina. These crystals possess great interest from their similarity in properties to pure crystallised carbon, or the diamond. They are remarkably transparent, are tinged yellow or red (though the colours may be accidental), and rival the ordinary diamond in their lustre and refractive power. Boron diamonds not only scratch glass, but also the corundum and the sapphire; they are, however, somewhat softer than real diamonds.

Resembling as in some degree they do the carbon diamond, it was at first hoped that as the method of manufacture became perfected, they would be obtained sufficiently large to become a serious rival to the *natural* carbon diamond; but as yet they have only been obtained in very small crystals, and their advent in the diamond-market is therefore problematical. They are very indestructible, even withstanding a temperature sufficient to burn the ordinary diamond.

Boron forms but one oxide, Boracic or Boric Anhydride, B_2O_3 (see BORACIC ACID), while it unites with chlorine and bromine directly to form a chloride, BCl_3, and bromide, BBr_3.

Bottle-gourd (*Lagenaria*, from Lat. *lagena*, 'a bottle'), a sub-genus of Cucurbita (natural order Cucurbitaceæ, q.v.). The Common Bottle-gourd, or False Calabash (*C. lagenaria* or *L. vulgaris*), is a native of India, but is now common almost everywhere in warm climates. It is a climbing musky-scented annual, clothed with soft down, having its flowers in clusters, and a large fruit, from 1 to sometimes even 6 feet in length, which is usually shaped like a bottle, an urn, or a club. The fruit has a hard rind, and when the pulp is removed and the rind dried, it is used in many countries for holding water, and is generally called a *Calabash* (q.v.). In its wild state it is very bitter and poisonous, and even in cultivation some of its varieties exhibit not a little of the bitterness and purgative properties of Colocynth (q.v.). Other varieties, particularly the more luxuriant, however, have a cooling edible pulp. The bottle-gourd appears to have been introduced into Europe about the close of the 16th century, but it requires for its advantageous cultivation a warmer climate than that of Britain. It is, however, much cultivated in warmer countries as an esculent, and its rind lends itself to many domestic uses, often furnishing, for instance, not only bottles and dishes, but spoons and bats.

Boyle's Fuming Liquor is the term applied to a solution of sulphide of ammonium obtained by distilling a mixture of slaked lime, sal-ammoniac, and sulphur. The same substance is produced by passing sulphuretted hydrogen into a solution of ammonia. It is a straw-coloured liquid, possessing the odour of rotten eggs, and liberating sulphuretted hydrogen on addition of an acid on exposure to the air.

Brass. In ancient history, biblical and profane, frequent allusions are made to the employment of brass in the construction of musical instruments, vessels, implements, ornaments, and even gates; but as no mention is made of its mode of manufacture, or even of its composition, it is doubtful if the brass of the ancients, with the exception of some made by the Romans, was composed of copper and zinc. Dr Percy (*Metallurgy of Copper*, Murray, 1861) concludes, from the analysis of some of their coins, that the ancient Romans were well acquainted with the art of preparing brass, in the sense of an alloy of copper and zinc. However this may be, it was bronze, and to some extent iron, not ordinary brass, that was all but universally used by them for metal objects other than those made of gold and silver. Zinc does not appear to have been known as a separate metal in Europe till the 16th century; but no doubt one or more of its ores might have been employed by the Romans along with copper to prepare brass.

The term brass is commonly understood to mean an alloy of copper and zinc of a more or less yellow colour. Bronze (q.v.), on the other hand, means an alloy of copper and tin. But there is now a tendency to make brass a generic term, so as to include bronze as well as alloys of copper and lead. In this way, under one general name, there would be a zinc, a tin, and a lead group of alloys. For the tin group, see BRONZE.

ZINC GROUP (W. Graham)—

Pinchbeck brass	4	of copper to	1	of zinc.
Dutch brass (Dutch metal)	2	"	1	"
Yellow brass	2	"	1	"
Pale brass	1·75	"	1	"
Ship sheathing brass (Muntz's metal)	1·50	"	1	"

LEAD GROUP (W. Graham)—

Stopcock metal	4 parts of copper, 1 of lead, 1 of zinc, and ⅛ of tin.
"	8 parts of copper, 1 of lead, and 1 of tin.
Pap and pot metals	Various proportions, from $\frac{1}{16}$ to 1 part of copper to 1 of lead.

A tough brass for engine-work can be made of ppper 6¾, tin 1, and zinc 1; and another kind for ery heavy bearings of copper 6¾, tin 1, and zinc ¼ Spretson).

As a rule, brass is easily fusible and also very alleable and ductile. Therefore it can be readily ast into moulds, rolled into sheets, hammered or tamped into various shapes, and drawn into wire. t is likewise of a pleasing colour. Brass is harder, nd so stands wear better than copper, resists tmospheric influences as well, and is cheaper than hat metal. These valuable properties render it ext in importance to iron and steel in the metallurgical arts. The malleability of brass, however, aries with its composition, with the temperature, nd with the presence, even in minute quantities, f foreign metals. Some kinds are malleable only while cold, others only while hot, and there are arieties wanting in this property at any temperature. All kinds become brittle if heated well up o their fusing-point.

Brass is more tenacious than any of the common etals except iron, steel, and copper. But if subected to a continuous tension for some length of me, it undergoes, in many cases at least, a molecular change, and loses its tenacity. It is therefore not quite safe to hang pictures with heavy frames or weights of any kind on brass chains or wire. The surface of this metal, if not protected by lacquer, soon tarnishes and becomes black.

The old process of making brass by mixing small bits of copper with powdered zinc ore, and heating the mixture in pots in a furnace, is now almost obsolete. The modern way of preparing it is by mixing metallic zinc directly with copper in crucibles or in a reverberatory or cupola furnace. There is least waste with crucibles. The copper is first melted, and the zinc then added in a hot state, care being required to prevent much loss by the latter volatilising. When other metals are added they are also heated first.

From the crucibles the molten brass is either poured into moulds to form ingots for remelting, or more commonly into ordinary sand moulds prepared from patterns (see FOUNDING). Brass takes a sharp impression when cast in a mould. Plates or slabs for rolling into sheets are cast between two marble blocks thinly lined with loam, the sides and ends being made up with sand. These are reduced by 'breaking-down rollers,' and afterwards by other rollers, till they become of the required thickness. As is the case with tube and wire drawing, these sheets are annealed at intervals during the process of rolling. See ANNEALING.

Brine-shrimp (*Artemia*), a genus of small animals belonging to the Branchiopod (gill-footed) division of Crustacea. They have leaf-like swimming and respiratory appendages; the last eight rings bear no legs. They are hatched at the lowest level of crustacean life as Nauplii (q.v.). The

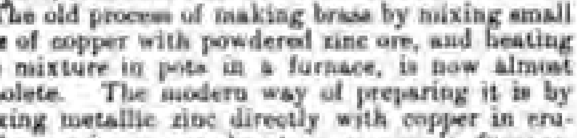


Fig. 1.—Side View of Male Brine-shrimp (*Artemia salina*), enlarged.

full-grown animal is about half an inch long, and having no shell, is transparent. The male has a strong embracing organ, the female a pouch-like brood-sac. The multiplication is very rapid. They swim actively and gracefully on their backs. There are five species of Artemia all found in salt-lakes or in brine-pools where salt is manufactured. Of these species the most unlike are *A. salina* and *A. milhausenii*. Schmankewitsch has made the exceedingly interesting experiment of transmuting one species of brine-shrimp into another. By increasing the salinity of the water, in the course of several generations, *A. salina* became *A. milhausenii*, and *vice versa*, by decreasing the salinity of the water in which the latter normally lives. Not only so, but by decreasing the salinity of the medium natural to *A. salina*, he was able to make it assume at least some of the characters of a quite different fresh-water genus—Branchipus. In the course of generations the Artemia acquired nine

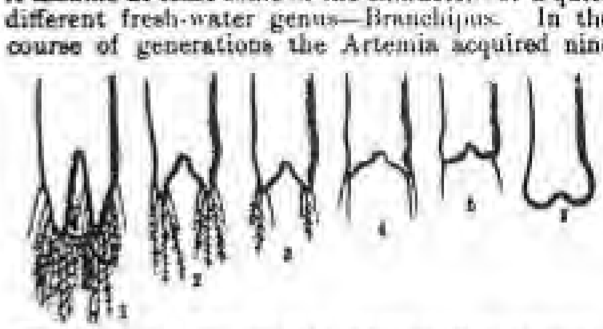


Fig. 2.—Transformation of *A. salina* to *A. milhausenii*: 1, tail-lobe of *A. salina*, and its transition through 2-5 into 6, that of *A. milhausenii*. (After Schmankewitsch.)

instead of eight rings in the tail region, and a partial transformation was thus effected. This is one of the most striking instances of the effect of the environment on the organism.

Briquette is the name, originally French ('small brick'), given to a comparatively new form of fuel, made mostly from waste coal-dust, and used not merely for household purposes, but in various industries. A briquette is simply an admixture of coal-dust with pitch, moulded under pressure and heat, the pitch or some similar substance being introduced to form the cementing material. The size most generally adopted in Britain is about double that of the common building brick, and the weight about ten pounds. For household and domestic purposes, the smouldering qualities of the briquette give it especial value; it will remain alight for seven or eight hours, and can at any moment be roused by the poker into a cheerful flame. The heat given out is equal to that obtained from coal; and there is almost no smell in burning. Briquettes do not deteriorate by keeping. The coal-dust having been thoroughly cleaned by a stream of water from particles of clay, pyrites, shale, &c., is well dried in a cylindrical tube; it is then mixed with lumps of pitch in a disintegrator, which thoroughly combines the two ingredients, prior to their delivery into a vertical 'pug-mill.' Steam is now introduced into the pug-mill, rendering the pitch viscid and adhesive; the mixture, thoroughly amalgamated, then passes into moulds cut in a rotary die. Powerful rams, exerting a pressure of twenty pounds per square inch, force the material into each mould as it passes in rotation beneath. Nothing further remains but the delivery of each briquette after moulding on to a creeping band, where it is met and cooled by a current of air from a fan, and delivered into a wagon below. Some kinds of baking coal will form briquettes without cementing material; and various substances have been used as cement—tar, asphalt, grease, spoilt flour and starch, waste from soap and other manufactures, gypsum, &c. On the Continent, brown coal is most frequently used, but there are briquettes of charcoal and coke also. France is the original home of briquette-making, which first attained commercial importance in 1832. France still manufactures briquettes on a larger scale than any other country. The use of hard pitch as cementing material is due to an Englishman, Wylam, in 1842. Briquettes have been approved of for heating the boilers of locomotives and marine engines, and in puddling and other furnaces, the chief hindrance in the way of their use being for a long time their cost.

Bromic Acid, $HBrO_3$, is the best-known compound of bromine and oxygen. It is prepared pure by acting on bromine, Br, with bromate of silver, $AgBrO_3$, when bromide of silver and bromic acid are produced. Bromic acid is a very unstable acid, being readily decomposed by reducing agents. It forms a whole series of salts called Bromates, none of which are of importance. They are mostly crystalline, but their watery solutions readily decompose when evaporated. When heated, they liberate oxygen and form bromides (see BROMINE). Mixed with sulphur or charcoal, they explode by percussion, and in this and other properties resemble the chlorates. See CHLORIC ACID.

Bromine (Gr. *bromos*, 'disagreeable smell;' sym. Br; atomic weight, 80), one of the elements, occurs in combination in sea-water to the extent of about 1 grain to the gallon. It is found more abundantly in certain saline springs, especially those at Kreuznach and Kissingen in Germany. It is also present in marine and land plants and animals. In the extraction of bromine from concentrated sea-water, from which common salt has been separated in quantity, and which is then called *Bittern* (q.v.), or from salt springs, the liquor—which contains the bromine, as bromide of magnesium, $MgBr_2$,—has a stream of chlorine gas, Cl, passed through it, which forms chloride of magnesium, $MgCl_2$, and liberates the bromine. The liquid thus becomes of a more or less yellow tint, and if it be then agitated with ether, and allowed to settle, the latter floats up the bromine. The ethereal solution is then treated with potash, which principally forms bromide of potassium, KBr, and fixes the bromine, so that the ether may be distilled off. The residue is then treated with oxide of manganese and sulphuric acid in a retort with heat, which results in the liberation and distillation of pure bromine. Bromine is a deep red liquid of density 2·98 at 59° (15° C.), which readily evolves red fumes of a very irritating and suffocating nature. It is very poisonous, acting by destroying the animal tissues. When even a little of its vapour is inhaled, there is danger of spasm of the glottis and consequent suffocation. In medicine it has been found of service internally in scrofulous diseases, and as an application to ulcers or in hospital gangrene. It is sparingly soluble in water, more so in alcohol and ether, and its watery solution possesses great bleaching properties. When raised to the temperature of 145°·4 (63° C.) it boils, and when reduced to 9°·5 (−12°·5 C.) it becomes a red crystalline solid. Treated with sulphuretted hydrogen, bromine yields hydrobromic acid, HBr, which is the analogue of hydrochloric acid, as bromine is of chlorine.

Bromides.—Bromine combines very rapidly with most of the metals, occasionally so as to cause ignition, as in the case of antimony, and forms a class of salts usually known as bromides, though perhaps they are rather hydrobromides (see HYDROBROMIC ACID). Bromide of silver, which is very sensitive to the sun's rays, is used in photography. Bromide of potassium, which is the most important of the bromides, may be prepared by the action of bromine on solution of caustic potash. The whole is then evaporated to dryness, and ignited along with charcoal. On solution in water and crystallisation, the bromide is obtained in colourless, cubical crystals, possessing a pungent saline taste, and which are very soluble in water. This salt has been used in a very large number of diseases, owing to its powerful sedative properties. Other bromides (such as those of sodium and lithium) are of comparatively little importance, although they possess similar medicinal properties. Hydrobromic acid combines with these the tonic effects of hydrochloric acid. In epilepsy, bromide of potassium affords marked relief. As a sedative in nervous excitement and sleeplessness, its use produces beneficial results, while in delirium tremens and tetanus large doses give relief. In excessively large doses, general depression, lowering of the temperature, and even death may result. And it should be known and remembered that the administration of bromine compounds in large doses and for long periods often leads to unpleasant effects, collectively termed *bromism*. The earliest and most common are skin eruptions, resembling Acne (q.v.) or boils; the further results are due to diminished activity of the nervous system—viz. lassitude, low spirits, weakened brain power, &c. All these symptoms soon disappear when the use of the drug is discontinued.

Brucin is one of the Alkaloids (q.v.) present in *Strychnos Nux Vomica*, and St Ignatius' bean, along with strychnine, &c. In action it resembles strychnine, but is only about one-twelfth of its strength, and on this account is seldom employed. It is mainly characterised by giving a blood-red colour with concentrated commercial nitric acid, and, indeed, the red colour always yielded by nux vomica, and occasionally by strychnine, when treated with nitric acid, is due to the presence of brucin. Brucin is capable of being converted into strychnine by heating it with five times its weight of dilute nitric acid, carbonic acid gas being given off.

Brunswick Black is a varnish employed for coating over coarsely finished iron grates, fenders, &c., and is prepared by melting together asphalt, linseed oil, and oil of turpentine. For finer work, it has been superseded by Berlin Black, a similar composition of finer quality.

Brunswick Green is a pigment used in the arts, the composition of which is very variable. The native varieties sometimes consist of carbonates of copper, but the artificial compounds frequently contain arsenite of copper, Prussian blue, indigo, or chrome yellow. A superior product is obtained by the action of sal ammoniac on copper filings, an oxychloride of copper being produced identical with the mineral Atacamite (q.v.).

Brushes. Few things are in more universal use than brushes. One kind or another is to be found wherever people dwell or are at work. The materials used for the manufacture of brushes are, taking first those of animal origin, hog's bristles, horse-hair, strips of whalebone, and to a smaller extent goat's hair, badger's hair, fitch (polecat), sable and camel's hair. Those of vegetable origin are principally aloe fibre, called also Mexican fibre (*Agave americana*); kittool fibre (*Caryota urens*); bass or piassaba fibre (*Attalea funifera*); and cocoa-nut fibre (*Cocos nucifera*). But many other vegetable fibres, as well as esparto grass and the like, are used locally for brushes or brooms in different parts of the world. Brushes of steel and brass wire are used for certain purposes.

For the stocks of the commoner kinds of brushes and brooms, native woods, such as sycamore (often called plane-tree), beech, elm, birch, chestnut, and oak, are employed, and ash for the handles of small brooms. Veneers or plates of rosewood and satinwood, of ivory, tortoise-shell, mother-of-pearl, xylonite, and silver adorn the backs and handles of toilet-brushes.

Bristles, though less so than they were, are still the chief material used in the manufacture of brushes. The chief sources from which they are obtained are noted under BRISTLES. They are so far sorted into qualities when received by the manufacturers, who separate the larger and more valuable sizes by means of steel combs with one row of vertical teeth. The largest size stick in the teeth of the first comb, the next size in the second comb, and so on. Every bundle of the better qualities yields a small proportion of long and strong bristles which have a high value, and are not made into brushes but sold to shoemakers. The bristles are also sorted by hand and a size-stick or gauge into various lengths, and by the eye into various colours, as black, gray, white, and other shades. Either before or after they are sorted, bristles require to be washed, and the 'whites' are bleached with sulphurous acid or other agent (see BLEACHING). French white bristles are generally beautifully bleached.

A hair-brush may be taken as an example of how the class known as 'drawn' brushes are made. With the assistance of a perforated lead or wood gauge the stock is drilled with holes for the tufts. These are formed by doubling the bristles, and are then drawn into their place by thin brass wire, which loops in tuft after tuft, and is continuous all through the filling of a single brush (see fig. 1, in which the bold line shows the wire). A back which conceals this wire-looping is then glued on and otherwise fixed. It may be stated that a hair-brush has the points of the bristles of unequal length, in order to penetrate the hair. Hat-brushes and baby's hair-brushes are made of horse-hair. The work of filling drawn brushes with bristles is very generally done by women working in their own homes.

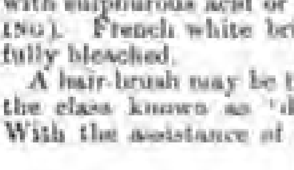


Fig. 1.

Brooms, bannister, and other 'set' brushes, many of which have long tufts, are made in a different way. The stocks are turned, cut to shape, and drilled with holes of the proper size, but in this style of work they are only sunk to a certain depth. The root ends of the tufts, which are also the root ends of the bristles, if they are not doubled, are first dipped into melted brushmakers' pitch, next tied with a string at the root, and again dipped into the pitch; this fixes the tuft when pushed with a certain twist of the hand into one of the holes of the stock. In some cases the stock is twisted with one hand, and the tuft held steady by the other. In this manner the broom or brush is filled with bristles.

A painter's round brush or sash tool is one of the simplest kinds of brushes, and is made in one way by fixing a bundle or tuft of bristles, previously dipped into a cement formed of rosin and linseed oil, to the end of a two-pronged wooden handle by a piece of twine, which is then coated with glue. There are other methods of binding the bristles of large round brushes, such as by an iron or copper ring, or by wire.

Whitewash and other flat brushes of similar shape consist, in some cases, of two, three, or more cylindrical brushes, placed side by side, and fastened separately on a projecting edge of a flat stock or handle. Each of these single brushes forming the compound brush is bound with twine or copper wire, the latter being now preferred. There are other kinds of the same shape differently made; one variety, for example, is merely a single brush of oblong form with the bristles held together by a strip of leather and nails; another sort is formed by tufts fixed with pitch in the manner of a hearth-broom. In those cases where the root ends of the bristles are exposed, they are singed with a hot bar of iron. It is curious how sometimes one, sometimes another kind of these brushes is preferred for the same purpose in different districts of the country. The brushes used by artists are, for large sizes, made of hog's hair bound with tin, and for small sizes of sable and camel hair. The latter are either bound with quill or tin. A sable-hair pencil is the most costly brush for its size that is made. Softening brushes of badger's hair are used both by artists and grainers of wood.

Machine-made Brushes.—There are several kinds of mechanism in use for making brushes. The Woodbury machine, which has been extensively used in America, is perhaps the best known. Its chief parts are a comb with an arrangement for filling its divisions with bristles; a shaft to work devices by which the bristles are fed in tufts to plungers that double them, bind them with wire, and introduce them into the back of the brush; an arrangement by which the wire is fed to and through the bristles after doubling; and mechanism for centring the brush-back under the two plungers concerned in preparing and inserting the tuft. The machine is too elaborate for illustration here. Fig. 2 shows how the tufts are bound with wire, which takes the form of a spiral, and by a movement of the plunger is made to screw its way into the hole in the brush-back.

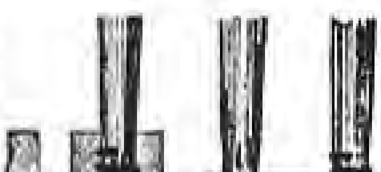


Fig. 2

In England, machinery is chiefly applied to the manufacture of the cheaper kinds of brushes from vegetable fibres, although it is not confined to these. The fibres have to undergo a process of preparation. The tufts in these machine-made brushes are secured in different ways, such as by a cross wire, shown in fig. 3, or by a hard steel wire loop bent into a triangular shape, and placed as in fig. 4, with the shoulders pressed firmly on the sides of the drilled hole, and the points fixed to the bottom.

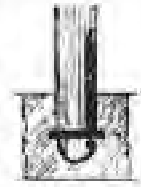


Fig. 3.

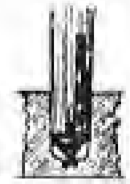


Fig. 4.

Bryony (*Bryonia*), a genus of Cucurbitaceæ (q.v.), of which the Common Bryony (*B. dioica*) is the only British species. It is frequent in hedgerows in England, but becomes rarer in the north, and is not indigenous to Scotland. It has cordate palmate leaves, axillary bunches of flowers, and red berries about the size of a pea. It abounds in a fetid and acrid juice. The root-stock is perennial, very large, white and branched, has a repulsive smell, and is acrid, purgative, and emetic, owing to the presence of a bitter and poisonous alkaloid, *bryonin*. *B. alba*, which is monœcious,

Common Bryony (*Bryonia dioica*):
a, flowering, and *b*, fruiting branch.

with black berries, is common in Central Europe, and possesses similar properties. The root of both is applied to bruises, was formerly in use as a purgative, and its tincture is still employed in homœopathic and veterinary practice. The young shoots of both species are free from acrid and dangerous qualities, and are sometimes used as pot-herbs, especially in Eastern Europe.—The roots of other species of the genus are also acrid and purgative; and are used medicinally in India; but it is said that the root of *B. abyssinica*, when cooked, is eaten without danger.—*B. boykinii* is a species found native in the southern United States.—Black Bryony (*Tamus communis*) is a plant of a different natural order (Dioscoreæ, q.v.). Its habit and distribution is similar to that of Bryony proper, but it may be readily distinguished by its simple entire heart-shaped leaves, which are smooth and somewhat glossy. The flowers are small and greenish, and the berries red, the root-stock very large and fleshy, black externally. The berries are unwholesome, and the whole plant is acrid, the roots so much so as to have been formerly employed for stimulating plasters. But the young suckers, in which the acrid principle is not much developed, may be eaten like asparagus, after careful boiling with change of water.

Bryophyllum (Gr. *bryon*, 'blossom,' and *phyllon*, 'leaf'), a genus of Crassulaceæ (q.v.). *B. calycinum*, a succulent shrubby plant, a native of the Moluccas, with oblong, crenulated leaves, and large drooping panicles of greenish-yellow flowers, is not unfrequent in British and other hothouses, being regarded as an object of interest on account of its producing buds on the edges of the leaves more readily than almost any other plant, especially when the leaf is pegged down upon the soil, the buds then at once forming independent plants. The same habit is exhibited by the British Bog-orchis (*Malaxis paludosa*), by some species of ferns, &c. The leaves are valued for poulticing in the East.

Buck-bean, or Marsh Trefoil (*Menyanthes trifoliata*), a species of Gentianaceæ (q.v.), widely

Buck-bean (*Menyanthes trifoliata*):
a, fruit; *b*, a flower.

distributed in all the colder parts of the northern hemisphere, common in Britain, and not rare in the northern parts of the United States and in Canada. It is easily recognised by its trefoiled leaves, and its small white or pink shaggy flowers These are dimorphic, like Primrose (q.v.) or Lythrum. It grows in marshy places, its creeping root-stocks and densely matted roots often rendering boggy ground firm. It is a traditional tonic and febrifuge in rustic and veterinary medicine, especially in Germany, and is also sometimes employed to give bitterness to beer. The root-stock was formerly used as a source of starchy food in Northern Europe.

Buckthorn (*Rhamnus*), a genus of Rhamnaceæ (q.v.), including sixty species, all shrubs or trees, widely distributed through temperate and tropical regions, but absent from Australia.—The Common Buckthorn (*R. catharticus*) is characterised by its spinous and cross-like branchlets, serrate leaves, and yellow-green diœcious flowers. The berries, which are about the size of peas, globular, bluish-black, nauseous, and violently purgative, were formerly much used in medicine, but now more rarely, and only in the form of a sirup prepared from their juice. They supply the Sap Green (q.v.) or Bladder Green of painters. The bark affords a beautiful yellow dye. The buckthorn is sometimes planted for hedges, but is of too straggling a habit.—The Alder Buckthorn, or Breaking Buckthorn (*R. frangula*), also (wrongly) called Black Alder, or Berry-bearing Alder, is spineless, with oval entire leaves, and small, whitish, axillary flowers. The berries are small and black, and also violently purgative, yet are freely eaten by birds. The charcoal of the wood is light, and is used by gunpowder-makers and called dogwood. The bark, leaves, and berries are used for dyeing. The flowers are peculiarly grateful to bees.—Dyer's Buckthorn (*R. infectorius*) is a low shrub, abundant in the south of Europe, whose unripe fruit yields a brilliant yellow dye. The French Berries, Avignon Berries, or Yellow Berries of dyers, are the fruit of this and other species.—Of North American buckthorns there are, besides the Common one, six or more peculiar species. The most important is the *R. purshiana* of the north-west Pacific slope (especially south-west Oregon), the

Alder Buckthorn (*Rhamnus frangula*):
a, a flower.

cathartic bark of which is used in medicine under the name of Cascara Sagrada.—The Sea Buckthorn (q.v.; *Hippophae rhamnoides*) is a shrub of a different genus and order (*Elæagnaceæ*). It is occasionally planted as an ornamental shrub.

Buckwheat (*Fagopyrum esculentum*, or *Polygonum Fagopyrum*) is a native of the basin of the Volga, the shores of the Caspian Sea, and many parts of Central Asia. A recent German authority affirms that there is no authentic mention of it until 1436 at Mecklenburg, whence it spread over Europe in the following century. It is also said to have been introduced by the Moors into Spain, and thence to have extended over Europe, or, again, to have been brought to Europe by the Crusaders. The French name *Sarrasin* seems to support these latter traditions. It is cultivated on account of the farinaceous albumen of its seeds, which are used, as grain, for food of man and cattle. It is upright, branched, 1 to 3 feet in height; the leaves are between heart-shaped and arrow-shaped, the flowers

Buckwheat (*Fagopyrum esculentum*):
a, a flower; *b*, a seed; *c*, root.

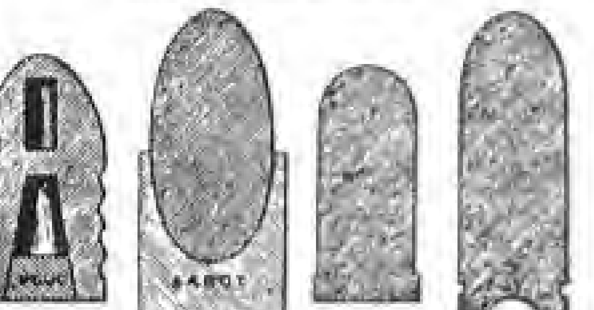
pale red, the seed (nut) black and triangular, its angles entire. The resemblance of this seed in form to the beech-nut is supposed to be the reason of the German name *Buchweizen* (lit. 'beech wheat'), from which the English name is derived. Buckwheat is a very common crop in some parts of Europe and of the United States of North America, but is seldom sown in Britain, except as food for pheasants, as it requires continued dry weather in autumn for profitable harvesting. In north-east Germany, and also in Brittany, buckwheat is valued as a crop, particularly for sandy heaths, moorlands, and other poor soils. It yields abundantly, and requires little manure or attention. Forty bushels or more per acre may be expected, weighing 46 or 48 lb. per bushel; and notwithstanding the resemblance of the seed to grain in its qualities and uses, wheat or any other cereal crop generally succeeds well after buckwheat. The seed is most frequently used in the shape of groats, or made into pottage; in the United States, thin cakes of the flour are a standard food. It is very nutritious, containing about 10 per cent. of gluten and 52 per cent. of starch, besides about 6 per cent. of gum and sugar. It is said to be as good as barley for fattening cattle, and better for horses than oats. But as the seed is covered with a very hard rind or thin shell, it must always be shelled before being given to cattle. Poultry are very fond of it. Beer is sometimes brewed from it, and it yields a spirituous liquor of good quality; indeed, it is frequently used in gin-distilleries. As green fodder, the herbage of the plant is said to be more nutritious than clover; but it is said to act as a narcotic on sheep. Bees delight in its flowers, and in some parts of the United States it is sown on this account. In America the seed is usually sown broadcast over the land, which has been ploughed in autumn or early spring, and well scarified or harrowed. About a bushel and a half of seed per acre is required when sown broadcast, but a bushel is sufficient if drilled with a machine. In the latter case it should not be sown in narrower drills than one foot apart, but two feet is recommended as being better for the succeeding crop, as the wider intervals can be properly cultivated. It should not be sown in England before the middle of May, as the least frost is injurious. When the lower seeds are ripe it should be mown, as they are easily shed out if allowed to stand too long.—Tartarian Buckwheat (*F. tataricum*) is distinguished by the toothed edges of the seeds and its more vigorous growth. It is hardy, and adapted for cold situations, but yields inferior meal, and is reckoned a mere weed in Germany. In Canada, on the other hand, it is much grown; but its use, as well as that of common buckwheat, is thought by many to induce skin disease. *F. emarginatum* is cultivated in China.—Dyer's Buckwheat is *Polygonum tinctorium*.

Bugbane, or Bugwort (*Cimicifuga*), a fetid genus of Ranunculaceæ, allied to Baneberry (*Actæa*), of which both the European and American species are said to drive away insects.

Bullet is the leaden projectile discharged from any kind of small-arm. Case-shot or canister and Shrapnel Shell (q.v.) are also filled with spherical bullets hardened by the addition of antimony to the lead. Formerly all bullets were spherical, and cast in moulds. Now all rifle-bullets are elongated. A machine unwinds a leaden rod of the proper thickness, cuts it into the required length, and stamps the bullets into shape by means of steel dies, dropping them into a box when finished. Each machine can turn out 7000 per hour, and one man can attend to four.

The only spherical bullet adapted to the rifle is a belted ball. The elongated forms are singularly numerous. Robins's bullet was egg-shaped, with the centre of gravity at the larger end; Beaufoy's was ovoid, with a hemispherical cavity at one end; Greener's was oval, with a plug of mixed metal driven into a hole barely large enough for it; Norton's, Delvigne's, and others were of various shapes, generally with some kind of plug, which, driven

MODERN RIFLE-BULLETS.



Snider.	Prussian Needle-gun.	French Chassepôt.	Martini-Henry.
Length, 1·062" in.	1·06"	1"	1·31"
Diameter, ·573"	·53"	·462"	·45 at base, ·432 at shoulder;
Weight, 480 grs.	480 grs.	390 grs.	480 grs.

into the lead by the force of the explosion, caused it to expand and take the grooves in the barrel. This expanding or dilating action has been claimed by many inventors; but the government in 1857 awarded Mr Greener £1000, as the person who had practically solved the difficulty as far back as 1836. Its effect is to communicate a twist to the bullet, thus steadying it, and causing it to travel point first. This enables a heavier, because longer, projectile to be fired with accuracy from a smaller bore than was formerly used; thereby presenting less surface to the resistance of the air, and so increasing the range.

The plug in the Snider bullet is of baked clay, and the grooves or *cannelures* round it easily take the rifling. Its head is hollow, to lessen the weight while preserving the length. The Prussian bullet does not touch the grooves; the *sabot* takes them and communicates the twist to the bullet. The shoulders of the Chassepot bullet and the slight taper in the Martini-Henry are for the same purpose. To avoid fouling the grooves, rifle-bullets are sometimes covered with steel, copper, or nickel. Bullets partially hollow, which expand in the wound, are sometimes used for shooting deer. Hollow-headed explosive bullets are only used for shooting big game, such as elephants and tigers. Their use in war is forbidden by the Convention of Geneva.

The diameter of rifle-bullets has been decreasing ever since their introduction. The new Enfield-Martini rifle, issued in 1888 to the troops of the British army, is designed to fire a bullet weighing 384 grains and only ·402" in diameter, but resembling in other respects the Martini-Henry bullet; that of the new French military rifle of 1887 is only ·314 inch calibre. That of revolvers is, of course, often still smaller; but those used in the British army have the ·45" bore, and can take the Martini-Henry cartridge. See CARTRIDGE, RIFLE; and, for steel bullets, MACHINE GUNS. SHOT is treated in a separate article.

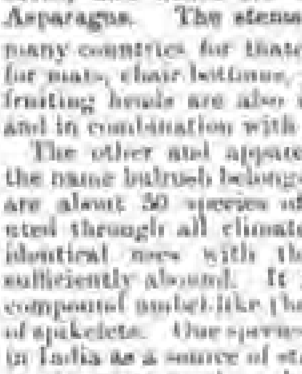
Bulrush, an English popular name for large rush-like or reed-like plants growing in marshes, not very strictly limited to any particular kind. The application of the term, both in literature and botany, has hesitated particularly between two distinct plants of tolerably similar vegetative habit—*Typha latifolia* and *Scirpus lacustris*. The former of these, also called Reed-mace or Cat's-tail, belongs to the Typhaceæ; it is a large handsome plant of grass-like habit, and reaching a height of 5 to 7 or 8 feet. The characteristic long flowering heads

Bulrush:
A, Common Cat's-tail (*Typha latifolia*); B, Common Bulrush (*Scirpus lacustris*).

bear the male above the female flowers, although other species are diœcious. The cloud of pollen is collected to adulterate the Lycopodium (q.v.) of pharmacy; the rhizome is astringent, but contains starch used by the Kalmucks; and the shoots of this and allied species are eaten by the Don Cossacks, and hence are sometimes called Cossack Asparagus. The stems of bulrushes are used in many countries for thatching and fuel, the leaves for mats, chair-bottoms, packing, &c. The woolly fruiting heads are also used as packing material, and in combination with feathers to stuff beds.

The other and apparently rightful claimant of the name bulrush belongs to the Cyperaceæ. There are about 30 species of Scirpus, widely distributed through all climates, and applied to almost identical uses with the preceding where they sufficiently abound. It is easily recognised by its compound umbel-like (but probably cymose) heads of spikelets. One species, *S. tuberosus*, is cultivated in India as a source of starch. The common British species may reach a height of 8 feet, and like Typha grows in vast swamp jungles along the margins of lakes and slow-running streams, to which they impart a characteristic picturesqueness. *S. maritimus* grows extensively along the shores of the Baltic.

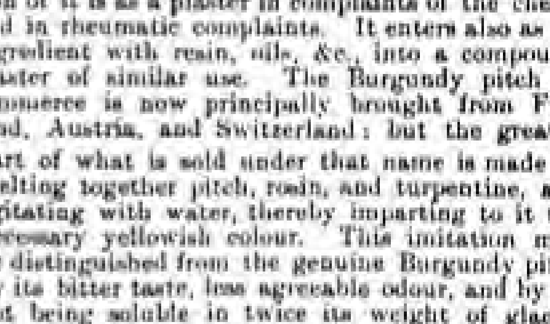
Bunsen Burner. Probably no invention has done so much to facilitate work in the chemical laboratory as that of the Bunsen burner, so named after the distinguished chemist. Prior to its introduction, the heating by gas or oil had been unsatisfactory, owing to the imperfect combustion of the carbon causing the deposit of soot on any body in contact with the flame. Applying the principle of the Blowpipe (q.v.), a plentiful supply of air was caused to mingle with the gas before ignition, so that a smokeless flame of low luminosity but great heating power was the result. The Bunsen burner has undergone many changes, by which it has been adapted to the various requirements of domestic life, but through all, the essential principle remains the same. The simplest form consists of an ordinary gas-jet, over which is placed a piece of metal tube, 4 to 6 inches long, and perforated with holes at the bottom. The gas having been turned on, air rushes in at the holes, so that when a light is applied to the upper end of the tube, a greenish-blue flame is obtained. If the air is in excess, the flame inclines to green; if deficient, a yellow flame results. The great objection to this, the original form, lies in its tendency to *burn back*, if the gas pressure be but small. When this occurs, and the flame burns at the jet, before it mixes with the extra volume of air, a long smoky flame issues from the tube, while the disagreeable odour of acetylene, C_2H_2, a product of the imperfect combustion of coal-gas, at once becomes apparent. To remedy this drawback, wire-gauze, through which flame cannot pass, is sometimes placed over the aperture, forming a 'solid flame' burner, or the mixture of gas and air is allowed to issue through small holes or narrow slits. The purposes for which the Bunsen burner is used are very varied. For cooking, fire-lighting, heating, ironing, soldering, &c., its utility is well known, while for the production of asbestos gas-fires many ingenious forms have been devised.



Bunsen Burner.

Burgundy Pitch, a resinous substance prepared from common Frankincense (q.v.), the spontaneous exudation of the Norway spruce-fir (*Abies excelsa*; see FIR) by melting it in hot water, by which means it is freed from a considerable part of the volatile oil which it contains. By straining it through a coarse cloth, impurities are also removed. Burgundy pitch is of a yellowish-white colour, hard and brittle when cold, but softening by the heat of the hand, and readily adhering to the skin. It has a not unpleasant resinous odour, and when pure, no bitter taste. It is used in medicine as an external application only, and generally acts as a mild irritant. A very common application of it is as a plaster in complaints of the chest, and in rheumatic complaints. It enters also as an ingredient with resin, oils, &c., into a compound plaster of similar use. The Burgundy pitch of commerce is now principally brought from Finland, Austria, and Switzerland; but the greater part of what is sold under that name is made by melting together pitch, rosin, and turpentine, and agitating with water, thereby imparting to it the necessary yellowish colour. This imitation may be distinguished from the genuine Burgundy pitch by its bitter taste, less agreeable odour, and by its not being soluble in twice its weight of glacial acetic acid.

Burnet, the English name of two closely



1. Common Burnet (*Poterium Sanguisorba*);
2. Great Burnet (*Sanguisorba officinalis*):
a, a floret; *b*, flower-head.

allied and often united genera of Rosaceæ—Poterium and Sanguisorba.—Great Burnet (*Poterium* [*Sanguisorba*] *officinale*) is common in meadows in all parts of Europe. It is cultivated in Germany on poor soils for fodder. The root-stock is astringent, and was formerly used in medicine.—Common Burnet (*Poterium Sanguisorba*) grows in dry pastures, especially on chalky soils, on which it sometimes becomes of importance, and has also been cultivated as a fodder plant. It grows wild in the United States. It used to be cultivated in gardens, its slightly astringent leaves being used in salads or soups, also as an ingredient in *cool tankard* (the name *Poterium* being from a Greek word signifying a drinking-vessel). *S. Canadensis* is an interesting American species sometimes cultivated in gardens.

Burnett's Disinfecting Liquid is a liquid introduced by Sir William Burnett (1779-1861) for the purpose of deodorising the bilge-water of ships, sewage-water, &c. It is a strong solution (sp. gr. 2) of chloride of zinc, accompanied by a small amount of chloride of iron; and when intended to be used, it is mixed with water in the proportion of one pint to five gallons of water. The liquid acts only as a *deodoriser* and *antiseptic* (see ANTISEPTICS), and does not yield any vapour which can exhibit the properties of a Disinfectant (q.v.). It is of service in preserving dead animal tissues, as in the dissecting-room, and in jars containing anatomical specimens. It is said to have little action on dissecting knives, but this is doubtful. When added to bilge or sewage water, the chloride of zinc, $ZnCl_2$, mainly acts by decomposing the offensive sulphide of ammonium, NH_4HS, which it does by forming the sulphide of zinc, ZnS, and chloride of ammonium, NH_4Cl, both of which are odourless. The strong solution of chloride of zinc has also been applied to the preservation of timber from the ravages of dry-rot, and the process of so treating wood is called, after its inventor, *Burnettising*. *Crewe's* disinfectant liquid is chemically the same as the above.

Butyl. See ALCOHOL.

Butyric Acid. C_3H_7COOH, is a volatile fatty acid, first prepared by Chevreul, by treating butter with an Alkali (q.v.). It possesses the disagreeable odour of rancid butter, and it is to it, in part at least, that the perspiration of animals owes its unpleasant smell. It is a mobile liquid, specific gravity ·974, the vapour of which is inflammable, burning with a blue flame. It is readily soluble in water and alcohol, possesses a sour burning taste and corrodes the skin. Butyric acid forms a whole series of salts, of which butyrate of sodium, $NaC_4H_7O_2$, and butyrate of ethyl or Butyric Ether, $C_2H_5C_4H_7O_2$ (q.v.), may be taken as typical examples.

While butyric acid itself and its inorganic salts (butyrates of sodium, calcium, &c.) have a disagreeable smell, it is interesting to note that the organic salts (butyrates of methyl, ethyl, &c.) have a pleasant odour, and are used in the manufacture of artificial fruit essences.

Butyric acid may be prepared by causing milk to undergo butyric fermentation. Chalk being then added, a butyrate of calcium is obtained, which, on treatment with hydrochloric acid and subsequent distillation, yields the pure acid.

Butyric Ether, or PINE-APPLE OIL, is an exceedingly fragrant oil obtained by distilling butyric acid (or the butyrate of lime), alcohol, and sulphuric acid. The material which passes over is the butyric ether, and it is generally mixed with alcohol, and sold in commerce as *Artificial Pine-apple Oil*. It possesses the same very pleasant flavour which belongs to pine-apples, and there is little doubt that pine-apples owe their flavour to the presence of natural butyric ether. The artificial variety is now extensively used for flavouring confections, as pine-apple drops, for sophisticating bad rum, and for flavouring custards, ices, and creams, as also an acidulated drink or lemonade named Pine-apple Ale. Butyric ether alone cannot be used in perfumery for handkerchief use, as, when inhaled in even small quantity, it tends to cause irritation of the air-tubes of the lungs and intense headache, but it is employed as one material in the manufacture of compound perfumes. Butyric ether is the butyrate of ethyl, $C_2H_5.C_4H_7O_2$, and is similar to butyrate of sodium, $NaC_4H_7O_2$, in composition, the sodium, Na, being in this case replaced by the organic radical ethyl, C_2H_5. It is remarkable that a substance possessing such a disagreeable odour as butyric acid (that of rancid butter) should be capable of forming, in part at least, a substance with such a pleasant flavour as artificial pine-apple oil.

Burdock (*Arctium*), a genus of Compositæ (q.v.), familiarly characterised by the bracts of the involucre which are hooked inwards at the point. By means of these hooks, the flower-head, popularly called a *bur*, readily lays hold of the clothes of a passer-by, the wool of a sheep, or the like, and thus the fruitlets are transported from one place to

Greater Burdock (*Arctium Lappa*, var. *majus*): a, section of flower-head, showing hooked bracts.

another, the short hairy pappus being insufficient to waft them far on the wind. The Common Burdock (*A. Lappa*) is consequently of wide distribution throughout the north temperate zone, and has numerous varieties or sub-species; it is very common in the United States. It flowers in July and August. The root was formerly used in medicine, and the young shoots for culinary purposes, for which it has even attained cultivation in Japan.

Cacodyle, or KAKODYLE, is an organic substance containing carbon, hydrogen, and arsenic, $((CH_3)_2As)_2$. The oxide of cacodyle, $((CH_3)_2As)_2O$, otherwise known as *Cadet's fuming liquor* or *alkarsine*, has the remarkable property of taking fire spontaneously when exposed to the air, and evolving abundant and exceedingly poisonous fumes of arsenic.

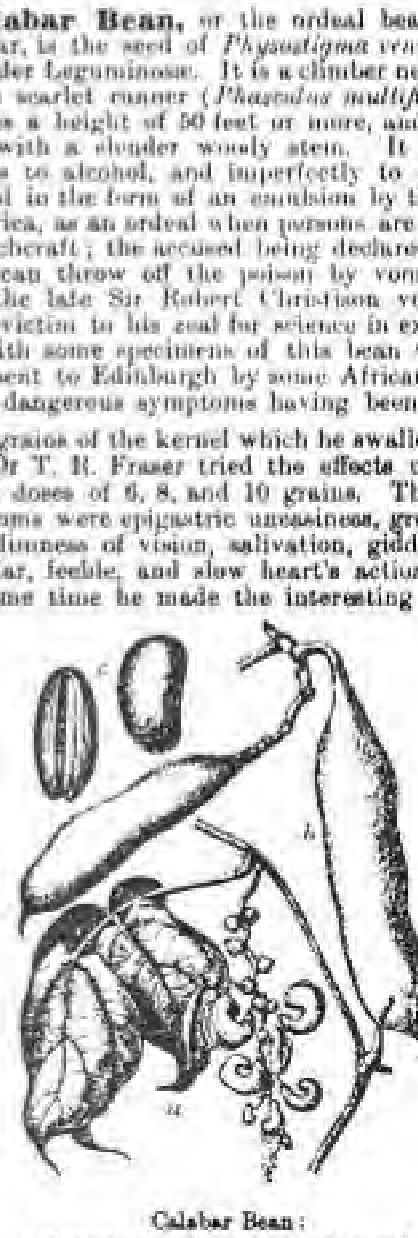
Cadmium (sym. Cd, atomic weight 112) is a metal which occurs in zinc ores. In the preparation of zinc, when heat is applied, the cadmium, being more volatile than that metal, rises in vapour, and distils over with the first portions of the metal (see ZINC). Cadmium is a white metal, somewhat resembling tin, than which it is rather denser, its specific gravity being 8·6. It is very soft, and is malleable and ductile, crackling like tin when a rod of it is bent. It fuses at 442° (227·8° C.), and volatilises a little below the boiling-point of mercury. It is rarely prepared pure, and is not employed in the arts as a metal, though several of its salts have been serviceable in medicine, and the iodide and bromide have been useful in photography. There are alloys of cadmium with various other metals. The sulphide of cadmium, CdS, occurs naturally as the mineral *Greenockite*, and when prepared artificially, is of a bright yellow colour. It is known as Cadmium Yellow, and is of great value to the artist. A great variety of tints are produced by mixing it with white-lead. Much of what is sold as Naples Yellow is thus prepared, but the genuine Naples Yellow, prepared by heating antimonic anhydride with plumbic oxide, has a greenish tint.

Cæsium, an alkaline metal, is most always found along with rubidium, was discovered by Bunsen and Kirchoff in 1860 by spectrum analysis. The metal, isolated for the first time in 1882, is silver white, soft and extensile, and like rubidium is highly analogous to potassium. Its symbol is Cs, and its atomic weight 133. Its melting-point is 26·5° C., and its specific gravity 1·88. It ignites spontaneously in the air, and when thrown on water, behaves like sodium, potassium, and rubidium. The name is derived from *cæsius*, 'sky-coloured,' from the colour given to the blowpipe flame by cæsium. See RUBIDIUM.

Caffeine, or THEINE, $C_8H_{10}N_4O_2H_2O$, is the alkaloid or active principle of Coffee (q.v.) and Tea (q.v.). When isolated, it forms beautiful white crystals, with a silky lustre, which are soluble in chloroform, water, alcohol, and ether. It is a remarkable fact that nearly all the beverages in use in different parts of the world owe their virtues to, or at least contain, the same or similar active principles. Thus caffeine is present in coffee, tea, guarana, Paraguay tea or *maté*, and in the kola nut; while in cocoa theobromine is the corresponding principle, differing but slightly from caffeine in chemical composition—the latter being methyl-theobromine—i.e. theobromine in which one atom of hydrogen has been replaced by the group methyl, CH_3. In coffee, caffeine is present to the extent of from 1 to 2 per cent., while ordinary tea and guarana contain from 2½ to 6 per cent. In large doses, caffeine proves fatal to the lower animals, causing convulsions and death. In man, doses of 8 to 12 grains produce diuresis, great excitement, anxiety, and even delirium; but it has been of late used medicinally as a powerful stimulant of the heart's action. It may be extracted from coffee or tea by making a decoction in hot water, and adding acetate of lead, which causes a precipitate of caffeotannate of lead. When the latter is acted on by sulphuretted hydrogen, the lead is separated, and the caffeine left in solution. On evaporation of the liquid, and recrystallisation from alcohol, the caffeine separates in crystals.

Caffeine forms a series of salts, of which the *citrate* has come largely into use. One grain given every hour is often found to give great relief in sick headaches.

Calabar Bean, or the ordeal bean of Old Calabar, is the seed of *Physostigma venenosum*, of the order Leguminosæ. It is a climber nearly allied to the scarlet runner (*Phaseolus multiflorus*), but reaches a height of 50 feet or more, and is perennial, with a slender woody stem. It yields its virtues to alcohol, and imperfectly to water. It is used in the form of an emulsion by the natives of Africa, as an ordeal when persons are suspected of witchcraft; the accused being declared innocent if he can throw off the poison by vomiting. In 1855 the late Sir Robert Christison very nearly fell a victim to his zeal for science in experimenting with some specimens of this bean which had been sent to Edinburgh by some African missionaries, dangerous symptoms having been produced by 12 grains of the kernel which he swallowed. In 1861 Dr T. R. Fraser tried the effects upon himself of doses of 6, 8, and 10 grains. The general symptoms were epigastric uneasiness, great feebleness, dimness of vision, salivation, giddiness, and irregular, feeble, and slow heart's action. About the same time he made the interesting discovery



Calabar Bean:
a, flowering branch; b, seed pod; c, seeds.

that, when placed on the eyeball, this substance contracts the pupil, and produces near-sightedness; and it is now frequently employed for these purposes in ophthalmic surgery. It has also been administered in tetanus and other nervous diseases. Fraser has also shown that since its action is precisely contrary to that of belladonna or its active alkaloid atropine, the latter can with certainty be administered (even in quantities which would be injurious or fatal under ordinary circumstances) as an antidote to the other. The Calabar bean owes its activity to the presence of a very powerful alkaloid, called Eserin, which, in the form of gelatine discs, each containing $\frac{1}{1000}$th grain of eserin, is much used in ophthalmic operations; and sometimes similarly in solution as a local tonic to strengthen a relaxed power of accommodation. Eserin is used to contract the pupil, as belladonna relaxes it.

Calamus, the traditional name of the Sweet Flag (*Acorus Calamus*), which is no doubt the 'Calamus Aromaticus' of Roman authors, and probably the sweet calamus and sweet cane of Scripture, although it has, however, been attempted to identify calamus with one of the fragrant grasses (see LEMON-GRASS) which yield the grass-oil of India. The sweet flag, although resembling Iris in habit, belongs to the order Aroideæ, and is widely distributed through the Eastern palæarctic region, and is also indigenous to North America. It is said to have been introduced into Europe from Asia Minor in the 16th century, and is now widely naturalised in ditches and by the sides of ponds.

A, *Acorus Calamus*, showing rhizome; B, flower-head; *c*, separate floret; *d*, floral diagram, showing essentially liliaceous type; *e*, vertical section of ovary; *f*, single seed.

Hooker indeed regards it as a native of Britain. The root-stock yields an aromatic stimulant and tonic, which has fallen into disuse in regular medicine, but is still of high repute in the East. It is in fact cultivated in Ceylon and Burma. It is sometimes used to flavour beer, and in the perfuming of tooth-powder and snuff; and was masticated to clear the voice and sweeten the breath. It is also made into confections and used in the preparation of liqueurs in Germany, &c. The plant was formerly used to strew floors instead of rushes, and particularly in cathedrals on festival days. The name Calamus is also given to a genus of palms. See RATTAN, and DRAGON'S BLOOD.

Calcareous, in Chemistry, is a term applied to substances containing much lime (Lat. *calx*). Thus *Calcareous waters* are those which hold in solution much carbonate and sulphate of lime, and which are generally known as hard waters, and form a deposit in kettles and other vessels when heated therein.—*Calcareous rocks* are those in which lime forms the prevailing element. They may be chemically formed, as in the case of tufas, where a saturated solution of carbonate of lime in water is deposited from evaporation or other causes; but they are generally aqueous rocks, the materials of which are supplied by animal remains. Thus, many rocks, like the mountain-limestone, are composed of shells, corals, and encrinites; while others, like chalk, consist largely of foraminifera and fragments of other marine organisms. A crystalline structure, varying in degree from the partially crystallised carboniferous limestones to the saccharine statuary marble, is produced in calcareous rocks by metamorphic action. Oolite is a variety of limestone composed of small egg-like grains resembling the roe of fish. The existence of lime in rocks can always be detected by the application of dilute hydrochloric acid, when it effervesces from the liberation of the carbonic acid. Pure lime is obtained from calcareous rocks by calcining them—i.e. by driving off the carbonic acid and other volatile matter by heat.—*Calcareous soils* are produced from the disintegration of calcareous rocks. When the rocks are perfectly pure, they generally yield barren soils, as in many chalk and limestone districts of Britain; but when the lime is mixed with clay, so as to form marl, and has a little vegetable matter added, it forms an excellent though rather light soil. Calcareous soils are difficult of drainage, owing to the property that soft lime has of retaining water, although it easily yields it up by evaporation. Such soils are consequently soon dry at the surface after rain, but yet rarely suffer severely from drought.

Calcination, or CALCINING (see CALX), is the process of heating or roasting in furnaces or in heaps the various metallic ores. It is resorted to as the first stage in the extraction of the majority of the common metals from their ores, and is essentially a process of oxidation.

Calcite, CALCAREOUS SPAR, or CALC-SPAR, the name usually given by mineralogists to carbonate of lime, rhombohedral in its crystallisation. It differs from aragonite only in crystallisation (see ARAGONITE). Calcite is one of the commonest minerals. Marble, for example, is composed of small crystalline granules of this mineral. It is abundantly met with in very many rocks as a *secondary* mineral; that is to say, it is a decomposition product—the result of the chemical alteration of various rock-constituents, such as the felspars. Thus it frequently occurs in the cracks, fissures, and vesicles of igneous rocks (see AMYGDALOID). It often completely fills cavities in rocks of various origin; and although it has been prevented by want of space from assuming a crystalline form, is readily divided by the knife and hammer into rhomboids, the primary form of its

Calcite: various forms of Crystals.

crystals being a rhomboid, of which the greatest angles are 105° 5′. Its secondary forms are more numerous than those of any other mineral. More than seven hundred have been observed. One of the most common, a rather elongated pyramid, is sometimes called Dog-tooth Spar. Calcite is colourless and transparent, except in consequence of impurities which may be present in it; and when perfectly transparent, it exhibits in a high degree the property of double refraction of light, which was first discovered in it by Bartholinus. The presence of foreign substances frequently renders calcite gray, blue, green, yellow, red, brown, or even black.

The name Iceland Spar has often been given to calcite, at least to the finest colourless and transparent variety, because it is found in Iceland, filling up clefts and cavities in the basalt rocks of that region. Slate Spar is a lamellar variety, often with a shining, pearly lustre, and a greasy feel, and is found at Wicklow in Ireland, Glen Tilt in Scotland, and Kongsberg in Norway.

Calcium (sym. Ca, atomic weight 40) is the metal present in chalk, stucco, and other compounds of lime. It may be obtained by passing a powerful current of electricity through fused chloride of calcium, $CaCl_2$, when the metal separates in minute globules. It is a yellowish-white metal, can be rolled into sheets, and hammered into leaves, and is intermediate between lead and gold in hardness. It has a specific gravity of 1·578; being more than a half denser than water. At ordinary temperatures, it slowly tarnishes by oxidation; and when placed in contact with water, it rapidly decomposes the water, H_2O, forming lime, CaO, whilst hydrogen escapes. To be retained bright, calcium must be kept under the surface of naphtha. At a red heat, it melts and burns with a dazzling white light, accompanied by scintillations.

Calcium is of no value in the arts, but many of its compounds are of the highest importance. When oxidised, either by exposure to air, or by combustion, it forms an oxide, Lime (q.v.), having the composition of 40 parts of calcium and 16 parts of oxygen. This, when united with water, yields a hydrate, slaked lime.

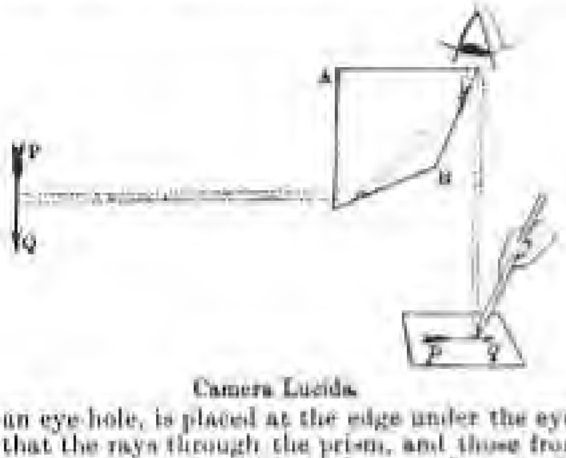
Sulphate of calcium, $CaSO_4$, is Gypsum (q.v.) or plaster of Paris. It is present in most drinking-waters, rendering them *permanently hard*, so called because the sulphate of calcium is not precipitated by boiling the water. Temporary hardness, due to the presence of carbonate of calcium, $CaCO_3$, or chalk, is removable by boiling, when the carbonate, which is retained in solution as bicarbonate, is readily decomposed into Carbonic Acid (q.v.), which escapes as gas, and chalk, which falls to the bottom.

The salts of calcium do not seem to possess any medicinal properties characteristic of the metal itself. They are, however, extensively used—e.g. the phosphate, to supply phosphorus for the bones and nerves, the carbonate as an antacid, and so on, with other salts.

Calomel is the popular name of one of the compounds of mercury, Hg, and chlorine, Cl, known to chemists as the subchloride of mercury or mercurous chloride, HgCl. It is prepared by taking two equal portions of mercury, dissolving one portion in hot concentrated sulphuric acid, H_2SO_4, which forms sulphate of mercury, $HgSO_4$, thereafter adding the second part of the metal, and triturating the whole in a mortar till the metal becomes incorporated with the sulphate of mercury. This mixture is then added to about one-third of its weight of common salt, NaCl, and heated in a retort, when calomel sublimes, and condenses in the cool part of the receiver as a fine white powder. A minute portion of corrosive sublimate which accompanies it is removed by washing with water. Calomel is very dense. It is not soluble in water, and sparingly so in acids. It turns black on the addition of lime-water, potash, soda, or ammonia; and when heated in an iron spoon, or on a knife, it does not char, but rises in vapour, sublimes unaltered, and readily condenses again on any cool surface held near it. By these tests it may be readily distinguished from flour. Although calomel has been more used in British practice than any other preparation of mercury, it is not known to have been employed before the 17th century. It is the most valuable of the mercurial preparations, possessing, in addition to their general properties (see MERCURY), those of a vermifuge and purgative.

Calx is the Latin term for quicklime. As quicklime is produced by burning limestone, the alchemists applied the term *calx* to the substance of a metal or mineral that remains after being subjected to extreme heat, and *Calcination* (q.v.) to the process.

Camera Lucida (so named in contrast to Camera Obscura, q.v.), an optical instrument constructed of various forms and for various purposes. Dr Robert Hooke invented one about 1674; whilst Dr Wollaston's (1807), intended to facilitate the perspective delineation of objects, consists of a small quadrilateral prism of glass, of which AB in the annexed figure is the perpendicular section, held in a brass frame, which is attached to an upright rod, having at its lower end a screw-clamp, to fix it to the edge of a table. The prism being at the height of about a foot from the table, has its upper face horizontal. Two of its faces, as in the figure, are at a right angle at A; the contiguous faces make respectively with them angles of 67½°; so that the remaining obtuse angle at B contains 135°. Rays coming from an object PQ, and falling nearly perpendicularly on the first surface, enter the prism, and undergo total reflection at the contiguous surface (see OPTICS); they then fall at the same angle on the next surface, and are totally reflected again; finally, they emerge nearly perpendicularly to the remaining surface. An eye, as in the figure, then receives the emergent pencil through one part of the pupil, so that an image, *pq*, of the object is seen projected upon a sheet of paper upon the table. The rays from the drawing-pencil passing the edge of the prism, enter the other part of the pupil; and the pencil and image being seen together upon the paper, a sketch of the latter can be taken. There is, however, a practical difficulty—the image and the drawing-pencil are at distances sensibly different from the eye, and so cannot be seen together distinctly at the same time. To obviate this, a plate of metal, with a small aperture

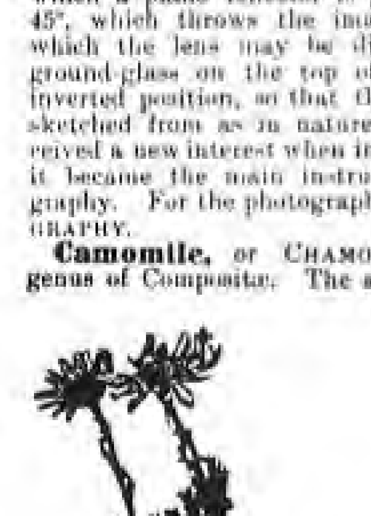


Camera Lucida.

as an eye-hole, is placed at the edge under the eye, so that the rays through the prism, and those from the drawing-pencil, which both pass through the eye-hole, form only very small pencils. By this the difficulty is greatly diminished. It is still, however, difficult to use the instrument satisfactorily; and though many acquire great readiness in its use, others have never been able to attain the same facility. A simpler form is merely a piece of smooth glass fixed at an angle of 45° to the horizon. In this case, however, the image seen on the paper below will be inverted. In Amici's form of the instrument a right-angled triangular prism is used, involving two refractions and one reflection.

Camera Obscura (lit. 'a dark chamber'), an instrument described by Giambattista della Porta in his *Magia Naturalis* (1569). It is known in its simplest form as a familiar toy, consisting of a rectangular box, furnished at one end with a lens whose focal length is equal to the length and depth of the box; at the opposite end of which a plane reflector is placed at an angle of 45°, which throws the image of any objects to which the lens may be directed on a piece of ground-glass on the top of the box in a non-inverted position, so that they may be viewed or sketched from as in nature. The instrument received a new interest when in the hands of Daguerre it became the main instrument used in photography. For the photographic camera, see PHOTOGRAPHY.

Camomile, or CHAMOMILE (*Anthemis*), a genus of Compositæ. The species are annual and perennial herbs, all palæarctic. The most important species of the genus is *A. nobilis*, which has long been known for the medicinal virtues of an infusion of its flowers (*Flores Anthemidis*) as a bitter stomachic and tonic. These properties seem mainly due to an essential oil which is prepared by distillation; a bitter principle is also present, but no alkaloid. The plant is chiefly cultivated at Mitcham in Surrey, and at Kieritzsch and elsewhere in Saxony. Its flowers differ from the wild forms in being all more or less double, but those in which the conversion of tubular into ligulate florets has been less complete, leaving a somewhat yellow centre, are called by druggists *single camomiles*. The largest, whitest, and most completely double flowers are most esteemed. The other British species are mere weeds; one of them, called Stinking Camomile (*A. Cotula*), is so acrid as to blister the fingers. But the flowers of the Dyer's Camomile (*A. tinctoria*), common on the Continent, yield a beautiful dye.


Camomile (*Anthemis nobilis*).

Wild Camomile (*Matricaria Chamomilla*) is the common camomile of German writers. It has long been employed as an adulterant or substitute for the other, and (illicitly) in brewing; its flower-heads are, however, easily distinguished, being quite single and not bitter; the receptacle is also hollow and devoid of the bracteoles which largely characterise the true camomile. A cultivated variety of *M. Parthenium* (*Feverfew*, q.v.) has also to be distinguished. The camomile of the Indian bazaars is said to be a variety (*M. Suaveolens*) of the former species.

Camphene, or CAMPHILENE, is an artificial variety of camphor obtained from turpentine, by acting thereon with the dry vapour of hydrochloric acid, and keeping the whole at a low temperature by immersing the vessel in a freezing mixture. A solid substance is produced, which separates in white crystalline prisms, and has the taste and agreeable aromatic smell of common natural camphor. The name Camphene has, however, a wider signification, being applied to the whole class of oils isomeric with turpentine, of which the best known are the oils of bergamot and lemon.

Camphine is the name applied to a variety of spirit of turpentine obtained from the *Pinus australis* of the southern states of America, and formerly used as an illuminant in this country. It is very volatile, burning freely with a pure white brilliant light. Its vapour forms with air a very explosive mixture. Under this name are sometimes sold burning oils in which the illuminating power has been increased by the addition of camphor.

Camphor is a solid essential oil which is found in many plants, and may be separated from many essential oils. It particularly abounds in certain species of Lauraceæ (q.v.). The principal source of the camphor of commerce is the Camphor Laurel (*Cinnamomum* (*Laurus*) *Camphora*), a tree of China, Japan, Formosa, and Cochin-China, and which has been introduced into Java and the West Indies. Camphor is chiefly imported in the crude or unrefined state from Formosa and Japan, where the wood is cut into chips and distilled with water, the vapour of camphor rising with the steam being collected in the head of the still. After collection *camphor oil* drains off, which is used in China for rheumatism. In the refining process the grains of impure camphor are detached, and being introduced, along with a small proportion of quicklime, into a large globular glass vessel in quantities of about 10 lb., are reheated, when first the water rises in steam, and is allowed to escape at a small aperture; and thereafter, this aperture being closed, the camphor sublimes and resolidifies in the interior upper part of the flask as a semi-transparent cake, leaving all the impurities behind. The flasks are then cooled and broken by throwing cold water on them, and the camphor taken out and sent into market. The glass globes employed are called by an Italian name, *bombilo*, the sublimation of camphor having been first practised in Venice. Camphor has also of recent years been sent into the market sublimed in almost powdery crystals, as 'flowers of camphor,' a very convenient form for pharmaceutical purposes.—Camphor was unknown to the Greeks and Romans, but has been highly valued since ancient times in the East, and was first brought to Europe by the Arabs. It is a white tough solid, slightly lighter than water, and having the formula $C_{10}H_{16}O$. It is very sparingly soluble in water, but freely soluble in alcohol, ether, acetic acid, and the essential oils. It fuses at 347° (175° C.), and boils at 399° (204° C.), but volatilises somewhat rapidly at ordinary temperatures. When set fire to, it burns with a white smoky flame. Thrown upon water, it floats, and may be set fire to, when the currents generated alike from the gradual solution of the camphor in the water and the irregular burning of the pieces, cause a curious rotatory motion. It has a peculiar hot aromatic taste, and an agreeable characteristic odour.

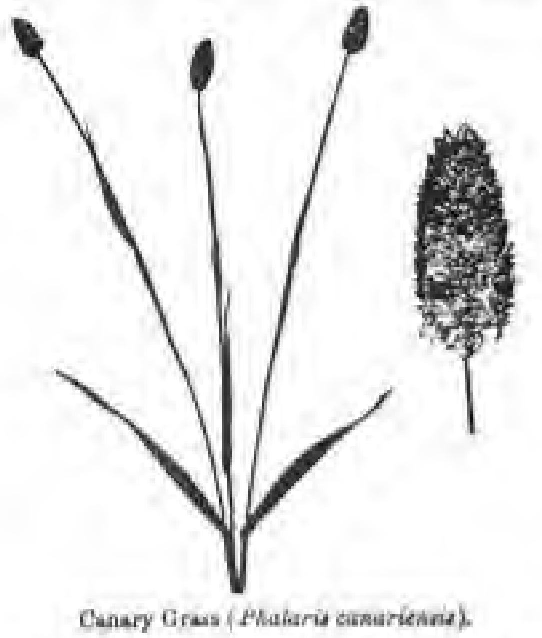
Camphor is used alike in European and oriental medicine, both internally and externally, as a temporary stimulant. It is frequently employed in gout and rheumatism. In small doses it acts as an anodyne and antispasmodic; in very large doses it is an irritant poison. It is generally reckoned an anaphrodisiac, although some maintain that it has an opposite action. Its alcoholic solution, and liniments in which it is the principal ingredient, are much used for external application in sprains and bruises, chilblains, chronic rheumatism, and paralysis. The odour of camphor is very noxious to insects, and it is therefore much used for preserving natural history specimens, and its fumes have been from early times regarded as of antiseptic value, an opinion confirmed by recent bacteriologists. Raspail in 1845 laid special stress on the value of camphor.

The Borneo or Sumatra Camphor of commerce, sometimes called Hard Camphor, is the produce of *Dryobalanops aromatica*, a large tree of the order Dipterocarpeæ. The camphor is obtained by cutting down the tree, and splitting it into small pieces, being found in crystalline masses in natural cavities of the wood. To this substance the Chinese ascribe extraordinary medicinal virtues, so that it is sold among them at sometimes more than fifty times the price of common camphor. Hence, although the form of camphor earliest known, it no longer appears in European commerce. Its composition is $C_{10}H_{18}O$, and it can be converted into common camphor by the action of nitric acid. The same tree also yields a 'camphor oil' isomeric with oil of turpentine, $C_{10}H_{16}$. This is collected by tapping or felling the tree. A third variety, *Ngai*, or *Blumea Camphor*, of intermediate but still high value, is manufactured at Canton from *Blumea balsamifera*, a tall herbaceous composite. Its chemical composition is identical with the last. It is consumed in Chinese medicine, and in perfuming the finer sorts of Indian ink. Similar crystalline bodies separate from the oils of bergamot, neroli, thyme, buchu, sassafras, &c., but are of no special importance.

Canada Balsam is a kind of Turpentine (q.v.) obtained from the Balsam Fir or Balm of Gilead Fir (*Abies* or *Pinus balsamea*), a native of Canada and the northern parts of the United States (see FIR). It exists in the tree in vesicles between the bark and the wood, and is obtained by making incisions. It is a transparent liquid, almost colourless, and with an agreeable odour and acrid taste. It pours readily out of a vessel or bottle, and shortly dries up, and becomes solid. When fresh, it is of the consistence of thin honey, but becomes viscid, and at last solid by age. It consists mainly of a resin dissolved in an essential oil, and its composition is approximately: Essential oil, 24 parts; resin, soluble in boiling alcohol, 60; resin, soluble only in ether, 16. Canada balsam was formerly employed in medicine as a stimulant for the cure of mucous discharges, and as a detergent application to ulcers, but it is now rarely used as a remedy. The balsam is much valued for a variety of purposes in the arts—as an ingredient in varnishes, in mounting objects for the microscope, in Photography (q.v.), and by opticians as a cement, particularly for connecting the parts of achromatic lenses to the exclusion of moisture and dust. Its value for optical purposes is very great, and depends not only on its perfect transparency, but on its possessing a refractive power nearly equal to that of glass. See BALSAM.

Canary Grass (*Phalaris canariensis*), a grass of which the seed is much used, under the name of *canary-seed*, as food for cage-birds, and which is on that account cultivated to some extent in the south of Europe, and in certain districts of Germany and England. It has become naturalised in many parts of Northern Europe, including Britain, but is a native of Southern Europe and the Canaries, where it sometimes furnishes a wholesome and palatable addition to or substitute for wheaten flour.

It is largely grown for seed in Southern California. The large Reed Canary Grass (*P. arundinacea*), common on river banks, is an abundant source of coarse fodder. A striped variegated variety is



Canary Grass (*Phalaris canariensis*).

cultivated as 'gardeners' garters,' 'ribbon grass,' or 'ladies' traces.'

Cancer (Lat., 'a crab'), or CARCINOMA (Gr.), is the medical name for an important group of malignant tumours (see TUMOUR). The term cancer used to be applied to malignant tumours generally, but recent research, with the aid of the microscope, into their structure has led to their division into two groups—Carcinomata and Sarcomata (q.v.); and cancer is now used only of the first. To prevent confusion, carcinoma is generally used in preference to cancer in scientific works, but the more familiar name will be retained here.

Cancer may be defined as a tumour consisting of masses of cells of an epithelial type, grouped together irregularly within the spaces of a framework of fibrous tissue. The form of the cells, as seen under the microscope, usually corresponds in some degree to that of the normal epithelium of the part in connection with which the primary tumour has developed, and on this the classification of the different forms of cancer is partly based. *Flat-celled* cancer or *epithelioma* occurs most commonly as a primary tumour on the lips, tongue, penis, and near the anus; *Columnar-celled* or *adenoid* (gland-like) cancer, in the stomach and intestines. *Scirrhus* or *hard*, and *encephaloid* or *soft* cancer, have cells of less characteristic form, but usually more or less rounded, and differ from each other structurally only in the greater or less abundance of the fibrous framework. They are most common as primary tumours in the female breast, the womb, and certain parts of the alimentary canal. *Colloid* cancer is a hard or soft cancer in which the cells undergo rapid and extensive degeneration into a gelatinous mass.

These different forms of cancer differ widely in their rate of growth and degree of malignancy. Epithelioma is the slowest in its progress, and comparatively rarely gives rise to growths in internal organs. Soft cancer usually grows with great rapidity, and secondary tumours in internal organs are apt to appear early.

The general structure of the secondary tumours usually corresponds to that of the primary; but they are often softer and show greater activity of growth, so that when they appear the progress of the disease is accelerated. These secondary tumours are believed usually to result from a transference of infective elements from the primary growth, either in the lymph or the blood, to some resting-place where they determine the growth of a new tumour. The lymphatic glands in the neighbourhood of the primary growth are usually first affected, and are by far the most constant site of secondary growths. But any portion of the body, even the most distant, may suffer; most commonly the liver or the lungs.

The symptoms attending the early development of cancer, even cancer affecting the same part of the body, are very variable. If the disease affect an external organ o. tissue, the tumour is generally noticed at an early stage; if an internal organ, on the other hand, some disturbance of its functions, or pain, or general deterioration of the health often appears before the presence of a growth is suspected. But wherever or however it begins, a cancerous tumour always tends to increase, with breaking down of the older portions, ulceration, and fetid discharge, to encroach upon neighbouring tissues, to set up secondary growths, and ultimately to cause the death of the patient. The cases where an undoubtedly cancerous tumour has spontaneously disappeared are so very rare, that the above statement, for practical purposes, hardly needs qualification. The duration of the case may be a few months or many years, according to the part affected and the malignancy of the tumour. The symptoms produced, and the mode in which the disease causes death, are almost as various as the organs affected. But in the later stages there is nearly always loss of appetite, flesh, and strength, and a peculiarly unhealthy, sallow appearance. Cancer is popularly believed to be an intensely painful disease, and in many cases really is so; but it is most important that it should be known that it may, and often does, run its whole course to the fatal issue without any pain whatever.

The causation of cancer is a most complex and obscure problem. It is rare before middle life, and after that period becomes increasingly frequent as age advances. The tendency to its development is frequently hereditary. It is more common in the female sex, because the womb and female breast are its most common situations; excluding these organs, it is probably more common in the male than the female. It sometimes occurs in situations where an injury has been sustained, and more frequently where there has been long-continued irritation. But here our certain knowledge with regard to it ends. It has been maintained by some that cancer is always from the first a constitutional disease; that the local tumour is merely an expression of a vitiated state of the constitution, or *cachexia*, and therefore that its removal is useless. But it is undoubted that in the vast majority of cases the patient's health is otherwise good when the growth begins, and that it remains for a time limited to its original seat; moreover, cases are not uncommon where early removal of the primary tumour has been followed by no return of the disease. It seems reasonable therefore to conclude that cancer is at first a merely local process, at least in many cases, and only secondarily becomes a constitutional disease.

The analogy between the behaviour of cancer and that of certain diseases known to be produced by microscopic parasites (e.g. leprosy, tuberculosis) has led to a suspicion that some such agent may be present in cancer too; but no positive evidence has yet been found in support of this view.

The leading character of cancer being a tumour or morbid growth in a part, it is important to observe that not all, nor even the majority, of morbid growths are cancerous. A very large proportion of growths, involving swelling or change of structure in a part, are either determined by a previous process of inflammation—leading to chronic abscess and induration—or belong to the simple or non-malignant order of tumours.

Now, the practical distinction, or *diagnosis*, to use the technical phrase, of these different tumours is founded upon a very careful and delicate appreciation of the characters of the malignant and non-malignant tumours, considered as morbid products, and also upon a thorough knowledge of the anatomy and relations of the textures in which they arise. The attempt, therefore, to determine the character of a particular growth must always call for the highest qualities of the surgeon—large experience, minute and thorough knowledge of natural and morbid structure and function, and a full and judicial consideration of all the various facts of the case. Indeed the difficulties of the inquiry are such that even in the dead body, or in a tumour excised from the living body, all the resources of the anatomist, aided by the microscope, will occasionally fail in distinctly and surely discovering the true character of the morbid structure.

Generally speaking, a tumour may be said to fall under the suspicion of being cancer when it more or less completely infiltrates the texture in which it arises, and passes from it into the surrounding textures; when it invades the lymphatic glands adjoining the part first affected; when it is attended by stinging or darting pains, or by obstinate and slowly extending ulceration, not due to pressure; when it occurs in a person having impaired health, or past the middle period of life, and is not traceable to any known cause of inflammatory disease or local irritation, nor to any other known constitutional disease, such as syphilis or scrofula. The probabilities are of course increased if the tumour be in one of the habitual seats of cancer, or if it be attended by evidence of disease in some internal organ known to be frequently thus affected. But it is hardly necessary to point out that the very complex elements of diagnosis here referred to ought to be always submitted to the scrutiny and judgment of a well-educated medical adviser, whose skill and personal character place him above suspicion, before the disease has assumed such a form as to be beyond the reach of remedial procedure. The patient who broods in secret over a suspicion of cancer, or who declines to apply for advice from a fear of encountering the truth, is in all probability only cherishing the seeds of future suffering; while if, as often happens, the suspicion is unfounded, a few minutes' careful examination would suffice to remove a source of misery which otherwise would poison the mind for years.

These remarks apply still more emphatically to the misguided persons who trust to the non-professional *cancer-curer*, or to the quasi-professional specialist. The charlatan who pretends to hold in his hands a secret remedy for this most terrible disease, will invariably be found to pronounce almost every tumour cancer, and every cancer curable. By this indiscriminating procedure, and by the fallacious promise of a cure without an operation, many persons who have never been affected with cancer at all, have been persuaded to submit to the slow torture of successive cauterisations by powerful caustics, at the expense of needless mutilation and no small risk to life. In other cases, truly cancerous tumours have been removed slowly and imperfectly, at the cost of frightful and protracted sufferings, only to return at the end of a few weeks; and Sir Spencer Wells has shown that in some notorious instances persons were reported as cured when they had actually died of the disease at no long period after the supposed cure was stated to have taken place. (*Cancer and Cancer-curers*, 1860.)

The occasional spontaneous disappearance of cancerous tumours alluded to above warrants the hope that a means may some day be found of inducing by drugs or otherwise the occurrence of a curative process thus shown not to be beyond the possible. As yet, however, it is only a hope; for none of the many remedies that have been suggested has ever stood the test of experience. The only means of cure yet recognised is complete removal of the tumour by operation or by caustics. It is only in the earliest stage of the disease that there is any prospect of a successful result; and unfortunately the majority of patients present themselves to the surgeon when that stage has passed. Moreover, even in cases where the tumour has been early and freely removed, recurrence too often disappoints the hopes of the patient and the surgeon. But when the tumour is seen early, when there are no secondary growths, and when the patient's health is good, it is considered by the great majority of surgeons that he should be given the chance of cure which an operation affords.

In aged persons the question often resolves itself into a calculation of the chances of life, founded on a great number of conflicting data, and only to be solved by a careful attention to the state of the general health, as well as to the rate of progress of the local disease. Operations are now very rarely performed after the lymphatic glands are involved, or when there is evidence of a deteriorated constitution, or of internal disease; but sometimes great pain, or profuse and exhausting discharge from an external tumour, may justify its removal, as a palliative measure, even under these unfavourable circumstances. For the mode of removal of cancerous and other tumours, see TUMOURS.

Among the lower animals this disease is more rare; nevertheless, cases are not unfrequent, presenting the same malignant characters as those observed in the human subject.

Cancer Root, or BEECH-DROPS (*Epiphegus virginiana*), a parasitic herb of the order Orobánchee (q.v.), a native of North America, growing on the exposed roots of beech-trees. The whole plant is powerfully astringent, and the root is especially bitter and nauseous. In conjunction with arsenious acid, it is believed to have formed a medicine once famous in North America under the name of *Martin's Cancer-powder*.—Another American plant of the same order, *Phelipæa biflora*, sometimes shares the same name and repute in popular medicine; and an infusion of the Common Broomrape (*Orobanche major*)—a native of Britain and of the south of Europe, parasitic on the roots of broom, furze, and other leguminous plants—has been employed as a detergent application to foul sores.

Candle, a cylinder of wax, paraffin, or fatty matter, inclosing a central wick, and intended for giving light. The chief raw materials employed in the manufacture of candles are wax and spermaceti for the more expensive kinds, and tallow, palm-oil, and paraffin for those in general use. Candles are made in three ways—viz. by basting and rolling, by dipping, and by moulding. The first method, basting followed by rolling, is employed in the case of wax, which cannot be moulded satisfactorily on account of its great contraction on cooling and the tenacity with which it adheres to the moulds. Dipping is employed in the case of tallow dips and the more modern 'snuffless dip' candles, both of which are used when a large flame is desired that is not readily extinguished in a draught. The bulk of the candles in use are made by the third method—viz. moulding. As a large proportion of the candles consumed in the present day are composed of stearin or paraffin, or mixtures of these, the production of these substances therefore deserves most attention. Paraffin candles are most largely used in the United Kingdom, but on the Continent stearin candles are preferred.

Stearin.—This is the trade name for stearic and palmitic acids and mixtures thereof. Previous to the classical researches of Chevreul (1811–25) oils and fats were regarded as simple organic substances, but he proved them to be compound bodies. The neutral fats as they occur in nature are mixtures in variable proportions of the solids stearin or palmitin, and the liquid olein. Thus, fresh tallow consists of a mixture of stearin and olein, and neutral palm-oil of palmitin and olein. These bodies are known to chemists as glycerides or saponifiable fats—that is to say, when heated with an alkali, alkaline earth, or metallic oxide, in the presence of water, soap is formed, and glycerin is set free. When an alkali is used, the soap is soluble in water; but when an alkaline earth—e.g. lime—is employed, an insoluble soap is formed. When the soap is decomposed by the action of sulphuric acid, the fatty acids are liberated, and an insoluble sulphate of lime produced. Thus, from olein are obtained glycerin and oleic acid; from stearin, glycerin and stearic acid; and from palmitin, glycerin and palmitic acid. Chevreul, in conjunction with Gay-Lussac, began the industrial attempt of applying the scientific principles he had discovered, but he was unsuccessful, and it was left to another Frenchman, M. de Milly, to lay the foundation of the stearic acid industry in 1832. The researches of Messrs G. Wilson and Jones in 1842–43, which showed how dark fats could be converted into white fatty acids, gave a great impetus to the manufacture. Up to the time of the introduction of Messrs Wilson and Jones' acidification method, only tallow of good colour was available for conversion into fatty acids.

The process in most general use for converting fats into glycerin and fatty acids (distilled stearin) is briefly as follows: A mixture of palm-oil and tallow is digested in a copper vessel, called an 'autoclave,' with water and a small quantity (about ½ per cent.) of lime under a pressure of eight atmospheres, and the result is the production of a dilute solution of glycerin ('sweet water') and a mixture of palmitic, stearic, and oleic acids, partly in combination with the lime used as the decomposing agent. The contents of the autoclave are transferred to a tank whence the 'sweet water' is drawn off, and the lime is then separated from the fatty acids by means of sulphuric acid. The fatty acids, which are dark in colour, are now treated with sulphuric acid at a high temperature, and subsequently well boiled with water, and then distilled. The distillate is of a good white colour, and may be used for composite or snuffless dip candles. The next stage in the process is the separation by hydraulic pressure, cold and hot, of the liquid oleic acid from the solid fatty acids. The oleic acid (technically 'olein') is used chiefly by wool-workers for oiling the wool. The solid fatty acids (technically 'stearin') is now ready for the candlemaker. The process here described is employed for the manufacture of what is known in the trade as 'distilled stearin;' but a harder and more expensive material, known as 'saponified stearin,' is prepared from tallow of good colour by saponification and hydraulic pressure, but without acidification or distillation.

Paraffin.—This substance was practically unknown to the candlemaker until 1847–50, when the late Dr James Young discovered the method of producing hydrocarbons by the distillation of coal at a low red heat. It is now produced in Scotland from shale in large quantities, in the United States from petroleum, in Germany, in smaller quantities, from brown coal, and in Burma, in yet smaller quantities, from Rangoon petroleum. Crude paraffin (technically 'scale') contains, in addition to the harder paraffins suitable for candles, soft paraffin (used by match-makers), and a small proportion of oil. The refining of paraffin is a very simple matter, and is now generally carried on in the way introduced into the works of Price's Patent Candle Company, by the inventor, Mr Hodges. The scale is melted and cast into thin cakes, which are then placed on sloping shelves in an oven kept at a regulated temperature sufficiently high to melt the soft paraffin. The soft paraffin and oil flow away, and leave behind a mass of hard paraffin, which, after a treatment with ivory or other black, is ready for the candlemaker.

Candle Moulding.—Before describing the manner in which stearin, paraffin, and other candles are moulded, the wicks need attention. Previous to the introduction of plaited wick almost all candles needed to be snuffed from time to time—that is to say, the imperfectly consumed wick standing in the midst of the flame had to be removed by snuffers, a necessary domestic instrument resembling a pair of scissors with a small box attached to one of the limbs. With the plaited wick (which was introduced in France in 1825 by Cambacères) snuffing is not required, for during combustion the wick bends over, so that the heated extremity receives a supply of oxygen, and is completely consumed. Before being used the wick is steeped in a solution of borax and sulphate of ammonia, and afterwards thoroughly dried, the object of this chemical preparation being to allow of the regular removal during combustion of the ash of the wick in minute glassy particles. But for this treatment the ash would remain to impede the capillary action of the wick.

The modern candle-moulding machine is the result of the labours of several inventors, both English and American. It may be described as an oblong cast-iron box, a little deeper than the length of the candles, supported and fixed to frames at each end. On the top of the box, and partly within it, are fixed two cast-iron dishes or troughs; at the bottom of these troughs, and also at the bottom of the box, are drilled holes to receive the candle-moulds, to which they are securely and accurately fitted so as to be quite watertight. Under the box is an iron plate, called the rising table, having holes coinciding with the holes in the box; this is actuated by a rack and pinion or wheel fixed to the frames so that the table can be raised or lowered at pleasure. Under the table is fixed a box to hold the bobbins on which the wick is wound, one bobbin for each mould.

The moulds may be described as tapered tubes, one end being contracted inside so that a nut may be screwed thereon; the part of the mould in which the tip of the candle is cast or moulded is made separate from the body of the mould, but it is accurately fitted to the bottom part of the mould so that no hot candle material can leak past it; this tip is fixed to one end of an iron tube, the other end of the tube being fixed to the iron table, so that when the table is raised or lowered the tips are raised and lowered also; the tips thus become a plunger to force the candles out of the moulds. There is a small hole through each tip just large enough to admit the cotton wick, and when the table is lowered the wicks are pulled down so as to be straight and central in the moulds. To complete the machine it is necessary to have two movable clamps to hold one set of candles while another set is being moulded. It is necessary also to attach a steam and water pipe to the cast-iron box so as to warm or cool the moulds. The candle is cast downwards, the top of the candle being at the bottom of the mould.

The bobbin-box having been filled with the bobbins upon which is wound the properly prepared wick, one end of each wick is pulled through the tubes and little holes in the tips by means of an elongated crochet-hook, the table is lowered and the moulds brought to a proper temperature by the surrounding water that had been warmed by turning on the steam for a short time. The candle material in a melted state is then poured into the dishes or troughs, so filling the moulds and partly filling the troughs—the material in the troughs being needed to make up for the contraction while cooling. As soon as the moulds are full, cold water is turned into the box in order to cool the candles speedily; and when they are sufficiently cooled, the superfluous material is scraped out of the troughs. The table is now raised, forcing the candles out of the moulds and into the clamps which had been placed on the machine to receive them. The clamps are then closed, thus holding the candles over the moulds, and the tips are withdrawn by lowering the table, leaving the candle-machine ready for a second lot of candles.

The production in the United Kingdom of paraffin, stearin, and composite candles is estimated to be about 38,000 tons per annum. The largest candlemaking establishment in the world is that of Price's Patent Candle Company, whose works are situated near London and Birkenhead.

Corpse candles are candles used at the watching of a corpse before interment, and the name is given also to Will-o'-the-wisp, as portending death. For candles in public worship, see LIGHTS (USE OF).

Candleberry, CANDLEBERRY MYRTLE, WAX TREE, WAX MYRTLE; TALLOW TREE, or BAYBERRY (*Myrica cerifera*), a small tree, or more generally a low spreading shrub, a native of the United States, most abundant and luxuriant in the south. The evergreen leaves are dotted with resin-glands, and are fragrant when bruised. The drupes—popularly called berries—are about the size of peppercorns, and when ripe, are covered with a greenish-white wax; the wax is collected by boiling them and skimming, and is afterwards melted and refined. A bushel of berries will yield four or five pounds. It is used chiefly for candles, which burn slowly with little smoke, and emit an agreeable balsamic odour, but do not give a strong light. An excellent scented soap is made from it. Several species are found at the Cape of Good Hope, one of which (*M. cordifolia*) bears the name of Wax Shrub, and candles are made from its berries. The well-known Bog Myrtle (q.v.) or Sweet Gale is *M. Gale*.

Canker is a malignant disease of the horse's foot, which is sometimes hereditary, and affects certain localities more than others. It usually attacks horses which have large fleshy-looking frogs, and commences by discharge from the heels or the cleft of the frog. The horn becomes soft and disintegrated, the vascular structures beneath become inflamed, and the pain which the animal endures is sometimes intolerable. It is therefore very lame on one, two, or all feet, according to the number affected. Though there is no constitutional fever, the horse becomes emaciated and unfit for work. During wet weather, and on damp soil, the symptoms increase in severity. The sore structures bleed on the least touch, and considerable fungoid granulations, commonly called proud flesh, form rapidly, and there is a continuous discharge of a whitish-coloured fluid, which has an offensive smell. This disease is occasionally hereditary, and it is most frequently seen in lowbred draught or coach horses, though it also, with too much frequency, affects thoroughbred Clydesdale and other stallions. Dirt, cold, and wet favour the production of the disease, and there is always a tendency to relapse when once an animal has been affected. By way of treatment, pare away detached portions of horn, and, in mild cases, sprinkle powdered acetate of copper over the sore; apply over this pledgets of tow, fixed over the foot by strips of iron or wood passed between shoe and foot. In severe cases, tar and nitric acid, creosote and turpentine, chloride of zinc paste, and other active caustics, have to be used for a time with the regular employment of pressure on the diseased surface. The animal requires to be treated constitutionally by periodical purgatives and alteratives. Good food, fresh air, and exercise often aid much in the treatment of the disease. Unfortunately, many cases, though subjected to every possible treatment, become worse and worse. The disease spreads under the sole of the foot, and causes such great pain and lameness that the animal dies. Other cases again do not get better, though the inflammation subsides, but remain at a standstill; and such horses, if the canker is carefully dressed daily, may do slow work for a year or two.

Capillaire, a medicinal syrup, used as a pectoral in chronic catarrhs, formerly prepared by adding sugar and orange-flower water to an infusion of the maidenhair fern, now more generally applied to any flavoured syrup.

Caproic, Caprylic, and **Capric Acids** are represented by the formulæ $HC_6H_{11}O_2$, $HC_8H_{15}O_2$, and $HC_{10}H_{19}O_2$, and are members of the acetic or fatty-acid series. They derive their names from *capra*, 'a goat,' in consequence of their more or less resembling in smell the odour of that animal. They may all be obtained from butter by pressing out the portion which remains liquid at 60° (15·5° C.), saponifying this oil, and distilling the soap which is then formed with sulphuric acid. The liquid which passes over contains, along with butyric acid, these three acids, which, by being converted into baryta salts, are separable from one another. All three of these acids are also obtained by the oxidation of oleic acid by nitric acid; and capric acid is also obtained by acting upon oil of rue with fuming nitric acid; hence it is frequently called *rutic acid*. Each acid forms a series of salts, Caproates, Caprylates, and Caprates; but the inorganic ones, such as those containing barium, potash, and soda are of little importance. The Ethyl and Methyl salts, however, resemble each other, and by virtue of their pine-apple flavour, similar to that of Butyric Ether (q.v.), are sometimes used in the production of artificial fruit-essences.

Capsicum, a genus of Solanaceæ, yielding the powerful condiment variously known as Pod Pepper, Red Pepper, Guinea Pepper, Chillies, Capsicum, &c. The species are all of a shrubby, bushy appearance, and have more or less woody stems, although they are annual or biennial plants. Some of them are in very general cultivation in tropical and subtropical countries for their fruit, which is extremely pungent and stimulant, and is employed in sauces, mixed pickles, &c., often under its Mexican name of *Chillies*; and when dried and ground, forms the spice called *Cayenne Pepper*. As a condiment it improves the flavour of food, aids digestion,

Capsicum annuum.

and prevents flatulence; while in medicine, besides being sometimes given to promote digestion, it furnishes a useful local stimulant, especially as a gargle, and sometimes also as a liniment. The so-called *capsicin* is a mixture of resinous and fatty matters, with a volatile alkaloid. The species and varieties are not easily discriminated; their fruits especially differing in form, size, and colour, but Flückiger and Hanbury ascribe the supplies of capsicum imported to Britain to two species: (1) *C. fastigiatum*, as furnishing the greater quantity of pod pepper; and *C. annuum* (*longum*, *grossum*), as yielding the larger sorts of this, as well as most of the cayenne pepper imported as powder.

Carat. Goldsmiths and assayers divide the troy pound, ounce, or any other weight into 24 parts, and call each a carat, as a means of stating the proportion of pure gold contained in any alloy of gold with other metals. Thus, the gold of our coinage and of wedding-rings, which contains 22/24 of pure gold, is called '22 carats fine,' or 22-carat gold. The lower standard, used for watch-cases, &c., which contains 18/24 of pure gold, is called 18-carat, and so on. The carat used in this sense has therefore no absolute weight; it merely denotes a ratio. This, however, is not the case with the jewelry carat used for weighing diamonds and other precious stones, pearls, &c., which has a fixed weight, equal to 3⅙ troy grains, and is divided into quarters, or 'carat grains,' eighths, sixteenths, thirty-seconds, and sixty-fourths. These carat grains are thus less than troy grains, and therefore the jeweller has to keep a separate set of diamond weights. Even the carat with fixed weight varies in various countries—from about 216 milligrams in Leghorn to 195 in Florence. In England it is 205·3090 milligrams; in France, 205·5000.

The name seems to have come through the Arabic *qirrat* from the Greek *keration*, the fruit of the Carob (q.v.) or locust-tree (*Ceratonia siliqua*), used also as a weight. The origin of the word has also been sought in *Kuara*, the native name of the *Erythrina Abyssinica*, or coral-tree, the seeds of which, it is said, were very equal in size, and were used for weighing gold and precious stones.

Caraway (*Carum Carvi* or *Carui*), a species of Umbelliferæ, which has long been valued and cultivated in Europe for the sake of the well-known aromatic 'caraway seeds' which it bears; these being, however, in strictness not seeds, but the *mericarps*, into which the fruit in this order splits when ripening (see UMBELLIFERÆ). Their properties are due to the volatile caraway-oil, which is contained in the large oil-glands (*vittæ*) of the fruit, and is distilled on a large scale, chiefly for the preparation of the liqueur known as *kummel*, but also for use in perfumery and in pharmacy, as an aromatic stimulant and flavouring ingredient. Caraways are, however, chiefly used entire as a spice by bakers and confectioners, and the cultivation of the plant thus attains considerable importance, particularly in Germany and Holland.

Carbazotic Acid. See PICRIC ACID.

Carbides, formerly termed *carburets*, are the compounds of carbon with the various metals. The carbides of iron are the most important, and it is to the addition of carbon, in one way or other, that we are indebted for the valuable properties of cast iron and steel, both of which contain carbides.

Carbohydrogens. See HYDROCARBONS.

Carbolic Acid, PHENOL, or PHENIC ACID, C_6H_5OH, is one of the most important substances derived from coal-tar. Although called an acid, and forming salts, it is neutral to test-paper, and has more in common with the alcohols than with the acids (see ACIDS and ALCOHOLS). It is obtained by distilling coal-tar, reserving the portion passing over between 356° and 374° (180°–190° C.). After rectification, this constitutes the crude carbolic acid used so largely for disinfecting purposes. By careful purification it can be obtained pure, when it forms minute white or colourless plates or needles, possessing a burning taste, and an odour resembling that of creosote. By exposure to the air it becomes pinkish, but is not otherwise injured. It rapidly absorbs water from the air, forming an oily liquid, which does not readily mix with water until about 15 volumes have been added, when it forms a solution. Carbolic acid is apt to be confounded with cresylic acid and creosote, which possess an odour somewhat similar. This remark applies only to the liquid acid, as neither of these substances can be crystallised. Liquid carbolic acid has no action on polarised light, in this respect differing from creosote. Carbolic acid is readily soluble in alcohol, ether, chloroform, glycerin, olive-oil, and volatile oils. Although called an acid, it forms but very weak combinations with the alkalies, some of the so-called carbolates used for disinfecting purposes being probably only earthy substances mixed with carbolic acid.

In solution carbolic acid coagulates albumen, arrests fermentation, destroys parasites, whether animal or vegetable, and prevents moulding or putrefaction. Owing to these valuable properties it has come largely into use as an antiseptic and disinfectant. Applied to the cavity of a decayed tooth it quickly relieves certain forms of toothache, acting as a local anæsthetic. Owing to its powerful action on the mucous membranes, it must not be allowed to touch the interior of the mouth. Taken internally, concentrated carbolic acid acts as an irritant poison, accompanied by a numbing of the stomach, which prevents the action of emetics. Medicinally, carbolic acid may be given in doses of one to three grains dissolved in glycerine or water. See ANTISEPTIC SURGERY.

Carbon (sym. C; atomic weight 12) is one of the elementary substances most largely diffused in nature. It occurs uncombined in the mineral graphite or Black Lead (q.v.), and in the Diamond (q.v.), which is pure crystallised carbon. It is much more abundant, however, in a state of combination. United with oxygen, it occurs as Carbonic Acid, CO_2 (q.v.), in the atmosphere, in natural waters, in limestone, dolomite, and ironstone. In coal it is found combined with hydrogen and oxygen; and in plants and animals it occurs as one of the elements building up wood, starch, gum, sugar, oil, bone (gelatin), and flesh (fibrin). Indeed there is no other element which is so characteristic of plant and animal organisms, and it ranks as the only element never absent in substances obtained from the two kingdoms of organic nature. Wood charcoal, coke, lampblack, and animal charcoal are artificial varieties, more or less impure, of carbon. The specific gravity of the different forms of carbon greatly varies; that of the diamond being 3·330 to 3·550, while graphite is only about 2·300. Carbon, in its ordinary forms, is a good conductor of electricity; in the form of diamond, it is a non-conductor. Of heat, the lighter varieties of carbon, such as wood charcoal, are very bad conductors; graphite in mass has very considerable conducting powers. At ordinary temperatures, all the varieties of carbon are extremely unalterable; so much so, that it is customary to char the ends of piles of wood which are to be driven into the ground, so as by this coating of non-decaying carbon to preserve the interior wood; and with a similar object, the interior of casks and other wooden vessels intended to hold water during sea-voyages, is charred (coated with carbon), to keep the wood from passing into decay, and thereby to preserve the water sweet. Even as regards combustion there is a marked difference. Wood charcoal takes fire with the greatest readiness, bone-black (animal charcoal) less so; then follow in order of difficulty of combustion—coke, anthracite, lampblack, black lead, and the diamond. Indeed, black lead is so non-combustible, that crucibles to withstand very high temperatures for prolonged periods without breakage or burning, are made of black lead; and the Diamond (q.v.) completely resists all ordinary modes of setting fire to it. In the property of hardness carbon ranges from the velvet-like lampblack to diamond, the hardest of gems. In 1879 it was announced that a method of producing pure crystallised carbon, or diamond, had been discovered, but, so far, the artificial crystals obtained have only been of microscopic size.

Besides the physical properties already alluded to, carbon possesses very remarkable absorbent powers; enabling it not only to decolourise syrupy liquids (see CHARCOAL, ANIMAL), but also to absorb gases. Thus freshly ignited wood charcoal will absorb ninety times its own volume of ammonia gas, and sixty-five times its volume of sulphurous anhydride gas. Owing to this property it has many important uses. When employed in the construction of respirators, so arranged that the air is drawn through a layer of charcoal, it is possible to breathe an atmosphere which otherwise would be irrespirable. Water and wine which have become tainted may be readily rendered wholesome by means of charcoal; while as a remedy for troublesome flatulence and as a tooth-powder, its value lies in the absorbent power referred to.

Gardeners find that when it is mixed with potting-soil it prevents the souring of the soil, which is so injurious to the finer varieties of plants.

Most of the filters so much in use nowadays for the purification of water contain charcoal, which not only removes organic matter, but even lessens the hardness of the water. For decolourising liquids bone-black is preferable. The varieties of carbon, as mentioned above, differ very considerably in the readiness with which they combine with oxygen; but when burned they all yield Carbonic Anhydride, CO_2 (see CARBONIC ACID). Carbon forms another oxide, called carbonic oxide, CO, when it is burned with only a limited supply of air. When heated with sulphuric acid carbon decomposes it, forming carbonic oxide and sulphurous anhydride. Thus:

$$\underset{\text{Carbon.}}{C} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Sulphurous Anhydride.}}{SO_2} + \underset{\text{Carbonic Oxide.}}{CO} + \underset{\text{Water.}}{H_2O}.$$

Carbon unites with metals to form Carbides (q.v.), the chief of which are those of iron. With hydrogen carbon forms a very important class of organic compounds, including such unlike substances as turpentine, oil of lemon, $C_{10}H_{16}$, and marsh gas, CH_4. As carbon unites with nearly all the elements to form chlorides, bromides, &c., the number of carbon compounds is virtually unlimited (see AROMATIC SERIES), and those already known far surpass in numbers all other chemical compounds put together. When carbon is obtained sufficiently dense, it is found to be a good conductor of electricity, and to make an excellent electro-negative element in a galvanic pair. For this purpose graphite and the hard incrustation of carbon found in gas retorts are admirably suited; but, owing to their comparative scarcity, recourse is had to an artificial method of preparing dense carbon, devised by Professor Bunsen of Heidelberg. The carbons thus obtained for galvanic batteries, owing to their efficiency and cheapness, have given a great impetus to electrical work. The following are the more important steps in the process: A mixture of two parts of coke and one of coal in powder is placed in an iron mould and heated in a furnace. As soon as the liberation of gas has ceased, the mould is allowed to cool, and on opening it a carbon block is obtained which may be ground to the desired size. Although hard, it is still far too porous, and to remedy this it is soaked in thick gas-tar, allowed to dry, and finally heated in a fireproof crucible for some time. A second or even third time this may be repeated, care being taken to prevent the access of air to the crucible, and eventually a carbon very dense, sonorous when struck, and a good conductor of electricity, is obtained.

For a reference to the manufacture of charcoal, see separate article; and see ELECTRIC LIGHT.

Carbonated or **Acidulous Waters** are those which contain a great excess of carbonic acid gas. They may be divided into the artificial and the natural. The former are treated of under Aerated Waters (q.v.), and the latter under Mineral Waters (q.v.).

Carbonic Acid, CARBON DIOXIDE, or CARBON ANHYDRIDE, also called Fixed Air or Choke-damp, exists as a normal constituent of the atmosphere, of which it forms about $\frac{1}{2500}$th part. While enormous quantities of it are poured into the atmosphere by the respiration of animals and by the combustion of fuel in our furnaces, this proportion scarcely seems to vary; for, as plants absorb carbonic acid by the leaves, and therefrom obtain the carbon necessary for the formation of wood, they remove it as fast as it is produced, and thereby keep the atmosphere in a state suitable for animal life. Carbonic acid also exists in combination as *carbonates*, the most largely distributed of which are the carbonate of lime, $CaCO_3$, either alone, or in combination with magnesium as *dolomite*, the blackband ironstone (carbonate of iron, $FeCO_3$), malachite (basic carbonate of copper, $CuH_2O_2,CuCO_3$), &c. The term *carbonic acid* is hardly a correct one, and it is better to call the gas, CO_2, carbon dioxide or carbonic anhydride, reserving the term carbonic acid for the solution in water. The gaseous carbonic acid is represented by the formula CO_2, and contains 12 parts of carbon and 32 parts of oxygen by weight. It is a very dense gas, having a specific gravity of 1·529, that of air being 1·000. In consequence of this it can be poured from one vessel to another like a liquid; while in vats in which it is being disengaged by fermentation, it remains at the bottom, for some time even when freely exposed to the air, giving rise to fatal accidents when workmen carelessly enter them. Carbonic acid is a colourless gas, possessing a pleasant acidulous taste. Under a pressure of about forty atmospheres (600 lb. per square inch) it becomes condensed to a liquid. When the liquid carbonic acid is allowed to escape through a small jet, it rapidly evaporates and produces intense cold, with the result that a certain portion becomes frozen into a solid resembling snow. The solid carbonic acid volatilises without becoming liquid, and by the low resulting temperature produces strange phenomena. Thus when pressed on the skin it produces the sensation of burning, and when thrown into a hot crucible along with mercury, the latter (under suitable conditions) becomes frozen into a solid mass.

At ordinary pressures carbonic acid is soluble in about its own bulk of water, its solubility increasing with increased pressure. This property is taken advantage of in the manufacture of Aerated Waters (q.v.), the sparkling appearance of which is due to the liberation of carbonic acid. Carbonic acid is non-combustible, and it does not support combustion or animal life. A lighted taper is immediately extinguished when plunged into a vessel containing carbonic acid, and this simple experiment is used to test if workmen may safely enter a vat which has contained the gas. Although irrespirable by itself, acting as it does, like water, by causing spasm of the glottis, it can be breathed when diluted with air, and in such circumstances it acts as a narcotic poison, even so small a proportion as 4 per cent. acting rapidly. In much less quantity it causes depression and headache, but in aerated water works, where carbonic acid gas is liberated in quantity, it has never produced this effect, probably owing to the efficient ventilation. The French suicides who make use of a charcoal fire to terminate their existence, are partly poisoned by the carbonic acid, and partly by the Carbonic Oxide (q.v.) produced by the burning carbon.

Carbonic acid may be very readily prepared from chips of marble, water, and hydrochloric acid, which are placed in a glass bottle furnished with suitable tubes (see *fig.*). The hydrochloric acid, HCl, acts on the marble, $CaCO_3$, forming chloride of calcium, $CaCl_2$, and water, H_2O; while the carbonic acid gas, CO_2, escapes with effervescence, and may be collected in suitable vessels. Carbonic acid, as indicated before, is the principal product of combustion; the carbon of the burning substance (wood, coal, paper, coal-gas, &c.) uniting with the oxygen of the air to form carbonic acid. It is also a product of Respiration (q.v.), and is evolved more or less largely by all animals not only by the lungs, but also by the skin. During the Fermentation (q.v.) of beer or wine it is liberated, while decaying vegetable or animal matters give off the gas in quantity. There is a popular prejudice against having plants in a bedroom during the night-time. This is based on the fact that plants give off carbonic acid in the dark, while they absorb it during the day. Plants also liberate carbonic acid during the flowering season, but the total amount from these two sources is so very small, that a single gas-burner will vitiate the air of a room more rapidly than a large collection of plants. The prejudice based on the carbonic acid theory seems therefore to be practically groundless. Carbonic acid forms two classes of salts, called *carbonates* and *bicarbonates*. The bicarbonates differ from the carbonates in containing twice as much carbonic acid gas relatively to the base. Thus carbonate of soda, Na_2CO_3, may be regarded as consisting of soda, Na_2O, and carbonic acid, CO_2; while the bicarbonate, represented in the same way, would be $NA_2O + H_2O + 2CO_2$, or shortly, $2NaHCO_3$ (see SODA, SODIUM). The bicarbonates very readily lose the extra molecule of carbonic acid, yielding then the ordinary carbonate. For the carbonates of potash and of iron, see POTASH, IRON.

The bicarbonate of lime is interesting as being the form in which most of the lime present in drinking water is held in solution. When the rain, impregnated with carbonic acid from the atmosphere, or charged with the gas from subterranean sources, percolates down through a chalky soil, it dissolves the chalk, or carbonate of lime, $CaCO_3$, forming a bicarbonate, and thus becomes what is known as a *hard* water. Such a water may be readily *softened* by boiling, when the carbonic acid escapes, and the chalk, no longer soluble, falls to the bottom. This gives rise to the domestic phenomenon known as the furring of the kettle. A solution of slaked lime in water (the lime-water of the shops) forms a ready test for carbonic acid. Thus, if a little be placed in a wine-glass, and a steady stream of expired air from the lungs be blown into it, a turbidity will soon be noticed, due to the formation of carbonate of lime. On continuing to blow, the carbonic acid dissolves this up, and a clear solution of bicarbonate is obtained.

Other carbonates, such as those of silver, iron, copper, baryta, &c., are not of sufficient importance to warrant further notice here.

Carbonic acid in solution forms a refreshing drink in feverish states of the system, while in nausea and gastric irritation its value is very considerable. It acts also as a diuretic, and probably, when taken in moderation, as a stomach tonic. Owing to its sparkling properties it is used to conceal the taste of many drugs; and the granular effervescing preparations, such as citrate of magnesia, now so widely known, have come into use mainly on account of the ease with which nauseous drugs may be administered under the guise of an effervescing drink. In the form of gas, carbonic acid is said to be beneficial in the irritable states of the larynx, owing to its exercising a slight local anæsthetic action.

The carbonates possess mainly the medicinal properties of the bases, than which they are less irritating, the soda, potash, lime, and magnesia salts being recognised antacids. The magnesia salt, in the form of the bicarbonate, is well known as 'fluid magnesia,' which possesses both antacid and aperient properties.

Carbonic Oxide is the lower oxide of Carbon (q.v.), and is represented by the formula CO. It consists of 12 parts by weight of carbon and 16 parts of oxygen. It does not occur naturally, but may be observed burning with a pale-blue flame in fireplaces and stoves, especially in frosty weather. During the combustion of the fuel at the lower part of the grate the oxygen of the air unites with the carbon of the fuel to form carbonic acid, CO_2; and this gas rising up through red-hot coal or carbon, C, has part of its oxygen abstracted by the carbon, and two molecules of carbonic oxide, CO, are produced, which taking fire on the top of the coals, burn with the characteristic blue flame, abstracting more oxygen from the air, and re-forming carbonic acid, CO_2. Carbonic oxide can be prepared for experimental purposes by heating in a retort a mixture of oxalic acid, $H_2C_2O_4$, and sulphuric acid, H_2SO_4, when the latter abstracts the water from the oxalic acid, and the other elements, C_2O_3, escape as carbonic acid, CO_2, and carbonic oxide, CO. On passing the mixed gases through a solution of potash, KOH, the carbonic acid is retained as carbonate of potash, K_2CO_3, whilst the carbonic oxide remains as gas. Carbonic oxide is a transparent, colourless gas, with an oppressive odour. It is rather lighter than air, its specific gravity being only ·968. In this it differs very markedly from Carbonic Acid (q.v.). For many years it resisted all attempts to liquefy it, but at last, on December 2, 1877, it yielded to the modern methods of combined cold and pressure. It burns with a blue flame, but is a non-supporter of combustion, and at once extinguishes a lighted candle introduced into it. It is very poisonous, and even when largely diluted with air, if inhaled, it produces a sensation of oppression and tightness of the head, and ultimately acts as a narcotic poison. It enters into many compounds known to the organic chemist, such as urea. It is used in Siemens's and other 'producer' gases, of which it is a principal ingredient; and is the most important reducing agent in blast-furnace processes.

Carbuncle, so called from the two prominent symptoms—a glowing fiery redness, and a burning pain—is closely allied to Boil (q.v.), but the symptoms, both local and general, are much more severe. It consists of an inflammation, caused by some vitiated condition of the blood, or some atmospheric influence, attacking a patch of skin on the shoulders, nape of the neck, or indeed on any part of the body. The part swells slightly, feels hard, and this hardness extends deeply into the tissues; the pain is very severe, and the patient much depressed with loss of appetite, and general derangement of the secretions. As the disease advances, the redness assumes a dark purple or livid hue, the cuticle rises in blisters, and many small specks of matter appear on its surface, which discharge, and leave apertures like those in the rose of a watering-pot; through this a viscid purulent fluid escapes, and after some time the small sloughs or cores of the true skin which have been killed by the disease. In some cases the apertures meet, forming large openings, and in others the whole patch of skin sloughs and comes away.

The treatment of carbuncles consists in restoring the secreting organs to a healthy condition, the agents for which must depend on the individual case; in supporting the patient's strength by easily digested food, wine, brandy, and bark, with nitric acid; relieving pain by opiates, and encouraging suppuration with warm poultices; carrot, turnip, and yeast poultices being favourite applications in this disease. Sulphide of calcium in small doses is sometimes useful in arresting the disease.

Free incision has been strongly recommended by some surgeons; but has not been generally adopted. Quite recently (1888) early and complete removal of the sloughing tissue by cutting or scraping has been used with success. By this means it is said that the pain is arrested, the constitutional symptoms rapidly subdued, and the healing of the sore greatly hastened.

Carburet. See CARBIDES, CARBON.

Carburetted Hydrogen is a term in chemistry applied to several compounds of carbon and hydrogen. Thus, light carburetted or monocarburetted hydrogen, CH_4, is the gaseous compound popularly known as marsh gas and firedamp, and is the principal constituent of coal-gas (see GAS). Heavy carburetted or bi-carburetted hydrogen, C_2H_4, is otherwise known as Olefiant Gas (q.v.).

Cardamoms are the capsules of certain species of Zingiberaceæ (q.v.), particularly *Elettaria Cardamomum*, a flag-like perennial, abundant in the moist shady mountain forests of the Malabar coast, where they are largely cultivated on small clearings. The three-celled capsules contain numerous wrinkled seeds, which form an aromatic pungent spice, weaker than pepper, and with a peculiar but agreeable taste. On account of their cordial and stimulant properties they are employed in medicine, very generally to qualify other medicines; they are also used in confectionery, although not to a great extent in Britain; but in Asia they are a favourite condiment; and in Russia, Scandinavia, and Northern Germany they are used in almost every household to flavour pastry. Other plants belonging to the same order yield drugs employed under the same name, but all are of inferior value; thus *Amomum Cardamomum* of Siam, &c. yields Round Cardamoms, *A. xanthoides* Wild or Bastard Cardamom, &c.

Carminatives (from Lat. *carmen*, 'a charm'), medicines to relieve flatulence and pain in the bowels, such as cardamoms, peppermint, ginger, and other stimulating aromatics.

Carmine (Arabic *Kermes*) is the red colouring principle obtained from the cochineal insect (see COCHINEAL). The method by which it is prepared is said to have been accidentally discovered by a Franciscan monk at Pisa, while compounding a medicine containing cochineal; and in 1656 its manufacture was begun. There are several processes by which carmine may be prepared, all of which in effect depend on exhausting powdered cochineal with boiling water, and precipitating the pigment by the addition of a weak acid or an acid salt. The following is an example of the processes: Digest 1 lb. of cochineal in 3 gallons of water for 15 minutes, then add 1 oz. of cream of tartar, heat gently for 10 minutes, add ¼ oz. of alum, boil for 2 or 3 minutes, and after allowing impurities to settle, the clear liquid is placed in clean glass pans, when the carmine slowly separates and deposits. After sufficient time the liquid is drained off, and the pigment is dried in the shade. It is alleged that bright sunny weather is essential to the production of the finest qualities. Hence it is said the United Kingdom is unfavourably situated for the manufacture; but the fact is that details of successful processes are guarded with jealous care; and in all probability brightness and purity of product are due to important minor details in the manufacturing process. Carmine is soluble in water, weak spirit, and in ammoniacal solutions; the latter agent affording a ready means of detecting the presence of the adulterants—chalk, China clay, and vermilion—frequently added to the costly pigment. Carmine is a most beautiful pinky red, sometimes used for silk and wool dyeing, but more sought for colouring fine confections, and dyeing feathers and artificial flowers; and it is not unknown as cosmetic rouge. Carmine Lake, prepared with alumina, is a most important artist's colour. There are various other tinctorial agents known under the name of carmine, of which the commonest are Archil Carmine made from Archil (q.v.); Brilliant Carmine Red, a lake of Brazil-wood; Indigo Carmine, a purple preparation of indigo, and Sorgho Carmine, obtained from the juice of the sugar or Chinese Sorghum, *Sorghum Saccharatum*.

Carob, ALGAROBA, or LOCUST-TREE (*Ceratonia siliqua*), a tree of the order Leguminosæ, suborder Cæsalpinieæ, a native of the Mediterranean countries. In size and manner of growth it somewhat resembles the apple-tree, but with abruptly pinnate dark evergreen leaves, which have two or three pair of large oval leaflets. The flowers are destitute of corolla; the fruit is a brown leathery pod, 4 to 8 inches long, a little curved, and containing a fleshy and at last spongy and mealy pulp, of an agreeable sweet taste, in which lie a number of shining brown seeds, somewhat resembling small flattened beans. The seeds are bitter and of no

Branch of Carob.

use (although they were formerly used as weights by jewellers, and are said to be the original of their *carats*), but the sweet pulp renders the pods an important article of food to the poorer classes of the countries in which the tree grows. In Cyprus, &c., they are even pressed for their sugar, the residue being given with fodder. They are much used by the Moors and Arabs. They are also valuable as food for horses and cattle, for which they are much employed in the south of Europe, and are also imported into Britain under the name of Locust Beans, which name and that of St John's Bread they have received in consequence of an ancient opinion or tradition, that they and not the true (insect) locust are the 'locusts' which formed the food of John the Baptist in the wilderness. It seems more probable that they are the 'husks' (*keration*) of the parable of the Prodigal Son.—The Arabs make of the pulp of the carob a preserve like tamarinds, which is gently aperient.—The carob-tree is too tender for the climate of Britain, but its extensive introduction into the north of India has been recommended. The produce is extremely abundant, some trees yielding as much as 800 or 900 lb. of pods. The wood is hard, and much valued, and the bark and leaves are used for tanning.—The LOCUST-TREE (q.v.) of America is quite distinct from this.

Carpets. When and where the earliest carpets were made can only be matter of conjecture. Skins of animals covered with fur, and plaited plant stems, such as those of rushes, would in all probability be used as mats in prehistoric times. Sir G. Wilkinson states that imperfectly preserved fragments of woollen stuff, presenting the appearance of a carpet, were found at Thebes in Egypt. He also calls attention to a small ancient rug brought from Egypt to England. It is made of woollen threads on linen string, and has upon it the figures of a boy and a goose—the hieroglyphic of a child. But in Dr Birch's opinion this rug is of the Greek or Roman, not of the Pharaonic period. Carpets were in use in ancient Greece and Italy.

Persian Carpets.—The manufacture of these goes back to a very remote period. Indeed it appears to be certain that pile carpets were first made in Persia, and from that country introduced into India by the Mohammedan conquerors. The Persian habit of sitting and sleeping on the ground probably brought into use soft floor-coverings suited to such a custom. Even among the higher classes in Persia carpets constitute the whole furniture of a room, except a few ornaments placed in niches in the wall. A Persian not only sits and sleeps upon, but also makes a table of a carpet. Fine Persian fabrics of this kind are very highly prized for their beautiful and appropriate designs, and for the quiet harmony of their colours. They are of great durability. Sir Murdoch Smith states that the floor of the chief pavilion of the Chahal Situn palace at Ispahan is covered with a fine carpet which has been in use since the time of Shah Abbas, who reigned in the end of the 16th century. Persian pile carpets are made by firmly knotting tufts of woollen yarn on the warp threads, and these tufts are held in their place by the woof yarn. The finest are those of Kurdistan; but carpets are made in many parts of Persia, so also are felts or nŭmuds, the best of which are fully an inch thick. These felts are formed of camel's hair, more or less mixed with wool, and are ornamented on one side with inlaid devices. They are used to cover the sides and end of a room, and owing to their thickness are softer to sit upon than ordinary carpets. An attempt was made to introduce the making of Persian carpets after the Persian manner into Finland in 1888. At the sale of the Goupil collection in Paris in the spring of 1888, two small old Persian carpets, each 7 feet by 6 feet, brought respectively £800 and £1300. For three others, also of small size, the sum of £1500 was obtained. About £200 is believed to be the highest price hitherto paid in Persia itself for a small carpet. There are photo-engravings of two of Goupil's carpets in the *Gazette des Beaux-Arts* for 1885, and larger coloured illustrations of fine Persian carpets in the *Portfolio of Persian Art*, issued by the South Kensington Museum.

Indian Carpets.—Both cotton and woollen carpets are made in India. Those composed of cotton are chiefly made in Bengal and Northern India, and are usually in two coloured stripes, such as red and blue. They are often further ornamented with squares and diamond shapes, and occasionally with gold and silver. Sir George Birdwood, a high authority on the history of Indian manufactures, considers that the patterns upon these cotton carpets, as well as those upon portions of some native dresses, illustrate the most ancient ornamental designs of India. The patterns on the woollen pile carpets of India can be traced back to Persian originals, and both fabrics are made in the same way. Many of the older ones, as well as some quite recently made, are scarcely less remarkable than those made in Persia for their beauty and other meritorious qualities. In numerous parts of India, however, the designs have suffered from European influence. Fig. 1 shows an Indian carpet loom; those used in Persia are equally primitive. Carpets are made in Cashmere, the Punjab, Sind, and on the Malabar coast; also at Agra, Mirzapur, Jubbulpore, Hyderabad, Masulipatam, and elsewhere. Some silk and velvet carpets are likewise made in India.

Turkey Carpets.—Like the carpets of Persia, India, and North Africa, these are made on rude simple looms by knotting tufts of woollen yarn on the warp threads across the width of the carpet, and firmly binding the rows of these tufts by the weft. The most characteristic patterns of Turkey carpets are diamond shapes and zigzags—that is,

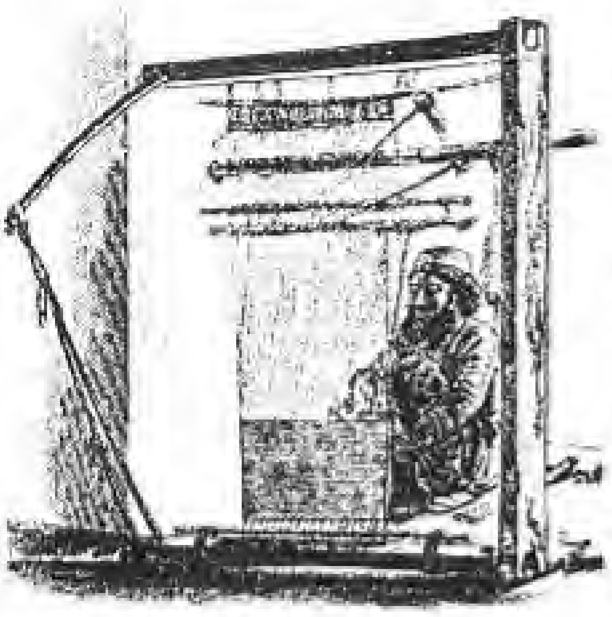


Fig. 1.—Carpet Loom, Cawnpore.

they are more purely geometrical than the Persian designs. The arrangement of the colours usually adopted produces a rich and pleasing effect, and the fabric from its mode of construction and depth of pile is extremely durable. Turkey carpets are chiefly made at Ushak, near Smyrna, in Asia Minor.

The carpets of the kind manufactured from 1755 till 1835 in England at Axminster, and still made to a small extent at Wilton, as well as some of the highly ornamental French carpets, such as those of Aubusson and Beauvais, are made on the same principle as oriental pile carpets.

Kidderminster or Scotch Carpet.—This is the oldest kind of machine-made carpet. It has no pile, the yarn of which it is composed lying flat upon the surface like an ordinary worsted cloth. In some respects, although coarser and stronger, it resembles a woollen damask of two colours, and like it is reversible. The pattern is most perfect on the face side, but if in this position it shows a purple flower on a green ground, then on the other side the flower is green on a purple ground. This would be a two-ply carpet, the purple portion forming a separate layer from the green portion, except at the edges of the flower, where the yarn in passing from the front to the back binds the two layers together. A three-ply is in three layers, and is usually in three or more colours or shades of colour. The different layers are interlocked by the manner in which the threads are used to form the pattern. *Union Kidder Carpets* resemble the two-ply kind, except that instead of being all wool, they have cotton warps and worsted wefts. In these the colour of the cotton usually fades before that of the wool. Kidderminster carpeting is woven on power-looms with Jacquard apparatus.

Brussels Carpet.—In this make of carpet the worsted threads are arranged in the warp, and are interwoven into a network of linen. Still the bulk of the carpet consists of wool. What is called a six-frame 'Brussels' consists of six layers or thicknesses of coloured worsted yarn, but there are also five, four, and three frame carpets of this kind, each formed of a corresponding number of worsted threads. Of these the best and thickest is the six-frame variety. The number of colours in the carpet indicates often, but not always, the number of frames used in its construction. These frames are placed behind the loom, and each of them contains about 260 reels or bobbins of worsted, which as a rule is of one colour, that being the number of threads in a carpet of the usual width of 27 inches. But by a little ingenuity five or six

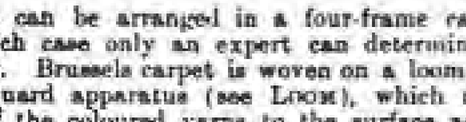


Fig. 2.

colours can be arranged in a four-frame carpet, in which case only an expert can determine its quality. Brussels carpet is woven on a loom with a Jacquard apparatus (see LOOM), which raises each of the coloured yarns to the surface as the pattern requires at each throw of the shuttle. These are at the same time formed into loops by the insertion of wires, which are immediately withdrawn. Fig. 2 shows a section of a Brussels carpet in which these wires are shown.

Velvet Pile or Wilton Carpet.—This only differs from a Brussels carpet in having the raised loops cut so as to give it a velvet-like surface.

Tapestry Carpet (fig. 3), the name given to a carpet made of parti-coloured yarns by a very ingenious method patented by Mr Richard Whytock of Edinburgh in 1832. It resembles the 'Brussels' make inasmuch as the surface is formed of loops of worsted yarn, but instead of each thread being of a single colour, it is of several colours in the tapestry carpet. It is really a printed carpet, but it is only the woollen warp yarn, not the woven fabric, which is printed. These yarns are placed on a large drum which is traversed by small rollers charged with dyes, and thus the threads are printed in bands of various widths. When the parti-coloured warp threads are arranged for weaving, the pattern appears long drawn out. In that stage what are to be squares in the woven pattern appear as oblongs, and what are to be circles as ellipses.

Fig. 3.

The weaving draws them up into proper shape, and the looms are simple. Although the back of a tapestry carpet may be of any vegetable fibre, it is very frequently of jute, but the wool is practically all on the surface. In a Brussels carpet on the contrary the worsted yarns are not only on the surface but in layers below it.

Carpets of undyed worsted yarn are made of a similar structure to the tapestry kind, and afterwards printed with a pattern on the surface.

Patent Axminster Carpet (fig. 4).—Mr J. Templeton of Glasgow patented in 1839 a method of making carpets by the use of chenille which are known by this name. The wool chenille is first woven on a separate loom, and cut into strips for the weft. In this kind of carpet the elements of the design or pattern exist in the chenille weft, which somewhat

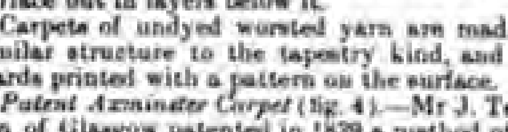


Fig. 4.

resembles the parti-coloured warp yarn in the tapestry carpet; but this chenille, having a pile to begin with, does not require to be formed into loops. The surface of the carpet is in fact formed of weft lines of chenille, which, so to speak, has a backbone of thread. By means of 'catcher warps' crossing its backbone, the chenille is bound to a strong under-fabric of cotton, linen, or hemp.

Royal Axminster Carpet.—This is a kind of carpet which has been recently introduced. It differs from Templeton's patent Axminster in not requiring the preliminary weaving of the chenille, and from 'Brussels' in not requiring the use of Jacquard apparatus to weave it. In the Royal Axminster the pattern is arranged line by line on a succession of small spools of yarn, from which tufts are cut by machinery and fastened into the carpet by the interlacing of linen or jute warp and weft.

Jute Carpets.—Owing to the fact that jute is neither a very durable fibre nor easily dyed with permanent colours, carpets made of it are not highly esteemed, but they are much cheaper than other kinds. They are made (at Dundee on a very large scale) either with a looped or plain surface, and their patterns may be as beautiful as any on Brussels or Kidderminster carpet.

Carrion Flowers, a name which, on account of their smell resembling that of putrid meat, has been given to the flowers of many species of Stapelia, a genus of Asclepiadeæ, which is otherwise remarkable for the succulent development of the cellular tissue of the stem and reduction of the leaves, resulting in a general aspect like that of the Cactus family. There are about 100 species, all natives of the Cape of Good Hope. The flowers

Carrion Flower (*Stapelia variegata*).

are often large and beautifully marked, but the carrion stench is very strong. They attract carrion flies, which may even lay their eggs in the flowers, and by these visitors it would appear that cross-fertilisation is effected. The name carrion flower is also given in some parts of the United States to *Smilax herbacea*, a totally distinct liliaceous plant.

Carthamine, or CARTHAMEINE. The dye so called is obtained by a chemical process from *Carthamus tinctorius*, or Safflower (q.v.), in crystals which are insoluble in water, slightly soluble in ether, and which with alcohol readily form a purple-red solution. When newly precipitated, carthamine immediately and permanently attaches itself to cotton or silk (but not to wool), requiring no mordant. It dyes the fabric a fine red, which is changed to yellow on the addition of alkalies, and may be returned to red again on being treated with acids. The safflower contains about ·5 per cent. of carthamine, and also about 25 per cent. of a yellow colouring matter called safflower-yellow, which, however, is of no value in dyeing.

Cartridge, a cylindrical case containing the powder charge only in the case of Cannon (q.v.), but powder, cap, and shot in that of small-arms; or the bullet may be omitted, when it is called 'blank cartridge.' Those for large guns are bags usually of serge or flannel, filled with the proper weight of powder, tied round the neck, and strengthened by worsted hoops. In the largest cartridges a strong stick is placed to give greater strength, and those used for drill and salutes have cases of raw silk, because that material does not smoulder.

The cartridge formerly used with muzzle-loading rifles was a paper cylinder inclosing the powder and bullet and greased outside the latter. To load, the end was torn or bitten off, the powder poured into the barrel, and the bullet, together with the paper cartridge-case, rammed down above it. A cartridge for breech-loading Small-arms (q.v.), as constructed in 1888, is a cylinder of solid brass, with a strong base, in the centre of which is the percussion arrangement. Those made of coiled brass have been discarded as being liable to jam in the barrel. The new Enfield-Martini rifle has a cartridge of the form shown in fig. 1, containing,

Fig. 1.

besides the cap, 85 grains of powder, and a Bullet (q.v.) weighing 384 grains. Between them is a compound wad ¼ inch thick, half of that thickness being cardboard, next the powder, and the other half beeswax, so that the bore is cleaned out by each discharge. All modern military rifles have similar cartridges, the actual shape depending upon that of the Chamber (q.v.), the calibre, and the powder charge. The solid-drawn case being almost indestructible, can be re-charged and capped twenty times, and the rifle cartridge can be used with Machine Guns (q.v.) of the same bore, and with carbines.

Pistol or revolver cartridges are similar to those for rifles, but shorter, and some of the smaller patterns are ignited differently, the hammer striking a rim at the base of the cartridge, which contains the fulminate.

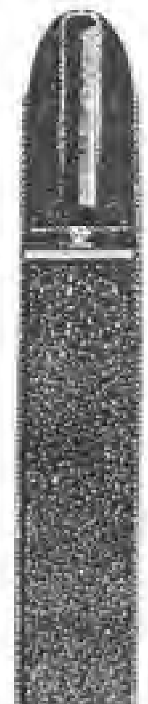


Fig. 2.

For sporting rifles of large bore the same cartridge-case is generally used as for shot-guns, the bullet being spherical, solid conical, hollow conical, or explosive. For small-bore, or what are known as Express rifles, one similar to the Enfield-Martini cartridge, but containing 4 drachms of powder, is used. This rifle fires a light (270 grains) hollow conical bullet with great velocity, low trajectory, and immense killing power. Fig. 2 shows a section of a ·450-inch Henry express cartridge (full size).

The cartridge for breech-loading shot guns is usually a stout cylinder of paper with

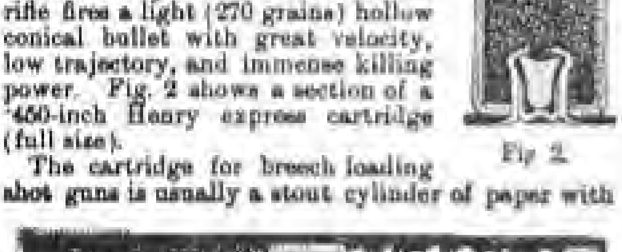


Fig. 3.—Central-fire Shot Cartridge Section (full size).

a metal base (fig. 3). The size varies with the calibre, and they have either pin or central-fire ignition. In America the case is often solid brass.

For the cartridge used in blasting with dynamite and the like, see BLASTING.

Cartridge-paper, a light-coloured strong paper, originally manufactured for cartridges, is extensively used in art, its rough surface being useful for certain kinds of drawing.

Case-hardening is the process of converting the surface of certain kinds of malleable-iron goods into steel, thereby making them harder, less liable to rust, and capable of taking on a better polish. Fire-irons, gun-locks, keys, and other articles of limited size, are very commonly so treated, but the process is sometimes applied to large objects, such as iron railway-bars. The articles are first formed, and heated to redness with powdered charcoal or cast-iron, the malleable-iron taking carbon from either of these to form a skin of steel upon it; the heated objects are then cooled in cold water, or in oil when they are of a delicate nature. Yellow prussiate of potash or parings of leather have also been a good deal used for coating iron articles with steel by heating them together. Some chemists consider that in this case nitrogen combines with the iron and effects the hardening. The coating of steel is very thin, seldom exceeding $\frac{1}{16}$th of an inch. A Swedish ironmaster has found that a very excellent case-hardening is obtained by treating iron or steel objects with a mixture of animal matter, such as rasped leather or horn, and arsenious acid dissolved in hydrochloric acid, and heating as usual.

Casein is an organic compound allied to Albumen (q.v.), found in the milk of the Mammalia. It also exists in peas, beans, and other leguminous seeds, and is then known as Legumin. The proportion of casein in Milk (q.v.) varies, but averages about 3 per cent., and it may be coagulated and separated therefrom by the addition of a little Rennet (q.v.), as in the manufacture of Cheese (q.v.), or by the employment of a few drops of a mineral acid, such as dilute sulphuric acid. In either case the casein separates as *curd*, which still retains attached to it some oil and earthy salts, though the greater portion of these substances, along with the sugar, remain in the watery liquid or *whey*. The elementary bodies which enter into the composition of casein, and the proportion in which these are present in 100 parts, are—carbon 53·83; hydrogen, 7·15; nitrogen, 15·65; oxygen, 22·52; and sulphur, 0·85. The properties of casein are, that it is not coagulated by heat, as is well evidenced in the heating of milk, but is coagulated on the addition of rennet; sulphuric, hydrochloric, or nitric acids; alcohol, creosote, or infusion of galls, but not by acetic acid. It also forms insoluble precipitates with solutions of the poisonous salts, acetate of lead, nitrate of silver, and bichloride of mercury (corrosive sublimate), and hence the efficacy of taking large doses of milk in cases of poisoning by those deadly salts, as the casein in the milk, forming an insoluble compound with the poison, keeps it from exerting its deadly powers. When casein is heated with chalk, it forms a compound, insoluble in water, and hardening by exposure to air, which may be used as a cement. The compound with lime is used in destemper painting.

The form of casein obtained from plants, and termed legumin, is generally procured from leguminous seeds, like peas or beans, though it can also be extracted from the majority of vegetable substances, especially from sweet and bitter almonds, and even from tea and coffee. Dried peas contain a fourth of their weight of legumin, and this can be extracted by bruising the peas to powder, and digesting in warm water for two or three hours. The liquid is then strained through cloth, which retains the insoluble matters, and allows the water with the legumin dissolved therein, and with starch mechanically suspended, to pass through. On settling, the starch falls to the bottom of the vessel, and the clear liquid holding the legumin in solution, on the addition of a small amount of acetic acid, yields a precipitate of legumin or vegetable casein. So perfectly does the vegetable casein resemble the casein from milk, that the one can hardly be distinguished from the other by chemical tests or by taste. In various parts of China, especially near Canton, there is a form of cheese made from peas. Casein is a most important article of food. See DIET, DIGESTION, NUTRITION.

Caster-oil, a fixed oil obtained from the seeds of the castor-oil plant. In extracting the oil, the seeds are first bruised between heavy rollers, and then pressed in hempen bags under a hydraulic or screw press. The best variety of oil is thus obtained by pressure in the cold, and is known as *cold-drawn* castor-oil; but if the bruised and pressed seeds be afterwards steamed or heated, and again pressed, a second quality of oil is obtained, which is apt to become partially solid or frozen in cold weather. In either case, the crude oil is heated with water to 212° (100° C.), which coagulates, and separates the albumen and other impurities. Exposure to the sun's light bleaches the oil, and this process is still resorted to, but since the introduction of the nearly tasteless Italian castor-oil, which in itself is almost colourless, there is not the same demand for the bleached article. When pure and cold drawn, castor-oil is of a light-yellow colour; but when of inferior quality, it has a greenish, and occasionally a brownish tinge. It is somewhat thick and viscid. Its specific gravity is high for an oil, being about ·960. It is miscible with alcohol or spirits of wine and ether. Reduced to a temperature of 0° (−18° C.), it does not become solid; but exposed to the air, it very slowly becomes rancid, then dry and hard, and serves as a connecting link between the drying and non-drying oils. The commoner qualities have a nauseous smell, and an acrid, disagreeable, and sickening taste, but the fine medicinal article is frequently almost free from those objectionable properties. Repeated attempts have been made to obtain from it an active principle, to which it might owe its purgative properties, but without success. It, however, contains a peculiar oily acid, called Ricinoleic Acid, $C_{18}H_{34}O_3$.

Castor-oil is one of the most convenient and mildest of purgative medicines. Given in doses of one or two tea-spoonfuls, it forms a gentle laxative for those who are easily acted on by medicine; while a dose of a table-spoonful, or a little more, will almost always succeed if it remains on the stomach. The only serious objections to the use of castor-oil are its flavour and the sickness often produced by it. It may be administered floating on peppermint or cinnamon water, or on coffee, or shaken up with glycerine. But the most effectual plan for disguising the disagreeable flavour is to inclose it in thin gelatin capsules, holding as much as a tea-spoonful or more.

The adulterations of castor-oil may be various. Several of the fixed oils, including lard, may be employed. The best test of its purity is its complete solubility in its own volume of absolute alcohol. It is used also as a lubricant, and in India for burning in lamps. Croton-oil is occasionally added.

CASTOR-OIL PLANT (*Ricinus communis*; natural order Euphorbiaceæ) is a native of India, but now

Castor-oil Plant (*Ricinus communis*).

naturalised in most tropical, subtropical, and even warm temperate countries. It is known in the Mediterranean countries as *Palma Christi*. It is also found in cultivation even in northern Europe, where, however, it is only annual. Under these circumstances it attains a height of 4 to 6 or more feet, while in warmer climates it becomes a small tree. The flowers are comparatively inconspicuous, in monœcious racemes, but the foliage is peculiarly handsome. There are a large number of varieties, many described as distinct species.

Catalysis (Gr., 'dissolution') is a term applied in Chemical Physics to a force supposed to be exerted by one substance upon a second, whereby the latter is subjected to change or decomposition, whilst the former, or acting substance, remains comparatively unaltered, and does not combine with it. The force, indeed, has been ascribed to the mere 'action of contact.' Fermentation is an example of this force (see BEER), when one part of yeast acting upon the sugar of the sweet worts, without entering into combination with it, compels 100 parts of sugar to pass into alcohol and carbonic acid. So also, when platinum or gold are brought in contact with peroxide of hydrogen, the latter is decomposed, while the metal remains unchanged. No plausible theory has been brought forward to account for these changes, or to define what the force of catalysis is.

Catawba, a name of wines, both still and sparkling, produced in various parts of the United States from the Catawba grape, the fruit of a variety of the *Vitis Labrusca*, a North American and Asiatic species, from which have been derived most of the cultivated North American varieties of the vine. It is often said that it was 'first found growing on the banks of the Catawba River' (in North and South Carolina); but it is on record that it was named by Major Adlum, who found it growing wild near Washington, D.C., about 1825. Catawba wines are of various grades, the best being of very decided value. The vine is extremely prolific, the fruit being large, of a deep coppery red, and very sweet. The Catawba grape does best on southern slopes, and on limestone soils. Its slight musky aroma pervades the wines made from it, and causes some connoisseurs to reject all but the very choicest of the vintage from the catalogue of first-class wines.

Catchfly, the name of the genus Silene, of which many species produce a sticky secretion on the calyx, the joints of the stem, &c., which prevents the access of ants and other creeping insects to the honey, so preserving it for the bees or other flying insects by which alone cross fertilisation is effected. Other Caryophyllaceæ, notably *Lychnis Viscaria*, possess the same means of defence. The Nottingham Catchfly is *Silene nutans*. The unrelated *Dionæa muscipula* is also sometimes called the Carolina Catchfly. See DIONÆA.

Ca'techu, a substance employed in tanning and dyeing and medicinally as an astringent. The catechu of commerce is obtained chiefly from two East Indian trees (*Acacia Catechu* and *A. Sumâ*). The former is common in most parts of India, and also in tropical East Africa, and the latter grows in Southern India, Bengal, and Gujerat. Catechu is known in India by the name *kat* or *kut*. Cutch is another form of one or other of these names, and is a common commercial name. The trees are cut down when they are about a foot in diameter, and according to some accounts only the heart-wood is used, but other reports say that the whole of the woody part of the trunk is utilised. The catechu is obtained by cutting it into small chips, and boiling it in water, straining the liquid from time to time, and adding fresh supplies of chips, till the extract is of sufficient consistence to be poured into clay moulds; or when of the thickness of tar, it is allowed to harden for two days, so that it will not run, and is formed into balls about the size of oranges, which are placed on husks of rice or on leaves, and appear in commerce enveloped in them. Catechu is of a dark-brown colour, hard and brittle, and when broken has a shining surface. It possesses an astringent taste, but no odour. It is a very permanent colour, and is employed in the dyeing of blacks, browns, fawns, drabs, &c. Ordinary commercial catechu or cutch is composed of catechu-tannic acid, which is soluble in cold water, and catechin or catechuic acid, which is nearly insoluble in cold but soluble in boiling water. The latter can be separated in the state of minute, acicular, colourless crystals. It is often adulterated with earthy substances, but its ready solubility in water and alcohol should at once show the presence of such by leaving them behind in an insoluble state. Areca or Palm Catechu, sometimes called Ceylon Catechu, differs wholly from the above. It is got from the ripe nuts of the Betel palm, which yield, by boiling, a black, very astringent extract, resembling true catechu, but of inferior quality. This substance is rarely exported from India (see ARECA, BETEL).—Gambir (q.v.) may be regarded as a kind of catechu. *Terra Japonica*, or *Japan Earth*, is an old name for catechu, not quite disused, given in mistake as to its nature and origin. About 6000 tons of catechu or cutch are annually imported into Great Britain from India.

Catgut is employed in the fabrication of the strings of violins, harps, guitars, and other musical instruments; as also in the cords used by clock-makers, in the bows of archers, and in whipcord. It is generally prepared from the intestines of the sheep, rarely from those of the horse, ass, or mule, and *not* those of the cat. The first stage in the operation is the thorough cleansing of the intestines from adherent feculent and fatty matters; after which they are steeped in water for several days, so as to loosen the external membrane, which can then be removed by scraping with a blunt knife. The material which is thus scraped off is employed for the cords of battledoors and rackets, and also as thread in sewing the ends of intestines together. The scraped intestines are then steeped in water, and scraped again, when the large intestines are cut off and placed in tubs with salt, to preserve them for the sausage-maker; and the smaller intestines are steeped in water, thereafter treated with a dilute solution of alkali (4 oz. potash, 4 oz. carbonate of potash, and 3 to 4 gallons of water, with occasionally a little alum), and are lastly drawn through a perforated brass thimble, and assorted into their respective sizes. In order to destroy any adherent matter which would lead to putrefaction, and the consequent development of offensive odours, it is customary to subject the catgut to the fumes of burning sulphur—i.e. sulphurous acid, which acts as an Antiseptic (q.v.), and arrests decomposition. The best strings come from Italy, and are used for musical instruments. These are known as *Roman strings*, but they are made in several Italian towns, the most valuable coming from Naples. About 10 per cent. of the violin strings manufactured are *false*—i.e. they produce two sounds. Gut strings for musical instruments become useless after being kept a few years. Cord for clockmakers is made from the smallest of the intestines, and occasionally from larger ones, which have been split longitudinally into several lengths. The catgut obtained from the intestines of horses, asses, and mules is principally made in France, and is employed in the same way as leather belts for driving lathes and other small machines.

Catha, a genus of Celastraceæ, often reckoned under Celastrus. *C. edulis*, Arabian Tea, the Khât of the Arabs, is a shrub highly valued by them on account of its leaves, which are chewed or infused like coffee or tea, to which its properties seem essentially similar. It is cultivated along with coffee.

Cathartics (Gr. *kathairo*, 'I purify'), a name originally for all medicines supposed to purify the system from the matter of disease (*materies morbi*), which was generally presumed by the ancients to exist in all cases of fever and acute disease, and to require to be separated or thrown off by the different excretions of the body. Ultimately the term cathartics became limited in its signification to remedies acting on the bowels, which are popularly called *Purgatives* (q.v.)—a mere translation of the Greek word.

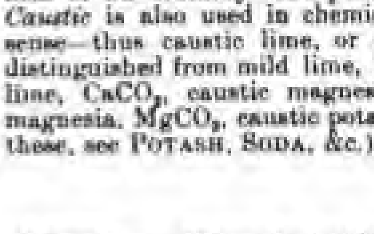
Ca'theter (Gr. *kathiemi*, 'I thrust into') was a name applied indifferently to all instruments for passing along mucous canals. In modern times, however, it has generally been reserved for tubular rods through which fluids or air may pass, and is now restricted to those used for emptying the urinary bladder, and those used for injecting air or fluids into the Eustachian tube (Eustachian Catheter). The catheter for the former purpose is a very old surgical instrument. The ancients made theirs of copper, which accumulated verdigris. In the 9th century silver was substituted by the Arabian surgeons as a cleanlier metal, and is still used by all who are not obliged, for economical reasons, to have their catheters made of German silver or pewter. The urinary catheter for the male varies in length from 10 to 11 inches; the female catheter need not be more than 4 or 5 inches. The form is a matter of less importance, but most surgeons prefer an instrument straight to within the last few inches of its length; the latter should be curved into the segment of a small circle. Others, however, use a double curve, and indeed nearly every surgeon has a peculiar fancy in this respect. Flexible catheters are made of gum elastic (see BOUGIES), which may be used either alone or supported on a wire. Many other materials have been proposed, but vulcanised india-rubber is the only one generally in use. The Eustachian catheter is generally made of metal or vulcanite, 6 or 7 inches in length, with the last inch or less slightly curved. It is introduced into the Eustachian tube along the floor of the nose, and air or fluid may be forced along it by an india-rubber bag which can be attached to it.

Caul, a portion of the amnion or thin membrane enveloping the fœtus, sometimes encompassing the head of a child when born, mentioned here on account of the extraordinary superstitions connected with it from very early ages almost down to the present day. It was the popular belief that children so born would turn out very fortunate, and that the caul brought fortune even to those who purchased it. This superstition was so common in the primitive church, that St Chrysostom inveighed against it in several of his homilies. In later times midwives sold the caul to advocates at high prices, as an especial means of making them eloquent, and to seamen, as an infallible preservative against drowning (cf. Dickens's *David Copperfield*). It was also supposed that the health of the person born with it could be told by the caul, which, if firm and crisp, betokened health, but if relaxed and flaccid, sickness or death (*Notes and Queries*, 1884-86). During the 17th century cauls were often advertised in the newspapers for sale—from £10 to £30 being the prices asked; and so recently as 8th May 1848, there was an advertisement in the *Times* of a caul to be sold, which 'was afloat with its late owner thirty years in all the perils of a seaman's life, and the owner died at last at the place of his birth.' The price asked was six guineas.

Caustic (Gr., 'burning'), in Medicine and in Chemistry, is the term applied to such substances as exert a corroding or disintegrating action on the skin and flesh. *Lunar caustic* (so called because silver was called *luna*, 'the moon,' in the alchemists' mystical jargon) is nitrate of silver, and *common caustic* is potash. When used as a caustic in medicine, the substance is fused and cast into moulds, which yield the caustic in small sticks the thickness of an ordinary lead pencil, or rather less.—*Caustic* is also used in chemistry in an adjective sense—thus caustic lime, or pure lime, CaO, as distinguished from mild lime, or the carbonate of lime, $CaCO_3$, caustic magnesia, MgO, and mild magnesia, $MgCO_3$, caustic potash, caustic soda (for these, see POTASH, SODA, &c.). See CAUTERY.

Caustics. When the incident rays are parallel to the principal axis of a reflecting concave mirror, they converge, after reflection, to a single point, called the principal focus. In the case of parabolic mirrors this is rigorously true. For, as is easily seen from the fundamental property of the parabola, any ray falling on the mirror parallel to the axis is reflected so as to pass *exactly* through the focus. For other mirrors it is approximately true only when the breadth of the mirror is very small in comparison with its radius of curvature. When the breadth of the mirror is large in comparison with its radius of curvature there is no definite image, even of a luminous point. In such cases the image is spread over what is called a *Caustic*, or sometimes a *Catacaustic*.

An example of the caustic is given in the annexed figure for the simplest case—namely, that of rays falling directly on a concave spherical mirror, BAB', from a point so distant as to be practically parallel.



Two very near rays, P and Q, will after reflection intersect at C. By finding in this way all the points of intersection of the reflected rays, we get a continuous curve, BCFB', which is the section of the caustic surface by a plane passing through its axis. The curve BCFB' varies of course with the form of the reflecting surface. In the case under consideration it is known as an epicycloid.

The reader may see a catacaustic on the surface of tea in a tea-cup half full by holding the circular rim to the sun's light. The space within the caustic curve is all brighter than that without, as it clearly should be, as all the light reflected affects that space, while no point without the curve is affected by more than the light reflected from half of the surface. The rainbow, it may be mentioned, forms one of the most interesting of the whole family of caustics.

When a caustic is produced by refraction, it is sometimes called a *Diacaustic*. No such simple example can be given of the diacaustic curve as that above given of the catacaustic. It is only in the simplest cases that the curve takes a recognisable form. In the case of refraction at a plane surface, it can be shown that the diacaustic curve is the evolute either of the hyperbola or ellipse, according as the refractive index of the medium is greater or less than unity.

CONTINUED IN VOLUME 2

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From the Archives

This generation is filled with anxiety and unrest. The commonplace has become a threat. Our universal energy, oil, which powers worldwide civilization, is now seen as only temporary. Many, now, are seeking alternatives to some of the most familiar aspects of our civilization.

Medicine is in doubt so acupuncture becomes a fad - again - although few know our ancestors gave it a good hearing.

Old books hold detailed descriptions of alternatives to aspects of our present technology. The alcohol engine was developed to a point and then abandoned. Did the then cheaper petroleum put it out of the running for practicality? If so, it is time to look at it again.

Then there was the ammoniacal engine which showed promise to some. It never got off the ground. But was its development also stopped because of the cheapness of petroleum and wood?

Sun power is a new concept to most young people. Sun power developers believe themselves to be pioneers. Yet, our ancestors used the sun as a weapon. Their varied applications of sun power were far more advanced than many of its present applications.

The elders even tried dog-power. This isn't a bad idea when you consider our great canine population.

It will be a regular feature of THE SURVIVOR to dig up and dust off old methods of gathering and using energy.

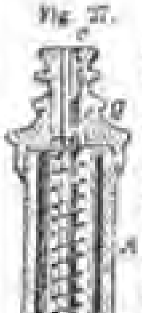
The following articles are from Knight's American Mechanical Dictionary, 1872.

Ac'u-punct'u-ra'tor. Derived from acus (Lat.), a needle. An oriental instrument for treating certain complaints, such as headaches, lethargies, etc. It is of great antiquity in the East, and of late years it has been introduced somewhat extensively into Europe and the United States. The essential apparatus employed is simply a set of needles set in a handle, or detached needles, which by a slight rotary movement are passed to the required depth beneath the tissues and allowed to remain for a length of time varying from a few minutes to an hour.

In the sixteenth century, according to Jerome Cardan, the practitioners of this art travelled from place to place, and rubbed their needles with a magnet or substance which they pretended rendered their insertion painless. Without any such application, however, the punctures are so minute that pain is not felt after the first insertion of the needle.

The needles are sometimes used for conducting the galvanic current to parts at some distance beneath the surface of the skin, and are sometimes made hollow for the injection of a sedative into the tissues, for the relief of neuralgic affections. This latter mode of application was suggested by Dr. Alexander Wood of Edinburgh, Scotland.

Fig. 27.



Kier's Acupuncturator.

It is sometimes called a *Dermapathic* or *Irritation Instrument*, and is used to introduce a vesicatory liquid beneath the epidermis.

FIRMENICH's instrument, March 18, 1862, may be considered a type of its class. The piston containing the needles is adjustable in its cylinder, which holds the medicinal preparation. The needles project through the diaphragm to the required extent, and the epispastic liquid insinuates itself along with the needles into the punctures.

KIER's acupuncturator, June 19, 1866, has a regulating nut *g*, to adjust the depth of penetration of the needles which project through the diaphragm to conduct the liquid from the cylinder *A* and introduce it through the skin. The needles *b* are stocked in the piston *B*, whose stem *d* is sleeved in the stem-screw *c f*.

In Oriental countries the needles are made of gold or silver. In China their manufacture is regulated by law. They are of different sizes, some about four inches in length and having spiral handles to facilitate their rotation after insertion. They are driven in by a small, lead-loaded hammer with a leathern face. Their use is very common in China and Japan, and was communicated to Europe by the physician to the Dutch Embassy in the seventeenth century. It was revived in France in 1810. The English needles are long, made of steel, and have knobbed heads to facilitate turning after introduction. The tendency here, judging by the patents, is to have the needles in clusters.

The operation is well performed by a tubular needle connected with a syringe, by which a weak solution of morphia is injected into a diseased tissue, producing local anæsthesia.

Burn'ing-glass. (*Optics.*) A convex lens of large size and short focus, used for causing an intense heat by concentrating the sun's rays on a very small area.

Pliny states that the ancients had globes of glass and crystal which produced fire, and Lactantius adds that a glass sphere full of water did the same.

Any convex lens may be employed as a burning-glass, its calorific effect, as in the case of a mirror, being proportional to the number of rays concentrated in a given area, or to the relative circular areas of the lens and the spot on which the refracted rays fall.

About 1774, M. de Trudano constructed a hollow glass lens, of 11 feet focus, filled with oil of turpentine, of which it held 140 Paris pints (nearly equal to the same number of English quarts). By this lens a bar of steel 4 inches long and ½ of an inch square was melted in five minutes. Three and six livre silver pieces were fused in a few seconds, and grains of platinum were melted sufficiently to cohere, but not to form a spherical drop.

The "Parker" lens or burning-glass was made in London at a cost of $3,500. It was of flint glass, 36 inches in diameter, double convex, its sides portions of a sphere of 18 feet radius. Its focus was 6 feet 8 inches; diameter of focus at that distance, 1 inch; weight, 212 pounds. A second lens, of 16 inches diameter and weight 21 pounds, was used to concentrate the rays, the focal distance being then 63 inches, the diameter of focus ½ inch. This lens was carried to China by an officer in the suite of Lord Macartney, and left at Pekin.

The effects of the burning arrangement were as follows: —

Substances.	Weight. Grains.	Time. Seconds.	Substances.	Weight. Grains.	Time. Seconds.
Gold (pure)	20	4	Carnelian	10	75
Silver (pure)	20	3	Jasper	10	25
Copper (pure)	33	20	Onyx	10	20
Platinum			Garnet	10	17
(pure)	10	3	Spar	10	60
Nickel	16	3	Rotten-stone	10	80
Bar-iron	10	12	Slate	10	2
Cast-iron	10	3	Asbestos	10	10
Steel	10	12	Limestone	10	35
Topaz	3	45	Pumice-stone	10	24
Emerald	2	25	Lava	10	24
Flint	19	30	Volcanic clay	10	60

Burn'ing-mir'ror. A concave mirror, or a combination of plane mirrors, so arranged as to concentrate the sun's heating rays on a common object.

The most celebrated of these are the mirrors of Archimedes, who thereby burned the Roman fleet of Marcellus at Syracuse. Each concave mirror was separately hinged, and they were brought to bear in combination upon the object in the common focus.

In Peru, previous to the Spanish Conquest, the rays of the sun were collected in a concave mirror and fire kindled thereby.

Besides the familiar instance of the burning of the fleet of Marcellus by Archimedes, another instance is cited by the historian Zonaras, who records that Proclus consumed by a similar apparatus the ships of the Scythian leader Vitalian, when he besieged Constantinople in the beginning of the sixth century. It must, however, be mentioned that Malaba, another old chronicler, says that Proclus operated on this occasion by burning sulphur showered upon the ships by machines.

Stettala, a canon of Milan, made a parabolic reflector with a focus of 45 feet, at which distance it ignited wood. It is understood to be the first of that form, though Digges in the sixteenth century, Newton and Napier in the seventeenth century, experimented with parabolic mirrors.

Villette, an optician of Lyons, constructed three mirrors about 1670. One of them, purchased by the King of France, was 30 inches in diameter and 36 inches focus. The diameter of the focus was about 1 inch. It immediately set fire to green wood; it fused silver and copper in a few seconds, and in one minute vitrified brick and flint earth.

The Baron von Tchionhausen's mirror, 1687, was a concave metallic plate 5 feet 3 inches in diameter, and having a focal length of 3½ feet. Its effects were similar to those of the mirror just cited, and it is recorded that slate was transformed into a kind of black glass, which, when laid hold of by a pair of pinchers, could be drawn out into filaments.

Buffon made a machine with 140 plane mirrors 4 × 3 inches, placed in a frame and separately adjustable by temper-screws. With 24 of the mirrors adjusted to a common focus at a distance of 66 French feet, he fired pitch and tow. With a polyhedron frame set with 168 pieces of plain looking-glass, 6 inches square, he fired beechwood at 150 feet, and melted a silver plate at 60 feet. He then constructed one on similar principles, with 360 mirrors 8 × 6 inches in a frame 8 × 7 feet. With this most metals were melted at 25 to 40 feet distance, and wood was burned at 210 feet distance.

Among the more remarkable modern mirrors may be cited several of from 20 to 36 inches diameter. One made by Villette was tested by Drs. Desaguliers and Harris. It was composed of an alloy of tin, copper, and bismuth. It was 47 inches in diameter, and was ground to a sphere of 76 inches radius. Its effects were as follows: —

Tin was melted in	3	seconds.
Cast-iron	16	"
A silver sixpence	7	"
A half-penny of George III.	34	"
Slate	3	"
Granite vitrified	54	"
Copper ore	8	"
Bone, calcined	4	"

Tschirnhausen's mirror was 4½ French feet in diameter; its focus, 12 feet.

It vitrified pumice, slate, tiles, shells, pieces of crucibles; lighted green wood instantly, and dissolved an alloy of lead and tin like so much lard.

Newton's mirror had 7 concave glasses, each 11½ inches in diameter; one in the center, the others encircling it, so as to have a common focus. The diameter was 34½ inches, the focus 22½ inches distant. It vitrified brick in 1 second, and melted gold in 30 seconds.

Zeicher formed his mirrors by pressing disks on a hot convex former, to give them their curvature.

Buffon constructed a combination of 140 plane mirrors, each 4 × 3 inches, on a wooden frame 6 feet square. Three set screws to each mirror gave perfect adjustability, and the result was a vindication of the probability of the statement in regard to Archimedes. With but 24 of the mirrors in focus, he lit pitch and tow at a distance of 66 French feet. By a subsequent arrangement of 168 pieces of plane looking-glass, 6 inches square, he lit beech-wood at 150 feet distance and melted a silver plate at 60 feet.

His final attempts were with a frame of 360 plane mirrors, 8 × 6 inches; and one of 400 mirrors, 8 × 8 inches. Wood was kindled at 210 feet distance, tin melted at 160 feet.

Pol'y-zo'nal Lens. A burning-lens constructed of segmental lenses arranged in zones.

Fig. 3876.

Polyzonal Lens.

In the illustration, the lens is shown with a central piece surrounded by four segments which are encircled by eight segments.

The object is to obtain lenses of large size for lighthouses, free from defects, and having but slight spherical aberration. Buffon first suggested the idea. Brewster made them.

Al'co-hol En'gine. An engine in which the vapor of alcohol is used as a motive-power.

The first suggestion of the machine was by Rev. Edmund Cartwright at the latter end of the last century. The reason why the elastic vapor of alcohol was supposed to be preferable to that produced from water is that it boils at a temperature considerably below that of water. It must be recollected, however, that all leakage and escape of alcohol is not alone an absolute loss of a valuable material, but that such leakage is very dangerous, owing to the inflammability of the material.

HOWARD's alcohol engine, English patent, 1825, was in use at the Rotherhithe Iron-Works for some time, but appears to have wearied out the patience or means of the inventor, no engine of that description being now usefully employed so far as we are aware. The engine referred to was intended to work up to 24 horse-power.

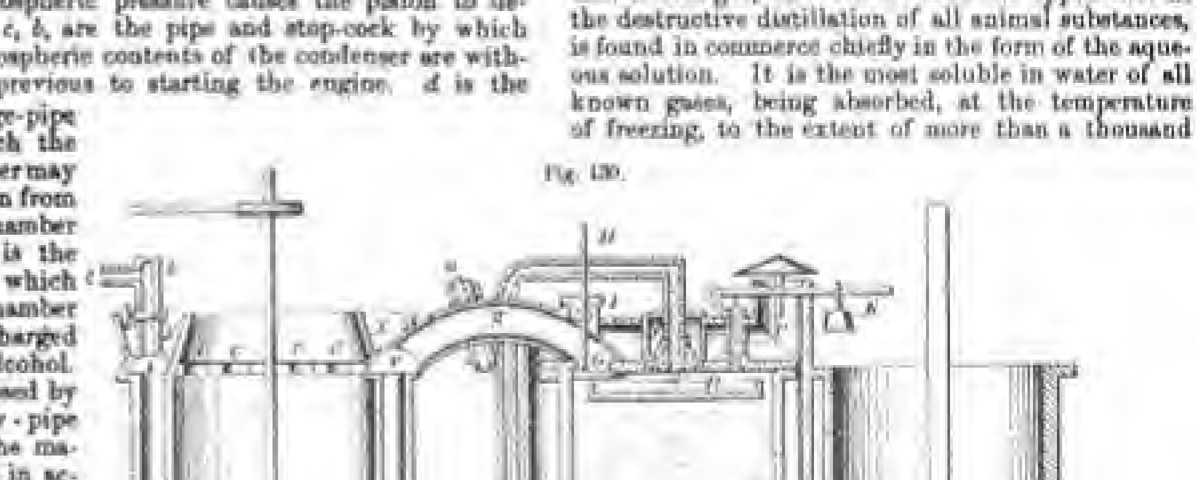
The engine had two vertical cylinders *A B*, of equal capacity, connected by a pipe *C*, at the lower part of each. A quantity of mercury or oil, which will not vaporize at the heat to be applied, is placed in each cylinder, so as to fill the base of one and nearly the whole of the other.

Within the cylinder *B* is a piston, exposed above to the pressure of the atmosphere, and packed in the cylinder in the usual manner. In the other cylinder *A* is a thin metallic dish *D*, floating freely upon the surface of the oil. A tube *E*, terminating in a nozzle pierced with small holes, passes through a stuffing-box in the cover of the cylinder *A*, in which also is a flap-valve *G* opened by a rod *H* as occasion requires. The valve is otherwise kept to its seat by a spring. *I* is the stuffing-box of the valve-rod; *K* the safety-valve. The piston has a plug by which a certain quantity of the fluid is admitted above its upper surface, there to remain. *N* is a discharge-cock. *o o* are argand-burners, which heat the cylinders *A B* by direct action upon their lower surfaces, the hot-air flue extending around them and terminating in the chimney *P*, which has a register-cap *a* by which the draft is regulated.

By means of a force-pump *R*, worked by the engine, a small quantity of alcohol is drawn from the condenser and injected through the pipe *E* into the dish *D*, which floats upon the hot oil in the cylinder *A*, and is thereby flashed into steam. The expansion of the alcohol depresses the column of oil in the cylinder *A*, driving it through the passage *C* into the cylinder *B*, where it raises the piston.

When the piston has attained its highest elevation, the valve *G* is opened and the vapor escapes by pipe *S* to the condenser, which consists of an upper and lower chamber connected by pipes *V V*. These pipes are surrounded by flannel constantly wetted by water dripping from the trough *X*, and the evaporation is expedited by a continued draft of air from the rotating fly *Z*, which is driven by the engine. *Y* is the lower trough, which receives the superfluous water, and *W* is the bottom chamber, which contains the condensed vapor and from which it is drawn by pump *R* to produce each upward movement of the piston. A cork or wooden packing in the connecting-pipe *S* prevents the conduction of heat from one part of the apparatus to the other. The condensation of the alcoholic vapor causes the return of the oil into the cylinder *A*, and the atmospheric pressure causes the piston to descend. *c*, *b*, are the pipe and stop-cock by which the atmospheric contents of the condenser are withdrawn, previous to starting the engine. *d* is the discharge-pipe by which the condenser may be drawn from the chamber *W*. *f* is the pipe at which the chamber *W* is charged with alcohol. It is closed by a screw-pipe when the machine is in action.

Fig. 130.



Howard's Alcohol Engine.

Am'mo-ni'ac-al En'gine. This motor seems to be yet in an inchoate state, but has received some attention in Europe. The machine described is the invention of M. Froment. The London "Mechanics' Magazine" thus refers to it (it appears to have been at work — or rather in action, for it was not usefully employed — at the Paris Exposition): "Strong liquid ammonia is used in the boiler, and the vapor generated is said to be a mixture of at least eighty parts of ammoniacal gas and twenty parts of steam, so it may be fairly called an ammoniacal engine. The principal recommendations of ammonia, when applied as a motive-power, consist in the small amount of fuel required, and the short time it takes to get up the steam, so to speak. The economy in fuel is very considerable, being about one fourth of that required to generate steam alone. As regards the boiler, it may be of either of the ordinary forms, the only complete novelty being the apparatus for condensing the steam and ammonia. The gas disengaged (about six atmospheres at 110° Centigrade with an ordinary solution of ammonia) does its work in the cylinder and then escapes into the tubes of a condenser, where the steam is condensed and the gas is cooled. The gas then meets with a cold liquid from an injector, which dissolves it, and the solution is carried on into a vessel called the 'dissolver,' from which it is pumped back into the boiler to do its work over again. The liquid for the injector is taken from the boiler, and is cooled before meeting with the ammoniacal gas by passing through a worm surrounded with cold water."

"Ammonia, at the temperature of our atmosphere, is a permanent gas of well-known pungent odor. It is formed by the union of three volumes of hydrogen to one of nitrogen, condensed into two volumes. Its density is 596; air being 1,000. The density of the liquid, compared with water, is 76, or about one quarter lighter than that liquid. Its vapor at 60° Fahr. gives a pressure of 100 pounds to the square inch, while water, to give an equivalent pressure, must be heated to 325° Fahr. The volume of ammoniacal gas under the above-named pressure is 983 times greater than the space occupied by its liquid, while steam, under identical pressure, occupies a space only 303 times greater than water." — *Annals of Chemistry* (French).

"Ammoniacal gas, which is an incidental and abundant product in certain manufactures, especially that of coal-gas, and which makes its appearance in the destructive distillation of all animal substances, is found in commerce chiefly in the form of the aqueous solution. It is the most soluble in water of all known gases, being absorbed, at the temperature of freezing, to the extent of more than a thousand volumes of gas to one of water; and at the temperature of 50° Fahr., of more than eight hundred to one. What is most remarkable in regard to this property is that, at low temperatures, the solution is sensibly instantaneous. This may be strikingly illustrated by transferring a bell-glass filled with the gas to a vessel containing water, and managing the transfer so that the water may not come into contact with the gas until after the mouth of the bell is fully submerged. The water will enter the bell with a violent rush, precisely as into a vacuum, and if the gas be quite free from mixture with any other gas insoluble in water, the bell will inevitably be broken. The presence of a bubble of air may break the force of the shock and save the bell.

"This gas cannot, of course, be collected over water. In the experiment just described, the bell is filled by means of a pneumatic trough containing mercury. It is transferred by passing beneath it a shallow vessel, which takes up not only the bell-glass, but also a sufficient quantity of mercury to keep the gas imprisoned until the arrangements for the experiment are completed.

"The extreme solubility of ammoniacal gas is, therefore, a property of which advantage may be taken for creating a vacuum, exactly as the same object is accomplished by the condensation of steam. As, on the other hand, the pressure which it is capable of exerting at given temperatures is much higher than that which steam affords at the same temperatures; and as, conversely, this gas requires a temperature considerably lower to produce a given pressure than is required by steam, — it seems to possess a combination of properties favorable to the production of an economical motive-power.

"Ammonia, like several other of the gases called permanent, may be liquefied by cold and pressure. At a temperature of 38.5° C., it becomes liquid at the pressure of the atmosphere. At the boiling-point of water it requires more than sixty-one atmospheres of pressure to reduce it to liquefaction. The same effect is produced at the freezing-point of water by a pressure of five atmospheres, at 21° C. (70° Fahr.) by a pressure of nine, and at 38° C. (100° Fahr.) by a pressure of fourteen." — *Barnard.*

LAMM'S Ammonia Engine is driven by the expanding pressure of liquefied ammonia, and is specially adapted for small powers, especially portable engines for street cars, etc. The ammonia is to be liquefied at a central station, at which the reservoirs on the cars receive their supply.

The engine is driven by the force of the gas upon the piston, and the gas is exhausted into a body of water surrounding the gas reservoir. The absorption of the gas by the water is instantaneous, and the water derives an increment therefrom which is imparted, through the walls, to the contents of the reservoir.

Dog-pow'er. A machine by which the weight of a dog in traveling in a drum or on an endless track is made to rotate a spit, or drive the dasher of a churn.

The turnspit-dogs of the last and previous centuries ran on the inside of a hollow tread-wheel, which rotated with their weight and communicated motion by a band to the spit. See ROASTING-JACK.

In the modern dog-powers, as in the example, the animal walks on an endless chain-track, which slips

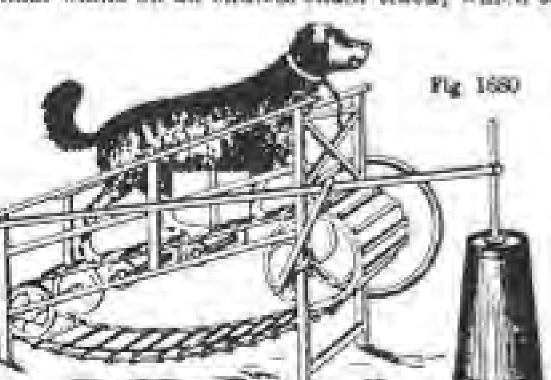


Fig. 1680

Dog-Power.

to the rear, rotating a drum which oscillates an arm, and vertical reciprocation is given to a lever and the churn-dasher.

This selection is from Harper's New Monthly Magazine, June to November, 1870.

The first item describes a machine for generating electricity directly from steam. I don't know how practical the idea is but it may be worth considering.

The second is on forcing seeds to germinate. The third carries the idea to absurdity and shows that our science editor of 1870 wasn't above a little leg-pulling unless he was just an idiot.

As everyone knows, a drunken lettuce seed will believe it's mature but it's not. I think both the contributor and the editor who passed on it had had enough brandy to make anything seem sensible.

Passing over several interesting and practical ideas we get to methylated ether as an intoxicant. (Methylated ether is a mixture of wood alcohol and ether).

I suppose the Irish drank it, although a single belt would amount to only an eighth of an ounce. They might have sniffed it but I don't think so. It was probably mixed with something or immediately followed by a beer chaser.

Methylated spirits (wood alcohol, rubbing alcohol) is purposely poisoned to frustrate winos. I don't know if doses of 1/16th of an ounce would be cumulative but I wouldn't advise using it. There is no practical difference between wood and grain alcohol so if I wanted to try this I'd substitute grain alcohol.

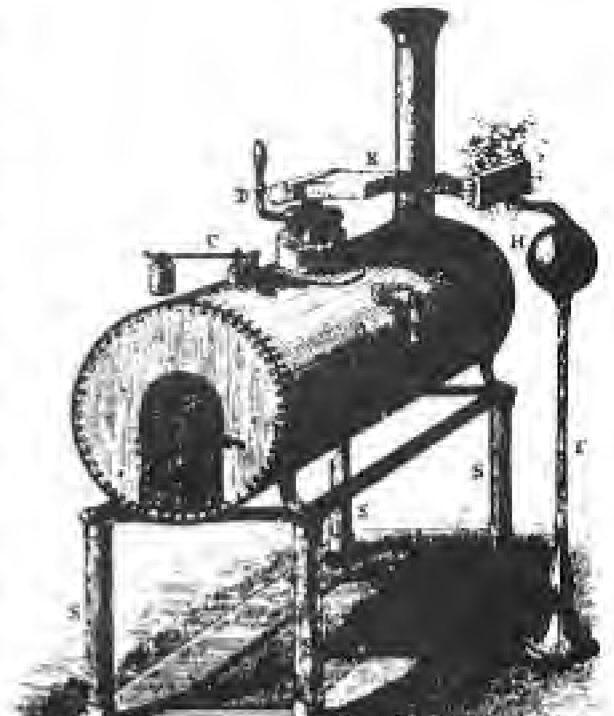
I would mix 1/16th of an ounce of ether with 1/8th of an ounce of 100 proof vodka. More practical would be to mix eight ounces of ether with a pint of 100 proof vodka. Dosage would be one teaspoonful at each shot.

One pint of 100 proof vodka and a half pint of ether would keep you flying for forty-eight days at three shots a session. That's pretty cheap booze.

Liver or even brain damage might result from frequent use of this mixture. Brain damage wasn't mentioned as a problem in the little notice, but since the drinkers were Irish, how could one tell?

Further along is the recipe for making artificial gold. See issue two, first and last page. I thought Dick's (1872) was first with this formula but apparently Harper's was. Then, maybe they stole it from someone else.

This connection between the development of electricity and the condensation of aqueous vapor, which was for a long time known only to exist in the case of the thunder-cloud, has since been found to be universal. The attention of scientific men was called strongly to this subject by an incident which occurred to an engineer in charge of a locomotive near Newcastle, in England, in 1840. This engineer hap-



ARMSTRONG'S MACHINE.

pened to pass one hand very near the cloud of vapor which was issuing from the escape-pipe of his engine, at the instant when the other was in contact with a metallic handle attached to some part of the machinery. The combination happened to be such as to make his body part of an electric circuit, and he experienced a sudden and quite powerful shock.

This incident led to a more thorough study of the electrical phenomena connected with the condensation of water, and it was found that electricity could be excited in any quantity by this means. The engraving represents a machine or engine constructed by Armstrong for this purpose. It consists of a boiler mounted upon insulating columns, provided, as usual, with fire-box, water-gauge, safety-valve, and smoke-pipe, and also furnished with an apparatus by which jets of the steam may be thrown upon a system of metallic points connected with an insulated conductor. The operation of such a machine as this is very powerful, though, for obvious reasons, it is not a convenient one for practical use.

GERMINATION OF SEEDS.

Some curious statements have recently been published in regard to the extent to which the germination of seeds can be facilitated by chemical agencies, especially by ammonia and oxalic acid. By placing them in a solution of the latter substance, they will begin to germinate within one or two days, even after having been kept for forty years, and are then to be planted out in the usual way. Coffee seeds, which are proverbially hard to start, are best forwarded by placing in a covered vessel, containing equal parts of water and of spirits of sal ammoniac, at the ordinary temperature. At the end of twelve hours the roots will be found to have started, and even the young leaves can be discovered by careful inspection. In 1834 wheat was exhibited to the German Scientific Association, raised from seed found in an Egyptian tomb, 2000 to 2500 years old. This had been soaked for a considerable time in fatty oil before planting.

HEAD LETTUCE.

It is said that heads of lettuce can be produced in winter in from twenty-four to forty-eight hours by taking a box filled with rich earth, in which one-third part of slacked lime has been mixed, and watering the earth with lukewarm water; then taking seed which has been previously softened by soaking in strong brandy twenty-four hours, and sowing in the usual way. We are assured, but will not vouch for the fact, that a good-sized head of lettuce may be obtained in the time mentioned.

REMOVAL OF HUSK FROM GRAIN.

The subject of removing the outer husk of grain by means of chemical applications continues to excite the interest of economists. A liquid well fitted for the purpose, according to Mr. Weiss, is prepared in the following manner: The general operation consists in moistening the grain with an alkaline solution, which is prepared by boiling, for one or two hours, two parts of common calcined soda in thirteen parts of water, and adding one part of quick-lime previously dissolved in three parts of water. This forms a cheap caustic soda, which is to be applied by means of a watering-pot, the mass of grain being stirred continually. Seven quarts of this solution are sufficient to remove the hull from two hundred pounds of grain, at a small cost, the liquid having the property of dilating the tissues of the exterior thin envelope of the grain which forms the pure bran, and which is then easily detached by the slightest friction. The operation does not require more than fifteen to twenty-five minutes of time, and leaves to the grain all its nutritive qualities, since the only portion removed is the dry woody hull, on the outside.

USE OF CHARCOAL IN FATTENING TURKEYS.

Four turkeys were cooped up and fed with meal, boiled potatoes, and oats; four others of the same brood were treated in a similar manner in another pen, but with a pint daily of finely pulverized charcoal added to the food, and an abundant supply of the lumps of the coal. All eight were killed the same day, and those fed with charcoal were found to weigh about a pound and a half each more than the others, and to be of much better quality.

CURE FOR OBESITY.

Mr. Schindler is the latest addition to the list of persons who have undertaken the treatment and cure of excessive fatness in the human race—this condition being considered by him as a disturbance of the animal economy, in consequence of which the carbon taken in is accumulated in the form of fat. Diet and exercise, as might be expected, constitute the basis of his treatment. As in the method of Mr. Banting, which some years ago was so much in vogue, the diet advised for fat persons consists of food containing a large percentage of nitrogen, to which some vegetables without starch, and cooked fruit, are to be added, for the purpose of moderating the excitation due to animal nourishment. This diet is to be varied, according as individuals are of a sanguine or lymphatic temperament. The use of certain wines is permitted; beer is, however, entirely forbidden. Coffee and tea are allowed, with as little sugar as possible. Cheese, potatoes, rice, beans, pease, maize, maccaroni, tapioca, arrow-root, and soups are not allowed. The use of sulphate of soda is recommended, as moderating the transformation of nitrogenous materials and stimulating the oxidation of fat; and the use of mineral waters containing the sulphate of soda in solution is considered of the greatest importance in this respect. The waters of Marienbad, which are especially rich in this salt, are stated to have, usually, the most happy effect. Their use, together with that of some alkaline pills, and a strict adherence to the conditions above mentioned, caused a decrease in weight of from twenty-five to sixty pounds in different individuals in the course of a few weeks.

GOMA OIL.

The Japanese colony, at Placerville, California, has lately engaged in the cultivation of an oil-plant, of the nettle family, called goma. The seeds of this plant are said to be so rich in oil that one hundred and thirty-six pounds of oil can be obtained from the product of an acre. The plant itself needs a great deal of moisture, which is to be supplied by means of irrigation. The young shoots form an excellent salad; the flowers are much sought after by bees; and the stems furnish a large amount of fibre. It is asserted that this goma oil, well prepared, is equal to the best olive oil, and does not become rancid so quickly, replacing the olive oil in all its technical applications. The price is expected to be considerably less than that of olive oil.

ACTION OF MALTINE.

In a recent communication to the Academy of Sciences of Paris M. Coutaret calls attention to some valuable applications of maltine, or vegetable diastase—a substance obtained by the continued maceration of germinating barley at a lukewarm heat. When this is added to ordinary cooked food, containing starchy matter, it gives rise, in the course of an hour, to a milky liquid, composed of unchanged starch, dextrine, and glucose. Water is an indispensable requisite of this artificial digestion, not less than ten times the amount of that of the substance treated being needed. The solvent action of the maltine upon starchy substances varies according to their species—five grains of maltine causing the digestion of from one to four pounds of the cooked starch. A temperature of 95° to 105° Fahrenheit proves to be the best suited for this artificial digestion. The author goes on to show that this saccharifying influence of maltine upon starch is precisely that of the salivary juice, or the animal diastase, upon the same substance; indeed, he maintains that these two forms of diastase are entirely similar in their chemical, physical, and physiological properties, both having the same solvent effect upon cooked starchy matters. Our author infers, from his observations, that maltine is a very important substance in the treatment of dyspeptics, since starchy substances constitute the basis of human food. In the greater number of cases of dyspepsia, he maintains that it is the lack of the digestion of the starchy substances that causes the trouble, as is shown especially where there is alteration, diminution, or absence of saliva. For these cases maltine is of special benefit, as it may be used to supply any deficiency in the natural secretion. For several years the author has found that maltine renders the most important service in instances like those mentioned. He maintains that, next to a proper diet and the use of alkaline waters, there is no medicine so harmless, and, at the same time, with such a curative tendency, under the same conditions.

ASPARAGUS SEEDS AS A SUBSTITUTE FOR COFFEE.

The extensive use of coffee and the expense of the better qualities, as also the occasional difficulty of obtaining all the varieties, owing to the interruption of commerce by war, etc., has induced the employment of a great many substitutes, such as roasted turnips, chiccory roots, burned corn, pease, and other substances. But these, apart from giving a color resembling that of coffee and occasionally an odor similar to it, have no relationship to the original material, owing to the entire absence of the principle of coffee itself—the caffein. A German author, having found that asparagus seed contains caffein in very large proportion, now presents it to the public as the true substitute for coffee. He prepares it by crushing the red berries in a mortar, and allowing the mass to ferment for some days in a tub, and afterward turning out the solid portion upon a sieve with holes a little larger than the asparagus seeds. These seeds, after passing through the sieve, are again washed and dried. They have a dark brown appearance, and are horny externally like coffee, having a greenish tint inside and a peculiar aroma, similar to that of coffee, a fatty oil, and a nitrogenous alkaloid. On being roasted these seeds give out an aroma astonishingly like that of coffee; and when ground and prepared, the result can scarcely be distinguished from that of coffee of the finest quality.

GUARANA—A NEW STIMULANT.

Attention has been called of late years to the virtues of a drug known as guarana, which is used in Brazil as a stimulant and a remedy in many forms of nervous affection. It is said to be prepared from the seeds of a sapindaceous plant known as *Paullinia sorbilis*, which ripen in October or November, and are then removed from their capsules and dried in the sun. Afterward they are placed in stone mortars over a charcoal fire, first slightly roasted, and then rubbed to a fine powder, which is moistened with water or exposed to the dew by night, and assumes the consistency of a paste. This is worked up into cylinders or balls, weighing from twelve to sixteen ounces, then dried in the sun or the smoke of the hut until they become dry and of a stony hardness, requiring the blow of an axe or hammer to break them. For use this preparation is rubbed on a grater or file, so as to be reduced to a powder, and then mixed with sugar and steeped in water.

A chemical examination of the substance proves its value as a drink, since it embraces the same principle as coffee or tea, and, in fact, contains four or five per cent. of the alkaloid caffein, a proportion vastly greater than that of the coffee bean, which has but two per cent. of the same ingredient, or of tea, which has from six-tenths of one per cent. to two per cent. of the same. It is not at all improbable that in time this substance will come much more generally into use, especially for travelers, and for regions where transportation is expensive, and where concentration is an object, since so much larger a percentage of an important stimulant can be obtained by its use in a given weight than in any other way. It is said that at the present time about 6,000,000 pounds are prepared annually in Brazil, nearly the whole of which is used in that country. The plant from which it is derived is very abundant; and should a demand arise for it, it can be furnished in almost any reasonable quantity.

METHYLATED ETHER AS AN INTOXICANT.

It is stated that methylated ether is used very largely as an intoxicant, in the place of alcohol, in the counties of Londonderry, Antrim, and Tyrone, Ireland. The quantity taken at one time is from two to four drachms to the dose, which is repeated twice, thrice, or even four or five times daily. This practice is said to have affected the inland revenue to such an extent as to have diminished it nearly $30,000 per annum. The attention of the insurance companies has been directed to the subject, as much risk of fire is incurred by the keeping of so inflammable a substance among persons ignorant of its properties.

PREPARATION OF LAMB AND RABBIT SKINS.

Among the mechanical employments especially suited to women, that of dressing small skins, such as those of lambs and rabbits, for ornamental purposes, has lately been suggested, there being a great demand for such articles, and one that can be readily extended. The best method of preparing these consists in taking about four skins at a time, and first washing them in cold *strong soap-suds made with hot water,* allowed to cool before use. The dirt is to be thoroughly removed from the wool or hair, and the skin is again washed in clean cold water until all the soap is removed. Half a pound each of salt and alum are then to be dissolved in a little hot water, and put in a tub with cold water sufficient to cover the skins, which are allowed to soak therein twelve hours, and afterward hung over a pole to drain. When well drained they are stretched very carefully on a board to dry, and while drying they are to be restretched several times. Before they are entirely dry, the flesh side is sprinkled with a mixture of one part each of finely powdered alum and salt; and this is to be well rubbed in. The flesh sides are then to be laid together, and the skins hung in the shade two or three days, turning them over every day until perfectly dry. The flesh side is finally to be scraped with a blunt knife to remove any remaining scraps of flesh. The skins are then rubbed up to soften them, and finished finally with pumice-stone.

ARTIFICIAL GOLD.

This material is manufactured largely in the United States, into imitation jewelry and other articles, scarcely distinguishable from gold, except by the inferior gravity; and it is a matter of surprise to almost any one to learn that it does not contain a single grain of the precious metal. It is made by taking 100 parts of pure copper, 17 of pure tin, 6 of magnesia, 9 of tartar of commerce, 3.6 of sal ammoniac, and 1.6 of unslacked lime. The copper is first melted, and the other substances (excepting the tin) added, a little at a time, and the whole well stirred for half an hour, so as to produce a perfect mixture, when the tin is thrown in and stirred round until melted. The crucible is then covered, and the fusion kept up for twenty-five minutes, and the scum taken off, when the substance is ready for use. It is malleable and ductile, and can be worked in any form, even into leaves like gold.

FROM THE ARCHIVES

Here are some more of the oldies but goodies such as I started on page 36. Actually, they are like the little inserts, blurbs, hints and suggestions used as fillers in our modern science and mechanics magazines.

They were gleaned from such publications in the 1860s and early 70s and put in the science section of HARPER'S NEW MONTHLY MAGAZINE from late 1869 through 1872. As the accumulated knowledge piled up, Harper's altered their science format to rambling summaries and then dropped it altogether.

Since those were the days of discovery, I chose from that section those subjects I considered the most interesting to the Survivalist. Many are applicable to present day survival projects. Others suggest lines of research abandoned then but which might prove practical in these times of diminishing resources. Others are simply thought provoking. You've got to get your thoughts provoked, at least on alternate Tuesdays, so people will find out how really smart you are.

CLOSING CRACKS IN STOVES.

It may be convenient to know a ready method of closing up cracks, which are not uncommon, in cast iron stoves; and we are assured that the following recipe is a reliable one. Good wood ashes are to be sifted through a fine sieve, to which is added the same quantity of clay, finely pulverized, together with a little salt. The mixture is to be moistened with water enough to make a paste, and the crack of the stove filled with it. This cement does not peel off or break away, and assumes an extreme degree of hardness after being heated. The stove must be cool when the application is made. The same substance may be used in setting in the plates of a stove, or in fitting stove-pipes, serving to render all the joints perfectly tight.

FURNACE SLAG FOR ROAD BALLAST.

The journal of the Franklin Institute mentions a method of utilizing slag, as used at the blast furnaces at Osnabrück, which consists in allowing it to fall into a stream of water from a height of about eight feet. By this means it becomes granulated into particles of the size of beans, and it is then used as ballast for roads and railways.

COMPOUNDS OF GELATINE AND GLYCERINE.

An English journal mentions certain properties of the compound of these substances as of much importance in the arts. It solidifies on cooling, and then forms a tough, elastic substance, having much the appearance and characteristics of India rubber. If a corked bottle have its upper end dipped into the melted composition several times, allowing each new coating to dry before repeating the operation, the stopper will be sealed almost hermetically. It may be further stated that the two substances united form a mixture entirely and absolutely insoluble in petroleum or benzine, and that the great problem of making casks impervious to these fluids is at once solved by brushing or painting them on the inside with the compound. This is also used for printers' rollers and for buffers of stamps, as benzine or petroleum will clean them when dirty in the most perfect manner and in an incredibly short space of time. All these applications have, we believe, been made the subject of patents. Water must not be used with the compound, except as a passing application.

GREAT HEAT FROM STEAM.

The apparent paradox of raising certain solutions, by means of steam at 212 degrees Fahrenheit, to an appreciably higher degree than this, has been presented by Mr. Spence. Thus he selects a solution of some salt (as nitrate of soda) having a high boiling-point, or one of about 250 degrees Fahrenheit, and this is placed in a vessel surrounded by a jacket. Steam is let into the intervening space until the temperature of 212 degrees is reached. The steam is then shut off and an open pipe immersed in the solution, and steam from the same source thrown directly into the liquor. In a few seconds the thermometer begins to rise slowly, but continues to do so until it finally reaches the point of 250 degrees. This method, applicable in a great variety of ways, promises to be of immense value in obtaining readily an unusually high degree of temperature, and one by means of which important chemical combinations and decompositions can be accomplished.

REACTIONS OF ALCOHOL.

Mr. Hugo Tamm, in a brief abstract of certain experiments upon the action of permanganate of potash upon various substances, such as filter-paper, tartaric acid, coal gas, tallow, turpentine, benzole, alcohol, ammonia, etc., states that the two most interesting facts which he found were that alcohol boiled with an equal bulk of a solution of permanganate of potash was partially transformed into acetate of potash, and that in the same condition ammonia was converted into nitrate of potash.

THE PRICKLY COMFREY AS A FODDER PLANT.

According to Voelcker, the prickly comfrey, a native of Caucasus, is at present cultivated in some parts of Ireland as food for dairy stock. The plant is perennial, is easily propagated by cuttings from the root, and yields a heavy crop. The ordinary produce is about thirty tons to the acre in several cuttings; but eighty-two tons have been reached. An analysis made of this substance showed that it would probably have the same feeding value as green mustard, turnip tops, or Italian rye-grass grown on irrigated land.

HYDRATE OF CHLORAL AS AN ANTISEPTIC.

When hydrate of chloral was first introduced into the *materia medica* its expense was so enormous as very materially to interfere with its applications. In consequence, however, of improved methods for its preparation, and the great extent to which this is now carried on, the cost is now very much less, and it is, therefore, possible to make use of it as a reducing agent of metals, as a preservative of objects of natural history, etc. For this latter purpose it would really seem to be of much value, as it is decidedly antiseptic in its character. In one experiment one-half of one per cent. of chloral added to some concentrated dried egg albumen kept it for a long time from putrefying. For such application the chloral hydrate must first be dissolved in water, and then the albumen added to the solution.

CUPRO-AMMONIUM.

If shreds of copper are introduced into a bottle half full of ammonia solution, the metal will be dissolved, with the production of what is called cupro-ammonium, and with the accompaniment of a deep blue color. This substance has the remarkable property of dissolving various substances, as silk, lignine or cellulose, paper, etc., with great rapidity. It has been proposed to apply this agent in the preparation of solutions which can be converted to important industrial uses, such as readily suggest themselves in connection with this power of dissolving the substances in question. Paper, linen, wood, etc., can be readily united almost indissolubly by means of this substance; and it is said that, when thus adherent, the copper which they hold may be extracted by a weak acid, leaving the material pure and white, but without disturbing the adhesion already established. It is not known in what particular chemical combination the two substances unite, or what is the precise character of their union. The name given, cupro-ammonium, is to be considered as of no chemical significance.

ECONOMICAL MANUFACTURE OF OXYGEN.

We have already adverted to the employment of oxygen in ordinary illumination in the city of Paris, an application which, to be of economical value, requires an improved method of manufacturing the gas. This is done by placing 500 pounds of manganate of soda in a retort and superheating it, steam being passed over it with the result that all the oxygen is extracted in five minutes. Hot air is then passed over this residue for five minutes more, and the percentage of oxygen is again restored; and this alternation is continued to the number of six times in an hour, at the end of which time two and a half cubic yards of oxygen have been furnished. The oxygen, as it first issues from the gasometer, contains about fifteen per cent. of nitrogen; but by allowing the first portions to escape, the quantity of this gas in the mixture can be reduced to two and a half per cent. According to the statement of the inventor of this process, one ton of manganate of soda will yield 100 cubic yards of oxygen daily, or more than 36,000 cubic yards per year, without the necessity of renewing the salt during the whole time.

METHOD OF COVERING A BANK OF EARTH WITH GRASS.

To cover a steep bank quickly with grass the following method is recommended by a German horticultural association. For each square rod to be planted take half a pound of lawn grass seed, and mix it intimately and thoroughly with about six square feet of good dry garden earth and loam. This is placed in a tub, and to it liquid manure, diluted with about two-thirds of water, is added, and well stirred in, so as to bring the whole to the consistency of mortar. The slope is to be cleaned off and made perfectly smooth, and then well watered, after which the paste just mentioned is to be applied with a trowel, and made as even and thin as possible. Should it crack by exposure to the air, it is to be again watered and smoothed up day by day, until the grass makes its appearance, which will be in eight or fourteen days, and the whole declivity will soon be covered by a close carpet of green.

COD-LIVER OIL PILLS.

Dr. Van der Court, of Brussels, prepares cod-liver oil by adding carefully pulverized slacked lime to the oil, little by little, until the consistency requisite for forming into pills is obtained. Of this mass he gives four or five grains as a dose, after each meal, flavoring it with a small quantity of oil of bitter almonds, or other substance. This remedy he considers to be in many respects better than the liquid oil, and quite useful in the early stages of consumption. The more chronic the character of the disease, the more good may be expected from its administration.

MEAT EXTRACTS NOT NUTRITIOUS.

The increasing skepticism of physiologists in regard to the nutritive value of the various meat extracts, so much advertised at the present day, has been rather fortified by the publication of an elaborate paper of Müller, of Paris, upon the subject of the physiological character of meat extracts in general. In this, starting out with the proposition, first, that meat extracts do not have any nutritive value, and second, that they sometimes have a certain action which is to be attributed only to their mineral principles, and especially to the salts of potash, he proceeds to examine the various preparations, whether bouillons or extracts, and then inquires into the action of the nitrogenous principles contained in these preparations, and finally devotes a third part to a discussion of the action of the potash salts.

We have not the space to give the details of his elaborate researches under these three heads, but present the following summary of his conclusions upon the subject: First, that meat extracts are aliments neither directly, since they contain no albuminoid matters, nor indirectly, since their nitrogenous principles do not arrest disassimilation. Second, in feeble doses they may be useful by the stimulating action of the salts of potash, which favor digestion and circulation. Third, in stronger doses, instead of being useful, they may have an injurious influence; administered at the end of long sickness, when the economy of the system is exhausted by prolonged abstinence, the salts of potash may have an injurious effect, manifest in proportion as the system has lost all its chloride of sodium. Far from favoring nutrition, they interfere with it by the direct action of these potash salts upon the globule which produces the least absorption of oxygen, and by the predominance in the serum of salts which only dissolve carbonic acid physically, and do not permit the exhalation of the normal quantity of this gas, and consequently the introduction of oxygen. Fourth, the physician should always bear in mind that to give these extracts alone is to maintain the patient in a condition of inanition.

PREPARATION OF CARBONIC ACID.

Carbonic acid, now extensively used for various purposes, besides the preparation of soda-water, is made cheaply on a large scale by the following process: A number of retorts are placed in a furnace, precisely as for the production of coal gas, and filled with a mixture of sulphate of lime or plaster of Paris and charcoal, the latter in a quantity sufficient to absorb all the oxygen of the sulphate of lime. The plaster of Paris is converted into sulphide of calcium, and carbonic acid gas escapes, and after purification by passing through water, is conducted into gasometers. A current of air passed over the hot sulphide of calcium reconverts it into sulphate of lime, and the process may thus be repeated indefinitely.

PREPARATION OF HYDROGEN.

A new process for the preparation of hydrogen on a large scale consists in heating to redness a mixture of damp coals and alkaline hydrates. By this means a mixture of hydrogen and carbonic acid is disengaged and conducted over certain carbonates, which retain the carbonic acid and become bicarbonates. The pure hydrogen is collected in a gasometer, to be used as required. The bicarbonates are employed as such, or as reservoirs of carbonic acid. The oxides produced in the carbonization of the alkaline coals may be utilized for purposes of agriculture, or else to form the hydrates for subsequent operations. Hydrogen may also, it is said, be obtained pure by passing common illuminating gas over lime, heated to cherry redness, the dry residue being carbonate of lime.

DRY EARTH THE BEST DISINFECTANT.

In the course of a recent discussion before the Lyceum of Natural History upon the subject of disinfectants, in which Dr. Endemann, Professor Joy, and others participated, it was stated that, of all disinfectants, dry earth was the most satisfactory. Dr. Endemann had tried all the disinfectants sold in the market, by composting blood, decayed meat, and vegetable garbage with them in boxes, and leaving them for six months in the best condition for a fair test. At the expiration of the time the only sample that remained absolutely sweet and inodorous was the one made up of dry earth and peat. As the result of numerous experiments conducted by himself, Professor Joy stated that he fully concurred in the statement of Dr. Endemann.

IODINE AS A DISINFECTANT.

It is stated that an excellent method of disinfecting rooms in periods of epidemics consists in exposing to the air a piece of dry iodine, care being taken to prevent the access of children to it, as it is poisonous. An ounce of iodine will answer for an entire month.

NEW DETONATING MIXTURE.

A new detonating mixture is made by bringing together equal parts of nitrate of potash and of acetate of soda; these substances, when exposed to heat, enter into new combinations, in which the salts are converted into gases, with a violent explosion.

EFFECT OF THE RED RAYS ON THE ASSIMILATION OF GREEN PLANTS.

A series of experiments upon the influence of the different red rays upon the assimilation of green plants has resulted in showing that the middle red rays are in themselves capable of maintaining the growth of a plant, while the exterior red rays do not possess this power; also, that in this action it is by no means the luminous power, but simply the proper quality of the rays, that produces the effect.

GELATINE MOULDING.

The introduction of a process of casting known as gelatine moulding, which has come into vogue within a few years, has proved to be of great value in taking casts of delicate and intricate objects without showing any seam. For this purpose the object to be copied, whether in plaster or of other material, is properly coated with oil and soap, to prevent adhesion, and then covered with canvas for protection. Rolls of modeling clay are then laid on over the canvas, until the whole surface is covered to a suitable thickness, say from four to six inches, and against this a plaster coating or wall is built up, in two or more parts, to form a backing for the mould. The two parts are then opened, and the canvas and clay taken out and thrown away, the two parts are replaced, and a hollow interval of the thickness of the clay will exist, into which hot liquid gelatine is poured. After twelve hours the gelatine will have attained a semi-solid consistency, which will allow of the mould being opened and the gelatine impression peeled from the face of the model.

NITRATE OF SILVER FROM SILVER ALLOY.

Mr. R. Palm, of Russia, has succeeded in obtaining pure nitrate of silver from the metal alloyed with copper by a very quick and simple process. He dissolves the alloy in nitric acid, evaporates to the consistency of thick oil (not to dryness), and then adds concentrated nitric acid. The silver salts precipitate in crystals, while the copper remains in solution. The crystals have to be repeatedly washed in concentrated nitric acid, and then they contain no trace of copper.

CROTONATE OF CHLORAL.

Dr. Liebreich not long since presented to the consideration of the medical profession a new narcotic, which he named crotonate of chloral, and which he obtained by the action of chlorine upon allyl. The influence of this substance upon animals differs from that of chloral, the first result being a profound anæsthesia of the brain, the sensibility of the remainder of the body being retained. In the second stage, loss of function in the spinal cord occurs, characterized by the entire absence of reflex excitability. The pulse and respiration are unaffected. If the dose be increased, death results in the third stage from the paralysis of the medulla oblongata. The animals may be kept alive by means of artificial respiration, because the crotonate of chloral does not affect the heart's action, while chloral causes paralysis of the muscles of the heart.

RESTORATION OF EXCISED BRAIN IN PIGEONS.

Fifty years ago Mr. Flourens removed the brains of cats and rabbits, and demonstrated that these animals could live without them. Recently Mr. Voit, of Munich, has obtained still more remarkable results. On several occasions he removed the brain of a pigeon, and found, to his astonishment, that after some months it had grown again. The learned physiologist says that for some weeks after the operation the birds seem to sleep, with their heads under the wings, after which they open their eyes and commence to fly about. They do not strike against any obstacle, and skillfully avoid being caught. This shows that they can both see and hear. When some of the animals were killed, five months after the operation, the cavity of the skull was filled with brain matter in two lobes, between which a dividing membrane (septum) was found.

KEENAN'S BOILER COATING.

Much value is assigned to a substance known as Keenan's Boiler Coating, as a means of preventing the radiation of heat from steam-boilers, and the saving, in consequence, of fuel as well as of time in bringing steam up to the proper degree of tension. The substance is a pulp composed of paper, oil, and certain chemicals, and is laid cold on boilers, steam-chests, steam-pipes, or any other article that is to be protected from the outer atmosphere, to the thickness of an inch and a quarter; on superheaters two inches are required. The boiler, however, must be kept warm during the coating process. When the pulp has properly set it receives three coats of paint, and can, if necessary, be grained and made to look ornamental.

The editor of the London *Mechanic's Magazine* has recently examined certain boilers coated with this substance, and found that with boilers in actual operation the exterior exhibited a gentle warmth just perceptible to the touch. He also was informed that it was the practice of the stokers to draw their fires at half past three in the afternoon and to close the dampers, the steam being then at about thirty-five. On resuming work in the morning, at five o'clock A.M., the gauges generally showed twenty-five pounds of steam, or a loss of only ten pounds during the night as the result of radiation.

COMBINATION OF CHLOROFORM AND MORPHINE IN ANÆSTHESIA.

Some time ago Professor Claude Bernard ascertained that if a hypodermic injection of morphine be introduced into the system, a very complete anæsthesia will be produced by a much less quantity of chloroform than would otherwise be required. Messrs. Labbé and Guion have also been practically testing this same question. The experiment has been tried of making an injection of morphine while a patient to be operated on was under the influence of chloroform; this resulting in profound sleep, prolonged for several hours after the operation. The gentlemen referred to prefer to introduce the injection before the use of the chloroform, not so much for the purpose of preventing pain as for facilitating the production of anæsthesia, and rendering it less dangerous by reason of the smaller quantity of chloroform employed. In one case two centigrammes of morphia were injected, and after this twenty-eight grammes of chloroform were inhaled. In seven minutes anæsthesia was complete, and was prolonged for many minutes after the end of the operation, which lasted seventeen minutes. In another case the chloroform was given twenty minutes after the injection, and complete anæsthesia was produced in six minutes, extending through the operation, which lasted an hour and forty-five minutes. The total expenditure of chloroform was only forty-eight grammes.

It is not at all improbable that further experiments will determine whether a larger quantity of the morphine can be used with a proportionate reduction in the quantity of chloroform; and whether, by combining the substances in different ways, very important results may be produced both in causing anæsthesia and preventing the sensation of pain.

ICE EXPERIMENT.

A simple method of producing ice instantaneously consists in placing a little water in a small watch-glass or porcelain capsule laid upon wool or cotton. The water is then to be covered with a layer of sulphide of carbon, and a current of air directed upon it through a slender tube. The absorption of the heat of the water, in consequence of the rapid passage of the sulphide of carbon to a gaseous condition, is so great that a few seconds are sufficient to solidify the water. A lens of hemispherical and transparent ice is thus obtained, which can be preserved long enough to pass it from hand to hand.

ANHYDROUS ALCOHOL.

The best process for obtaining alcohol absolutely free from water is said by Erlenmeyer to consist in boiling with quicklime, in a vessel fitted with an inverted condenser, for about an hour, and then distilling. If the spirit contain more than five per cent. of water, it is necessary to repeat the treatment with lime two or three times. After distillation the whole product obtained will be anhydrous. With weak spirit not more than half the space occupied with spirit must be filled with lime at first, as otherwise the vessel might be broken by its slaking.

MODE OF REPRODUCING MANUSCRIPT.

An ingenious application of science to commercial purposes has been made by an Italian gentleman, M. Eugenio de Zuccato, of Padua. By means of the invention any number of copies of a manuscript or design, traced upon a varnished metal plate, may be produced in an ordinary copying-press. The *modus operandi* is very simple. To the bed and upper plate of a press are attached wires leading from a small battery, so that when the top of the instrument is screwed down the two metal surfaces come into contact, and an electric current passes. An iron plate resting upon the bed of the press is coated with varnish, and upon this surface is written with a steel point any communication it is desired to copy. The letters having thus been formed in bare metal, a few sheets of copying paper are impregnated with an acid solution of prussiate of potash, and placed upon the scratched plate, which is then subjected to pressure in the copying-press. An electric current passes wherever the metal has been left bare (where the writing is, therefore), and the prussiate solution acting upon the iron, there is found prussiate of iron or Prussian blue characters corresponding to those scratched upon the plate. The number of copies that may be produced by this electro-chemical action is almost unlimited, and the formation of the Prussian blue lines is, of course, instantaneous.

PREPARATION FOR SOFTENING LEATHER.

An oil has lately been introduced into commerce in Germany which answers an excellent purpose in softening stiffened leather, and rendering it almost as pliable as when new. This preparation, it is said, consists of a mixture of sixteen parts of oleic acid, two parts of alcohol of 90 per cent., and one part concentrated sulphuric acid. The oleic ether formed is poured off, it being a thin, brownish oil. It is separated from the free sulphuric acid and the alcohol by shaking it up in warm water and decanting it. On mixing this oleic ether with an equal weight of fish oil, and adding, for the purpose of concealing the smell, from a quarter to half an ounce of nitro-benzole to the pound, a preparation will be obtained which experiment has shown to possess all the qualifications required for the purpose.

METHOD OF DESTROYING APHIDES.

In answer to the inquiry so frequently made for some means of destroying aphides, and other insects on plants, without injury to the latter, the following method is recommended by the *Revue Horticole*, with an indorsement of its answering perfectly the desired object: The preparation is made by adding to seven pints of water three and a quarter ounces of quassia chips, and five drachms of the seed of the garden larkspur. These are to be boiled together until reduced to five pints. When the liquid is cooled it is to be strained, and used with a watering-pot or syringe, as may be most convenient. The use of larkspur seed for the destruction of the insects infesting the human head is a time-honored application among country people—beds of the plant being cultivated frequently for the express purpose of furnishing material for the decoction. The efficiency of this remedy seems to depend on the presence of the alkaloid called delphine, which appears to be a poison especially fatal to insects.

EJECTION OF YOUNG BIRDS FROM NESTS BY YOUNG CUCKOOS.

The fact has long been known that the English cuckoo lays its eggs in the nests of other birds to be hatched out, and that the parasite occupies the nest to the exclusion of the rightful owners. A communication by Dr. Jenner to the Royal Society of London gave the first record of this exclusion on the part of the cuckoo, and the method by which it was accomplished, and Mr. Blackburn, of the University of Glasgow, has lately verified and authenticated his statement. In one instance he found the nest of a titlark with two eggs in it, as well as one of the cuckoo. This was carefully watched, and at a subsequent visit to the nest the titlarks were found hatched, but not the egg of the cuckoo. At the end of forty-eight hours the young cuckoo was found in the nest, and the titlarks were outside of it, down a bank, apparently quite lively. They were returned to the nest with the cuckoo, which struggled about till it got its back under one of them, when it climbed, backward, up the side of the nest, and threw the titlark over the margin and down the bank. This was repeated in several instances, quite often enough to show that it was a regular instinct of the animal. The most remarkable fact in the case was that the cuckoo was perfectly naked, without a vestige of feathers, and its eyes still unopened, while the titlarks were more or less feathered and with bright eyes. A second case of similar character is recorded by Mr. G. E. Rowley in the May number of *Hardwicke's Science-Gossip*.

DEFECTIVE BRAIN AND DEFORMED FEATURES.

Attention has lately been called to an article by Professor Laycock, written as long ago as 1862, in which he notices the coexistence of weakness or defective organization of the brain with certain peculiarities of formation of the face, and especially of the parts answering to the ribs of the cranial vertebræ. Congenital defect of the brain and tendency to tissue degeneration are very prominently associated with a defective and receding chin, and the structure of the ear presents a similar harmony. In the perfect ear the cartilage is compressed within an ellipse or ellipsoid proportionate to the head, and to this is attached a geometrically formed helix and a pendent ellipsoid lobule. In proportion as these are defective, or as the ear is monstrous, triangular, square, or of irregular form, is indicated a tendency to cerebral degeneration or defect. Monstrous ears, with defective helix or lobules, are very common in idiots or imbeciles. The defective form, and absence of the lobule in the female Aztec Cretin, and in the case of dementia, are instances in point. The ear of the male Aztec Cretin is also defective, but is more nearly resembles the ear of the chimpanzee.

NEW PHOTO-LITHOGRAPHIC PROCESS.

According to the *London News*, a new system of photographic lithography has been introduced in Berlin, based upon the fact that caoutchouc, like Jew's-pitch and some other hydrocarbons, is capable of receiving a photographic impression. A thin film of caoutchouc dissolved in benzole is first spread upon paper, and exposed in the camera in the usual manner. The portions which have been subjected to the action of light are rendered insoluble, and the other portions are then washed away, as in Mr. Pouncey's process. The caoutchouc, wherever it remains on the paper, will receive a greasy ink from a roller which is now passed over the sheet, and the impression thus obtained may be transferred to the lithographic stone, and printed from in the usual manner. The plan is virtually a reproduction of Pouncey's process, with the substitution of caoutchouç for the bitumen of Judæa.

ACTION OF SALT OF POTASH ON VEGETABLES.

Considerable interest was excited some months ago by the detail of experiments prosecuted by Dr. George B. Wood upon the action of salts of potassa on vegetation. In a subsequent communication to the American Philosophical Society he states that in a field of grain devoted to these experiments, the soil of which was previously exhausted by bad culture, one-half was enriched by barn manure, and the other half with similar manure with the addition of a certain quantity of wood ashes. The effect of the latter application was especially marked, the yield being much greater than with the former. The most striking results were obtained by the use of ashes of the poke-berry (*Phytolacca decandra*).

WINDOW PHOTOGRAPHIC PROCESS.

A new and quite peculiar photo-lithographic process, lately announced by Window, bids fair to become of much practical value. For this, white paper is coated with a mixture of gelatine and bichromate of potash, and, after drying, illuminated under a negative. The soluble chrome salt is then washed out with water. If the wet picture is now touched with printer's ink the portions corresponding to the light lines of the negative take up the black. This is based upon the peculiarity of gelatine of resisting the fatty blacks, even in thin sheets; and also the fact that these blacks are readily taken up by the lithographic stone. A piece of gelatine paper is rendered sensitive in the ordinary manner in a bath of bichromate of potash, and illuminated under a positive matrix of the object to be lithographed. After a sufficient illumination the paper is immersed some seconds in water, and laid with the gelatine side down upon a clean polished lithographic stone, and then rubbed several times with a rubber pad to press out the superfluous water. A few minutes after warm water is poured on, of the temperature of about 97°, and the picture developed exactly like a carbon print. The paper becomes gradually loosened, and with a little action of the warm water can be completely removed. Warm water is then poured carefully over the side to separate all the remaining soluble gelatine.

The picture thus obtained is naturally a negative, because the matrix was a diapositive. After the picture has been developed so that the lights are entirely pure the stone is to be moistened with alum water, and then allowed to dry. If the experiment has been successful, the negative picture will appear clear and sharp after drying. The edges of the stone are now to be gummed in the ordinary way, and the stone rolled with lithographic black; after which it is to be well rubbed down with a folded flannel cloth dipped in gum water; the gelatine of which the negative picture was composed is removed, and the fat color remains on the originally clear spaces. If the experiment has succeeded, a positive of great delicacy will be produced, which can then be printed from.

EFFECT OF TOBACCO ON MAN AND ANIMALS.

Dr. Lebon, of Paris, has given a great deal of attention to the question of the effect of tobacco upon man and animals, and has lately presented a report on the subject to the Medico-Chirurgical Society of Liege. Among the conclusions which the author has reached in the course of his researches, the following may be mentioned as most important: 1. Smokers, and persons who without smoking are enveloped in an atmosphere of tobacco-smoke, absorb for each quantity of ten grammes of tobacco a proportion of nicotine varying from some centigrammes to a gramme. They absorb also about an equal amount of ammonia. 2. The quantity of tobacco consumed daily by a single individual addicted to its use is scarcely less than twenty grammes. A smoker is, therefore, liable to absorb daily a quantity of nicotine which may reach twenty-five centigrammes, with an equal proportion of ammonia. 3. Of all kinds of smoking the most dangerous is that of smoking a cigar or cigarette and swallowing the smoke; the least dangerous is that of smoking a nargile, or pipe with a long tube, in the open air. 4. The effect produced by the result of the condensation of tobacco-smoke is analogous to that of nicotine. Nevertheless there must be added the effects produced by the ammonia, which the smoke contains in considerable quantity. 5. The resinous semi-liquid which condenses in the interior of the pipe contains a considerable proportion of nicotine. It is little less poisonous than nicotine itself, and rapidly destroys the life of animals exposed to its action. 6. The liquid product which condenses in the lungs and mouth of the smoker contains water, ammonia, nicotine, fatty and resinous bodies, and coloring matters. A dose of one drop of this speedily produces paralysis of motion in small animals, and a state of apparent death. These effects quickly disappear, but death actually supervenes if the dose is carried up to several drops. If, instead of administering the liquid internally, the animal is made to breathe it for some time, it dies all the same. In this last case the effects seem due in a great measure to the presence of ammonia. 7. In a dose of a single drop dangerous results are not produced upon large animals, but those of small size are killed instantaneously. Among the effects observed the most constant are fibrillar tremblings, a general congestion of the superficial vessels, stupor, and especially the tetaniform contraction of the muscles of the abdomen. 8. Nicotine is one of the poisons the effect of which is most speedily dissipated, and the habituation to which is soonest accomplished. 9. Contrary to what has generally been assumed, the vapor of nicotine at the ordinary temperature is not dangerous, but it is quite otherwise if the liquid is carried to ebullition. It then produces palpitations, a decided suffocation, precordial pain, and vertigo. Smaller animals exposed to this vapor die almost instantaneously. 10. Among the effects of tobacco-smoke upon man may be mentioned, in small doses, excitation of the intellectual faculties for the moment; in repeated doses it produces palpitations, troubles of vision, and more especially a decrease of the memory, and particularly the memory of words.

FRIABLE GOLD COIN.

In some instances after a piece of gold coin has been struck in a mint it becomes friable and crumbling. It has been ascertained that this property is due to the presence of a very small quantity (hardly a thousandth part) of certain metals, among which lead is the most injurious. By an improved process, however, this difficulty has lately been overcome. This consists in passing a current of gaseous chlorine over the melted metal, which is covered with borax in the ordinary way. A chloride of gold would not be formed at this high temperature, but on the contrary would be decomposed; while the other metals unite with the chlorine so as to quickly purify the mass. Any silver which may happen to be present is not lost, as it becomes dissolved in the borax which serves as a cover for the molten gold.

RIVOT METHOD OF EXTRACTING GOLD AND SILVER.

A new process of extracting gold and silver from their ores, devised by Rivot for treating the California ores, has been lately published, and is said to be applicable under certain circumstances in which the usual methods can not so readily be employed. The principal stages in this method of treatment are presented in the following summary:

1. Roasting of the pyrites in heaps, or in reverberatory furnaces, in such a manner as to almost completely oxidize the metallic sulphides, and to reduce the formation of sulphates to a minimum.

2. Pulverizing and mixing of the roasted pyrites with the ores.

3. Roasting of the mixed mass with superheated steam in a revolving furnace, with exclusion of air.

4. Amalgamation in vertical mills, which are capable of a great out-turn, and of working wet or dry, as may be desired, and which divide the mercury well, and effect a more speedy and complete amalgamation, owing to the pressure of the millstones.

5. Separation of the mercury from the residues.

6. Squeezing of the mercury through coarse linen bags or wooden cylinders.

7. Distillation of the amalgam in cast iron tubes provided with receivers cooled by water.

8. Smelting of the metals recovered by amalgamation in black-lead crucibles, and casting in iron moulds.

NEW FIRE-ENGINE.

The *English Mechanic* publishes the description and figure of a fire-engine on an entirely new principle. This consists in charging the water used with carbonic acid and nitrogen. A special merit is in the remarkably cheap method of obtaining the carbonic acid, which is made by drawing atmospheric air through a charcoal fire, and forcing it into a tank containing water. A claim is made—and practical experiments seem to substantiate it—that one cubic foot of this solution, discharged upon any burning pile, is capable of doing as much execution in extinguishing a fire as fifty cubic feet of water from an ordinary fire-engine, and in one-twentieth part of the time.

Another important point is the capability of the invention to instantly depolarize vast quantities of sulphurous vapors, carbonic acid gas, carbureted hydrogen, and sulphureted carbureted hydrogen. A delivery jet one-quarter of an inch in diameter is said to be capable of instantly extinguishing and depolarizing carbureted hydrogen from a two-foot main, working at three-inch pressure from the gasometer. By this method the air in coal-pits, mines, caverns, etc., can, it is claimed, be rendered pure and healthy. This apparatus also may be used for softening water for brewing and dyeing, and for preventing incrustations in steam-boilers.

ALBERTYPE PRINTING.

This method of printing directly from the photographic negative, invented by Albert, of Munich, a year or two ago, is probably familiar to many of our readers, but as some additional details of manipulation have lately been announced, it may be of interest to many to have some account of the entire process. For this purpose a glass plate, about five-eighths of an inch thick, is coated with the following solution: Filtered water, 300 parts; white of egg, 150 parts; gelatine, 15 parts; bichromate of potash, 8 parts.

The plate thus covered is to be dried, a black cloth laid behind it, and exposed two hours to the light. It is then covered with a mixture of gelatine and bichromate of potash, in the proportion of gelatine, 200 parts; bichromate of potash, 100 parts; and water, 1800 parts. When this coating is dried the plate is printed upon by means of a negative, the rays of light falling perpendicularly. After a sufficient exposure the plate is washed and then printed from, like a lithographic stone—that is, a fatty ink applied by means of a roller, and then a print taken off, under a lithographic press. The theory of the process is as follows: The photographed surface of the plate is washed with cold water, not to take off any portion of the gelatine, but only to remove the chrome salt and to moisten the gelatine. The portions of the layer that have been the most exposed to the light, and corresponding to the deepest shades, are entirely insoluble, and do not take up the water. The less illuminated portions take up some water, not being entirely insoluble; but the higher lights, or the portions of the plate not exposed at all, absorb the water. The lower plate thus prepared is treated just like a lithographic stone. When the ink passes over it the color sticks to the dark shades, in a less degree to half lights, and not at all to the entirely light portion, on account of its coating of moisture. One peculiarity of the impressions thus obtained consists in the fact that lights and shades are not presented in a continuous tone, as in an ordinary lithograph, but in a fine granulation, which is the result of the manner in which the gelatine absorbs or repels the water. Sometimes this granulation is undistinguishable without a lens, but it can always be detected on close examination. It is said that a thousand impressions have been taken from a single plate, although this is perhaps questionable.

USE OF CASEINE IN COTTON PRINTING.

The use of caseine as a thickening material in cotton printing continues to increase in favor, the substance being applied by adding a very little cold water to the caseine, and about two to three per cent. of magnesia, giving a thick and gummy solution, which runs when exposed to heat, but not in the cold, the melted mass being soluble in alkaline liquids. When insoluble colors are printed with this solution they become fixed, in consequence of the running produced by steaming. The colors, however, will not wash. If the caseine is treated with a larger quantity of magnesia, say from five to ten per cent., we do not have a solution, but a thick, semi-fluid, homogeneous paste, which can be stirred around in water without giving a true solution. In barytes water, however, this paste becomes a thin, gummy solution, which is well adapted, in certain cases, for thickening. This melts almost completely by heat, and the mass is insoluble in alkali. The solution can be kept for a long time without decomposition, but must be protected against the carbonic acid of the atmosphere, which will gradually cause the barytes to precipitate, and thus diminish the solubility of the magnesian combination.

NEW WOODBURY PHOTOGRAPHIC PROCESS.

WOODBURY, the author of the well-known photographic process which bears his name, has devised a new mode of printing, which begins by rubbing a glass plate with wax, and then coating it with a thin layer of collodion. A solution of gelatine and bichromate of potash, containing a certain amount of finely pulverized glass, emery, etc., is then poured on. After drying, this sheet is removed from the glass and laid upon the negative, with the collodion side downward, and then exposed to the light. After sufficient illumination it is cemented by a solution of India rubber to a glass plate and washed with warm water, and after development the relief picture is again removed from the glass plate. The hydraulic press is next used to transfer this fine grain to a plate of metal, the minutest detail of the dry image being pressed into the soft metallic plate. A galvano-plastic counter-form is taken from this soft plate, and a cliché again taken from this, which is immediately coated with steel or iridium.

Another method of producing the relief granular picture consists in preparing the different mixtures of chrome gelatine as above, differing only in the greater or less degree of fineness of the granular substance. A sheet of thin paper is allowed to swim upon the mixture which contains the coarsest grains. After drying it is allowed to swim upon a second mixture, with the medium-sized grains, and then again, after drying, upon that with the finest. The gelatine sheet is now illuminated under a negative, then fastened under water to a finely polished steel plate, developed in warm water, and dried. The image thus obtained is transferred to a soft metallic plate, and a galvano-plastic copy taken. The finest grains in this way furnish the finest tones, while the half tones are supplied by those of medium size. This paper can be prepared like carbon paper, without chrome salt, and rendered sensitive before use.

ACTION OF SALINE WATERS IN DYEING.

It has generally been assumed that water containing saline matters is unsuited for dyeing and bleaching; but a correspondent of Reimann's *Färber-Zeitung* writes to say that the water of his village, which contains a little salt and some lime, is so far from being injurious to the process, that it furthers it in a decided degree. In cotton dyeing an inequality of color in the yarn is often met with; but the correspondent in question maintains that this is never the case in his neighborhood. In boiling out the cotton, whether in the yarn or in the piece, it comes out from the kettle already half white, thus far lighter than when boiled in ordinary non-saline water. The theory of this process is found in the suggestion that saline water boils at a higher temperature than pure water. Aniline colors, when used with saline waters, according to his experience are more beautiful, and light blue is never as fine as when saline water is employed. Should this communication prove to be founded in fact, it would be a question as to what extent common salt is to be hereafter added to the water for dyeing purposes.

MODERN CANNIBALISM.

The question as to how far the pre-historic man was a cannibal in his tendencies, although proved in many instances by the nature of the human bones found in certain localities, has received a very striking illustration in a recent account of the so-called cave cannibals in South Africa, a race still in existence, which, although not openly practicing this revolting habit, are believed yet to do it in secret.

Their abode was in a series of caves in the Transgaripe country, among the mountains beyond Thaba Bosigo. The principal of these caves, known as the Cannibal Caverns, is formed by an overhanging cliff, and in length is about one hundred and thirty yards, with a breadth of about one hundred. The roof is blackened with the smoke of the fires of the former inhabitants, and the floor is still strewn with heaps of human bones; and the interior of the cave, as far as the eye can reach, is lined with similar remains, with skulls especially. These seem to have been less mutilated than the other bones, which were generally broken or cut to pieces, apparently with

stone implements, the long bones being split open for the abstraction of the marrow, leaving the joints alone unbroken. A few bones were charred by fire; but most of them seem to have been boiled, as though that was considered the preferable mode of cooking.

There still remain inclosures in which the destined victims of the feast were penned up until their appointed time should come. The practice in question seems not to have been, by any means, a necessity to them, as there was an abundance of food of all kinds, consisting of fish, game, and fruits; and its exercise was as frequently upon members of the cannibal's own family as upon strangers—a lazy wife or child, or superannuated parent, being disposed of in this way as the most eligible method of utilizing them.

DETECTION OF FALSIFIED WRITING.

According to a French journal, alterations or falsification of writings, made with ordinary ink, may be rendered impossible by passing the paper to be used through a solution of gallic acid in pure distilled water. When dry, this paper may be used like ordinary paper; and any attempt to alter or change any thing written upon it will be left perfectly visible, and can thus be easily detected.

XYLOL IN SMALL-POX.

A good deal of interest has been excited by the published success of xylol (dimethylbenzol, one of the many products of the distillation of coal-tar) as a remedy for the small-pox, for which it has been applied for a considerable time in Berlin by Dr. Zeulzer. The experiments are stated to have proved very satisfactory, and its use in one of the principal hospitals of Berlin is becoming very extended. The dose of this substance for an adult is from ten to fifteen drops, and from three to five for children, every few hours. No injurious effect has hitherto been noted, even when given in considerably greater quantity. It is applied from the earliest period of the disease till the complete drying up of the pustules. The best method of administering the xylol is in capsules, which are now furnished, containing three, eight, and twelve drops, although it can be given drop by drop in wine or water. Toluol appears to have no effect.

BROMIDE OF POTASSIUM IN EPILEPSY.

Du Saulle has lately presented the result of his experiments in the treatment of 207 cases of epilepsy by bromide of potassium. He finds that this treatment does not produce any mischievous effects, provided that it be of perfect chemical purity. He has had patients who have taken from one to two drams daily for a long period without any evil results. The ill effects recorded from the use of this drug, in his opinion, are experienced only when it is not of the best quality. Of the 207 cases referred to, in 17 absolute suspension of the epileptic symptoms ensued for from two to four years; in 28 absolute suspension for from twelve to twenty-two months; in 33 considerable amelioration; in 93 partial amelioration; and in 110 failure. He considers the bromide of potassium to be of the utmost possible value in this disease, if properly administered, and very likely to effect, if not a cure, at least a considerable improvement of the symptoms.

EXTRACTION OF SUGAR FROM MOLASSES.

The attention of a French chemist was drawn to the fact that, after extracting all the sugar easily obtainable from beet juice, there was still left in the molasses 50 per cent. of its weight of sugar that could not readily be secured. He has now published as the result of careful experiment, and applicable to any kind of molasses, the simple process by which 70 per cent. of the remaining sugar can be obtained in a perfectly pure state. Alcohol of 85 per cent., mixed with 5 per cent. of monohydrated sulphuric acid, is to be added to the molasses, and all shaken well together. The liquid is then to be filtered, and additional alcohol of 95 per cent. is to be added. The sugar is now taken up by the stronger alcohol and retained in a state of so-called supersaturation, and would remain so for a long time, with but a slight deposit in a crystalline form. By adding a small quantity of powdered sugar, however, to the mass, the other sugar will be rapidly deposited with the new, and in a perfectly pure state, to be washed and freed from the alcohol in the ordinary way.

The advantages claimed for this process are: first, the extraction of 35 per cent. of the weight of the molasses in sugar; second, the obtaining of the pure sugar directly, without the necessity of various complicated processes; and third, the almost total suppression of the use of animal black in sugar refineries. The scientific theory of the process need not be given here, the statement of the facts and results being sufficient for our present purpose.

POISONOUS STOVES.

THE approach of cold weather calls out a renewed warning from the French sanitarians of the danger of heating stoves red-hot, especially those made of cast iron. It has been found that cast iron, under such circumstances, is permeable to the gases of combustion, particularly to carbonic oxyd, and that the simplest tests prove the existence of this highly poisonous gas in the immediate vicinity of the stove; and, where the ventilation is insufficient, throughout the atmosphere of the room.

Sheet-iron has been found less objectionable, except when red-hot; in which case, as well as that of very hot cast iron, there appeared to be a decomposition of the carbonic acid thrown into the atmosphere by respiration, and a transformation into carbonic oxyd. It is supposed also that the oxygen of the atmosphere combines, to a certain extent, with the carbon of the iron, so as to increase the percentage of carbonic oxyd. The evil effect of the presence of this gas, and others scarcely less objectionable which pass readily through the heated iron, is shown in various ways, apart from that of actual asphyxia or suffocation, several cases of severe fevers, especially in badly-ventilated rooms, having been traced directly to this cause.

The primary remedy against this evil result is to have the stove lined internally with brick or some substance other than cast iron, and to have the upper part made of sheet-iron, so that the gases may not pass through the cylinder of the stove, but be carried off directly into the chimney. If, however, a cast-iron cylinder is necessary, then it should be completely encircled by sheet-iron, with an air-chamber between, and some arrangement by which the air in that space may be passed into the flue, and not escape into the room.

EXTINCTION OF FIRES.

A recent German writer, in discussing the general theory of fires, and the best method of preventing and extinguishing them, mentions various mineral substances which may be mixed with the water employed, to give to it much greater efficiency. Chief among these, in his opinion, is common salt; and he maintains, as the result of actual experiment, that one part of water containing salt will have more effect than four without it.

He explains its action by explaining that a saline solution is less readily vaporized than pure water, and that it is not so easily decomposed into its constituent elements of oxygen and hydrogen, which, of course, tend to reunite, and produce a still greater intensity of combustion. He thinks that the salt itself also, falling on hot coals, is decomposed, its sodium combining with the oxygen of the water; but that the hydrogen of the water unites with the chlorine of the salt, and forms a completely incombustible gas, which has a very favorable effect in deadening the flame, and aiding in extinguishing the fire.

There is no danger of injury to the fire apparatus attendant upon the use of salt-water, provided it be subsequently flushed with fresh-water from the hydrant. Our author advises that a supply of rock-salt be kept in bags in every engine-house, and, as soon as a fire breaks out, that the solution be made. It is not necessary to have such a solution saturated, as a large percentage of water may be added without materially affecting the efficiency of the mixture.

An important preventive of fire is suggested in the coating of the beams and timbers of newly-built houses with soluble glass, applying this in several successive coats of a rather dilute solution, to be followed by a final application of a mixture of soluble glass and cement. Wood treated in this way may be exposed quite close to burning matters without actually taking fire.

FRENCH METHOD OF PREPARING HAMS.

Among the novelties, to the European public at least, exhibited during the Paris Exposition of 1867, and one which took a prize for excellence of result, was what was considered as an improved method of curing hams. This consists essentially in the injection of the pickle into the meat by means of hydrostatic pressure, a reservoir of the liquid being kept in an upper story, with a strong rubber tube passing downward, about twenty feet below, and terminating in a pointed metallic nozzle, the passage of the liquid through which is controlled by a stop-cock.

The point of this nozzle is to be inserted into the ham, and the cock opened, when the pressure from above quickly forces the solution throughout the ham, causing it to expand very materially, and to take up a sufficient quantity of pickle in a very short time. This appears to be the principal point of novelty. The general excellence of the hams exhibited, however, resulted from the great care used in the preparation of the pickle (which must always be of the same density of solution), the injection of a definite amount of the pickle for each pound of meat, and the allowing the hams to soak for a few days after injection in a solution of the same degree of strength as that previously used.

The hams are to be hung up in an upper room of the building, and exposed to the smoke and hot air from two chimneys, the hearths of which are in the lower story, and on which dry oak wood is allowed to burn and smoulder. A thermometer regulates the temperature of the upper room; and the combination of the dry air with the smoke is considered to be a matter of prime importance.

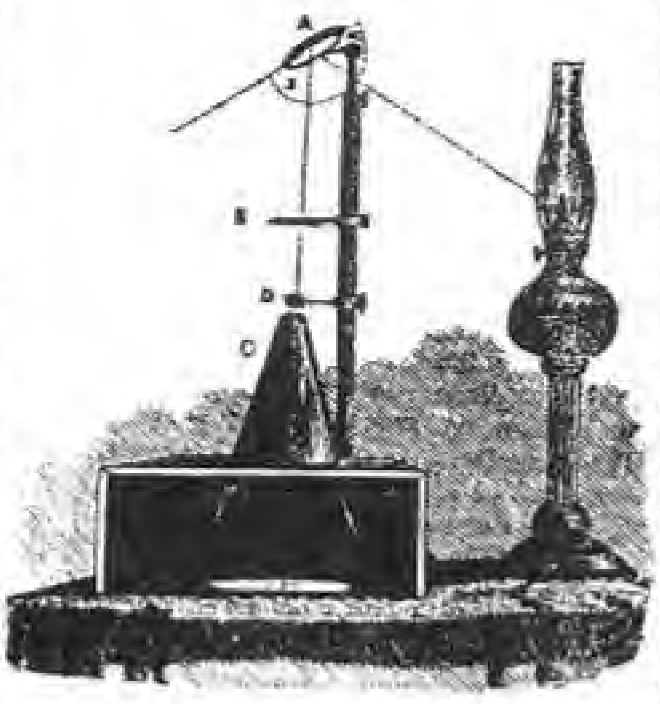
TREATMENT OF CHOLERA BY HYPODERMIC INJECTION.

Dr. Patterson, superintendent of the British Seamen's Hospital, Constantinople, gives an account of his experiments in the treatment of cholera by the hypodermic injection of morphine. During the recent severe epidemic the usual remedies had been tried by himself and colleagues with very little effect, and, as a last resort, a case which had been given up as incurable was selected for experiment. This patient had been previously suffering from inflammation of the liver, was in deep collapse, pulseless, with rice-water purging, severe vomiting, and cramps. A quarter of a grain of acetate of morphine was introduced, with a result far beyond expectation. In a quarter of an hour the cramps and vomiting ceased, the patient fell asleep, the skin gradually became warm and moist, and the pulse returned. After two hours the injection was repeated, and he again slept for three hours. He lived three weeks, but ultimately sank from typhoid exhaustion, as much produced by his old liver complaint as from the reactionary fever. The same good results followed in almost every case of trial. In ordinary cases one or two injections of from one-quarter to one-half a grain sufficed. It could be administered even to very young children, in doses of proper magnitude.

After the satisfactory result of this experiment the treatment of cholera patients in the hospital was confined almost entirely to that in question, and out of forty-two cases twenty-two recovered entirely, and twenty died. But of these eight were perfectly helpless from the first, being actually dying, one had severe liver complaint, and one was very far advanced in consumption. Of ten cases treated in the ordinary manner only one recovered.

APPARATUS FOR DRAWING MINUTE OBJECTS.

AN ingenious device for drawing microscopical objects has been recently invented by Fritsch, of Vienna, which has been found to be capable of valuable application in the interest of naturalists; and we accordingly reproduce a figure of it, for the purpose of illustrating its nature more satisfactorily. The instrument is intended to throw an enlarged image of the object upon a table so as to admit of its being copied accurately. When in use, the apparatus is placed near a burning lamp or gas flame, in such manner that a ray of light falling upon the adjustable concave mirror A, at an angle a, is reflected at the same angle b, upon a movable plate B, in the middle of which is an opening for the reception of the object to be magnified. The rays of light pass through this object to a lens D, and from that through a cone C, and fall upon a sheet of paper placed horizontally below, and upon which an enlargement takes place, readily varied in extent.



The image thus thrown down can be easily copied by the artist, line for line. The apparatus is so simple that any one can construct it out of wood and pasteboard, who can command a concave mirror of two and a half inches in diameter and a lens of good magnifying power.

IMPROVEMENT IN PRESERVING FRUITS.

A substance called preserving-powder has been patented in this country within a few years, and used in preserving fruits. It consists essentially of sulphite of lime, which, inert in itself, combines readily with the oxygen developed in fermentation, and is converted into sulphate of lime; and this in a small quantity does not seem to exert any injurious effect upon the animal economy.

Another somewhat similar suggestion, made by a German chemist, promises to be of value in the same connection. This is not intended so much to prevent fermentation as to reduce the amount of sugar required in preserving. It consists in adding aqua ammonia to the juice, which, by its alkaline nature, neutralizes an appreciable quantity of the free acid, and thereby renders less sugar necessary. The amount of ammonia required is easily determined by the disappearance of the sour taste of the juice; and should there be an excess at any time, it can be readily antagonized by the addition of a small quantity of vinegar. Any other alkaline substance than ammonia would produce a solid, permanent salt, which, if not injurious, would at any rate render the preparation more or less unpalatable. For preserving plums and gooseberries this process is said to be peculiarly well suited.

IMMUNITY OF COPPERSMITHS AGAINST CHOLERA.

The immunity from attacks of cholera enjoyed by workers in copper in the city of Paris has been shown to exist in London also; and it is supposed that a positive absorption of the metal into the system is the result of long-continued dealing with this metal. It is stated that workers in copper acquire green stains on the gums immediately above the teeth, exactly as workers in lead have a dark and blackish line in the same region. The perspiration of workers in copper is also stated to be of a bluish-green color; and in cases of ulceration the pus is also greenish.

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Dick's Encyclopedia of Formulas, Receipts, & Processes 1872

Some of the letters and even words in this section are indistinct. This is due to the condition of the original material. However, you should be able to make out any word by putting it in context.

Having been written in the last century, many of the terms here may be unfamiliar. I suggest you refer to GRANDDAD'S WONDERFUL BOOK OF CHEMISTRY. It has definitions of all the less familiar terms from Dick's, as I went through the entire work picking out every term which might be misunderstood and listed it along with its modern counterpart.

I advise you to read every entry, even if you aren't interested at this time. You'd be surprised at how many ideas are here which will be of use to you now or at some future time.

Tanning. When the skin of an animal, carefully deprived of hair, fat, and other impurities, is immersed in a dilute solution of tannic acid, the animal matter gradually combines with the acid as it penetrates inwards, forming a perfectly insoluble compound, which resists putrefaction completely; this is tanned leather. In practice, lime water is used for cleansing and preparing the skin; water acidulated with oil of vitriol (sulphuric acid) for raising or opening the pores; and an infusion of oak bark or some other astringent matter for the source of the tannic acid. The process is necessarily a slow one, as dilute solutions only can be safely used. Skins intended for curriers, to be dressed for "uppers," commonly require about 3 weeks; thick hides, suitable for sole-leather, take from 12 to 18 months. Various modifications have been introduced into the process, for the purpose of reducing the time required for tanning, but so far with only moderate success, as the leather so produced is spongy and inferior in quality.

643. Morocco Leather is prepared from goat or sheep skins; which, after the action of lime water and a dung bath, are slightly tanned in a bath of sumach, and subsequently grained and dressed.

644. Russia Leather is generally tanned with a decoction of willow bark, after which it is dyed, and curried with the empyreumatic oil of the birch tree. It is this oil which imparts to Russia leather its peculiar odor, and power of resisting mould and damp.

645. To Tan any kind of Fur Skins. This will be found an excellent plan for tanning any kind of skin with the fur on. After having cut off the useless parts, and softened the skin by soaking, remove the fatty matter from the inside and soak it in warm water for an hour. Next, mix equal parts of borax, saltpetre, and glauber salts (sulphate of soda), in the proportion of about ½ ounce of each for each skin, with sufficient water to make a thin paste; spread this with a brush over the inside of the skin, applying more on the thicker parts than on the thinner; double the skin together, flesh side inwards, and place it in a cool place. After standing 24 hours, wash the skin clean, and apply, in the same manner as before, a mixture of 1 ounce sal soda, ½ ounce borax, and 2 ounces hard white soap, melted slowly together without being allowed to boil; fold together again and put away in a warm place for 24 hours. After this, dissolve 4 ounces alum, 8 ounces salt, and 2 ounces saleratus, in sufficient hot rain water to saturate the skin; when cool enough not to scald the hands, soak the skin in it for 12 hours; then wring out and hang it up to dry. When dry repeat this soaking and drying 2 or 3 times, till the skin is sufficiently soft. Lastly, smooth the inside with fine sand paper and pumice stone.

646. To Tan Sheep's Pelts with the Wool On. Wash the pelts in warm water, and remove all fleshy matter from the inner surface; then clean the wool with soft soap, and wash clean. When the pelt is perfectly free from all fatty and oily matter, apply the following mixture to the flesh side, viz: For each pelt take common salt and ground alum, ¼ pound each, and ½ ounce borax; dissolve the whole in 1 quart hot water, and when sufficiently cool to bear the hand, add rye meal to make it like thick paste, and spread the mixture on the flesh side of the pelt. Fold the pelt lengthwise, and let it remain 2 weeks in an airy and shady place; then remove the paste from the surface, wash, and dry. When nearly dry, scrape the flesh side with a crescent-shaped knife. The softness of the pelt depends much on the amount of working it receives.

647. To Prepare Sheep Skins for Mats. Make a strong lather with hot water, and let it stand till cold; wash the fresh skin in it, carefully squeezing out all the dirt from the wool; wash it in cold water till all the soap is taken out. Dissolve a pound each salt and alum in 2 gallons hot water, and put the skin into a tub sufficient to cover it; let it soak for 12 hours, and hang it over a pole to drain. When well drained, stretch it carefully on a board to dry, and stretch several times while drying. Before it is quite dry, sprinkle on the flesh side 1 ounce each of finely pulverized alum and saltpetre, rubbing it in well. Try if the wool be firm on the skin; if not, let it remain a day or two, then rub again with alum; fold the flesh sides together and hang in the shade for 2 or 3 days, turning them over each day till quite dry. Scrape the flesh side with a blunt knife, and rub it with pumice or rotten stone. Very beautiful mittens can be made of lamb skins prepared in this way.

648. To Tan Muskrat Skins with the Fur On. First wash the hide in warm water, and remove all fatty and fleshy matter. Then soak it in a liquor prepared as follows: To 10 gallons cold soft water add 8 quarts wheat bran, ½ pint old soap, 1 ounce borax; by adding 2 ounces sulphuric acid the soaking may be done in one-half the time. If the hides have not been salted, add 1 pint salt. Green hides should not be soaked more than 8 or 10 hours. Dry ones should soak till very soft. For tan liquor, to 10 gallons warm soft water add ½ bushel bran; stir well and let stand in a warm room till it ferments. Then add slowly 2½ pounds sulphuric acid; stir all the while. Muskrat hides should remain in about 4 hours; then take out and rub with a fleshing knife—(an old chopping knife with the edge taken off will do.) Then work it over a beam until entirely dry.

649. To Cure Rabbit Skins. Lay the skin on a smooth board, the fur side undermost, and fasten it down with tinned tacks. Wash it over first with a solution of salt; then dissolve 2½ ounces alum in 1 pint of warm water, and with a sponge dipped in this solution, moisten the surface all over; repeat this every now and then for three days; when the skin is quite dry, take out the tacks, and rolling it loosely the long way, the hair inside, draw it quickly backwards and forwards through a large smooth ring, until it is quite soft, then roll it in the contrary way of the skin, and repeat the operation. Skins prepared thus are useful for many domestic purposes.

650. To Clean Furs. Furs may be cleaned as follows:—Strip the fur articles of their stuffing and binding, and lay them as much as possible in a flat position. They must then be subjected to a very brisk brushing, with a stiff clothes brush; after this, any moth-eaten parts must be cut out, and be neatly replaced by new bits of fur to match.

651. To Clean Dark Furs. Sable, chinchilla, squirrel, fitch, &c., should be treated as follows: Warm a quantity of new bran in a pan, taking care that it does not burn, to prevent which it must be actively stirred. When well warmed, rub it thoroughly into the fur with the hand. Repeat this two or three times; then shake the fur, and give it another sharp brushing until free from dust.

652. To Clean Light Furs. White furs, ermine, &c., may be cleaned as follows: Lay the fur on a table, and rub it well with bran made moist with warm water; rub until quite dry, and afterwards with dry bran. The wet bran should be put on with flannel, and the dry with a piece of book-muslin. The light furs, in addition to the above, should be well rubbed with magnesia, or a piece of book-muslin, after the bran process. Or dry flour may be used instead of wet bran. Ermine takes longer than Minevar to clean. They should be rubbed against the way of the fur.

653. To Improve Furs by Stretching. Furs are usually much improved by stretching, which may be managed as follows: To 1 pint of soft water add 3 ounces salt; dissolve; with this solution sponge the inside of the skin (taking care not to wet the fur) until it becomes thoroughly saturated; then lay it carefully on a board with the fur side downwards, in its natural disposition; then stretch as much as it will bear, and to the required shape, and fasten with small tacks. The drying may be quickened by placing the skin a little distance from the fire or stove.

654. To Preserve Furs and Woolen Clothing from Moth. Moths deposit their eggs in the early spring. This, therefore, is the time to put away furs and woolens for the summer. It is not the moth, but the maggot of the moth that does the mischief with furs and woolens. To effectually preserve them from the ravages of these insects, thoroughly beat the furs with a thin rattan, and air them for several hours, then carefully comb them with a clean comb, wrap them up in *newspapers*, perfectly tight, and put them away in a thoroughly tight chest lined with tin, or cedar wood. Take them out and examine them in the sun at least once a month, thoroughly beating them. This, indeed, is the secret of the fur-dealers in preserving their stock. Camphor, which is so much used to preserve furs, impairs their beauty by turning them light. The printing ink on the newspapers is just as effectual as camphor, being very distasteful to the moth. The above method may also be adopted to preserve feathers, and all kinds of woolen clothing, omitting, of course, the combing; camphor may be sprinkled among the woolens.

655. To Clean Ostrich Feathers. Cut some white curd soap in small pieces, pour boiling water on them, and add a little pearlash. When the soap is quite dissolved, and the mixture cool enough for the hand to bear, plunge the feathers into it, draw the feathers through the hand till the dirt appears squeezed out of them, pass them through a clean lather with some blue in it, then rinse in cold water with blue to give them a good color. Beat them against the hand to shake off the water, and dry by shaking them near a fire. When perfectly dry, curl each fibre separately with a blunt knife or ivory paper-folder.

656. To Clean Grebe. Carefully take out the lining, and wash it in the same way as directed for the ostrich feathers. They must not be shaken until quite dry, and any rent in the skin must be repaired before making up again.

657. To Clean Swansdown. White swansdown may be washed in soap and water; after washing, shake it out, and when the down is somewhat raised, shake it before a clear fire to dry.

658. To Curl Feathers. Heat them slightly before the fire, then stroke them with the back of a knife, and they will curl.

659. To Cleanse Feathers from Animal Oil. Mix well with 1 gallon clear water, 1 pound quicklime; and, when the lime is precipitated in fine powder, pour off the clear lime-water for use. Put the feathers to be cleaned in a tub, and add to them a sufficient quantity of the clear lime-water to cover them about 3 inches. The feathers, when thoroughly moistened, will sink down, and should remain in the lime-water for 3 or 4 days; after which, the foul liquor should be separated.

660. To Deodorize Skunk Skins, or articles of clothing scented, hold them over a fire of red cedar boughs, and sprinkle with chloride of lime; or, wrap them in green hemlock boughs, when they are to be had, and in 24 hours they will be deodorized.

661. To Stiffen Bristles. These are usually stiffened by immersing for a short time in cold alum water.

662. To Dye Bristles. Bristles are dyed by steeping them for a short time in any of the common dyes used for cotton or wool.

Fumigating Pastils; Incense Pastilles.

These are small masses essentially composed of powdered charcoal and aromatic substances that emit fragrant fumes during combustion, with the addition of sufficient nitre or saltpetre to cause them to slowly consume away, without flame, when kindled. Their common form is that of a small cone with a triangular or tripod base, of about ¾ to 1 inch in height, and about ½ inch diameter at the larger part. This form is most simply and conveniently given them by pressing the mass, whilst soft, into a mould of lead or porcelain. The dry ingredients should be first reduced to fine powder, and the balsams and essential oils (if any) being added, the whole should be thoroughly and perfectly incorporated, after which the mixture should be beaten to the consistence of a stiff ductile mass or dough with the liquid ordered for the purpose. When powdered gum is one of the ingredients, the mass should be beaten up with water; but otherwise mucilage must be employed. Gum-tragacanth, owing to its greater thickening and binding powers, is here generally preferred to gum-arabic. The charcoal of the light woods, as the linden, willow, and alder, make the best pastils; that of the first being most esteemed for this purpose in France. The following receipts are among the best that can be made, and will serve as examples of these articles, from which the operator will be able to devise others:

1338. Dr. Paris's Fumigating Pastils. Pulverize ½ pound benzoin, ½ pound cascarilla, 1½ ounces myrrh, and 1½ pounds charcoal; mix them through a sieve; then add ¼ ounce each of attars of nutmegs and of cloves; dissolve 2 ounces of nitre in sufficient mucilage of tragacanth to make the whole into a stiff paste; beat well in a mortar, make into pastils, and dry.

1339. Perfumers' Fumigating Pastils. Take of gum benzoin, 2 ounces (avoirdupois); olibanum (in tears), 1½ ounces; storax (in tears), 1 ounce; cascarilla and gum-tragacanth, of each ½ ounce; nitre, 2 ounces; charcoal, 1½ pounds; mix, and beat them up with water or rose water.

1340. Piesse's Fumigating Pastils. Dissolve ¼ ounce nitre in ½ pint rose water; mix this with ½ pound willow charcoal, and dry it thoroughly in a warm place. When the nitrated charcoal is perfectly dry, pour upon it a mixture of ¼ drachm each of the attars of thyme, caraway, rose, lavender, cloves, and santal; then stir in 6 ounces benzoic acid (flowers of benzoin); mix thoroughly through a sieve, then beat in a mortar with sufficient mucilage to bind together. Make into pastils, and dry.

1341. Basis for French Pastils. Take of charcoal, 1½ pounds avoirdupois; nitre, 2 ounces; gum-tragacanth, 1 ounce; mix in the dry state. It is used as a basis for the following French pastils, as well as many others:—

1342. Pastilles aux Fleurs d'Oranges. To each pound of Nos. 1341 or 1339, add of orange powder (genuine), 2½ ounces avoirdupois; neroli, 1 Imperial fluid drachm; and beat up the mass with eau de fleurs d'oranges.

1343. Pastilles à la Rose. To each pound of Nos. 1341 or 1342, add of pale rose powder, 3 ounces avoirdupois; essence of roses, 2 Imperial fluid drachms; and beat up the mass with eau de rose.

1344. Pastilles à la Vanille. To each pound of Nos. 1339 or 1341 (usually the first), add of vanilla (in fine powder), 2 ounces avoirdupois; cloves (in fine powder), ½ ounce; essence of vanilla, ½ Imperial fluid ounce; oil of cloves, oil of cassia, of each ¼ fluid drachm; and beat up the mass with cinnamon water.

1345. Pastils of Every Variety. The products of the preceding formulæ are of excellent quality. They may be varied, to please the fancy of the maker, by the omission of some of their aromatic ingredients, or by the addition or substitution of others. Cheaper articles are made by simply increasing the proportion of the charcoal and saltpetre. Good burning qualities depend greatly on the completeness of the mixture, and the moderate compactness of the mass. If they burn too slowly, a little more saltpetre may be added; if too fast, the quantity of saltpetre should be slightly lessened. Musk and civet, though often ordered in books as ingredients in pastils, should be avoided, as they give out a disagreeable odor during combustion. Ambergris is also unsuited for an ingredient in them.

1346. Incense. Storax, 2½ ounces; benzoin, 12 ounces; musk 15 grains; burnt sugar, ¼ ounce; frankincense, 2½ ounces; gum-tragacanth, 1½ ounces; rose-water sufficient to form a mass; to be divided into small tablets.

1347. Incense. Powdered cascarilla, 2 ounces; myrrh, storax, benzoin, burgundy pitch, each 1 ounce; mix. Or:

1348. Fine Incense. Take of olibanum (true), 7 parts; gum benzoin, 2 parts; mix. Or: To the last, add of cascarilla 1 part. The preceding, placed on a hot iron plate, or burned in a censer, were formerly used to perfume apartments. The incense used in the rites of the Roman Catholic Church, and in the temples of India, consists wholly or chiefly of olibanum.

1349. Preserved Flowers and Herbs. Flowers, herbs, and other like vegetable substances, are now generally preserved, for distillation, by means of common salt. The process simply consists in intimately mixing the flowers, &c., with about ⅓ their weight of good dry salt, and ramming down the mixture as tightly as possible, in strong casks or jars. The casks or jars are then placed in the cellar, or other cold place, and covered with boards, on which heavy weights are put, to keep the mass tight and close. In this state they may be preserved from season to season, or even for two or three years. The flowers, &c., should be recently gathered, and free from dew or moisture; and the salt should be quite dry, to ensure which it may be exposed for 2 or 3 hours in an oven. The above is the method now generally followed, by our manufacturing perfumers and wholesale druggists, for preserving fresh aromatic vegetable substances for subsequent distillation. It is

found that the odor of distilled waters, oils, **&c., obtained** from flowers, *&c.*, thus **preserved,** is superior to that of those from either the recent or dried vegetables; whilst the products keep better, and are quite free from the peculiar rawness found in those from fresh herbs and flowers, and which nothing but age, or redistillation, will remove.

1350. To Scent Tobacco. Fragrance may be imparted to tobacco, by mixing with it, while slightly damp, a little cascarilla, either in very fine shreds or recently powdered; or by a like addition of any of the substances noticed under fumigating pastils (*see No.* 1339) of which the odor is appropriate to the purpose. Cigars may be perfumed by moistening them externally with concentrated tincture of cascarilla, or tincture of benzoin or storax, or a mixture of them; or a minute portion of the powders, shred roots, or woods, may be done up with the bundle of leaves that form the centre of the cigar. The so-called anti-cholerale and disinfecting cigars are scented with camphor, cascarilla, and benzoin.

1351. Scented or Aromatic Candles. These are prepared by introducing a very small quantity of any appropriate aromatic into the material (fat, wax, or wick) of which they are made, whilst it is in the liquid state. Camphor, gum benzoin, balsam of Peru, cascarilla, essential oils, &c., are generally the substances selected. Care must be taken not to overdo it, as then the candles will burn smoky and give little light.

1352. To Make Snuff Scents. Of the substances used, singly and combined, to scent snuff, the following may be mentioned as the principal:—tonqua beans, and their oil or essence; ambergris, musk, civet, and their essences.

1353. To Scent Snuff. A sufficient quantity of the powder, essence, or oil, having been well mixed with a little snuff, the perfumed mixture is added to the whole quantity of snuff to be scented, and the mass well stirred up and turned over. It is lastly passed or rubbed through a sieve, to ensure the perfect diffusion of the scent through the whole mass.

1354. To Restore the Odor of Musk. Genuine musk frequently becomes nearly inodorous by keeping, but its perfume is restored by exposing it to the fumes of ammonia, or by moistening it with ammonia water.

1355. Peau d'Espagne, or Spanish Skin, is merely highly-perfumed leather. Take of oil of rose, neroli, and santal, each ½ ounce; oil of lavender, verbena, bergamot, each ¼ ounce; oil of cloves and cinnamon, each 2 drachms; in this dissolve 2 ounces gum benzoin. In this steep good pieces of waste leather for a day or two, and dry it over a line. Prepare a paste by rubbing in a mortar, 1 drachm of civet with 1 drachm of grain musk, and enough gum-tragacanth mucilage to give a proper consistence. The leather is cut up into pieces about 4 inches square; two of these are pasted together with the above paste, placed between 2 pieces of paper, weighted or pressed until dry. It may then be inclosed in silk or satin. It gives off its odor for years; is much used for perfuming paper, envelopes, &c.; for which purpose 1 or 2 pieces of the perfumed leather, kept in the drawer or desk containing the paper, will impart to it a fine and durable perfume.

SYRUPS

Syrups. Syrups are solutions of sugar more or less strong according to the object for which they are used. In the preparation of syrups, if care be taken to employ the best refined sugar, and either distilled water or filtered rain water, they will be rendered much less liable to spontaneous decomposition, and will be perfectly transparent, without the trouble of clarification.

1357. Clarification of Sugar for Syrups. When inferior sugar is employed, clarification is always necessary. This is best done by dissolving the sugar in the water or fruit juices cold, and then beating up a little of the cold syrup with some white of egg, and 1 or 2 ounces of cold water, until the mixture froths well; this must be added to the syrup in the boiler, and the whole whisked up to a good froth; heat should now be applied, and the scum which forms removed from time to time with a clean skimmer. As soon as the syrup begins to slightly simmer it must be removed from the fire, and allowed to stand until it has cooled a little, when it should be again skimmed, if necessary, and then passed through a clean flannel. When vegetable infusions or solutions enter into the composition of syrups, they should be rendered perfectly transparent, by filtration or clarification, before being added to the sugar.

1358. Filters for Syrups. Syrups are usually filtered, on the large scale, by passing them through creased bag filters; on the small scale, conical flannel bags are usually adopted. Thick syrups filter with difficulty, hence it is a good plan to dilute them before filtering, and afterwards evaporate them to the required consistency. For small quantities clarification involves less trouble than filtration. (*See No.* 1357.)

1359. To make a Conical Filter. Take a square piece of flannel or Canton flannel, fold it diagonally, and sew two of the corresponding edges together with an over-lap seam, leaving the other two edges open; then fold the open edge over, sufficiently to make the opening level. (*See Fig.* 1.) This fold gives a considerable degree of stiffness to the open end, preventing the filter in some measure from collapsing. Professor Parrish, in his book on Practical Pharmacy, recommends the use of a conical wire frame (*see Fig.* 2) to support the filter. The frame is made to fit into the top of a suitable tin bucket, being supported by a rim or flange around the top of the frame, projecting sufficiently to rest on the edge of the bucket. The filter must fit the frame.

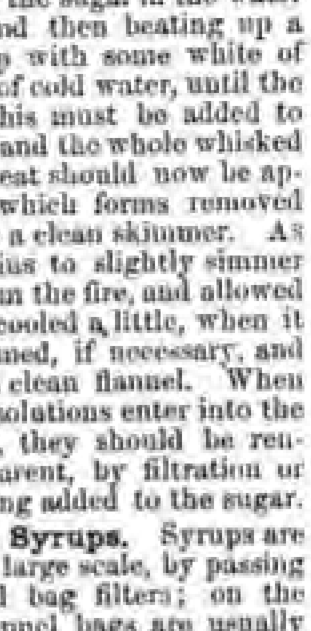


Fig. 1.

Fig. 2.

1360. Quantity of Sugar Used in Making Syrups. The proper quantity of sugar for syrups will, in general, be found to be 2 pounds avoirdupois to every pint of water or thin aqueous fluid. These proportions allow for the water that is lost by evaporation during the process, and are those best calculated to produce a syrup of the proper consistence, and possessing good keeping qualities. They closely correspond to those recommended by Guibourt for the production of a perfect syrup, which, he says, consists of 30 parts sugar to 16 parts water. To make highly transparent syrups the sugar should be in a single lump, and by preference taken from the bottom or broad end of the loaf; as, when taken from the smaller end, or if it be powdered or bruised, the syrup will be more or less cloudy.

1361. Amount of Heat to be Employed in Making Syrups. In the preparation of syrups it is of great importance to employ as little heat as possible, as a solution of sugar, even when kept at the temperature of boiling water, undergoes slow decomposition. The best plan is to pour the water (cold) over the sugar, and to allow the two to lie together for a few hours, in a covered vessel, occasionally stirring, and then to apply a gentle heat, preferably that of steam or a water-bath, to finish the solution. Some persons (falsely) deem a syrup ill prepared unless it has been allowed to boil well; but if this method be adopted, the ebullition should be only of the gentlest kind (simmering), and should be checked after the lapse of one or two minutes. When it is necessary to thicken a syrup by boiling, a few fragments of glass should be introduced, in order to lower the boiling point. In boiling syrups, if they appear likely to boil over, a little oil, or rubbing the edge of the pan with soap, will prevent it. Syrups are judged by the manufacturer to be sufficiently boiled, when some taken up in a spoon pours out like oil; or, a drop cooled on the thumb nail gives a proper thread when touched. (*See No.* 1363.) When a thin skin appears on blowing upon the syrup, it is judged to be completely saturated. These rude tests often lead to errors, which might be easily prevented by employing the proper proportions, or determining the specific gravity.

1362. Table of Specific Gravities of Syrups. The degrees of Baumé here given are those of his heavy saccharometer.

Sugar in 100 parts.	Specific Gravity.	Degrees Baumé.
0	1.000	0°
5	1.020	3
10	1.040	6
15	1.062	8
20	1.081	11
25	1.104	13.5
30	1.128	16.3
35	1.152	19
40	1.177	21.6
45	1.204	24.5
50	1.230	27
55	1.257	29.5
60	1.284	32
67	1.321	35

The latter density is about the syrupus of the pharmacopœias; that of the U. S. Ph. has a sp. grav. 1.317; that of the British Ph. is 1.330.

1363. To Determine the Density of Syrup. A fluid ounce of saturated syrup weighs 577¼ grains; a gallon weighs 13¼ pounds avoirdupois; its specific gravity is 1.319 to 1.321, or 35° Baumé; its boiling point is 221° Fah., and its density at the temperature of 212° is 1.260 to 1.261, or 30° Baumé. The syrups prepared with the juices of fruits mark about 2° or 3° more on Baumé's scale than the other syrups. (*Cooley.*) According to Ure, the decimal part of the number denoting the specific gravity of a syrup, multiplied by 26, gives the number of pounds of sugar it contains per gallon, very nearly.

1364. To Preserve Syrups. The preservation of syrups, as well as of all saccharine solutions, is best promoted by keeping them in a moderately cool, but not a very cold place. Let syrups be kept in vessels well closed, and in a situation where the temperature never rises above 55° Fah. They are better kept in small than in large bottles, as the longer a bottle lasts, the more frequently it will be opened, and, consequently, the more it will be exposed to the air. By bottling syrups whilst boiling hot, and immediately corking down and tying the bottles over with bladder, perfectly air-tight, they may be preserved, even at a summer heat, for years, without fermenting or losing their transparency.

1365. To Prevent Syrup from Candying. The candying or crystallization of syrup, unless it be over-saturated with sugar, may be prevented by the addition of a little acetic or citric acid (2 or 3 drachms per gallon); confectioners add a little cream of tartar to the sugar, to prevent granulation.

1366. To Prevent Syrup from Fermenting. The fermentation of syrups may be effectually prevented by the addition of a little sulphite of potassa or of lime. A celebrated French chemist recommends the addition of about 3 to 4 per cent. sugar of milk, with the same intention. Fermenting syrups may be immediately restored by exposing the vessel containing them to the temperature of boiling water. The addition of a little spirit is also good.

1367. To Bleach Syrup. Syrups may be decolored by agitation with, or filtration through, animal charcoal.

1368. Degrees of Boiling Sugar. In preparing sugar for candies, &c., the confectioner requires different degrees of boiling in order to bring the sugar to the proper state for the various articles he prepares. Well clarified and perfectly transparent syrup is boiled until a skimmer dipped into it, and a portion touched between the forefinger and thumb, on opening them, is drawn into a small thread which crystallizes and breaks. This is called a *weak candy height.*

If boiled again, it will draw into a larger string, and if bladders may be blown with the mouth through the drippings from the ladle, it has acquired the second degree, and is called *bloom sugar.*

After still further boiling, it arrives at the state called *feathered sugar.* To determine this, dip the skimmer and shake it over the pan, then give it a sudden flirt or jerk, and the sugar will fly off like feathers.

The next degree is that of *crackled sugar,* in which state the sugar that hangs to a stick dipped into it, and put directly into cold water, is not dissolved off, but turns hard and snaps.

The last stage of boiling reduces it to *caramel sugar,* and is proved by dipping a stick into the sugar and then into cold water, when, on the moment it touches the water, it will snap like glass. It has now arrived at a *full candy height.*

Throughout the boiling, the fire must not be too fierce, as it will discolor the syrup. The best safeguard against this is the use of steam heat. Color may be given to the candy by adding the coloring matter to the syrup before boiling it. Flavoring essences must be added when the process is nearly complete.

1369. To Make Syrups for the Manufacture of Cordials and Liquors. Take 1 pint of water to every 2 pounds of sugar used; this proportion will make a fine syrup, about 32° Baumé, but the manufacturer often requires weaker syrups when preparing inferior cordials, and the easiest method of ascertaining the proper point of concentration is by the use of that variety of Baumé's hydrometer, called a saccharometer. Beat up the whites of 2 eggs (if you are clarifying about 10 pounds of sugar, or mix in this proportion), until it is very frothy, and then mix in with the rest.

1370. Plain Syrup. Put into a very clean copper, 100 pounds loaf sugar and 3 gallons water; take the white of 12 good eggs, whisk them up to a froth in a pan, and put them into a copper before the fire is lighted; stir them well in the sugar, make a good fire, and let the mixture be still. As it comes toward boiling, the scum will rise; be particular not to let it bubble or boil, but simmer; as soon as the scum is seen to break through the edge of the copper, damp the fire, and take off the first scum; then stir it up and let it simmer; keep skimming it until it becomes clear and bright, and the scum as white as milk; then draw your fire, and take it out of the copper, and it will be fit for use. The quantity thus made will be 10 gallons.

1371. Gum Syrup. Dissolve 20 pounds best clear white gum-arabic in 4 gallons water nearly boiling hot; take 60 pounds sugar, melt and clarify it with 1 gallon water, add the gum solution, and boil for 2 minutes.

1372. Raspberry Syrup. This syrup is sometimes used to give a vinous body and flavor to brandy. It is made of 2 pints filtered raspberry juice, and 4½ pounds sugar. Select the fruit, either white or red. Having picked them over, mash them in a pan, which put in a warm place until fermentation has commenced. Let it stand for about 3 days. All mucilaginous fruits require this, or else they would jelly when bottled. Now filter the juice through a close flannel bag, or blotting-paper, and add sugar in the proportion mentioned above; this had better be powdered. Place the syrup on the fire, and as it heats skim it carefully, but do not let it boil; or mix it in a glass vessel or earthenware jar, and place in a pan of water on the fire. (This is simply a water-bath.) When the syrup is dissolved, so that when you dip your fore-finger in it and apply it to the ball of your thumb, and then separate the thumb and finger, the fine thread of syrup reaches from each without breaking, take it off; strain through a cloth; bottle when cold; cover with tissue paper dipped in brandy, and tie down with a bladder until wanted for use.

1373. Imitation Raspberry Syrup. Dissolve 30 pounds white sugar in 10 gallons water; then make an infusion of ½ pound powdered orris root in ½ gallon boiling water, in a covered vessel, stirring occasionally as it cools, and when cold, filter through flannel; stir this infusion into the syrup; then stir in ½ pound tartaric acid previously dissolved in 1 quart water. Color the mixture with ¼ to ½ gallon cherry juice, using more or less, as required to produce the desired color. This produces a splendid imitation of raspberry syrup at a comparatively trifling cost.

1374. Parrish's Strawberry Syrup. Take 4 quarts fresh fruit; express the juice, and strain; add water until it measures 4 pints. Dissolve 8 pounds raw sugar in this by the aid of heat; raise it to the boiling point, and strain. If it is to be kept till the following season, it should be poured, while hot, into dry bottles, filled to the neck, and securely corked. This furnishes a key for the treatment of the whole family of fruit juices.

1375. Lemon Syrup. Take 5 gallons lemon juice, 1 ounce best oil of lemons dissolved in ½ pint of alcohol; or the rinds of 16 lemons rubbed with sugar to extract the essential oil; dissolve 80 pounds of sugar in the juice, and boil for 2 minutes; skim, then strain.

1376. Orgeat Syrup. Take 10 pounds sweet almonds, 4 pounds bitter almonds; cover them with boiling hot water; let them stand till nearly cold, and peel them by pressing through your fingers; beat them in a stone or brass mortar to a very fine paste with some sugar, adding water slowly; press through a linen cloth, so as to get 5 gallons of a liquid resembling rich milk; dissolve in this liquid 80 pounds sugar; boil up once, and add 1 pint orange-flower water; then strain.

1377. Arrack Punch Syrup. Take 53½ pounds sugar; 3½ gallons water. Boil up well, then add 1⅝ gallons lemon juice, and stir till the liquid is clear; pour it into a clean tub, and, when nearly cool, add 5 gallons Batavia arrack, then filter.

1378. Syrup of Coffee. Take 10 pounds best Java coffee, fresh roasted and ground, and 6 gallons boiling water. Let it stand, well covered, till cool; strain and press; next dissolve in this infusion 80 pounds sugar; boil and skim for 2 minutes, and then strain.

1379. Cinnamon Syrup. Take 1 ounce oil of Ceylon cinnamon, rubbed and dried up with carbonate of magnesia in a mortar, so as to make it a powder; put it in a filter bag, and pour 5 gallons water on it; pour the water over and over till it runs clear; get in this way 5 gallons clear high-flavored water; dissolve 80 pounds of sugar in the flavored water, and boil for 2 minutes; then skim and strain.

1380. Sirop Capillaire. Maidenhair Syrup. Take 1 pound maidenhair herb, and 5½ gallons boiling water. Macerate till cold; strain without pressing, so as to get 5 gallons; take the whites of 3 eggs beaten to froth, and mix them with the infusion; keep back a quart of the liquid; then dissolve and boil in the above 80 pounds sugar by a good heat; when the scum rises, put in a little from the quart of cold liquid, and this will make the scum settle; let it raise and settle 3 times; then skim, and when perfectly clear add ½ pint orange-flower water; then boil once up again and strain.

1381. Cherry Syrup. Take 5 gallons cherry juice; let it ferment a few days; dissolve and boil 80 pounds of sugar; when clear, skim and strain.

1382. Syrup of Orange Peel. Reduce 2 ounces dried orange peel to coarse powder, put it in a small glass percolator, and pour deodorized alcohol slowly on it till 6 fluid ounces of tincture have passed; evaporate this spontaneously to 2 fluid ounces; triturate this with ½ ounce carbonate of magnesia, 1 ounce sugar and ½ a pint water gradually added; pour this on a filter, and when it ceases to pass, add water till a pint of filtrate is obtained; to this add 2½ pounds sugar; dissolve with a gentle heat, and strain if necessary.

1383. Punch Syrup. Digest 8 ounces fresh lemon peel cut in small pieces and bruised, in 12 ounces Jamaica rum for 3 days, and strain. Mix 28 ounces strained lemon juice with 18 ounces rum; allow it to settle, and filter through paper. Dissolve 5 pounds powdered white sugar in 42 ounces rum at a gentle heat, and when cool, mix all the liquids together. This is in no way inferior to the most celebrated European punch syrups.

Petroleum, or Crude Coal Oil.

The name of petroleum is now applied to all the native liquid substances which have a bituminous character. It consists, therefore, of an inflammable and more or less volatile oily substance, ranging in color and appearance from a yellowish white, transparent fluid, to a brown or almost black, opaque viscid mass. The former used to be called naphtha, but this name is now given to any oil of this description, whether native, or distilled from a darker grade of petroleum. The latter is the form in which the bulk of the petroleum is found in America; and this, when exposed to the air, gradually passes into *asphaltum*, or solid bitumen.

1527. To Purify Petroleum. Tank-shaped stills of a capacity of 500 to 2500 barrels are filled with crude oil, and heat applied by furnaces beneath them, causing vapors to arise, which are carried forward through pipes immersed in water, and condensed into a liquid, which runs out at the end of the pipe. The first product is gasoline, a very light hydrocarbon, marking as high as 83° and as low as 75° of Baumé's coal oil hydrometer. The heat is then somewhat increased, and the next product obtained is called *naphtha, benzine* (*not benzole*), which marks from 75° to 63° Baumé; and, when combined, will average about 67°. The heat being allowed to increase further, produces distillate, or crude burning oil. This passes over until about 8 or 10 per cent. of the original quantity contained in the still remains, which is called residuum or tar, and may be redistilled for the purpose of obtaining paraffine and lubricating oil. *Paraffine* is a fatty material, resembling sperm in appearance. The distillate or crude burning oil is converted into ordinary kerosene by a process of purification. For this purpose it is placed in a tank, where it is violently agitated by forcing air through it, and while thus agitated, 1½ to 2 per cent. sulphuric acid is added, after which the agitation is continued 15 to 30 minutes. The oil is then allowed to settle, when the acid and impurities are drawn from the bottom. The oil is then washed, first with water and then with caustic soda, by which means the remaining impurities are removed, and any acid remaining in the oil is neutralized. It is then taken to shallow bleaching tanks, where it is exposed to light and air, and allowed to settle; it is next heated by means of a coil of steam pipe running through it, to expel all gaseous vapors which will ignite at a temperature below 110° Fahr. The oil is now called a *fire test* oil, and is ready to be barreled and sent to market.

1528. To Clarify Coal Oil. Place in a close vessel 100 pounds crude coal oil, 25 quarts water, 1 pound chloride of lime, 1 pound soda, and ½ pound oxide of manganese. The mixture is violently agitated, and allowed to rest for 24 hours, when the clear oil is decanted and distilled. The 100 pounds coal oil are to be mixed with 25 pounds resin oil; this is one of the principal points in the manipulation; it removes the gummy parts from the oil, and renders them inodorous. The distillation spoken of may terminate the process, or the oils may be distilled before they are defecated and precipitated.

1529. To Decolorize Kerosene Oil. Kerosene oil is decolorized by stirring it up with 1 or 2 per cent. of oil of vitriol, which will carbonize the coloring matter, then with some milk of lime or some other caustic alkali, settling, and redistilling. The latter appears to be indispensable.

1530. Why Kerosene or Coal Oils Explode. No oil is explosive in and of itself; it is only when the vapor arising therefrom becomes mixed in the proper proportions with air, that it will explode. There should be no inflammable vapor from any oil used for burning in lamps at ordinary temperature. A volatile oil is unfit for the purpose of illumination.

1531. To Test Kerosene or Coal Oil. Burning oil is often adulterated with heavy oil, or with benzine. The adulteration with the former is shown by dimness of the flame after having burned for some time, accompanied by a charring of the wick. The latter may be readily detected by means of a thermometer, a little warm water, and a tablespoonful of the oil. Fill the cup with warm water, the temperature of which is to be brought to 110° Fahr. Pour the oil on the water; apply flame to the floating oil by match or otherwise. If the oil is unsafe it will take fire, and its use in the lamp is dangerous, for it is liable to explode. But if the oil is safe and good it will not take fire. All persons who sell kerosene that will not stand the fire test at 110° are liable to prosecution.

1532. To Extinguish the Flame of Petroleum or Benzine. Water, unless in overwhelming quantity, will not extinguish the flame of petroleum or benzine. It may, however, be speedily smothered by a woolen cloth or carpet, or a wet muslin or linen cloth, or earth or sand being thrown over it. These act by excluding the air, without which combustion cannot be maintained.

1533. To Deodorize Benzine. Shake repeatedly with plumbate of soda (oxide of lead dissolved in caustic soda), and rectify. The following plan is said to be better: Shake repeatedly with fresh portions of metallic quicksilver; let stand for 2 days, and rectify.

1534. To Manage Kerosene Lamps. These are so much used that a few hints on their management will no doubt be acceptable. There are very few common illuminating substances that produce a light as brilliant and steady as kerosene oil, but its full brilliancy is rarely attained, through want of attention to certain requisite points in its management. By following the directions here given, the greatest amount of light will be obtained, combined with economy in the consumption of the oil. The wick, oil, lamp, and all its appurtenances, must be perfectly clean. The chimney must be not only clean, but clear and bright. The wick must be trimmed exactly square, across the wick-tube, and not over the curved top of the cupola used to spread the flame; after trimming, raise the wick, and cut off the extreme corners or points. A wick cannot be trimmed well with dull scissors; the sharper the scissors, the better the shape of the flame. These hints, simple as they appear, are greatly disregarded, and the consequence is a flame dull, yellow, and apt to smoke. The burners made with an immovable cupola, and straight, cylindrical chimneys, require especial care in trimming; the wick has to be raised above the cupola, and has therefore no support when being trimmed. A kerosene lamp, with the wick turned down, so as to make a small flame, should not be placed in a sleeping room at night. A wick made of felt is greatly superior in every way to the common cotton wicks.

1535. To Keep Kerosene Lamps from Getting Greasy. The upper part of a kerosene oil lamp, after standing for a short time, frequently gets oily, from the condensation of the vapor of the oil. This will be greatly, if not entirely prevented, by taking a piece of felt and cutting a hole in it so as to fit exactly around the socket into which the burner is screwed; trim the felt off so as to leave a rim about ½ inch wide, and place this felt ring on the socket.

1536. To Cement the Socket on a Kerosene Lamp. The socket of a kerosene lamp, into which the burner is screwed, frequently becomes loose or comes off. To fasten this, take the socket off, pick out the old cement, and wash it with hot soap and water, with a little soda, to remove all trace of grease. Empty the lamp, and wash it in the same manner, especially the lip or neck which fits into the socket. Next take a cork which fits (not too tight) into the socket; grease it slightly, and screw it into the socket (the same way the burner is screwed in), until the end of the cork is nearly level with the bottom of the socket; this will leave a circular trench to receive the cement. Take the best plaster of Paris, mix it quickly as thick as it will flow, fill the trench in the socket, reverse the lamp, and press the lip of the glass firmly into the socket until the edge of the socket fits closely to the glass. This operation must be done quickly, before the plaster has had time to set. Let the whole remain about 12 hours in a warm place before using. Then unscrew the cork and scrape off any adhering plaster. (*See No.* 2260.)

1537. To Clean Vessels Used to Contain Kerosene. Wash the vessel with thin milk of lime, which forms an emulsion with the petroleum, and removes every trace of it, and by washing a second time with milk of lime and a very small quantity of chloride of lime, and allowing the liquid to remain in it about an hour, and then using it with cold water, even the smell may be so completely removed as to render the vessel thus cleansed fit for keeping beer in. At the same time the external surface of the vessel is to be washed with a rag dipped in the same substance. If the milk of lime be used warm, instead of cold, the operation is rendered much shorter. If particles of thickened petroleum adhere to the glass after the first washing, these can be removed by washing with fine sand, or by other mechanical means.

1538. To Clean Kerosene Lamps. Wash the lamp inside and out thoroughly with hot soap and water, and a little washing soda. When clean, rinse repeatedly so as to leave no trace of soap; let it drain till dry.

Lubricators.

Compounds to lessen the friction in machinery, and to prevent the bearings from rusting. Lubricators must possess a certain amount of cohesive and adhesive attraction. But they must also have the power to retain their cohesion and fluidity under the action of moderate heat, heavy pressure, and contact with metals and air. The oxygen of the air attacks many kinds of oils, rendering some acid and others resinous; and moreover some oils of mineral extraction are contaminated with acids, used in their rectification, which attack metallic surfaces, the oxides of the metals thus produced increasing friction mechanically. The oxides of metals have the power of saponifying vegetable and animal oils, and no doubt this combination often takes place when oils of this kind are used on rusty bearings. The soaps formed by the union of the saponifiable parts of oils with metallic oxides are hard and insoluble, and are, therefore, much less perfect lubricators than the oils themselves. Some oils, more particularly those extracted from petroleum, are volatile, and evaporate as soon as journals become slightly heated. Oils possessing these defects are unfit for purposes of general lubrication. Probably nothing else has ever been discovered that possesses in so high a degree all the properties desirable in a lubricator as good, pure sperm oil. There have been, however, some close approximations to it in oils extracted from petroleum. Many of the latter are, nevertheless, very inferior. Some excellent lubricating oils are also obtained from various seeds. The olive and the castor bean furnish oils very good for lubrication. Olive oil is, however, too expensive for general application to this purpose. (*See No.* 1495.)

1540. Sperm Oil as a Lubricator for Heavy Machinery. The superiority of winter sperm oil has been fully established by experiments made during 14 months, on the car and locomotive axles of a leading line of railroad; these went to prove that when using mineral, animal or fish oils, it required from 100 to 400 per cent. more of these oils to keep the temperature of the journals below 100° Fahr. than when winter sperm oil was employed; and in no instance could the pressure on the car-shaft be raised to 8,000 pounds with any other oil. It was also established that under various velocities, the amount of this oil consumed in lubrication decreased in almost the same ratio as the velocity; and as the velocity and the requisite amount of oil was diminished, the pressure could be increased without any increased consumption of oil.

1541. Booth's Axle Grease. This popular axle grease is made as follows: Dissolve ½ pound common soda in 1 gallon water, add 3 pounds tallow and six pounds palm oil (or 10 pounds of palm oil only). Heat them together to 200° or 210° Fahr.; mix, and keep the mixture constantly stirred till the composition is cooled down to 60° or 70°.

1542. Thin Axle Grease. A thinner composition than the last is made with ½ pound soda, 1 gallon water, 1 gallon rape oil, and ¼ pound tallow, or palm oil.

1543. French Liard for Lubrication. The French compound, called liard, is thus made: Into 50 parts of finest rape oil put 1 part of caoutchouc, cut small. Apply heat until it is nearly all dissolved.

1544. Bavarian Anti-Friction Composition. This composition has been employed in Munich with success and economy to diminish friction in machinery. It consists of 10½ parts pure hog's lard melted with 2 parts finely pulverized and sifted plumbago. The lard is first to be melted over a moderate fire, then the plumbago is thoroughly mixed in, a handful at a time, with a wooden spoon, and stirred until the mixture is of a uniform composition. This is applied in its cold state with a brush to the pivots, the cogs of the wheels, &c., and seldom more than once in 24 hours. It was found that this composition replaced satisfactorily the oil, tallow and tar used in certain iron-works, and saved about four-fifths of the cost of those articles.

1545. Lubricator for Wagon Axles. Tallow, 8 pounds; palm oil, 10 pounds; and plumbago, 1 pound, make a good lubricator for wagon axles. A mixture of glycerine and plumbago makes a fine liquid lubricator.

1546. Mankettrick's Lubricating Compound. 4 pounds caoutchouc dissolved in spirits of turpentine, 10 pounds common soda, 1 pound glue dissolved in 10 gallons water, 10 gallons of oil thoroughly incorporated by assiduous stirring, adding the caoutchouc last.

1547. Anti-Attrition Grease. Grind together blacklead with *four* times its weight of lard or tallow. This is used to lessen friction in machinery, and to prevent iron rusting. It was once a patent article. Camphor is sometimes added, 7 pounds to the cwt.

1548. Anti-Friction Grease. Boil together 1½ cwt. tallow with 1¼ cwt. palm oil. When boiling point is reached, allow it to cool to blood-heat, stirring it meanwhile, then strain through a sieve into a solution of ⅛ cwt. soda in 3 gallons water, mixing it well. The above is for summer. For winter, 1¼ cwt. tallow to 1¾ cwt. palm oil. Spring and autumn, 1½ tallow, 1½ palm oil.

1549. Watchmakers' Oil. Prepared by placing a strip of clean lead in a small white glass bottle filled with olive oil, and exposing it to the sun's rays at a window for some time, till a curdy matter ceases to deposit, and the oil has become quite limpid and colorless. Used for fine work; does not get thick by age. (*See No.* 1551.) Or:—expose the finest porpoise oil to the lowest natural temperature attainable. It will separate into two portions, a thick, solid mass at the bottom, and a thin, oily supernatant liquid. This is to be poured off while at the low temperature named, and is then fit for use. Delicate clocks and watches are now lubricated with glycerine.

1550. To Prepare Oleine for Watchmakers' Use. Oleine is the liquid portion of oil and fat; by saponification it yields oleic acid. Almond or olive oil is agitated in a stout bottle with 7 or 8 times its weight of strong alcohol specific gravity .798, at nearly the boiling point, until the whole is dissolved; the solution is allowed to cool, after which the clear fluid is decanted from the stearine which has been deposited, and after filtration, the spirit is removed by distillation at a gentle heat. By exposure at a very low temperature it deposits any remaining stearine, and then becomes pure.

1551. To Refine Oil for Fine Mechanism. Refined oil for fine mechanism can be prepared by putting zinc and lead shavings, in equal parts, into good Florence olive oil, and placing in a cool place till the oil becomes colorless. (*See No.* 1495.)

Waterproofing.

Numerous plans have been invented for rendering cloth and felting waterproof; the best methods adopted are given in the following receipts:

1553. Waterproof Porous Cloth. A porous waterproof cloth is the best for outer garments during wet weather, for those whose duties or labor causes them to perspire freely. The best way for preparing such cloth is by the process adopted for the tunics of the French soldiers during the Crimean war. It is as follows: Take 2¼ pounds alum and dissolve in 10 gallons boiling water; then in a separate vessel dissolve the same quantity sugar of lead in 10 gallons of water, and mix the two solutions. The cloth is now well handled in this liquid, until every part of it is penetrated; then it is squeezed and dried in the air, or in a warm apartment, then washed in cold water and dried again, when it is fit for use. If necessary, the cloth may be dipped in the liquid and dried twice before being washed. The liquor appears curdled when the alum and lead solutions are mixed together. This is the result of double decomposition, the sulphate of lead, which is an insoluble salt, being formed. The sulphate of lead is taken up in the pores of the cloth, and it is unaffected by rains or moisture, and yet it does not render the cloth air-tight. Such cloth is also partially non-inflammable. A solution of alum itself will render cloth, prepared as described, partially waterproof, but it is not so good as the sulphate of lead. Such cloth—cotton or woolen—sheds rain like the feathers on the back of a duck.

1554. To Waterproof Tweed Cloaks. Dissolve ½ pound alum in two quarts boiling water, and pour the solution into a vessel containing 2 gallons cold spring water. Immerse the garment in this vessel, and let it remain 24 hours. Dissolve ½ pound sugar of lead in 2 quarts of boiling water, and pour the solution into another vessel containing 2 gallons of cold spring water. Take the garment from the first vessel, gently wring or press it, and immerse it in the second vessel. Let it remain 6 hours, gently wring it, and hang it in the shade to dry. This receipt has been tried, and found to answer admirably. It is very similar to the last, but only half the quantity of sugar of lead is used, and the cloth is immersed in the solutions separately.

1555. Cooley's Method of Making Cloth Waterproof. This is a simple, but perfectly successful method of rendering cloth waterproof without being, at the same time, airproof. Spread the cloth on any smooth surface, and rub the *wrong side* with a lump of bees' wax (perfectly pure and free from grease), until the surface presents a slight, but uniform, white or grayish appearance. If this be done carefully and thoroughly, a lighted candle may be blown out through the cloth, if coarse; and yet a piece of the same, placed across an inverted hat, may have several glassfulls of water poured into the hollow formed by it, without any of the liquid passing through; pressure or friction will alone make it do so.

1556. French Waterproof Felting. This composition, heretofore regarded as a secret in France, has been adopted for use in the French navy. The information regarding this material was furnished by Mr. Parent to the "Journal of Applied Chemistry." The inoxidizable compound for waterproof is made thus: 106½ parts, by weight, India rubber, 175 parts finely sifted sawdust, 10 parts powdered sulphur, 25 parts slacked lime, 125 parts sulphate of alumina, 125 parts sulphate of iron, 10 parts hemp tow. To mix the above, use heated cylinders, so as to obtain a very homogeneous paste, which is made into thin cakes, and afterward divide into small pieces to be dissolved. To dissolve this substance, take 4½ pounds spirits of turpentine, benzine, (common is preferable), petroleum, or sulphuret of carbon, to 2½ pounds of the mixture. It must be stirred 5 or 6 times during 24 hours, at the end of which time the mass will be thoroughly dissolved. The solution is then spread on the fabrics or articles to be preserved, by means of rollers, knives, or spatulas, adapted to the purpose. Apply as many coats as may be necessary, and then let it dry. As soon as the fabric is dry, it is passed under pasteboard laminating rollers, in order to give a lustre to the surface. The fabric is then rolled up on a hollow iron pipe, which is covered with cloth to prevent it sticking to the iron, and the whole placed in a copper pipe, with a perforated lid or cover; steam is then introduced at a pressure of 4 atmospheres, which pressure is maintained for 1 hour, at the end of which time the operation is ended. If it be desired to give these impermeable covers a black color, a solution of sulphate of iron, nut-gall and logwood is applied with a brush.

1557. To Make Waterproof Joint Closers. Caps or joint closers can be made of about the same materials as the above by observing the following proportions: Dissolve 21½ parts, by weight, of India rubber, in sufficient benzine; then mix with it 15 parts sawdust, 2 parts sulphur, 3 parts red lead, and 5 parts each of alum, slacked lime, and hemp tow, adding benzine to make the whole into a paste. For closing the joints on steam engines, hydraulic pumps, &c.

1558. To Render Articles Waterproof. A patent has recently been taken out in Paris for a method of rendering paper, cloth, cork, sponge, and other porous substances waterproof, as well as articles manufactured from these materials, including bank-notes, envelopes, gloves, clothing, paper collars, umbrellas, labels, &c. The process consists in dissolving paraffine, cut up in small slices, in pure naphtha or benzine, entirely free from fat or oil. The solution is to be made in a vessel with a glass stopper, and is to be shaken repeatedly until the result is accomplished. An excess of paraffine should be used, so as to make sure of having a perfectly saturated solution. The articles to be treated are immersed in this for a time, according to the thickness or porosity of the tissue, and arranged to secure either a complete saturation or the penetration of the liquid to any required depth. After removal, the articles are to be dried by the application of heat, or in the air. The solvent evaporates, leaving the paper or other substance saturated with paraffine impermeable to water, and capable of resisting the action of acids. Articles of dress, such as paper collars and wristbands, should be subjected to the action of a flat-iron or heated cylinder, in order to give them a high degree of polish. The applications of this process are manifold, and new ones are constantly suggesting themselves.

1559. Balard's Waterproofing for Clothing. Balard recommends the application of acetate of alumina for the purpose of rendering clothing impervious to water. The cloth is to be immersed in a mixture of solutions of acetate of lead and sulphate of alumina; by mutual decomposition of the salts, acetate of alumina is produced on the cloth, and when the goods are dried, basic acetate of alumina adheres to the fibre, and thus protects it from the action of moisture. The process is particularly recommended for military goods.

1560. Berlin Waterproof Cloth. A firm in Berlin has for some years furnished a completely waterproof cloth, the process for making which has been kept a secret. It is now stated, however, that the method consists, in all probability, in saturating the cloth at first with a solution of sulphate of alumina and of copper, and then immersing it in a bath of water-glass and a solution of resin soap. The object of the copper seems to be to prevent the cloth from rotting or stiffening more perfectly than can be done by the alumina alone. *(See No. 1561.)*

1561. To Waterproof Linen, Canvas, &c. Three baths are prepared as follows: The first, by dissolving 1 part neutral sulphate of alumina (concentrated alum cake) in 10 parts cold water. For the second, boil 1 part light resin, 1 part soda crystals and 10 parts water, till the soda is dissolved; add ½ part common salt, to separate the water and collect the soap; dissolve this soap with an equal amount of good palm-oil soap in 30 parts water. This soap bath must be used hot. The third bath consists of water only. Soak the fabric thoroughly in the first, or alum bath; next pass it through the soap bath; and lastly, rinse in the water. *(See No. 1560.)*

1562. Metallic Soap. Metallic soap in linseed oil is highly recommended for coating canvas for wagon covers, tents, &c., as being not only impermeable to moisture, but remaining pliable for a long time without breaking. It can be made with little expense, as follows: Soft soap is to be dissolved in hot water, and a solution of copperas (sulphate of iron) added. The sulphuric acid combines with the potash of the soap, and the oxide of iron is precipitated with the fatty acid as insoluble iron soap. This is washed and dried, and mixed with linseed oil. The addition of dissolved India rubber to the oil greatly improves the paint.

1563. To Render Canvas Fire and Waterproof. Tents, awnings, canvas, &c., may be made fireproof as well as waterproof, by immersion in soluble glass diluted with boiling water to 25° Baumé. Before thoroughly dry, immerse in a solution of sulphate of alumina (alum cake) and sulphate of copper (blue vitriol), 1 part of each to 10 parts of water; then dry the fabric slowly in the air.

1564. Fireproofing Fabrics. A solution of 3 parts borax and 2½ parts sulphate of magnesia in 20 parts water is recommended. Or a mixture of sulphate of ammonia and sulphate of lime. Soluble glass is applicable to rendering wood and theatrical decorations less inflammable.

Honey. The sweet substance extracted by the bee from the juices of the nectaries of flowers, and deposited in the cells of wax forming the honey-comb. Pure honey consists of a syrup of uncrystallizable sugar and crystalline saccharine grains, resembling grape sugar. Virgin honey is that which flows spontaneously from the comb; ordinary honey, that obtained by heat and pressure.

1566. To Purify Honey. Take of honey, 3 pounds; water, 16 pounds; heat in a tin vessel to 212° Fahr. (not to boiling) for 1 hour; then set aside over night. Mix with fresh coarsely powdered charcoal, 2 ounces Troy, and strain through flannel, then evaporate in a steam bath, at about 175° Fahr., to the proper consistence.

Hoffmann dilutes the honey with water, adds solution of tannin as long as precipitation takes place, heats to 212°, strains and evaporates as before.

Mohr and Rebling have an unfavorable opinion of charcoal, and recommend tannin or powdered galls.

Strauss, of St. Petersburg, likewise removes an excess of tannin by means of gelatin.

1567. Rebling's Method of Purifying Honey. One half ounce of honey and ½ ounce water are mixed with ¼ grain powdered galls, heated to boiling, and then mixed with sufficient lime-water to neutralize the acid. For the best honey it takes 2 drachms. This is merely a preliminary test to determine the necessary quantity of lime-water. A flocculent precipitate takes place, which readily separates, leaving the honey perfectly clear and of a very pale yellow color, like that of an old Rhine wine; the strained liquor must be perfectly neutral. From the quantity of lime-water necessary, the quantity of the whole lot of honey is calculated, and is then treated as follows: 1 pound avoirdupois each of honey and water are heated, 4 grains powdered galls are added; the whole well stirred, heated to boiling, and the whole quantity of lime-water added at once. The fire is immediately slackened and after a few minutes the honey, when sufficiently clear, is strained; if still acid, reheating and an addition of more lime-water will be necessary. It is to be evaporated as above.

1568. Vogel's Method of Purifying Honey. Vogel's method is to beat 5 pounds honey with the white of 1 egg till it froths, and then add water to make it of the consistence of syrup; it is next boiled until the white of egg can be skimmed off. Pour it into an upright vessel into which a faucet has been inserted near the bottom, and let it settle for some weeks—when the pure honey may be drawn off through the faucet.

1569. To Clarify Honey. Melt the honey in a water-bath, remove the scum, and pour off the clear. Less agreeable than raw honey, but not so apt to ferment and gripe.

1570. Siller's Method of Clarifying Honey. Any quantity of honey is dissolved in an equal part, by weight, of water. The liquid is allowed to boil up 4 or 6 times without skimming; it is then removed from the fire, and after being cooled, brought on several strong linen strainers, stretched horizontally, and covered with a layer of clean and well-washed sand an inch in depth. When the solution has passed through the strainers, it is found to be of the color of clear white wine; the sand being allowed to remain on the strainers, is rinsed with cold water, and the whole of the liquor is finally evaporated to the thickness of syrup.

1571. To Clarify Honey. Dissolve the honey in water, add 1½ pounds animal charcoal to every 28 pounds of honey, gently simmer for 15 minutes, add a little chalk to saturate excess of acid, if required; strain or clarify, and evaporate. *Observe.*—Honey acquires a darker color if heated in copper or iron vessels; the above processes should therefore be conducted in earthen or well-tinned copper pans.

1572. Shute's Artificial Honey. Soft water, 6 pounds; pure best honey, 3 pounds; white moist sugar, 20 pounds; cream of tartar, 30 grains; essence of roses, 24 drops. Mix the above in a brass kettle, boil over a charcoal fire 5 minutes, take it off, add the whites of 2 eggs well beaten; when almost cold, add 2 pounds more honey. A decoction of slippery elm will improve the honey if it be added while cooling, but it will ferment in warm weather and rise to the surface.

1573. Cuba Honey. Good brown sugar, 11 pounds; water, 1 quart; old bee honey in the comb, 2 pounds; cream of tartar, 50 grains; gum-arabic, 1 ounce; oil of peppermint, 5 drops; oil of rose, 2 drops. Mix and boil 2 or 3 minutes and remove from the fire. Have ready, strained, 1 quart water in which a table-spoonful of pulverized slippery elm bark has stood sufficiently long to make it ropy and thick like honey. Mix this into the kettle with egg well beat up. Skim well in a few minutes, and when a little cool add 2 pounds nice strained bees' honey, and then strain the whole, and you will have not only an article which looks and tastes like honey, but which possesses all its medical properties. (The slippery elm will ferment in warm weather and rise to the surface.)

1574. Artificial Honey. Take 10 pounds Havana sugar, 4 pounds water, 40 grains cream of tartar, 10 drops essence of peppermint, and 3 pounds honey; first dissolve the sugar in the water over a slow fire, and take off the scum. Then dissolve the cream of tartar in a little warm water, and add, with some stirring; then add the honey, heated to a boiling point; then add the essence of peppermint; stir for a few moments, and let it stand until cold, when it will be ready for use.

1575. Excellent Honey. Take 5 pounds good common sugar, 2 pounds water, gradually bring to a boil, skimming well; when cool, add 1 pound bees' honey and 4 drops of peppermint. If you desire a better article use white sugar and ½ pound less water and ½ pound more honey.

1576. To Test the Purity of Honey. Honey is frequently adulterated with molasses, potato-sugar syrup, starch, wheat flower, and water. The molasses may be detected by the color and odor; the potato-sugar syrup, by boiling a sample of the honey for a short time in water containing 2 or 3 per cent. of caustic potassa; if the liquid remains colorless it is pure; but if it turns brown, more or less, it is adulterated according to the quantity of syrup present. The starch, by the honey not forming a nearly clear solution with cold water, and striking a blue color with iodine. When it contains wheat flour and is heated, it at first liquefies, but on cooling it becomes solid and tough. Water is added to honey to increase its bulk. Its presence may be suspected from the greater thinness of the liquid.

Bees' Wax.

The substance which forms the cells of bees; obtained by melting the comb in water after the honey has been removed, straining the liquid mass, remelting the defecated portion, and casting into cakes. Bees' wax, when pure, has neither taste nor smell; it melts at about 157° Fahr., and is of a specific gravity of .966. It burns without smoke or disagreeable odor. It is insoluble in water, but soluble in all proportions in the fixed and volatile oils, bisulphide of carbon, and benzine. Its complete solution in these substances demonstrates its freedom from fecula, sulphur, sawdust, or bone dust, which have been found in the wax of commerce, sometimes amounting to 60 per cent. of the whole weight. The abundance and low price of paraffine have made this substance one of the principal articles used in the falsification of wax, and perhaps of all others it is the least objectionable, being without marked physiological effect upon the system.

1578. To Bleach Wax. Pure white wax is obtained from the ordinary bees' wax by exposure to the influence of the sun and weather. The wax is sliced into thin flakes, and laid on sacking or coarse cloth, stretched on frames, resting on posts to raise them from the ground. The wax is turned over frequently, and occasionally sprinkled with soft water, if there be not dew and rain sufficient to moisten it. The wax should be bleached in about 4 weeks. If, on breaking the flakes, the wax still appears yellow inside, it is necessary to melt it again, and flake and expose it a second time, or even oftener, before it becomes thoroughly bleached. The time required being mainly dependent on the state of the weather. There is a preliminary process, by which, it is claimed, much time is saved in the subsequent bleaching; this consists in passing melted wax and steam through long pipes, so as to expose the wax as much as possible to the action of the steam; thence into a pan heated by a steam bath, where it is stirred thoroughly with water and then allowed to settle. The whole operation is repeated a second and third time, and the wax is then in a condition to be more readily bleached.

1579. To Bleach Wax. Wax cannot be bleached with chemicals; if any other agent but sunshine is employed, part of its properties will be destroyed, and it is genuine wax no longer. Chlorine will whiten, but at the same time greatly injure it. The chlorine is retained, and forms, on combustion, muriatic acid.

1580. French Method of Bleaching Bees' Wax. The wax is melted in copper vessels, and, after complete liquefaction, is agitated with 8 ounces of pulverized cream of tartar for each 100 pounds. After some minutes' agitation it is allowed to deposit its impurities, and is drawn into a wooden vessel and allowed to deposit a further amount of foreign substance—dirt, sand, bees, etc.—and, while still liquid, is drawn upon a little roller partly immersed in water, to which a regular rotation is given—thus producing thin sheets or ribbons of wax, which may be detached from the roller, being now ready for the process of bleaching. This is accomplished by the exposure of the yellow scales and ribbons, upon cloths, to the direct rays of the sun and the dew, for several days, during which time the wax completely loses its color. It is, however, in practice impossible to bleach the wax at a single operation, as the effect takes place only on the surface, and, as the ribbons have a certain thickness, it is necessary to melt them anew, and having repeated the operation of granulating, it is submitted to a second exposure. The wax thus bleached is melted, and cast into discs of 1 to 2 ounces weight, and forms the cera alba of the Pharmacopœia.

1581. Italian Method of Bleaching Bees' Wax. The yellow wax is first melted in a kettle, and then is dipped out into a long tin vessel that will hold 2 or 3 gallons, and which has a row of small holes, about the diameter of a knitting-needle, in the bottom. This vessel is fixed over a cylinder of wood 2 feet in length and 15 inches in diameter, which is made to revolve like a grindstone, in one end of a trough of water 2½ feet in width, 10 to 15 feet in length, and 1 foot in depth. As the melted wax falls in small streams on this wet revolving cylinder, it flattens out into a thin ribbon and floats off toward the other end of the trough of water. It is then dipped out with a skimmer (that may be made of osier twigs), spread on a table (with a top made of small willow rods, covered with a clean white cloth), and then exposed in this way to the sun until bleached.

1582. To Detect Spermaceti in Wax. The presence of spermaceti in what is sold as virgin wax, is shown by its reduced melting point, its bending before it breaks, and by its flavor when chewed.

1583. To Detect Japanese Wax in Bees' Wax. According to Hager, this is determined by their different behavior in a concentrated solution of borax, at the boiling point. Bees' wax is totally insoluble in such a solution, while Japanese wax dissolves, and on cooling forms a milky white, gelatinous mass. From a mixture of the two the latter is dissolved out, carrying with it a portion of the former, while another portion rises and congeals on the surface.

1584. To Refine Bees' Wax. Crude wax, especially that imported, is generally loaded with dirt, bees, and other foreign matter. To free it from these substances, it undergoes the operation of refining. This is done by melting the wax along with about 3 per cent. of water in a bright copper boiler, preferably heated by steam, and after the whole is perfectly liquid, and has boiled for a few minutes, withdrawing the heat, and sprinkling over its surface a little oil of vitriol, in the proportion of about 3 or 4 fluid ounces to every 100 pounds of wax. This operation should be conducted with great care and circumspection; as, if done carelessly, the melted wax will froth up, and boil over the sides of the pan. The acid should also be well scattered over the whole surface. The melted wax is next covered over, and left for some hours to settle, or till it becomes sufficiently cool to be drawn off into the moulds. It is then very gently skimmed with a hot ladle, and bailed or decanted into basins, where it is left to cool. Great care must be taken not to disturb the sediment. When no more clear wax can be drawn off, the remainder in the melting pan is allowed to cool, and the cake or foot, as it is called, is taken out, and the impurities (mostly bees) scraped from its under surface. The remaining portion is usually reserved for a second operation, but, if required, may be at once melted, and strained through canvas into a mould. The great art in the above process is to produce a wax which shall at once be bright or semi-translucent in thin pieces, and good colored. The former is best insured by allowing the melted mass to settle well, and by carefully skimming and decanting the clear portion without disturbing the sediment. It should also not be poured into the moulds too warm, as, in that case, it is apt to separate, and the resulting cakes to be streaky, or of different shades of color. It should also be allowed to cool very slowly. When cooled rapidly, especially if a current of air fall upon its surface, it is apt to crack and form cakes full of fissures. Some persons who are very nice about their wax, have the cakes polished with a stiff brush when quite cold and hard. It is necessary to have the cans, ladles, and skimmers used in the above process kept quite hot, as without this precaution the wax cools, and accumulates upon them in such quantity as to render them inconvenient, and often quite useless, without being constantly scraped out.

1585. To Refine Wax. Another method of refining crude wax, and which produces a very bright article, is to melt it with about 1 per cent. of concentrated nitric acid, in a large earthen or stoneware vessel, heated by steam or a salt-water bath, and to continue the boiling till nitrous fumes cease to be evolved, after which the whole is allowed to settle, and treated as before.

1586. To Color Bees' Wax. Much of the imported wax has a pale dirty color, which renders it, no matter how pure, objectionable to the retail purchaser. Such wax undergoes the operation of coloring. This is done as follows:—A small quantity of the best roll annotto, cut into slices (½ pound, more or less, to 1 cwt. wax, depending on the paleness of the latter), is put into a clean boiler with about a gallon of water, and boiled for some time, or till it is perfectly dissolved, when a few ladlefuls of the melted wax are added, and the boiling continued till the wax has taken up all the color, or till the water is mostly evaporated. The portion of wax thus treated has now a deep orange color, and is added in quantity as required to the remainder of the melted wax in the larger boiler, till the proper shade of color is produced when cold, observing to well mix the whole, and to cool a little now and then to ascertain when enough has been added. The copper must be then brought to a boil, and treated with vitriol, &c., as before. (*See No.* 1584.)

1587. To Color Bees' Wax. Another method is to add bright palm oil to the wax till it gets sufficient color; but this plan is objectionable from the quantity required for the purpose being often so large as to injure the quality of the wax; besides which the color produced is inferior, and less transparent and permanent.

1588. Factitious, or Imitation Bees' Wax. Yellow resin, 16 pounds; hard mutton suet or stearine, 8 pounds; palm oil, 24 pounds; melt together.

II. As last, but substitute turmeric, 1 pound, for the palm oil.

III. Best annotto, 6 ounces, or sufficient to color; water, 1 gallon; boil till dissolved, add hard mutton suet or stearine, 35 pounds; yellow resin, 70 pounds; boil with constant agitation till perfectly mixed and of a proper color, and as soon as it begins to thicken, pour it out into basins to cool. When cold rub each cake over with a little potato starch. Used instead of wax in ointments by farriers.

1589. Braconot's Method of Making Artificial Wax. Any animal grease or tallow is liquefied by oil of turpentine, and poured into small round boxes lined with felt in the inside, with a number of small holes bored in the sides and the bottom. From these little boxes the liquid is pressed out gradually, but sufficiently to get rid of the turpentine oil and all the fluidity. The firm mass remaining must be washed a long time in water, to take away the smell of the oil of turpentine, and then kept fluid for several hours with animal charcoal freshly prepared and afterwards filtered whilst boiling. When cooled, it is a substance beautifully white, half transparent, dry, brittle, and free from taste or smell; and will mix well with chlorine or muriatic acid, or with ⅙ of wax to give it the necessary suppleness. In this state the mass can be made into candles not to be distinguished from wax lights. The turpentine is separated from the other oil, and evaporated by means of distillation; and this oil, when purified and whitened with animal charcoal, is of great service in the preparation of a soap extremely well adapted for the trade and for household purposes. This animal oil, when saponified with potash, and then by means of the sulphuric acidulated soda often contained in the mother lye, can be changed into a hard soda soap. There is also a sulphate of potash, much in demand in the alum works, to be obtained from it.

1590. Modeling Wax. This is made of white wax, which is melted and mixed with lard to make it malleable. In working it, the tools and the board or stone are moistened with water, to prevent its adhering; it may be colored to any desirable tint with dry color.

1591. Wax for Polishing Floors. To prepare this, 12½ pounds yellow wax, rasped, are stirred into a hot solution of 6 pounds good pearl-ash, in rain water. Keeping the mixture well stirred while boiling, it is first quiet, but soon commences to froth; and when the effervescence ceases, heat is stopped, and there are added to the mixture, while still stirring, 6 pounds dry yellow ochre. It may then be poured into tin cans or boxes, and hardens on cooling. When wanted for use, a pound of it is diffused in 5 pints boiling hot water, and the mixture well stirred, applied while still hot to the floor by means of a paint-brush. It dries in a few hours, after which the floor is to be polished with a large floor-brush and afterwards wiped with a coarse woolen cloth. A coat of this paint will last six months.

Cheese.

The materials employed in making cheese are milk and rennet. The milk may be of any kind, from the poorest skimmed milk to that rich in cream, according to the quality of the cheese required. The poorest kind of cheese is made from the former, and the finer from the latter, to which additional cream is frequently added. The materials being ready, the greater portion of the milk is put into a large tub, and the remainder sufficiently heated to raise the whole quantity to the temperature of new milk. The whole is then whisked together, the rennet (*see No.* 1595) added, and the tub covered over. It is now allowed to stand until completely turned, when the curd is struck down several times with the skimming-dish, after which it is allowed to subside. The vat covered with cheese-cloth is next placed on a horse or ladder over the tub, and filled with curd by means of the skimmer; the curd is pressed down with the hands, and more added as it sinks. This process is repeated until the curd rises to about 2 inches above the edge. The cheese thus partially separated from the whey is now placed in a clean tub, and a proper quantity of salt added, or the salt is added to it without removing it from the vat, after which a board is placed over and under it, and pressure applied for 2 or 3 hours. The cheese is next turned out and surrounded by a fresh cheese-cloth, and pressure again applied for 8 or 10 hours, when it is commonly removed from the press, salted all over, and pressed again for 15 to 20 hours. The quality of the cheese especially depends on this part of the process, as, if any of the whey be left in the cheese, it will not keep, but will rapidly become bad flavored. Before placing it in the press the last time, the edges should be pared smooth and sightly. It now only remains to wash the outside of the cheese in warm whey or water, wipe it dry, color it with annotto, and place it in a cool place to mature or ripen.

1593. To Collect the Curd in Making Cheese. There are several methods adopted of collecting the curd; and as the flavor of the cheese varies accordingly, it is as well to notice them. One way is to break the curd early, and to remove the whey as soon as possible; another plan is to gather it with the hands very gently towards the sides of the tub, letting the whey run off through the fingers until it becomes cleared, and ladling it off as it collects. A third method is to remove it as quickly as possible with the curd-skimmer. Of these the second plan is said to be the best, as it preserves the oily particles, many of which are lost by the other methods.

1594. To Make Cream Cheese. This is made either of the "strippings" (the last of the milk drawn from the cow at each milking), or of a mixture of milk and cream. It is usually made up into small pieces, and a gentle pressure, as that of a 2 or 4 pound weight, applied to press out the whey. After twelve hours, it is placed upon a board or wooden trencher, and turned every day, until dry. In about three weeks it will be ripe. Nothing but raw cream, turned with a little rennet (*see No.* 1595) is employed, when a very rich cheese is wanted. A little salt is generally added, and frequently a little powdered lump sugar. The vats employed for cream cheeses are usually square, and of small size.

1595. Rennet. The stomach of the calf, freed from the outer skin, fat, and useless membrane, is washed, treated with either brine or dry salt for a few hours, and then stretched out upon a stick and hung up to dry. It is employed for curdling milk. A piece of the requisite size is cut off and soaked for some hours in whey or water, after which the whole is added to the milk slightly warmed, or, if necessary, heated to about 120° Fahr. In a short time the milk separates into a white curd, and a yellowish fluid called whey. 2 square inches from a good rennet are sufficient for a cheese of 60 pounds.

1596. Essence of Rennet. Knead together 12 ounces fresh rennet cut small, and 3 ounces common salt; leave the mixture for 5 or 6 weeks in a cool place; then add 18 ounces water, and 2 ounces good rum or proof spirit. Digest for 24 hours; filter, and color with a little burnt sugar. 2 or 3 teaspoonfuls will curdle a quart of milk.

1597. Condensed Milk. There is no difficulty in manufacturing condensed milk, and the process consists only in careful evaporation, addition of sugar, and sealing up of the article. The evaporation should be conducted in a vacuum, to prevent the milk from becoming brown and acquiring a bitter taste. It is best to stir it constantly, or the skin of coagulated casein at the top will prevent quick evaporation. When sufficiently thick or condensed it is mixed with ¼ its weight of granulated sugar, stirred well, filled in tins, and soldered up.

Preservatives.

These consist of such substances or methods as are employed for preventing decay in fruits, meat, and other perishable matter; together with valuable antiseptics.

1599. To Dry Fresh Meat. Cut the flesh into slices from 2 to 6 ounces in weight, immerse a small portion at a time in boiling water for 5 or 6 minutes, using only just water enough to cover the meat, and adding fresh water only to keep the liquor up to its original quantity. Lay the meat to dry on open trellis-work in a drying stove, keeping the temperature at about 122° Fahr. In about two days the meat will be completely dry, having lost about ⅘ its weight. Add a little salt and spice, especially coriander, to the liquor or soup in which the meat was immersed, and then evaporate it to a gelatinous consistence. When the flesh is perfectly dry, dip it, piece by piece, in the gelatinous matter liquefied by a gentle heat, and replace it in the stove to dry, repeating this varnishing and drying 2 or 3 times, so as to get the coating uniformly thick. Meat thus dried will keep good for a year.

1600. To Smoke Meat. This process consists in exposing meat, previously salted, to wood-smoke, in an apartment (usually called a smoke-house), into which the smoke is admitted by flues at the bottom of the side walls. The meat absorbs the pyroligneous acid of the smoke, and gets dried at the same time. It may be protected from soot by rubbing over with bran, or wrapping in a cloth. The smoke from oak or beech wood is preferable; and the smoking is better slow and gentle than rapid and powerful; the latter plan being too often adopted from motives of economy. Hams thus prepared, as is often the case, are ham merely on the surface, and corned pork inside. This process is sometimes imitated by immersing the meat for a few hours in diluted pyrolygneous acid, but it is apt to harden or toughen the meat.

1601. Smoking Fluid. One drop of creosote in a pint of water imparts a smoky flavor to fish or meat dipped into it for a few minutes.

1602. To Dry-Salt and Pickle Meat. This is best performed by well rubbing the meat with a mixture of salt, 2 pounds; saltpetre, 2 ounces; and moist sugar 1¼ ounces, till every crevice is thoroughly penetrated, after which it should be set aside till the next day, when it should be covered with fresh salt in such parts as require it. It may then be, advantageously placed in any proper vessel, and subjected to pressure, adding a little fresh salt as necessary, and turning it daily till sufficiently cured. When the brine as it forms is allowed to drain from the meat, the process is called dry-salting; but when, on the contrary, it is allowed to remain on it, the article is said to be wet-salted. On the small scale, the latter is most conveniently performed by rubbing the meat with salt, &c., as above, and after it has lain a few hours, putting it into a pickle formed by dissolving 4 pounds salt, ½ or 1 pound sugar, and 2 ounces saltpetre in 2 gallons water. This pickling liquor gets weaker by use, and should therefore be occasionally boiled down a little and skimmed, at the same time adding some more of the dry ingredients.

1603. Pickle to Give Meat a Red Color. Mix brown sugar, bay salt, common salt, each 2 pounds; saltpetre, 8 ounces; water, 2 gallons; this pickle gives meat a fine red color, while the sugar renders it mild and of excellent flavor. Large quantities are to be managed by the above proportions.

1604. To Salt Meat by Injection. The sooner meat is salted after being killed, the better, as it then possesses considerable absorbent power, which it gradually loses by age. On this property is based the process of M. Gaunel for the preservation of animals intended for food in a fresh state. This operation consists in injecting a solution of chloride of aluminum at 10° Baumé, into the carotid, by means of a syphon, as soon as the blood ceases to flow from the slaughtered animal, both extremities of the jugular vein being previously tied. 9 to 12 quarts of the solution are sufficient for an ox. When the animal has been well bled, and the injection skillfully performed, it is scarcely perceptible that the animal has undergone any preparation. The injected animal is cut up in the usual way; and when intended to be eaten within 2 or 3 weeks, merely requires to be hung up in a dry situation free from flies; but if it is to be kept for a longer period, it is directed to be washed with a mixed solution of common salt and chloride of aluminum at 10° Baumé, and then simply dried and packed in clean air-tight barrels, and kept in a cool, dry place. If the air cannot be perfectly excluded, it should be packed in dry salt, not for the purpose of preserving it, but to prevent the meat from becoming musty from exposure and the action of moisture. Meat preserved by this process may be kept for several years, and merely requires soaking for 24 hours in water, for the purpose of swelling its pores, to give it the appearance and taste of fresh meat, fit either for roasting or boiling.

1605. Pelouze's Process of Preserving Meat. The meat is to be cut up into pieces of convenient size, and subjected to an atmosphere of carbonic oxide under pressure. After this a current of dry air is passed over the meat, so as to carry off all the moisture, and this being accomplished, a solution either of salt or saltpetre, or much diluted carbolic acid, is to be brought into contact with it, and the mass then sealed up in a tight vessel.

1606. To Cure Hams. Cover the bottom of the cask with coarse salt, lay on the hams with the smooth or skin side down, sprinkle over fine salt, then another layer of hams, and so continue until the cask is full. This ought to be of the larger kind. A cask holding 64 gallons is small enough, and it would be better if it held 120 gallons. Make a brine in the following proportions: 6 gallons water, 9 pounds salt, 4 pounds brown sugar, 3 ounces saltpetre, 1 ounce saleratus. Scald and skim, and when cold pour the brine into the cask until the hams are completely covered. The hams should remain in this pickle at least three months, and a little longer time would do them no harm. A handful each of mace and cloves scattered in the brine will greatly improve the flavor of the meat.

1607. To Cure Beef and Pork. To each gallon of water add 1¼ pounds salt, ½ pound sugar, ½ ounce saltpetre, and ½ ounce potash. Let these be boiled together until all the dirt from the sugar rises to the top and is skimmed off. Then throw it into a tub to cool, and when cold, pour it over the beef or pork, to remain the usual time, say 4 or 5 weeks. The meat must be well covered with pickle, and should not be put down for at least 2 days after killing, during which time it should be slightly sprinkled with powdered saltpetre, which removes all the surface blood, &c., leaving the meat fresh and clean. Some omit boiling the pickle, and find it to answer well, though the operation of boiling purifies the pickle by throwing off the dirt always to be found in salt and sugar. Ham cured in this manner may be smoked as usual, and will be found excellent. This receipt has been tried with complete satisfaction.

1608. Brine or Pickle for Pork, &c. Brown sugar, bay salt, common salt, of each 2 pounds; saltpetre, ½ pound; water, 1 gallon. Boil gently and remove the scum. Another meat pickle is made with 12 pounds salt, 2 pounds sugar or molasses, ½ pound nitre, and sufficient water to dissolve it. To cure hams, mix 5 ounces nitre with 8 ounces coarse sugar; rub it on the ham, and in 24 hours rub in 2 pounds salt, and in two weeks 2 pounds more. The above is for a ham of 20 pounds; it should lie in the salt a month or 5 weeks.

1609. Liebig's Extract of Meat. Cut the lean of fresh-killed meat very small, put it into 8 times its weight of cold water, and heat it gradually to the boiling point. When it has boiled for a few minutes, strain it through a cloth, and evaporate the liquor gently by water-bath to a soft mass. 2 pounds meat yield 1 ounce extract. Fat must be carefully excluded, or it will not keep.

1610. To Preserve Meat with Vinegar. This may be done either by washing the meat, drying and laying in strong vinegar; or by being boiled in the vinegar, leaving it in the vinegar until cold, and then set aside in a cool cellar, where it will keep sound for several months.

1611. To Can Meat. Remove the bones from fresh meat, parboil the flesh, put it into a clean tin can, and fill up with rich seasoned soup; solder on the lid, pierced with a very small hole. Next put the tin into a bath of brine and heat until the steam issues from the hole; then solder up and at the same time remove the can from the bath. In a short time the pressure of the air will induce a slight concavity of the top and bottom of the can. If the process has been successfully performed, this concavity will be permanent; but if, at any future time, the concavity has ceased, or the ends become slightly convex, it is a sure sign that the meat has become putrid. The system of canning has been in later years applied to preserving fresh fruits and vegetables, and is done on substantially the same principles, namely, filling the can with steam, and hermetically sealing before the steam condenses. (*See No.* 1634.)

1612. To Keep Meat Fresh. Place the meat on a wooden support (or suspend it) in a close vessel, on the bottom of which some strong acetic acid has been poured. In this way it may be kept fresh for a considerable time.

1613. Preservation of Hams. Most grocers, dealers in hams, and others, who are particular in their meat, usually take the precaution to case each one, after it is smoked, in canvas, for the purpose of defending it from the attacks of a little insect, the dermestes lardarius, which, by laying its eggs in it, soon fills it with its larvæ, or maggots. This troublesome and expensive process may be altogether superseded by the use of pyroligneous acid. With a painter's brush, dipped in the liquid, one man, in the course of a day, may effectually secure two hundred hams from all danger. Care should be taken to insinuate the liquid into all the cracks, &c., of the under surface. This method is especially adapted to the preservation of hams in hot climates.

1614. To Make Carbolic Acid Paper for Preserving Meats. Carbolic acid paper, which is now much used for packing fresh meats, for the purpose of preserving them against spoiling, is made by melting 5 parts stearine at a gentle heat, and then stirring in thoroughly 2 parts carbolic acid; after which 5 parts melted paraffine are to be added. The whole is to be well stirred together until it cools; after which it is melted and applied with a brush to the paper, in quires, in the same way as in preparing the waxed paper so much used in Europe for wrapping various articles. (*See Nos.* 1936 *and* 1938.)

1615. To Preserve Fish Fresh with Sugar. A method adopted in Portugal for preserving fish consists in cleaning and sprinkling sugar over the interior, keeping the fish in a horizontal position, so that the sugar may penetrate as much as possible. It is said that fish prepared in this way can be kept completely fresh for a long time, the savor being as perfect as if recently caught. Salmon thus treated before salting and smoking possess a much more agreeable taste; a table-spoonful of sugar being sufficient for a five-pound fish.

1616. Aseptin. A substance called aseptin has recently been introduced into trade by a Swedish dealer as a preservative material for milk, meat, etc. This is said to be simply boracic acid, or borax; the double aseptin consisting of two parts of borax to one part of alum. Putrefaction is said to be prevented by the addition of this preparation, but mouldiness in animal substances is not. Although a very short time has elapsed since aseptin has been brought into notice, thousands of pounds are now sold almost daily in Scandinavia and Germany.

1617. Sportsman's Beef. Take a fine round of beef, 4 ounces saltpetre, ¼ ounce allspice, rub it well on the beef, and let it stand 24 hours; then rub in as much common salt as will salt it. Lay it by 12 days, turning it every day; then put it into a pan, such as large pies are baked in, with 3 or 4 pounds beef-suet, some under, some over. Cover it with a thick crust, and bake it for 6 hours. It will keep for 2 months, and most excellent it is.

1618. Preservation of Meat. By repeatedly immersing the meat in hydrochloric acid, subsequently drying, it is sufficiently cured to keep for a considerable time. When required for use, the acid must be neutralized by a little carbonate of soda, by which it will be salted. The strength of the hydrochloric acid must be determined by experiment.

1619. To Keep Dead Poultry, &c., Fresh. Dead birds may be preserved in a fresh state for some time by removing the intestines, wiping the inside out quite dry with a towel, and then flouring them. A piece of blotting paper, on which one or two drops of creosote have been placed, is now to be put inside them, and a similarly prepared piece of paper tied round them. They should then be hung up in a cool dry place, free from the attacks of flies or vermin, and will be found to keep much longer than without undergoing this process. (*See No.* 1614.)

1620. To Preserve or Cure Butter. Melt the butter in well glazed earthen pans, at a heat not exceeding 180° Fahr. in a water bath, and keep it heated, skimming it from time to time, until the butter becomes quite transparent, then pour off the clear into another vessel, and cool it as quickly as possible by surrounding it with cold water or ice. The above is the method of preserving butter employed by the Tartars who supply the Constantinople market, and in this state it may be preserved perfectly fresh for 6 months, if kept in a close vessel and a cool place. This plan received the approval of Thenard, as well as Mr. Eaton; the latter states that butter melted by the Tartar method, and then salted by ours, will keep good and fine-tasted for 2 years. Any of the following methods of salting may be adopted.

1621. To Preserve Butter by Salting. Mix well together 1 ounce each saltpetre and white sugar, and 2 ounces best salt, all in very fine powder, then add 1 ounce of this mixture to every pound of butter, and thoroughly incorporate them together. The butter thus prepared is then to be tightly pressed into clean glazed earthenware vessels, so as to have no vacant spaces. This butter does not taste well before it has stood for 2 or 3 weeks, after which it acquires a rich marrow flavor, which no other butter ever possesses. Any good well-made fresh butter, free from butter-milk, will succeed by this method, but the application of it to butter clarified by the Tartar plan, as described above, produces an article that will keep longer good than butter cured by any other process yet discovered.

1622. To Preserve Butter by Salting. Take fresh butter, 16 pounds; salt, 1 pound. Or: Fresh butter, 18 pounds; salt, 1 pound; saltpetre, 1½ ounces; honey or fine brown sugar, 2 ounces. Proceed as in the last receipt.

1623. To Preserve Butter from the Air. The best method to preserve butter from the air, is to fill the pots to within an inch of the top, and to lay on it common coarse-grained salt, to the depth of ¼ or ½ inch, and then to cover the pot up with any flat article that may be convenient. The salt, by long keeping, will run to brine, and form a layer on the top of the butter, which will effectually keep out the air, and may at any time be very easily removed by turning the pot on one side.

1624. To Preserve Butter Sweet. To every 20 pounds of butter take 3 pounds salt, 1 pound loaf sugar, ½ pound pulverized saltpetre; mix, and put a layer of butter about 8 inches thick, then sprinkle on a light covering of the above preparation alternately, until your cask is full. Pack in air-tight casks. Butter packed in this way will keep sweet for 2 or 3 years.

1625. To Restore Rancid Butter. Rancid butter may be restored by melting it in a water-bath with some fresh-burnt and coarsely powdered animal charcoal (which has been thoroughly freed from dust by sifting) and straining it through clean flannel. A better and less troublesome method is to well wash the butter, first with good new milk, and next with cold spring water. Butyric acid, on the presence of which rancidity depends, is freely soluble in fresh milk.

1626. To Improve Strong Butter. This operation is extremely simple and practicable; it consists in beating the butter in a sufficient quantity of water, in which put 25 to 30 drops chloride of lime to 2 pounds of butter. After having mixed it till all its parts are in contact with the water, it may be left in it for 1 or 2 hours, afterwards withdrawn, and washed in fresh water. The chloride of lime, having nothing injurious in it, can with safety be augmented; but it will generally be found that 12 to 14 drops to a pound of butter are sufficient. Butter, the taste and odor of which were insupportable, has been sweetened by this simple means. We have tried the above receipt, and find that the chloride removes the rancid taste of the butter, making it suitable for cooking, but scarcely purified enough for table use.

1627. To Preserve Milk. The following receipt appears in Cosmos: "To every liter (about 1 quart) of unskimmed milk, previously poured into a well-annealed glass bottle, add 40 centigrammes (about 6 grains) of bicarbonate of soda. Place the bottle (which must be well corked) containing the milk for about 4 hours in a water-bath, heated to 194° Fahr. On being taken out, the bottle is to be varnished over with tar; and in that state the milk contained in it will keep sound and sweet for several weeks."

1628. To Keep Milk Sweet. A tea-spoonful of fine salt or horse-radish in a pan of milk will keep it sweet for several days. Milk can be kept a year or more as sweet as when taken from the cow by the following method: Procure bottles, which must be perfectly clean, sweet, and dry; draw the milk from the cow into the bottles, and as they are filled, immediately cork them well, and fasten the cork with pack-thread or wire. Then spread a little straw in the bottom of a boiler, on which place the bottles, with straw between them, until the boiler contains a sufficient quantity. Fill it up with cold water, and as soon as it begins to boil, draw the fire and let the whole cool gradually. When quite cold, take out the bottles and pack them in sawdust in hampers, and stow them away in the coolest part of the house.

1629. Preservation of Eggs. When newly laid, eggs are almost perfectly full, but the shell is porous, and the watery portion of its contents begins to evaporate through its pores the moment it is exposed to the air, so that the eggs become lighter every day. To preserve the interior of the egg in its natural state, it is necessary to seal up the pores of the shell air-tight. This may be done by dipping them in melted suet, olive oil, milk of lime, solution of gum-arabic, or covering them with any air-proof varnish. They are then packed in bran, oats, meal, salt, ashes, or charcoal powder.

1630. To Preserve Eggs. Vegetable oils, more especially linseed, simply rubbed on to the egg, hinders any alteration for a sufficiently long period, and presents a very simple and efficacious method. We believe that two coatings of collodion should preserve eggs better than any other method that has yet been suggested. Or perhaps a single coating of paraffine might be equally effective.

1631. To Distinguish Good Eggs. To ascertain whether an egg is good or bad, hold it up to the light. A good egg is translucent, but a bad one is perfectly opaque; the difference is as easily perceived as that between a blue egg and a white one.

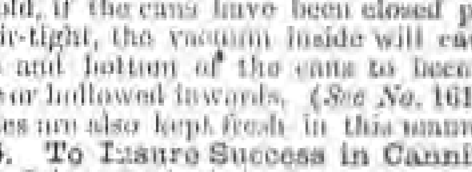
1632. To Preserve by Alcohol. Strong alcoholic liquors are used to prevent decomposition in both vegetable and animal bodies. They penetrate the substances, combine with its juices, and as the organic tissues have less attraction for the spirituous mixture, it escapes; and the tissues themselves shrink and harden in the same way as when salted. Alcohol also obstructs change by seizing upon the oxygen in the atmosphere, in virtue of its superior attraction for that gas, thus preventing it from acting upon the substance to be preserved.

1633. German Soup Tablets. Reinsch gives the following receipt for making the soup tablets so much in use in the German army during the late war: Take 11 parts by weight of good suet, melt it an iron pan, and make it very hot, so as to become brown; add, while keeping the fat stirred, 18 parts rye meal, and continue heating and stirring so as to make the mass brown; add then 4 parts dried salt and 2 parts coarsely pulverized caraway seed. The mixture is then poured into tin pans somewhat like those used for making chocolate into cakes. The cakes have the appearance of chocolate, and are chiefly intended for the use of soldiers while in the field. A quantity of about 1 ounce of this preparation is sufficient to yield, when boiled with some water, a ration of good soup, and, in case of need, the cakes, being agreeable to the taste, may be eaten raw.

1634. To Can Fresh Fruit. Procure a sufficient number of tin cans of suitable size, fill them quite full with the fruit, and solder them securely. Next pierce a small pin-hole in the top of each can, to allow the air to be expelled; place the cans in a boiler as deep as the cans are high, pour boiling water into the boiler until within ½ inch of the top of the cans; keep the water hot over a moderate fire, but not boiling, until the air ceases to escape from the cans, and then seal the air holes with solder before removing the cans from the water. The cans should then be taken out, wiped dry, and allowed to cool; when cold, if the cans have been closed perfectly air-tight, the vacuum inside will cause the top and bottom of the cans to become concave or hollowed inwards. (*See No.* 1611.) Tomatoes are also kept fresh in this manner.

1635. To Insure Success in Canning Fruit. Select fresh fruit that is perfectly ripe; but, at the same time, perfectly sound. One unsound berry may injure all in contact with it.

The *boiling* water poured into the boiler



will be considerably cooled by contact with the cans; care must be taken not to let the water return to the boil while the cans are in it; and yet it must become hot enough to expel the air from the cans.

The surest way to attain the desired object is to keep the bulb of a thermometer in the water. A heat of 200° to 208° Fahr. will answer best, but it must never exceed the latter degree. To ascertain when all the air possible has been expelled, put one drop of hot water on the air hole; the cessation or absence of air bubbles passing through it will denote that the cans are ready for final sealing.

1636. To Can Berries. Peaches, apples, pears, plums, &c., can be kept perfectly fresh in tin cans in the manner described in No. 1634, and will retain their fresh flavor almost, if not entirely, intact. Raspberries, strawberries, &c., are kept in better condition by adding ½ pound white sugar to each pound of fruit, letting them come to the boil, and then filling the cans *quite* full, soldering the lid of the can immediately. The hot fruit will, to all intents, expel the air from the can. No water should be used with fruits, except in cases where a little is necessary to dissolve the sugar, as it tends to render them insipid. Most vegetables can be kept in cans in this way, omitting the sugar, and scalding them in water sufficient to cover them.

1637. To Expel the Air from Cans. Air, by heating, expands many times its own bulk; consequently, if you take a jar and cover it tightly with the exception of a hole the size of a pin through the cover, and set it in boiling water, as air expands 20 times its bulk by heating, it is obvious that $\frac{19}{20}$ of the air passes out through the pin hole in the cover; now drop a little sealing wax or solder over the pin hole and you have but $\frac{1}{20}$ of the air in the jar that was in it before heating it. Of course the fruit and syrup, if put into the jar cold, displaces most of the air; but putting it in as hot as it can be, and filling as full as possible, expels the air to all intents and purposes. Cans managed in this way, when made of sheet metal, frequently collapse from outside atmospheric pressure as they cool off, showing that the exhaustion was complete; even more so than needed.

1638. To Keep Fruit Fresh in Jars. Use only self-sealing glass jars. Put into a porcelain-lined preserving kettle, enough to fill 2 quart jars; sprinkle on sugar, ¼ pound; place over a slow fire and heat through, not boiled. While the fruit is being heated, keep the jars filled with moderately hot water. As soon as the fruit is ready, empty the water from the jars, fill to the brim with fruit, and seal immediately. As it cools a vacuum is formed, which prevents bursting. In this way every kind of fruit will retain its flavor. Sometimes a thick leathery mould forms on the top—if so, all the better. The plan of keeping the jars full of hot water is merely to prevent the danger of cracking when the hot fruit is inserted. Some prefer to set the bottles full of cool water in a boiler of water and heating all together gradually; but the other way is much simpler and equally effective.

1639. To Can Peaches by the Cold Process. Pare and halve the peaches. Pack them as closely as possible in a can without any sugar. When the can is full, pour in sufficient pure cold water to fill all the interstices between the peaches, and reach the brim of the can. Let it stand long enough for the water to soak into all the crevices—say six hours—then pour in water to replace what has sunk away. Seal up the can, and all is done. Canned in this way, peaches retain all their freshness and flavor. There will not be enough water in them to render them insipid. If preferred, a cold syrup could be used instead of pure water, but the peaches taste most natural without any sweetening.

1640. To Dry Apples, Pears and other Fruits. Have a frame made in the following manner:—Two strips of board 7 feet long, 2 or 2½ inches wide—two strips 3 feet long, 1½ inches wide, the whole ¾ of an inch thick; nail the long strips across the ends of the short ones, and it makes a frame 7 by 3 feet, which is a convenient size for all purposes. On one of the long strips, nails are driven 3 inches apart, extending from one end to the other. After the apples are pared, they are quartered and cored, and with a needle and twine, or stout thread, strung into lengths long enough to reach twice across the frame; the ends of the twine are then tied together, and the strings hung on the nails across the frame. The apples will soon dry so that the strings can be doubled on the nails, and fresh ones put on, or the whole of them removed and others put in their place. As fast as the apples become sufficiently dry they can be taken from the strings, and the same strings used to dry more on. If large apples are used to dry, they can be cut in smaller pieces. Pears and quinces, and other fruits that can be strung, may be dried in this way. In pleasant weather the frames can be set out of doors against the side of the building, or any other support, and at night, or on cloudy and stormy days, they can be brought into the house, and set against the side of the room near the stove or fire-place.

1641. To Keep Apples and Pears Fresh. Gather the fruit during a dry day, and put it at once into earthen glazed pans, deep enough to contain two or three layers of fruit, and each pan having a tightly-fitting lid. If the fruit sweats, the exudation dries on the fruit's surface, and helps to keep in the moisture and flavor. The cover helps to do the same, and to exclude the light. Keep the pans in a dry, cool place, and never wipe the fruit until required for dessert. Pears may be kept in the same way, but require careful and constant watching.

1642. To Keep Fruit Fresh. After they have been allowed to lay on the shelves in the fruit-room, and sweat, they should be wiped dry, and packed in boxes with dry saw-dust enough to exclude the air from them. The saw-dust from resinous woods should not be used. If they were packed in dry sand, they would keep equally, and perhaps better; but the objection is that it is very difficult to clean them from sand, and therefore they always eat gritty when so kept.

1643. Preservation of Fruit in Glycerine. Glycerine of purest quality has been recommended for the preservation of fruits; previous to eating which, the glycerine should be removed by immersing the fruit in water.

1644. To Restore and Improve Musty Flour. Carbonate of magnesia, 3 parts; flour, 700 parts. Mix and use the flour in the usual way. This will not only greatly improve bad flour, but the bread will be much lighter, more wholesome, and keep longer than when alum is used.

1645. To Keep Game. Newly ground coffee, sprinkled over game, will keep it sweet and fresh for several days. Clean the game; that is, wipe off the blood, cover the wounded parts with absorbent paper, wrap up the heads, and then sprinkle ground coffee over and amongst the feathers or fur, as the case may be; pack up carefully, and the game will be preserved fresh and sweet in the most unfavorable weather. Game sent open and loose, cannot, of course, be treated in this manner; but all game packed in boxes or hampers may be deodorized as described. A tea-spoonful of coffee is enough for a brace of birds; and in this proportion for more or for larger game.

1646. To Preserve with Creosote. Creosote, a pungent compound existing in common smoke, and which starts the tears when the smoke enters the eyes, is a powerful antiseptic, or preventer of putrefaction. It is employed to preserve animal substances, either by washing it over them or by immersing them in its aqueous solution. A few drops in a saucer, or on a piece of spongy paper, if placed in a larder, will effectually drive away insects, and make the meat keep several days longer than otherwise. By all the modes in which creosote has hitherto been employed in preserving meat, it has acquired a disagreeable taste and smell. This may be obviated by placing a small plate containing a little creosote immediately under each piece of meat as it hangs in the larder, and covering them both over with a cloth. A small quantity added to brine or vinegar is commonly employed to impart a smoky flavor to meat and fish, and its solution in acetic acid is used to give the flavor of Scotch whiskey to plain spirit. The preservative effect of smoke-drying is partially due to creosote, which gives to the meat its peculiar smoky taste, and partly to desiccation.

1647. To Test Creosote. A large proportion of ordinary creosote is simply carbolic acid; but the pure creosote, which constitutes the peculiar smell of smoke, is quite a different substance, and may be distinguished from the false by its behavior with collodion. A mixture of this latter with carbolic acid gives a gelatinous precipitate, while with true creosote the collodion remains clear. Dr. Hager gives another test: To a weak solution of iron, a few drops of ammonia are added, until the precipitate which originally forms is dissolved. Carbolic acid communicates a blue or violet tinge to the solution, while genuine creosote gives a green color, afterward turning to brown.

1648. Charcoal as an Antiseptic. It is well known that charcoal possesses extraordinary powers in checking decomposition, as well as in deodorizing animal substances which have already begun to undergo change. Meat, either before or after it is cooked, may be preserved for a considerable time, even in warm weather, by being placed in the centre of a clean earthenware vessel, and closely surrounded with pieces of common charcoal. To prevent the flies from "blowing" the meat, the vessel ought to be covered with wire-gauze. Putrid water is immediately deprived of its bad smell by charcoal. When meat, fish, &c., from intense heat or long keeping, are likely to pass into a state of corruption, a simple mode of keeping them sound and healthful is by putting a few pieces of charcoal, each about the size of an egg, into the pot or saucepan wherein the fish or flesh is to be boiled.

1649. Caution About Charcoal. It must be recollected that in all cases, to exercise its highest powers as a disinfectant, deodorizer, and bleacher, charcoal should be both fresh-burnt and fresh-powdered, and carefully preserved out of contact with the air, until about to be employed. Exposed to the air, it rapidly loses its valuable qualities.

1650. To Prevent Water From Putrefying. Keep it in an iron vessel, or immerse fragments of iron in it. Distilled water should be kept in stoppered glass bottles.

Solutions for Anatomical Preparations.

These antiseptic fluids are used for preserving anatomical preparations, objects of natural history, &c., by immersing them therein, or by injection into the veins and arteries, arresting putrefaction, and preventing decay. Those containing corrosive sublimate (bichloride of mercury) are apt to render animal substances very hard.

1652. Creosote Antiseptic Solution. Nearly saturate water with sulphurous acid, and add a little creosote.

1653. Chloride of Tin Antiseptic Solution. Dissolve 4 parts chloride of tin in 100 parts water containing 3 parts muriatic (hydrochloric) acid.

1654. Antiseptic Solution of Ammonia. Mix 1 part, by weight, strong liquor of ammonia, with 3 parts water and 3 parts rectified spirit. Or:—1 part sal ammoniac and 10 or 11 parts water; for the muscular parts of animals. A solution of 1 part sulphate of zinc in about 20 parts water may also be used for the same purpose.

1655. Babington's Antiseptic Solution. 1 part of wood naphtha to 7 parts water. Wood naphtha undiluted serves for injection.

1656. Burnett's Antiseptic Solution. 1 pound chloride of zinc in 1 gallon water. The substance is immersed in this for 2 to 4 days, and then dried in the air.

1657. Gannal's Antiseptic Mixture. Dissolve ½ pound each alum and table salt, and ½ pound saltpetre, in 1 gallon water.

1658. Réboulet's Antiseptic. For pathological specimens. Dissolve 1 part nitre (saltpetre), 2 parts alum, and 4 parts chloride of lime in 16 to 20 parts water. To be afterwards diluted according to circumstances.

1659. Thwaites' Fluid. Mix 1 ounce spirit of wine with creosote sufficient to saturate it; rub up with chalk to form a thin paste, and mix gradually with 16 ounces water. To this may be added an equal quantity of water saturated with camphor.

1660. Simple Creosote Solution. Dissolve 1 drachm creosote in 1 drachm pyroligneous acid, and mix gradually with 1 pint cold water.

1661. Passini's Solution. For blood-globules, nerves, and white tissues generally. Chloride of mercury, 1 part; chloride of sodium, 2 parts; glycerine, 13 parts; distilled water, 113 parts.

1662. Preservative Fluids for Microscopic Objects. Canada balsam, spirit and water, glycerine solution of gelatine, saturated solutions of alum, chloride of zinc, and chloride of calcium, are all used to preserve microscopic objects.

1663. Solution for Preserving Feathers. Dissolve 16 grains strychnine in 1 pint rectified spirit.

1664. Corrosive Sublimate Antiseptic Solution. Dissolve 1 part corrosive sublimate (bichloride of mercury), and 3 parts chloride of sodium (table salt), in 100 parts water containing 2 parts muriatic (hydrochloric) acid.

1665. Goadby's Antiseptic Solutions. 2 ounces bay salt, 1 ounce alum, 1 grain bichloride of mercury (corrosive sublimate), and 1 pint of water. This is good for ordinary purposes. But for tender tissues, or where there is a tendency to mouldiness, double the proportions of corrosive sublimate and of water. For subjects containing carbonate of lime, double the proportion of bay salt, and omit the alum.

Or:—¼ pound bay salt, 10 grains arsenious acid, and 1 pint water; adding 1 grain corrosive sublimate when there is any tendency to softening in the parts of the subject. These are excellent antiseptic solutions.

1666. Embalming. Mix together 5 pounds dry sulphate of alumina, 1 quart warm water, and 100 grains arsenious acid. Inject 3 or 4 quarts of this mixture into all the vessels of the human body. This applies as well to all animals, birds, fishes, &c. This process supersedes the old and revolting mode, and has been introduced into the great anatomical schools of Paris.

1667. Preparation for Stuffing Birds and Animals. Camphor, 1 ounce; corrosive sublimate, 1 ounce; alum, ½ ounce; sulphur, 1 ounce; all finely powdered and mixed.

1668. Antiseptic for Preserving Birds and Animals. The simplest means of preserving anatomical and pathological preparations is the use of the following solution: Saturated solution of alum, 100 parts; saltpetre, 2 parts. The article to be preserved is immersed in the solution, when it becomes decolorized; but in a few days the color returns, when it is taken out of the solution, and kept in a saturated solution of alum and water only.

1669. Bécœur's Arsenical Soap. Camphor, 5 drachms; arsenic, 4 ounces; white soap, 4 ounces; carbonate of potash, 12 ounces; air-slaked lime, 4 ounces; make a stiff paste with a little water. Used for preparing the skins of birds and other small animals.

1670. Bécœur's Fluid Arsenical Soap. This is prepared as follows:—Cut 1 pound soap into thin slices, put it with a little water into a pot upon the fire, stirring frequently with a wooden spoon until dissolved; add 6 ounces carbonate of potassa and 2 ounces chalk. Then take it off the fire, and add 1 pound arsenious acid, stirring it in thoroughly; lastly, pound 3 ounces camphor in a mortar with a little alcohol, and incorporate it with the rest of the ingredients. This makes a composition of a consistence of paste. When required for use, dissolve 2 ounces in a pint of alcohol, and apply with a brush.

1671. Laurent's Antiseptic Soap. Place ½ ounce powdered soap in a bottle with 2 drachms each of arsenite of potassa, sulphate of alumina, and pulverized camphor; pour upon them 6 ounces alcohol, and allow them to stand 24 hours. When thoroughly combined, add 3 drops oil of thyme, and cork the bottle carefully.

1672. Beconi's Arsenical Soap. Arsenious acid, 32 ounces; carbonate of potassa, 12 ounces; camphor, 5 ounces; white soap, 32 ounces; powdered lime, 8 ounces. Reduce each to a powder, and mix. Used as a preservative for specimens of natural history against the attacks of insects.

1673. Carbolic Acid as a Preservative. Reference has been made in some of the scientific journals to experiments upon carbolic acid as a means of preserving objects of natural history, and the anticipation has been indulged in by many that this powerful agent may be able to replace all the ordinary methods of taxidermy. This, however, is a very great mistake, since it can be used to a small extent only in the preparation of entire bodies of animals that are to be preserved dry—because the process of desiccation will inevitably proceed until the original form of the animal is entirely lost. For many purposes, however, carbolic acid has proved of much value as a preservative, and its uses are increasing. Thus, diluted with about 50 times its bulk of water, it forms a capital substitute for alcohol in preserving fish and other objects; and, in fact, the larger fish, such as rays, sharks, etc., can be kept much better by its aid than even by means of alcohol. Added in small quantity to very weak spirit, it very materially increases its preservative strength.

1674. Carbolic Acid as a Temporary Preservative. Although carbolic acid cannot be used as a substitute for the usual methods in setting up birds and mammals, it can be employed to very great advantage in keeping them fresh until they can be properly skinned. An experiment of this kind was once made by Dr. Totten, of New York, who prepared a solution of 1 drachm of carbolic acid, 1½ ounces each of glycerine and dilute alcohol, and injected it into the mouth, the rectum, and under the skin of a large cormorant. The bird was kept on board ship until it reached New York, a period of about two months after its capture, and was then sent to a taxidermist, who found it to be in perfect condition, and who was able to mount it as satisfactorily as if it had been but just killed.

1675. Von Vetter's Process for the Preservation of Anatomical Specimens. Add to 7 parts of glycerine at 22° Baumé, 1 part raw brown sugar and ½ part nitre, till a slight deposit is formed at the bottom of the vessel. The portion required to be preserved is then immersed (dried or not dried) and left in the mixture for a time proportional to its dimensions; a hand, for example, should remain eight days in the liquid; when it is taken out it is as stiff as a piece of wood, but if it be suspended in a dry and warm place the muscles and articulation recover their suppleness.

1676. Preserving Insects. A good way to render insects durable is to perforate their bodies once or twice with a long pin dipped in a strong solution of corrosive sublimate. If you have cases full, clean the insects and cases as thoroughly as possible, paint the inside of the cases over with a brush dipped into a solution of the sublimate, and after putting a few pieces of camphor at the bottom of the case, fix the lid on, and paste a strip of paper over the crevices.

To Preserve Wood.

The following receipts for preserving timber from decay have been obtained from various sources, and are the results of careful experiment by scientific experts.

1678. To Prevent the Splitting of Logs and Planks. Logs and planks split at the ends because the exposed surface dries faster than the inside. Saturate muriatic acid with lime, and apply like whitewash to the ends. The chloride of calcium formed attracts moisture from the air and prevents the splitting. Tobacconists' signs, and other wooden images, have usually a hole bored through their centre, from top to bottom; this in a great measure prevents the outer surface from cracking, by allowing the wood to dry and shrink more uniformly.

1679. To Preserve Timber from Decay and Dry-Rot. The best way to preserve timber exposed to the action of the weather is to force into the pores of well-seasoned wood as much carbolic acid, or creosote, as possible. This soon resinifies, and most effectually prevents the timber from dry-rot and decay. On a large scale, as for railway sleepers, expensive appliances are needed; but for barns or outbuildings it may be applied to considerable advantage by the use of a paint brush.

1680. Solution to Preserve Wood. With every 25 gallons of water required, mix 5 pounds chloride of zinc. Wood steeped in this solution will effectually resist dry-rot.

1681. To Kyanize Wood or Cordage. Immerse the wood or cordage in a solution of 50 or 60 parts water and 1 part corrosive sublimate. This preserves it from decay, and renders wood tough and more difficult to split.

1682. To Preserve and Harden Wood. Wood steeped in a solution of copperas becomes harder and more indestructible.

1683. German Receipt for Coating Wood with a Substance as Hard as Stone. Melt together 40 parts chalk, 50 resin, and 4 linseed oil; to this should be added 1 part oxide of copper, and afterwards 1 part sulphuric acid. This last ingredient must be added carefully. The mixture, while hot, is applied with a brush, and forms, when dry, a varnish as hard as stone. This is an excellent application to protect posts, tubs, or other wooden articles which are set in the earth.

1684. To Preserve Wood Under Water. Wood impregnated with creosote oil has been found to resist effectually the ravages of the teredo worm; this worm being the cause of decay by honey-combing the entire substance of the wood. In Germany chloride of zinc is used for this purpose, the timber being placed in boilers, partly exhausted of air, and the vapor of chlorine thus driven into it. These remedies are recommended by a committee of practical experts, appointed by the Academy of Sciences in Holland to ascertain the best means for preserving timber under water.

1685. Preservation of Wood. Armand Muller has instituted some interesting experiments upon this subject, and arrives at the conclusion that the phosphate of baryta, formed by the mutual decomposition of phosphate of soda and chloride of barium, in the pores of the wood, is one of the best preservative agents available to chemists. Soak the wood 5 days in a 7 per cent. solution of phosphate of soda, and after drying, suspend in a 13 per cent solution of chloride of barium for 7 days. It is believed that wood thus prepared will withstand the action of moisture better than with any other preparation. The chief obstacle to the use of such chemicals is in their cost.

1686. To Petrify Wooden Objects. Take equal quantities of gem-salt, rock-alum, white vinegar, chalk and pebbles, powdered. Mix all these ingredients; ebullition will ensue. After it has ceased, throw some wooden objects into this liquid, and let them soak for 4 or 5 days, at the end of which time they will be transformed into petrifactions.

Mixtures for Freezing without Ice.

In the following table, the water should not be warmer than 50° Fahrenheit.

Mixtures.			Fahrenheit Thermometer Sinks from	Degrees of Cold Produced
Nitrate of Ammonia	1	part.	50° to 4°	46°
Water	1	"		
Muriate of Ammonia	5	"	50° to 10°	40°
Nitrate of Potash	5	"		
Water	16	"		
Muriate of Ammonia	5	"	50° to 4°	46°
Nitrate of Potash	5	"		
Sulphate of Soda	8	"		
Water	16	"		
Sulphate of Soda	3	"	50° to –3°	53°
Diluted Nitric Acid	2	"		
Nitrate of Ammonia	1	"	50° to –7°	57°
Carbonate of Soda	1	"		
Water	1	"		
Phosphate of Soda	9	"	50° to –12°	62°
Dilute Nitric Acid	4	"		
Sulphate of Soda	8	"	50° to 0°	50°
Hydrochloric Acid	5	"		
Sulphate of Soda	5	"	50° to 3°	47°
Diluted Sulphuric Acid	4	"		
Sulphate of Soda	6	"	50° to –10°	60°
Muriate of Ammonia	4	"		
Nitrate of Potash	2	"		
Diluted Nitric Acid	4	"		
Sulphate of Soda	6	"	50° to –14°	64°
Nitrate of Ammonia	5	"		
Diluted Nitric Acid	4	"		

1688. Table of Freezing Mixtures with Snow.

Mixtures.			Fahrenheit Thermometer Sinks from	Degrees of Cold Produced
Snow	3	parts.	32° to –23°	55°
Diluted Sulphuric Acid	2	"		
Snow	8	"	32° to –27°	59°
Muriatic Acid	5	"		
Snow	7	"	32° to –30°	62°
Dilute Nitric Acid	4	"		
Snow	4	"	32° to –40°	72°
Muriate of Lime	5	"		
Snow	2	"	32° to –50°	82°
Crys'd Muriate of Lime	3	"		
Snow	3	"	32° to –51°	83°
Potash	4	"		

1689. Freezing Mixtures with Pounded Ice or Snow. The following mixtures reduce the temperature down to a certain degree of cold, irrespective of the temperature of the materials at mixing.

Mixtures.			Fahr. Thermometer Sinks.
Snow, or Pounded Ice	2	parts.	to –5°
Muriate of Soda	1	"	
Snow, or Pounded Ice	5	"	to –12°
Muriate of Soda	2	"	
Muriate of Ammonia	1	"	
Snow, or Pounded Ice	24	"	to –18°
Muriate of Soda	10	"	
Muriate of Ammonia	5	"	
Nitrate of Potash	5	"	
Snow, or Pounded Ice	12	"	to –25°
Muriate of Soda	5	"	
Nitrate of Ammonia	5	"	
Snow, or Pounded Ice	2	"	to –5°
Common Table Salt, or Rock Salt	1	"	

1690. Metallic Freezing Mixture. An interesting experiment may be made by melting together 59 parts tin, 103½ lead, and 183 bismuth. If this be finely rasped or powdered, and introduced into 108 parts, by weight, of quicksilver, a thermometer immersed in the mixture will sink to nearly 3° Fahr.; and water placed in a thin test-tube, and allowed to remain for a few minutes in this bath, will be completely frozen.

1691. How to Keep Ice in Summer. No refrigerator or ice-box will prevent, or even retard the melting of the ice, which does not combine the following conditions: It must have double sides, bottom, and lid, with the space between the two casings filled with some non-conducting substance, in order to exclude the external temperature; and the inner lid or cover should be practically, if not hermetically, air-tight, in furtherance of the same result. If external air enters, it will bring its own temperature with it. There should be also a drainage-pipe at the bottom to carry off, instantaneously, every drop of water formed by the melting of the ice, and this pipe should either be fitted with a trap or curved in such a manner as to prevent the cold air from escaping. It is even more indispensable to carry off every drop of the water than it is to exclude the air—a view not generally entertained by consumers of the article, but which, according to experiments made, seems to be fully demonstrated. Thus, on exposing a piece of ice weighing, say 25

pounds, to the air, at a temperature of 75°, but so placed that it is perfectly drained, it will be found to have scarcely disappeared at the end of 24 hours. Wrap the same piece in 3 or 4 thicknesses of blanket or flannel, and place it in a small tub exposed to the same temperature, and as the water filters through the blanket, the ice will stand in its own water, and will be all dissolved in 5 or 6 hours. Wrap the same piece of ice carefully in a blanket, and place it on a grating, or on four crossed sticks, so that no water can accumulate underneath, and at the end of 3 or even 4 days it will not have entirely melted.

Disinfectants are substances which absorb, neutralize or destroy putrescent effluvia and miasmata, and thus remove the causes of infection. The principal disinfectants are chlorine, the chlorides (hypochlorites) of lime and soda, chloride of zinc, charcoal, carbolic acid, the fumes of nitric, nitrous, and sulphurous acids, and ventilation. The clothing, bedding, &c., of patients laboring under contagious diseases, may be effectually disinfected by exposing to a temperature of about that of boiling water. Neither the texture nor color of textile fabrics is injured even by a heat of 250° Fahr. It is a practice at some of the poorhouses to bake the clothes of the paupers who have the itch, or are infested with vermin. Quicklime rapidly absorbs carbonic acid, sulphuretted hydrogen, and several other noxious gases, and is therefore commonly used as a wash for the walls of buildings. Acetic acid, camphor, fragrant pastils, cascarilla, and other similar substances, are frequently burnt or volatilized by heat, for the purpose of disguising unpleasant odors. The chlorides as well as the sulphates of iron and lime have the property of rapidly destroying noxious effluvia. A quantity of either of these sulphates thrown into a cesspool, for instance, will in a few hours remove the fetid smell.

1693. Metropolitan Disinfecting Fluid. The Board of Health of the city of New York have recommended a disinfecting fluid composed of sesquichloride of iron, chloride of manganese, chlorine, and carbolic acid. The sesquichloride of iron has been found by experiment to deodorize more effectually than chloride of lime, sulphate of zinc, or other disinfectants. It is therefore recommended as an important constituent of any disinfectant. Sesquichloride of iron is prepared by dissolving the hydrated sesquioxide of iron in muriatic acid; to this is added 10 per cent. of carbolic acid. This forms the fluid in a concentrated form, and is largely diluted with water at the time of using. All night scavengers are compelled by the Board of Health of New York to use it. Its effects are compound. The iron checks fermentation, and the chlorine acts as an oxidizing agent. Its carbolic acid also aids in arresting decomposition and fermentation, and the whole combination, therefore, by its chemical action, decomposes the sulphuretted hydrogen.

1694. To Disinfect Stables and Slaughter-Houses. Dr. Letherby, Health officer of the city of London, says in a recent report on the subject, that the best disinfectant for stables and slaughter-houses is a mixed chloride and hypochlorite of zinc, and it has the advantage of mixing freely with the liquid matters of the slaughter-house, and not tainting the meat with any unpleasant odors; and it is also applicable to the disinfection of houses in place of chloride of lime, which it much resembles in its chemical nature and mode of action.

1695. Burnett's Disinfecting Fluid. A solution of chloride of zinc, made by dissolving zinc in commercial muriatic acid to saturation, and known as Sir William Burnett's Disinfecting Fluid, has been found most useful as a purifying agent, and in removing and destroying contagion. In purifying sick rooms or crowded places the solution should be moistened by means of a piece of flannel cloth, about 3 or 4 feet square, attached to a long rod and waved through the air for 10 minutes at a time; in addition to which the floor should be mopped or sprinkled over with the same dilute solution, if necessary, several times a day, and a small quantity put into the close-stools and bed-pans. The water-closets should also be cleansed with it, and 2 gallons occasionally thrown down each. When floors and woodwork are washed with the solution, the use of soap or soda should be avoided immediately before or after its application; and whitewashing should not be applied to any part recently washed or sprinkled with it.

1696. To Purify a Sick Chamber. The nitrous acid vapor, so invaluable as a disinfectant in contagious fevers, is obtained by decomposing nitre by means of heated sulphuric acid, in the following manner: Put ½ ounce sulphuric acid in a crucible glass or china cup and warm it over a lamp or in heated sand, adding to it from time to time a little nitre. Several of these vessels must be placed in the sick chamber and in the neighboring apartments and passages, at a distance of 20 feet or more from each other, according to the height of the ceiling and the virulence of the contagion. As an evidence of the value of this method of disinfection it may be mentioned that Dr. Carmichael Smyth, of London, by whom it was originally practiced, received from Parliament a premium of £5,000 for his discovery.

1697. Hyponitrous Acid as a Disinfectant. A special commission was appointed by the Academy of Sciences at Paris, to study the different means of disinfecting those localities which, during the siege, had been appropriated to persons afflicted with contagious diseases. Its report furnishes some useful guides to the selection and the application of disinfectants. It was agreed that the very first place among destructive agents which can attack and destroy infectious germs, should be assigned to hyponitrous acid. Great precaution should be exercised, however, by those employing the very dangerous nitrous vapors.

1698. Carbolic Acid as a Disinfectant. The French commission (*see No. 1697*) also reported that carbolic acid is much more easily applied, is less dangerous and expensive than hyponitrous acid, and seems to offer guarantees of quite equal efficacy, founded on experimental evidence. It is best employed by mixing with sand or sawdust in the proportion of 1 part by weight of acid, and 3 parts of the inert material. The mixture is placed in earthen pots. Carbolic acid, diluted with 25 to 30 times its weight of water, has been found useful in sprinkling daily the floors and the bedding of sick chambers. It has been stated by M. Devergie, that water containing only the $\frac{1}{1000}$ part of its weight of carbolic acid sufficed for the disinfection of a dead-house during the hottest weather, when it contained from 6 to 7 bodies.

1699. Collins' Disinfecting Powder. Mix 2 parts dry chloride of lime with 1 of burnt alum. To be set in shallow dishes in rooms, &c., with or without the addition of water.

1700. Ellerman's Deodorizing Fluid. This consists chiefly of perchlorides and chlorides of iron and manganese. In a report addressed to the Metropolitan Board of Works of London in 1859, Drs. Hoffman and Frankland stated that the perchloride of iron was the cheapest and most efficient deodorizer that could be applied to sewage; ½ gallon deodorized 7500 gallons. 1 bushel lime, or 3 pounds chloride of lime, would do the same.

1701. Condy's Solution. A saturated solution of permanganate of potassa is one of the most efficient and elegant of all disinfectants. A tea-spoonful in a soup-plate of water, exposed in a room, quickly removes any offensive smell; when the pink color disappears more must be added. It has been used to remove the smell of bilge-water and guano from ships. A word as to economy: One ounce of the crystallized salt costs about as much as a pound of the crude, which is just as good for deodorizing purposes. The crude gives a greenish solution, which, even while cold, but more rapidly and completely upon boiling, passes into the deep red so characteristic of the permanganate, and is fit for use. It speedily cleanses foul water and makes it drinkable. A tea-spoonful to a hogshead is generally enough, but if added until the water acquires a permanent faint tinge, we are certain that injurious organic matter has been destroyed. Then, as Condy suggests, if a piece of clean stick be put into the liquid, or if a little tea or coffee be added, the pink color will disappear, and the water will be fit for use. The very small amount of potassa remaining in the solution could not possibly do any harm, as it would not amount to $\frac{1}{10}$ part of a grain to the gallon.

1702. Siret's Compound. Sulphate of iron, 20 pounds; sulphate of zinc, 3¾ pounds; wood or peat charcoal, 1 pound; sulphate of lime, 26¼ pounds; mix and form into balls. To be placed in cesspools, &c., to deodorize them. M. Siret has subsequently modified this compound thus: Sulphate of iron, 100 parts; sulphate of zinc, 50; tan or oak-bark powder, 40; tar, 5; and oil, 5 parts.

1703. Ledoyen's Solution. This is a solution of nitrate of lead, and contains about 20 ounces of the salt in a gallon. The specific gravity should be 1.40. A similar compound may be made by mixing 13¼ ounces litharge with 6 pints water, and adding 12 ounces nitric acid at 1.38 specific gravity (or 8 ounces at 1.50) and digesting at a gentle heat till the solution is complete.

1704. Chloride of Lime as a Disinfectant. It is a great purifier. 1 pound requires 3 gallons of water; use the clear solution. To purify rooms, sprinkle on the floor, and, if needful, on the bed-linen. Infected clothes should be dipped in it and wrung out, just before they are washed. It purifies night commodes, water-closets, &c. It may also be used in its pure state. For butcher stalls, fish markets, slaughter houses, sinks, and wherever there are offensive putrid gases, sprinkle it about, and in a few days the smell will pass away. If a cat, rat, or mouse, dies about the house, and sends forth an offensive gas, place some chloride of lime in an open vessel near the place where the nuisance is, and it will soon purify the atmosphere. The presence of chloride of lime in a room causes iron or steel to rust rapidly. Articles of that material should therefore be removed during the use of this disinfectant.

1705. Precautions to be Observed Before Entering a Sick Room, particularly where there is Fever. Never enter fasting; if it is inconvenient to take refreshment of the ordinary kind, obtain a glass of wine and a cracker.

Do not stand between the patient and the door, if possible. Avoid sitting on or touching the bed-clothes as much as possible, and do not inhale the patient's breath. The hands should always be washed in clean water, if the patient has fever, before leaving the room to touch other people or things.

After visiting a fever patient, &c., change the dress, if possible. As soon as the fever is over, and the patient is convalescent, the dress which has been used by the nurse or attendant should be destroyed if there are no means of fumigation at hand, or it must be boiled in water to which carbolic acid has been added. The same treatment must be applied to the bed-clothes, &c., which have been used.

1706. Onions as a Disinfectant. Onions placed in the room where there is small-pox will blister, and decompose with great rapidity; besides this, they will prevent the spread of the disease. As a disinfectant they have no equal, when properly used; but keep them out of the stomach.

1707. To Prevent Infection. Let communication with the sick by actual contact be as far as possible avoided. Let the patient be lightly covered with the bed-clothes, his chamber freed from all unnecessary articles of furniture, and kept perfectly clean; the sheets and body linens frequently changed and removed from the sick room, as well as all substances producing, or likely to produce, any smell; and above all things let the chamber and the adjoining apartments and passages be completely and freely ventilated by opening opposite doors and windows; for although contagion may be carried by the air, it becomes inert when, instead of being concentrated, it is sufficiently diffused.

1708. Special Preservative Against Infection. In a lecture delivered in the Royal Institution, Professor Tyndall proved, by a series of interesting experiments, that the surest filter in a contagious atmosphere is cotton wool. "If a physician," said the Professor, "wishes to hold back from the lungs of his patient, or from his own, the germs by which contagious disease is said to be propagated, he will employ a cotton wool respirator. In the crowded dwellings of the London poor, where the isolation of the sick is difficult, if not impossible, the noxious air around the patient may by this simple means be restored to practical purity. Thus filtered, attendants may breathe the air unharmed, for it is exceedingly probable that the germs which lodge in the air-passages, and which, at their leisure, can work their way across the mucous membrane, are those which sow in the body epidemic disease. If this be so, such disease may be warded off by filters of cotton wool."

1709. To Diffuse a Fragrant Odor. A few drops of oil of sandal wood dropped on a hot shovel, will diffuse a most agreeable balsamic perfume through the room.

1710. Simple Mode of Purifying Water. A table-spoonful of pulverized alum sprinkled into a hogshead of water (the water stirred at the same time) will, after a few hours, by precipitating to the bottom the impure particles, so purify it that it will be found to possess nearly all the freshness and clearness of the finest spring-water. A pailful, containing 4 gallons, may be purified by a single tea spoonful of the alum.

1711. To Test the Impurity of the Atmosphere. A simple method of ascertaining the presence of impurity (carbonic acid) in the atmosphere, is to nearly fill a glass tumbler with lime-water, and to place it in any convenient position, as on the mantel-piece of a room. The rapidity with which a pellicle forms on its surface, or the water becomes cloudy, corresponds to the amount of the carbonic acid present in the atmosphere that surrounds it. A little moist carbonate of lead put on a plate or saucer, and exposed in the same way, will turn black, should any sulphuretted hydrogen be contained in the air. This is a delicate test for that destructive gas.

1712. To Purify Water in a Cistern. 2 ounces of permanganate of potassa thrown in a cistern will render the foulest water sweet and pure. (*See No.* 1701.)

1713. To Purify Dirty Water. Since, in dry seasons, any water may be of high value, at least for cattle drinking, M. Meunier advises to place, in a large-sized cask, a false bottom perforated with some holes; and to put on that bottom, first, clean pebbles, next, well washed sand, then a layer of coarsely granulated charcoal, and over all this a piece of canvas. The water, even that standing in shallow ditches after a shower of rain, may be poured into this filter, and thus become available for cattle-drinking, though it may not be quite clear.

Bleaching.

Under this head are included general receipts for bleaching and decolorizing. The methods employed for special purposes, such as bleaching fabrics for dyeing, removing stains, &c., will be found in their proper places by reference to the index.

1715. To Bleach Cotton Pure White. Boil for 3 hours in water containing 1 gill to the gallon of either caustic potassa or caustic soda; wash well from the lye, then lay the yarn or fabric to steep for 4 or 5 hours in cold water containing 1 pint of bleaching liquor (*see No.* 104) to the gallon; then lift out and steep for an hour in a sour of 1 wine-glassful of sulphuric acid to the gallon of water; lift, and wash well; then boil for 2 hours in a caustic lye, half the strength of the first; wash from this, and steep again for 4 hours in the bleaching liquor; wash from this and steep again for 1 hour in a clean sour, made in the same manner as the first; wash well from this, and dry. A little smalt blue is put into the last washing water to clear the white.

1716. To Bleach Wool. The first kind of bleaching to which wool is subjected, is to free it from grease. This operation is called scouring. In manufactories, it is generally performed by an ammoniacal lye, formed of 5 measures of river water and 1 of stale urine; the wool is immersed for about 20 minutes in a bath of this mixture heated to about 130° Fahr; it is then taken out, suffered to drain, and rinsed in running water. This manipulation softens the wool, and gives it the first degree of whiteness. It is then repeated a second, and even a third time; after which the wool is fit to be employed. In some places, scouring is performed with water slightly impregnated with soap; and indeed, for valuable articles, this process is preferable; but it is too expensive for articles of less value. Bisulphide of carbon and benzine have been employed in cleansing wool. The fat may be saved by distilling off the solvent, which may be used over and over again. (*See No.* 439.) Sulphurous acid gas unites very easily with water; and in this combination it may be employed for bleaching wool and silk.

1717. Sulphuration. The process by which silk, cotton, woolen, and straw goods, &c., are bleached or decolored by exposure to the fumes of burning sulphur. This is effected in a close chamber of a size proportioned to the scale on which the operation is conducted, and supplied with only just sufficient air to keep up the slow combustion of the sulphur, the fumes of which are sulphurous acid. (*See Nos.* 360 *and* 364.)

1718. To Prepare Sulphurous Acid for Bleaching. Sulphurous acid is used either as gas or in solution in water, which dissolves 30 times its volume of the gas. In the former case sulphur is burned in a close room in which the stuffs (moistened) are hung; for small articles a barrel with a lid answers well. 2 exposures, of 24 hours each, suffice for wool. (*See No.* 360.) To get a solution of sulphurous acid, the cheapest and best plan is to heat in a glass retort 12 ounces sulphuric acid and 2 ounces sulphur. The gas, which comes off quietly, is collected in a large glass bottle partially filled with water; or, better, a series of bottles so connected together that the gas must pass successively through the water contained in each.

1719. A New Wash for Wool and Silk. Instead of using the fumes of sulphur, M. Freson proposes the following mixture: 4 pounds oxalic acid, 4 pounds table salt, 200 quarts water. The goods are laid in this mixture for an hour. They are then generally well bleached, and only require to be thoroughly rinsed and washed. For bleaching straw it is best to soak the goods in caustic soda and afterwards to make use of chloride of lime or Javelle water. (*See Index.*) The excess of chlorine is afterwards to be removed by hyposulphite of soda, called antichlor.

1720. To Bleach Straw Bonnets. Get a deep box, air-tight, if possible; place at the bottom a stone, on the stone a flat piece of iron red hot, or a pan of charcoal, on which scatter powdered brimstone; close the lid, and let the bonnet remain a night. There should be hooks on the box, on which to hang the bonnets. (*See last receipt.*)

1721. To Bleach Sponge. Sponge may be bleached almost snow-white by repetitions of the following process: Soak it in diluted muriatic acid 10 or 12 hours, then wash it with water and immerse in a solution of hyposulphate of soda to which a small quantity of diluted muriatic acid has been added. Wash and dry it.

1722. Blanched Sponge. Soak the sponges for several days in cold water, renewing the water and squeezing the sponges occasionally. Then wash them in warm water, and place them in cold water to which a little muriatic acid has been added. Next day take them out and wash them thoroughly in soft water; then immerse them in an aqueous sulphurous acid (specific gravity 1.034) for a week. They are afterwards washed in plenty of water, squeezed, and allowed to dry in the air.

1723. To Bleach Lac. Dissolve the lac in a boiling lye of pearlash or caustic potash, filter it and pass chlorine through the solution until all the lac is precipitated. Collect the precipitate, wash well in hot water, and finally twist into sticks, and throw them into cold water to harden. Lac thus purified is used to make pale varnishes and the more delicate tints of colored sealing-wax. Shellac bleached by this method is liable to stain furniture inlaid with brass. The following process is free from this objection, and has the additional advantage of being much cheaper:

1724. To Bleach Shellac with Animal Charcoal Any quantity of yellow shellac, previously broken in small pieces, is conveyed into a flask, alcohol of .830 specific gravity poured upon it, and the whole heated on a stove, or, in the summer, in the sun, until the shellac is dissolved; upon this so much coarsely powdered animal charcoal is added to the solution that the whole forms a thin paste; the flask is closed, not quite air-tight, and left so for some time exposed to the sun; and in 8 to 14 days a small sample is filtered, sufficient to ascertain whether it has acquired a light yellowish brown color, and whether it yields a clear, pure polish, on light colored woods. If this be the case, it is filtered through coarse blotting paper, for which purpose it is best to employ a tin funnel with double sides, similar to those employed in filtering spirituous solutions of soaps, opodeldoc, &c. The portion which first passes through the filter may be preserved separately, and used as a ground or first polish. Then some more spirit is poured over the charcoal upon the filter, and the solution used as a last coating. The solution of shellac purified by animal charcoal has a brown yellow color, but it is perfectly clear and transparent; when diluted with alcohol, the color is so slight that it may be used in this state for polishing perfectly white wood, such as maple, pine, &c., without the wood acquiring the least tint of yellow.

1725. To Bleach Gutta Percha. Dissolve 1 part gutta percha in 20 parts hot benzole, shake the solution with $\frac{1}{4}$ part freshly calcined plaster, and set aside, with occasional agitation, for 2 days. The clear pale brownish-yellow liquid is then decanted into another vessel containing double its bulk of alcohol fortius (*see No.* 1439), when the gutta percha will be precipitated in the form of a brilliantly white tenacious mass, which is pounded together in a mortar, and rolled into cylindrical sticks.

1726. Bleaching Woolen Rags. These are most effectually bleached by the application of sulphurous acid. Of course, in many instances, the color of the rags, supposing the same to be dyed or printed goods, will be also destroyed. Chlorine cannot be used for this purpose, because it causes woolen and silk fabrics to become yellow, and impairs the strength of the fibre, by entering into chemical combination with the wool, silk, and other similar substances of animal origin; as, for instance, sponge, animal gut, isinglass, &c., all of which, if requiring bleaching, are bleached by sulphurous acid.

1727. New Method of Bleaching Feathers. This process is an entirely newly-discovered one, whereby the feathers of ostriches and other birds may be bleached, even if these feathers are naturally black or dark gray colored. The feathers are placed for from 3 to 4 hours in a tepid dilute solution of bichromate of potassa, to which, cautiously, some nitric acid has been added. After this lapse of time the feathers will be found to have assumed a greenish hue, owing to the oxide of chromium precipitated on the substance; in order to remove this, the feathers are placed in a dilute solution of sulphurous acid in water, whereby the feathers become perfectly white and bleached. Care is to be taken that the solution of bichromate be not made too strong, and especially that not too much nitric acid be used, which would cause an irremovable yellow color.

1728. Table Showing the Number of Parts of a Weak Bleaching Liquor, Required to be added to 1 Part Bleaching Liquor of 6° Twaddell, to Produce a Liquor of a given Strength. According to Mr. Crum, the strength of liquor for bleaching cotton should be less than 1° Twaddell; the following table enables an operator to increase the strength of a weak bleaching liquor with a great degree of accuracy. The left hand column gives the strength of the weak liquor, expressed in $\frac{1}{12}$ parts of 1°. At the head of the other columns stands the degree of strength required, and under these headings will be found the number of parts of weak liquor required to be added to 1 part of a liquor of 6° Twaddell, to produce the required strength of the mixture. (*See No.* 63.)

Strength of Sample.	Strength Required.			
	$\frac{8}{12}$°	$\frac{6}{12}$°	$\frac{4}{12}$°	$\frac{3}{12}$°
Water.	6 parts	11 parts	17 parts	23 parts
$\frac{1}{12}$°	9½ "	13½ "	23 "	35 "
$\frac{2}{12}$	11 "	17 "	35 "	71 "
$\frac{3}{12}$	13½ "	23 "	71 "	
$\frac{4}{12}$	17 "	35 "		
$\frac{5}{12}$	23 "	71 "		
$\frac{6}{12}$	35 "			
$\frac{7}{12}$	71 "			

1729. Properties of Charcoal. This article, when fresh, possesses the property of taking lime and other saline matter from syrups and other aqueous solutions, especially organic ones, at the same time that it decolors them. As a decolorizer and deodorizer, animal charcoal (prepared from bones) is vastly superior to vegetable charcoal. Charcoal should be fresh burnt and fresh powdered and preserved from contact with the air. Unless these precautions be observed it rapidly loses its valuable qualities. (*See No.* 1752.)

1730. Aluminized Charcoal. This is recommended by Dr. Stenhouse as a cheap and very efficient decolorizing agent. Dissolve in water 54 parts of the sulphate of alumina of commerce, and mix with 92½ parts finely powdered wood charcoal. When the charcoal is saturated, evaporate to dryness, and heat to redness in covered Hessian crucibles till the water and acid are dissipated. The charcoal contains just 7½ per cent. of anhydrous alumina.

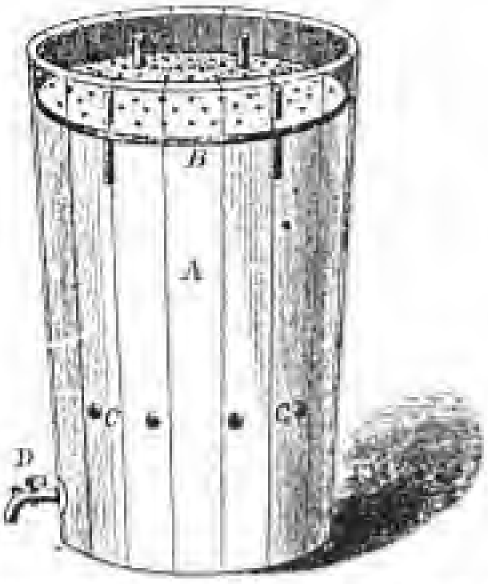
1731. Charcoal from Coal-Tar. Heat gently in an iron pot till it melts, 1 pound coal-tar pitch. Add 2 pounds fluid coal-tar, and mix. Stir in 7 pounds hydrate of lime in very fine powder. The thick mass is now roasted, stirring all the time till it is reduced to a fine powder. It is then ignited in a covered crucible till all the vegetable matter is carbonized. The charcoal, when cold, is digested with dilute hydrochloric acid, and finally washed with water in a filter, and dried. Dr. Stenhouse recommends this as an admirable form for decolorization. For such liquids as decoction of logwood it is four times as efficient as animal charcoal.

Vinegar.

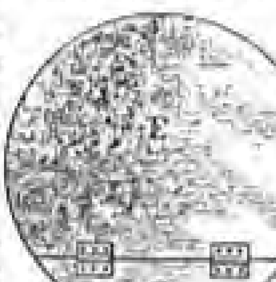
Vinegar is dilute acetic acid more or less mixed with gum, sugar, and other vegetable matter. It can be made from any liquid which is susceptible of the vinous fermentation. In this country it is made chiefly from cider and alcoholic liquors; in England, from malt liquors and molasses; in wine growing countries, from inferior or damaged wine. The cultivation of the vine is gradually gaining importance in this country, and it seems more than probable that, at no distant time, vinegar will be made here largely from wine.

1733. To Make Vinegar by the German, or Quick Method. Many methods have been invented to produce vinegar; but that known as the "German, or quick method," has superseded all others, and is now in general use in the United States. By this process (which is very simple) time and labor are both greatly abridged, and a very fine article is produced. The method will be found embodied in the five following receipts:

1734. How to Make a Vinegar Generator. The construction of a vinegar generator is very simple. A is a tub, 8 feet in height, 3 feet in diameter at the bottom, and 3½ feet in diameter at the top, with a cover, E, of which one part, G, is movable, in order to permit the liquid to be poured in when necessary. B is a shelf or false bottom perforated with a number of holes $\frac{1}{8}$ of an inch in diameter, placed about 8 inches from the top of the generator, at which place a stout hoop must be nailed to support it. When this false bottom is placed in the generator, it should be packed carefully on the sides with cotton batting, so as to prevent the liquid from escaping at any place except through the holes. The shelf or false bottom has also four $\frac{1}{2}$ inch holes, in which are inserted 4 open reed tubes as air vents, each having its ends projecting above and below the shelf, the upper ends projecting at least 1½ inches below the top cover, E, and the other ends penetrating the contents of the generator. C C is a horizontal row of holes at about 18 inches from the bottom of the generator, equidistant, and $\frac{1}{2}$ an inch in diameter, bored in about every other stave, and in a vertical or slanting direction from the outside downward inside. There is also a hole for the insertion of the thermometer, 6 inches below the false top; this hole should slant from the outside, downward inside. The holes are bored in this manner to prevent the vinegar from running out. It is essential to the success of the process that a current of air should pass through the tub. In order to establish this circulation, the above holes are made, and the air enters by them, and passes out through the tubes in the



false bottom above. Some parties insert a perforated false bottom about 2 inches below the slanting ventilation-holes, to support the shavings, leaving the portion of the tub below free; others prefer a similar false bottom about 2 inches above the holes, in order to prevent the shavings from coming in contact with the holes and obstructing the ventilation.



D is a stop-cock, or faucet, 6 inches from the bottom of the generator, the discharging capacity of which must be controlled by the size of the generator. Never draw off the vinegar below this faucet.

1735. How to Pack a Vinegar Generator. Having made the generator, the next part of the process of making vinegar consists in packing or charging it; this is done in the following manner: Take pieces of beech board about 18 inches in length (maple or basswood boards will do, but not as well as beech), and plane thick, heavy shavings from the edge; the shavings should curl and roll up, or they must be rolled up and tied. Next cut clean corn-cobs into pieces 1½ or 2 inches long. The shavings and corn-cobs must be thoroughly soaked in water; or, what is still better, boiled in vinegar. Fill the tub half full with the corn-cobs, and let the cobs remain in the tub just as they are thrown there, without further arrangement. Then fill up the balance of the generator with the beech shavings and arrange them so that those which touch the upper false bottom are more strongly pressed than the rest, as the degree of pressure should increase as you pack from the bottom to the top of the generator. The generator being filled, the false bottom must be fitted in and rest level upon the shavings, and great care must be taken not to have the air-tubes stopped up, or the cobs packed too solid in the vicinity of the slanting holes. The shavings or cobs may be loosened at the thermometer and ventilating-holes, by means of a stick thrust therein. The generator may also be entirely packed with beech shavings or entirely with cobs; the latter, however, are inferior, as they soon rot and become worthless. Beech chips are preferred to shavings by some vinegar manufacturers.

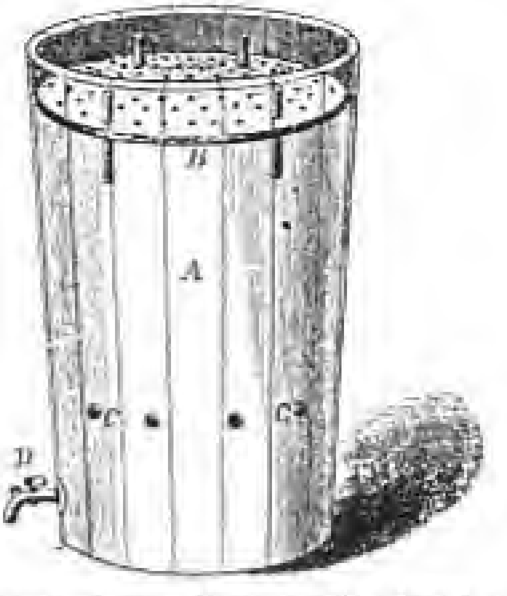
1736. Mode of Acetifying Shavings. The next step in the process of manufacturing vinegar consists in acetifying the shavings and cobs; and this is accomplished in the following manner: Preserve a temperature of between 75° and 85° Fahr., and pour over the shavings and cobs, every hour, a mixture of 2 gallons vinegar and ½ gallon common whiskey (this liquid should first be heated, to hasten fermentation), until there are 10 gallons in the generator above the faucet, but not more. Muspratt recommends a *standard liquor*, both for the acetification of the shavings and for generating of vinegar. It consists of 50 gallons 60 per cent. whiskey, and 37 gallons beer or malt wort. A mixture of 5 gallons of the above mixtures with 40 or 50 of weak vinegar, acetifies still quicker than the standard mixture used alone. Draw off from the generator every hour 2 gallons, and add it again at the top; continue this until the fermentation commences; this usually begins at the top of the generator in the course of 4 or 5 days. The contact of the air with the minutely divided liquid promotes the acetification, which consists essentially in the oxidation of the alcohol. As the oxygen is absorbed, the temperature of the liquor rises to 100° or 105°, and when the thermometer indicates that temperature when placed through the opening in the cover, the generator is ready, and in proper condition for the manufacturer. Pay special attention to the fermentation, for that is the principal point to be observed. It is scarcely necessary to say that the vinegar used for acetifying the shavings should be pure, or at all events free from the mineral acids. It is well known that essential oils, or a mere trace of wood-vinegar, arrest acetification; consequently the vinegar must also be free from pyroligneous acid. After the acetification occurs, proceed as follows:

1737. Mode of Manufacturing Vinegar. Keep the vinegar room at a temperature of from 75° to 85° Fahr., and maintain the temperature of the generators at 95° to 100°. Then make up a mixture or wash composed of the following ingredients: 3 gallons common whiskey; 4 gallons manufactured vinegar; 33 gallons pure water. Muspratt uses 15 or 20 gallons of his *standard liquor (see last receipt)*, diluted with 60 gallons soft water. The water, if not clear, must be filtered through charcoal. Draw off every hour 4 gallons of vinegar from each generator, and pour in at the top 4 gallons of the above wash, with an additional quart for waste in manufacturing; and pour the vinegar into another generator as soon as it is drawn. Vinegar is thus made by being passed only once or twice through the shavings, according to the quality and degree of strength required. Keep a large tank to hold the vinegar when made, and put ¼ gallon of molasses into it every day until you get a bed 2 or 3 inches thick. The molasses will improve the vinegar and give it a fine color. This is the quickest process which has yet been obtained for manufacturing large quantities, and the vinegar made in this way finds ready sale.

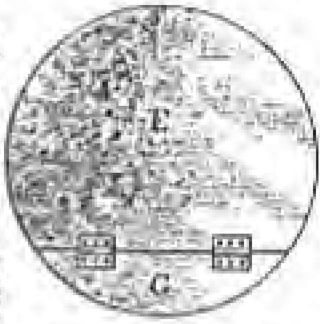
1738. Useful Hints to Those Making Vinegar by the Quick Method. The success of the whole process of making vinegar by the German, or quick method, depends almost entirely upon the free circulation of air throughout the generator. It sometimes happens that the vinegar, when it comes from the generator, is not perfectly clear and transparent; to remedy this, some manufacturers use two false bottoms to each generator, and have a bed of white sand, 15 inches deep, upon the lower one. The sand will have to be packed in before the chips are, as follows: First cover the false bottom with flannel, to prevent the sand from coming through the holes, then put in a layer of sand 5 inches deep, cover this with two thicknesses of flannel, and then another layer of sand; repeat this again, and then pack in the chips as already directed. This will produce an article of a fine color, and will pass for a fine wine-vinegar if colored. Persons who are skeptical about this way of making vinegar may test it at a trifling expense on a small scale by experimenting with a keg arranged on the same principle as the generators. Those who desire to go into the business extensively, can have a series of generators. They may be arranged one above the other, and connected from floor to floor by gutta percha tubes, and thus vinegar may be made by passing once through three generators, instead of two or three times through one generator.

1739. To Make Vinegar Quickly. Take a cask or hogshead with the head out, and a faucet near the bottom; fill it with beech shavings prepared as in No. 1735; or, instead of shavings, the casks may be filled with corn-cobs or beech chips; over these lay a coffee sack, and cover it with fine shavings, to keep the heat in. Next throw some good vinegar on the shavings, and let it soak in for a few hours; then draw it off through the faucet and throw it on to the shavings again, repeating this until the shavings are thoroughly soured, and adding each time 1 quart of high wines to the vinegar before throwing it back on the shavings; this addition prevents the vinegar from becoming flat by the absorption of the acid by the shavings. Then mix 1 gallon 90 per cent. high wines, and 1 quart molasses, with 14 gallons river water; pour it upon the shavings; draw it off and put it on the shavings again 2 or 3 times a day until sour. By using several casks, sufficient vinegar may be made at a time to put into barrels. Sour ale, or the rinsings of sugar hogsheads, may be poured on the shavings and turned into good vinegar in this way. It is better for the fluid to be weak at first, adding the molasses or other material being converted into vinegar, by degrees during the successive drawings. By following this plan, the strength of the vinegar may be gradually increased to almost any degree.

1740. To Make Good Cider Vinegar. Take 10 gallons apple juice fresh from the press, and suffer it to ferment fully, which may be in about 2 weeks, or sooner if the weather is warm; and then add 8 gallons like juice, new, for producing a second fermentation; in 2 weeks more add another like new quantity, for producing a third fermentation. This third fermentation is material. Now stop the bunghole with an empty bottle, with the neck downward, and expose it to the sun for some time. When the vinegar is come, draw off one-half into a vinegar cask, and set it in a cool place above ground, for use when clear. With the other half in the first cask, proceed to make more vinegar in the same way. Thus one cask is to make in, the other to use from. When making the vinegar, let there be a moderate degree of heat, and free access of external air. The process is hastened by adding to the cider, when you have it, a quantity of the mother of vinegar, as it is called—a whitish, ropy coagulum, of a mucilaginous appearance, which is formed in the vinegar and acts as a ferment. The strength of vinegar depends on the amount of sugar or starchy matter to be ultimately converted into acetic acid.



false bottom above. Some parties insert a perforated false bottom about 2 inches below the slanting ventilation-holes, to support the shavings, leaving the portion of the tub below free; others prefer a similar false bottom about 2 inches above the holes, in order to prevent the shavings from coming in contact with the holes and obstructing the ventilation. D is a stop-cock, or faucet, 6 inches from the bottom of the generator, the discharging capacity of which must be controlled by the size of the generator. Never draw off the vinegar below this faucet.



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1736. Mode of Acetifying Shavings. The next step in the process of manufacturing vinegar consists in acetifying the shavings and cobs; and this is accomplished in the fol-

1741. To Make Alcohol Vinegar. The following is the German method of making acetic acid, and is excellent and simple: In a bell glass or tall glass case, arrange shelves a few inches apart, one above another, on which place small flat dishes of earthenware or wood; then fill these dishes with alcohol, and suspend over each, in small trays or capsules, a portion of the black powder of platina (*see Platinum-Black*); hang strips of porous paper in the case, with their bottom edges immersed in the spirit to promote evaporation. Set the apparatus in a light place at a temperature of from 68° to 86° Fahr., for which purpose the sunshine will be found convenient. In a short time the formation of vinegar will commence, and the condensed acid vapors will be seen trickling down the sides of the glass, and collecting at the bottom, whence it may be removed once or twice a day. We shall find that during this process, produced by the mutual action of the platina and the vapor of alcohol, there will be an increase of temperature, which will continue till all the oxygen contained in the air enclosed in the case is consumed, when the acetification will stop; the case must then be opened for a short time, to admit of a fresh supply of air, when the operation will commence again.

1742. Artus' Process for the Manufacture of Vinegar. Dr. Artus has discovered a process for making vinegar from alcohol, which he says has proved entirely satisfactory. There is a very general complaint that the oxidation of spirits of wine in the vinegar process is far from complete, and that the results are not equal either in quality or quantity to what ought to be expected from the materials employed. His plan is as follows: Take ½ ounce dry bichloride of platinum, and dissolve it in 5 pounds alcohol; with this liquid moisten 3 pounds wood charcoal broken in pieces the size of a hasel-nut; heat these in a covered crucible, and afterwards put them in the bottom of a vinegar vat. Here the platinum in its finely divided spongy state absorbs and condenses large quantities of oxygen from the air, by which alcohol is rapidly oxidised. When the charcoal has been in use for 5 weeks it should be again heated in a covered crucible.

1743. To Improve Alcohol Vinegar. Vinegar made from pure alcohol and water does not possess the flavor of wine or cider vinegar, and is therefore inferior to them for table use; but a little acetic ether added to it renders it agreeable. Raw spirits containing some fusel oil produce a more pleasantly flavored vinegar than refined spirits; hence a few drops of fusel oil added to rectified spirits, in making the wash for vinegar, improves its aroma. A little oil of cloves or butyric ether added in the same manner improves its flavor. A very small quantity of cider vinegar gives a large quantity of whiskey vinegar a pleasant flavor. An infusion of chicory is sometimes added to high wine vinegar, to give it the color of cider vinegar.

1744. To Keep Up a Constant Supply of Cheap Vinegar. A supply of vinegar can be kept constantly on hand by retailers in the following manner: Before a barrel is quite sold out, fill up the barrel with 1 gallon molasses to every 11 gallons soft water. This mixture will become good vinegar in about 3 weeks—and can be treated in its turn in the same way. Where less than a barrel a week is used, 3 barrels thus treated and used in rotation, will be sufficient to keep up a perpetual supply. If the barrels stand on end, there must be a hole made in the top, protected with gauze to keep out insects. If standing on the side, the bunghole must be left open and similarly protected.

1745. To Make Vinegar in Three Weeks. Mix in the following proportions: 1 quart molasses, 1 pint yeast to 3 gallons warm rain water. Put the mixture into a keg or barrel with the bunghole open, but protected with gauze against insects.

1746. Distilled Vinegar. Put 1 gallon vinegar in a retort; and distill by a sand-bath, 7 pints. This should produce a vinegar of specific gravity 1.0065. The use of a lead or pewter worm must be avoided, as it renders the product cloudy and poisonous.

1747. To Make Vinegar from Sugar. An excellent domestic vinegar may be made by dissolving 1½ pounds sugar to each gallon water used, with ½ pint good yeast. If the heat of the mixture be maintained at 70° to 80° Fahr., acetification will set in, so that in 2 or 3 days it may be racked off from the sediment into a cask; it then receives the addition of 1 ounce cream of tartar, and 1 ounce crushed raisins; when completely free from sweet taste, it should be bottled and corked closely. The juice of currants, gooseberries, and many other fruits, and of beets, may be thus made into vinegar, either alone or in combination with syrup. Vinegar made in this manner keeps better than that made from malt liquors.

1748. Tests for Vinegar. The methods of testing the *strength* of vinegar are given under the head of *Acetimetry*. The following tests of purity will be found useful:

Paper written on or smeared with pure vinegar, is not charred when strongly warmed before the fire; if it is, the vinegar contains fully 2 per cent. of sulphuric acid.

Dip a small porcelain capsule or china cup into a solution of ¼ ounce sugar in 15 ounces water, and then heat the capsule to a temperature of 212° Fahr. A drop of vinegar let fall on it will not be materially discolored if pure; it will turn a dark brown or black, if the vinegar contains only $\frac{1}{200}$ part of sulphuric acid; the presence of $\frac{1}{1000}$ of sulphuric acid will cause the spot to turn an olive green; a less proportion will produce a pale green color.

Chloride of barium testifies the presence of the same acid by forming a heavy white precipitate; each grain of this precipitate, after being dried and gently ignited, represents .344 grain of dry sulphuric acid; and if the precipitate from 1000 grains of vinegar exceed 2¼ grains, it contains an undue proportion of sulphuric acid.

If a solution of nitrate of silver gives a cloudy white precipitate, hydrochloric acid is present.

If, after the addition of 2 or 3 grains carbonate of potash, and evaporation of the sample to dryness, the residuum deflagrates when ignited, the sample contains nitric acid.

1749. To Strengthen Weak Vinegar. If in pickles, turn it off, heat it scalding hot, put it in the pickles, and when lukewarm, put in a small piece of alum the size of a filbert, and a brown paper 4 inches square, wet with molasses. If it does not grow sharp in 2 weeks it is past recovery, and must be thrown away. Or, freeze it and remove the ice which forms on the surface. The water of the vinegar alone freezes, leaving the acetic acid in solution in the remaining water.

1750. To Determine the Strength of Vinegar. The hydrometer is not to be much relied on in testing the strength of vinegar. The simplest test is to take a fragment of fine marble, weigh it and suspend it by a thread in a known measure of vinegar until all action ceases and the liquid has no longer a sour taste. Take out the marble, wash and dry it, and note the loss of weight it has sustained. $\frac{6}{5}$ of this is real (hydrated) acetic acid. An ounce of good vinegar should saturate from 30 to 32 grains of pure and dry carbonate of soda; such vinegar contains about 5 per cent. of anhydrous (absolute) acetic acid. Vinegar above 30 per cent. of real acid will dissolve the essential oils and camphor. The strength of vinegar may also be ascertained in the same way as any other acid (*see Nos.* 69 *and* 78); but vinegar manufacturers designate the strength of their products by the number of grains of pure carbonate of potassa required to neutralize 1 fluid ounce of the vinegar tested. Thus, if 1 fluid ounce of a sample of vinegar requires 16 grains of carbonate of potassa to neutralize it, the vinegar is said to be of a strength of 16 grains.

1751. To Deprive Vinegar and Other Vegetable Liquids of their Color. To take away the color of vinegar, 2 pints red wine vinegar, cold, are mixed with 1½ ounces bone-charcoal (prepared as directed in the next receipt) in a glass vessel. Shake this mixture from time to time, and in 2 or 3 days the color completely disappears. When the process is to be performed in the large way, throw the charcoal into a cask of vinegar, which must be stirred from time to time. The highest colored *red wines* treated in the same manner become perfectly limpid. Ivory-black possesses the same property as bone-black. Filtering through charcoal will produce the same result.

1752. To Prepare Animal Charcoal to Decolorize Vinegar and other Vegetable Liquids. Fill a crucible with the most compact parts of ox and sheep bones, lute the cover, carefully leaving only a small opening at the top, place the crucible on a forge fire, and heat it gradually till red; when the flame from the oily and gelatinous parts has ceased, diminish the opening and suddenly raise the fire; when cold, reduce the charcoal to fine powder. (*See No.* 1729.)

Sauces, Catsups, and Pickles.

The following receipts are given to illustrate the methods employed in preparing a number of well known condiments. This department of our work might have been greatly extended, but it was not thought advisable to occupy space with particulars that may be found in any of the popular treatises on cookery:

1754. Soy. The pure article is imported from China, but an excellent substitute may be prepared by boiling 1 gallon of the seeds of Dolichos soja (if this cannot be had, haricot or kidney beans will answer) in sufficient water until soft; add 1 gallon bruised wheat, and keep in a warm place for 24 hours; then add 1 gallon salt, and 2 gallons water, and keep for 2 or 3 months in a tightly bunged stone jar; after which, press out the liquor.

1755. Epicurean Sauce. Indian soy, 2 ounces; walnut catsup, mushroom catsup, each 8 ounces; port wine, 2 ounces; bruised white pepper, ½ ounce; shallots, 3 ounces; cayenne, ½ ounce; cloves, ½ ounce. Macerate for 14 days in a warm place, strain, and add white wine vinegar to make up a pint.

1756. Kitchener's Sauce Superlative. Port wine, and mushroom catsup, of each 1 pint; walnut or other pickle liquor, ½ pint; pounded anchovies, 4 ounces; fresh lemon-peel cut thin, sliced shallots, and scraped horseradish, of each 1 ounce; allspice and black pepper, of each ½ ounce; cayenne, 1 drachm; curry powder, 3 drachms; celery seed, 1 drachm; put them into a wide-mouthed bottle, stop it close, shake daily for 2 weeks, and strain; ¼ pint soy may be added.

1757. To Make Quin Sauce. Mix together 2 gallons walnut catsup, 2 gallons mushroom catsup, 1 gallon soy, 1 pound garlic, and 6 pounds sprats. Boil for 15 minutes, strain and bottle.

1758. To Make Harvey's Sauce. Take 48 parts Quin sauce, 16 parts soy, and 1 part cayenne.

1759. Worcestershire Sauce. Mix together 1½ gallons white wine vinegar, 1 gallon walnut catsup, 1 gallon mushroom catsup, ½ gallon Madeira wine, ½ gallon Canton soy, 2½ pounds moist sugar, 19 ounces salt, 3 ounces powdered capsicum, 1½ ounces each of pimento and coriander, 1½ ounces chutney, ½ ounce each of cloves, mace and cinnamon, and 6½ drachms assafœtida dissolved in 1 pint brandy 20 above proof. Boil 2 pounds hog's liver for 12 hours in 1 gallon of water, adding water as required to keep up the quantity; then mix the boiled liver thoroughly with the water; strain it through a coarse sieve. Add this to the sauce.

1760. Indian Curry. The true Indian curry is said to be thus made: Coriander seed, 6 drachms; turmeric, 5 scruples; fresh ginger, 4½ drachms; cummin seeds, 18 grains; black pepper, 54 grains; poppy-seed, 94 grains; garlic, 2 heads; cinnamon, 1 scruple; cardamom, 5 seeds; 8 cloves, 1 or 2 chillies; half a cocoa-nut grated; all but the last to be ground on a stone.

1761. Italian Tamara. Coriander seed, cloves, and cinnamon, of each 8 ounces; anise and fennel seeds, of each 4 pounds; mix.

1762. Bengal Chutney. Chillies, 1½ pounds; unripe mangoes (or apples), 1 pound; red tamarinds, 2 pounds; sugar candy, 1 pound; fresh ginger root, 1½ pounds; garlic, ½ to 1½ pounds; sultana raisins, 1½ pounds; fine salt, 1 pound; and 5 bottles of the best vinegar, soak the chillies for 1 hour in the vinegar, then grind all with a stone and muller to a paste.

1763. Kitchener's Essence of Soup Herbs. Take of lemon thyme, winter savory, sweet marjoram, and sweet basil, of each 1 ounce; grated lemon peel and eschalots, of each ½ ounce; bruised celery seed, ¼ ounce; proof spirit, 1 pint. Digest for 10 to 14 days. A superior flavoring essence for soups, gravies, seasonings, &c.

1764. Essence of Savory Spices. Take of ground black pepper, 4 ounces; powdered turmeric, 3 drachms; ground coriander seeds, 1½ drachms; oil of pimento, 1½ fluid drachms; oil of nutmeg, oil of cloves, oil of cassia, and oil of caraway, of each ½ drachm; alcohol, 1 pint. Digest with agitation for 2 weeks.

1765. Tincture of Savory Spices. Take of black pepper, 1½ ounces; allspice, 5 drachms; nutmegs and burnt sugar, of each ½ ounce; ground cloves, cassia, coriander and caraway seeds, of each 1 drachm; proof spirit, 1 pint. Digest with agitation for 2 weeks; press and filter. Used for flavoring. When made with alcohol and double the above weight of spices it makes an *essence* of savory spices.

1766. Cautions in the Preparation of Catsups, &c. In preparing catsups, pickles, &c., vessels of earthenware, stoneware or well-tinned copper pans should alone be used, as salt, vegetable juices and vinegar rapidly corrode copper, and render the results poisonous. Nothing in the shape of copper, lead, or pewter should be allowed to come in contact with them at any time. Even a plated copper spoon left in a bottle of catsup for some time will render its contents poisonous. Unpleasant and even dangerous attacks of vomiting, colic, and diarrhœa have resulted from neglect of these precautions.

1767. Mushroom Catsup. Lay alternate layers of mushrooms and salt in an earthenware pan, using ¼ pound of salt to each 2 quarts of mushrooms. After 6 hours, break them into pieces, and set in a cool place for 3 days, stirring every morning. Next strain, and to every quart of the juice add ½ ounce each allspice and ginger, ½ tea-spoonful powdered mace, and 1 tea-spoonful cayenne pepper. Put it into a closely covered stone jar, set in a pan of boiling water, and boil briskly for 5 hours; then empty it into a porcelain lined kettle and simmer gently for 1 hour; let it stand over night in a cool place to settle. Decant the clear liquor and cork tightly in bottles filled to the mouth. It is better to seal the corks and tie down with bladder, and to use small bottles, as it soon spoils when exposed to the air.

1768. Tomato Catsup. Take 1 peck ripe tomatoes, cut a slit in them, and put them into a porcelain lined kettle. Boil until the pulp is dissolved; strain and press, first through a cullender, then through a hair-sieve then boil for 5 hours with 1 ounce salt, 1 ounce mace, 1 table-spoonful black pepper, 1 teaspoonful cayenne, 1 table-spoonful powdered cloves, 7 of ground mustard, and 1 of celery seed; this last tied in a thin muslin bag; stir frequently, especially during the last hour turn it into a stone jar to cool; and, when cold, add 1 pint strong vinegar; take out the bag of celery seed, and bottle. Seal the corks, and keep in a dark cool place.

1769. Tomato Catsup. Cut ½ bushel tomatoes to pieces, and boil them in their own liquor until soft; strain and press through a hair-sieve to separate the skins and seeds; boil down to a thick pulp, stirring all the time; then add 6 ounces salt, 6 drachms allspice, 1 ounce 5½ drachms yellow mustard, 3 ounces black pepper, 6 drachms cloves, 3 drachms mace, 2 drachms cayenne pepper, and 1 gallon vinegar. The spices must all be ground fine before using them. Let the whole boil up twice, and, when cool, bottle.

1770. Walnut Catsup. Take young, tender walnuts, prick them in several places, bruise them with a wooden billet, and place in a jar with sufficient water to cover them, adding a handful of salt for every 25 walnuts; stir them twice a day for 14 days; then drain off the liquor into a saucepan. Cover the walnuts with boiling vinegar, crush to a pulp and strain through a cullender into the liquor in the saucepan. Add, for every 2 quarts, 2 ounces each black pepper and ginger, 1 ounce each cloves and nutmeg pounded fine, a pinch of cayenne, a shallot minced fine, and a thimbleful of celery seed tied in a muslin bag. Boil all together for an hour, and, when cold, bottle. In the above manner an excellent catsup may be made from butternuts.

1771. Tarragon Vinegar. Put fresh tarragon leaves into a stone jar, and pour on them a sufficient quantity of the best wine vinegar to cover them. Set the jar in a warm place for 14 days; then strain through a jelly bag. In the same way may be made *elder-flower, basil, green mint*, and *Burnet* vinegars.

1772. Cress and Celery Vinegars are made with ½ ounce of the bruised seed to a quart of vinegar.

1773. Horseradish Vinegar, with 3 ounces of the scraped root, 1 ounce of minced shallots, 1 drachm cayenne, to 1 quart vinegar.

1774. Garlic Vinegar is made with 2 ounces minced garlic to 1 quart wine vinegar.

1775. Shallot Vinegar in the same manner, using challots instead of garlic.

1776. Chili Vinegar, with 50 chillies (peppers) cut or bruised (or ½ ounce cayenne pepper), to 1 pint of the best vinegar; digest for 14 days, strain, and keep in *half-pint bottles*.

1777. Camp Vinegars. Take 12 chopped anchovies, 2 cloves of garlic minced, 1 drachm cayenne, 2 ounces soy, 4 ounces walnut catsup, and 1 pint best vinegar; digest for 1 month, and strain. Or: Vinegar, 1 quart; walnut catsup, 1 pint; mushroom catsup, 3 table-spoonfuls; garlic, 4 heads; cayenne, ½ ounce; soy, 2 table-spoonfuls; port wine, 2 glasses; 3 anchovies, and 1 table-spoonful of salt; put them into a bottle, shake daily for a month, and decant.

1778. Curry Vinegar. Infuse 3 ounces curry powder in 1 quart vinegar, near the fire, for 3 days.

1779. Superfine Raspberry Vinegar. Pour 1 quart vinegar on 1 quart raspberries; the next day press and strain the juice upon another quart of the fruit, and repeat this every day for 6 days. Then add 1 pound white sugar to every pint of the vinegar, and put it into a jar, which must be placed in a pot of boiling water to be scalded through.

1780. Fine Raspberry Vinegar. Bruised ripe raspberries and white wine vinegar, of each 3 pints; macerate 24 hours, press, strain, and to each pint add white sugar, 1 pound; boil, skim, cool, and to each pint add brandy, 2 ounces. In a similar way may be made *Strawberry Vinegar* and *Cherry Vinegar*.

1781. Raspberry Vinegar. Macerate 2 pounds fresh raspberries with 1 pint best vinegar for 14 days, and strain; or, to 1 quart of juice add 2 ounces strong acetic acid or enough to render it sufficiently acid.

1782. Raspberry Vinegar from Raspberry Syrup. Mix together 2 pints raspberry syrup and ½ fluid ounce acetic acid. Added to iced water according to taste, this is one of the most delightful of refrigerant drinks.

1783. Eschalot Wine. Bruised shallots, 3 ounces; sherry wine, 1 pint; infuse for 10 days; 1 ounce scraped horseradish and 1 drachm thin lemon-peel may be added. Dr. Kitchener says this is the most elegant preparation of the onion tribe. Wines of several herbs may be made in the same proportion as the vinegars.

1784. Table Mustard. Mix 8 spoonfuls of flour of mustard with 2 of salt and 9 of water. Mix to a smooth paste, add 6 spoonfuls more water, and mix.

1785. Le Normand's Superior Table Mustard. Take of best flour of mustard, 2 pounds; fresh parsley, chervil, celery, and tarragon, of each ½ ounce; garlic, 1 clove; 12 salt anchovies (all well chopped); grind well together, add of salt, 1 ounce; grape juice or sugar sufficient to sweeten, with sufficient water to form the mass into a thinnish paste by trituration in a mortar. When put into pots, a red-hot poker is to be thrust into each, and a little vinegar afterwards poured upon the surface.

1786. Soyer's Table Mustard. Steep mustard seed in twice its bulk of distilled vinegar for 8 days; grind to a paste, and put it into pots, thrusting a red-hot poker into each.

1787. Moutarde à l'Estragon. Gently dry 1 pound black mustard seed; then powder it fine, and mix it with 2 ounces salt, and sufficient tarragon vinegar to make a paste. In a similar way are prepared several other mustards, by employing vinegars flavored with the respective substances, or walnut or mushroom catsup, or the liquors of the richer pickles, in proportions to suit the taste.

1788. Moutarde Superbe. Take of salt, 1½ pounds; scraped horseradish, 1 pound; garlic, 2 cloves; boiling vinegar, 2 gallons; macerate in a covered vessel for 24 hours; strain, and add of flour of mustard a sufficient quantity.

1789. To Make Cayenne Pepper. This is prepared from the pods of the Chili or bird-pepper. The ripe pods, dried in the sun, are placed in layers with wheaten flour in a dish or tray, and exposed in a stove room or half cold oven until perfectly dry; they are then removed from the flour and ground to fine powder; to every ounce of this powder, 15 ounces wheaten flour are added, and made into a dough with a little tepid water and a tea-spoonful of yeast; after fermentation is well set up, the dough is cut into small pieces, and baked in a slow oven until perfectly hard and brittle. It is then beaten or ground to powder, and forms cayenne pepper.

1790. Pickles. In making pickles, use none but the best cider vinegar. Never keep pickles in glazed earthenware, but in glass or hard stoneware, and well covered with vinegar. They should be examined every month or two, and soft pieces removed. If there is much tendency to soften, it is advisable to strain off the vinegar, add to each gallon a cupful of sugar, boil it, and return it to the pickle jar while hot. The occasional addition of a little sugar keeps pickles good, and improves them. Spices in pickles should be used whole, slightly bruised, but preferably not ground; if ground, they should be tied up in thin muslin bags. Most pickles, if well kept, improve with age, by the vinegar losing its raw taste, and the flavor of the spices, &c., improving and blending. (*See No.* 1766.)

1791. Spiced Vinegar for Pickles Generally. Bruise in a mortar 2 ounces black pepper, 1 ounce ginger, ½ ounce allspice, and 1 ounce salt. If a hotter pickle is desired, add ½ drachm cayenne, or a few capsicums. For walnuts add also 1 ounce shallots. Put these in a stone jar, with a quart of vinegar, and cover them with a bladder wetted with the pickle, and over this a piece of leather. Set the jar near the fire for 3 days, shaking it 3 times a day; then pour it on the walnuts or other vegetables. To save time, it is usual to simmer the vinegar gently with the spices, which is best done in an enameled saucepan. For walnuts it is used hot; for cabbage, &c., cold.

1792. Pickled Cauliflower. These should be sliced, and salted for 2 or 3 days, then drained, and spread upon a dry cloth before the fire for 24 hours; after which they are put into a jar, and covered with spiced vinegar. Dr. Kitchener says that if vegetables are put into cold salt and water (½ pound salt to 1 quart water) and gradually heated to a boiling heat, it answers the same purpose as letting them lie some days in salt.

1793. Pickled Cucumbers. Gherkins. Small cucumbers, but not too young, are wiped clean with a dry cloth, put into a jar, and boiling vinegar, with a handful of salt, poured on them. Boil up the vinegar every 3 days, and pour it on them till they become green; then add ginger and pepper, and tie them up close for use. Or cover them with salt and water (as above) in a stone jar, cover this and set them on the hearth before the fire for 2 or 3 days, till they turn yellow; then put away the water, and cover them with hot vinegar, set them near the fire, and keep them hot for 8 or 10 days, till they become green; then pour off the vinegar, cover them with hot spiced vinegar, and keep them close. Half a dozen peppers improve a jar of cucumbers, as the heat of the former is absorbed by the latter.

1794. Pickled Onions. Let them lie in strong salt and water for 2 weeks; then take them out and peel them; put them in fresh salt and water for 2 weeks more; take them out, wash them clean, and let them lie in fresh water all night. Next day place them on a cloth to drain; then put them in a jar, and pour over them hot spiced vinegar. If you wish them of a nice color, use white vinegar.

1795. Pickled Onions. Peel small silver button onions, and throw them into a stew-pan of boiling water; as soon as they look clear, take them out with a strainer-ladle, place them on a folded cloth covered with another, and when quite dry put them into a jar and cover them with hot spiced vinegar. (*See No.* 1791.) When quite cold, bung them down, and cover with bladder wetted with the pickle.

1796. Pickled Peppers. Soak fresh hard peppers in salt and water for 9 days, in a warm place, changing the brine every day. Then put them into cold vinegar. If the pickles are not required very hot, take out the seeds from the greater portion of the peppers.

1797. Beetroot Pickles. Simmer the roots till ⅔ parts done (from 1½ to 2½ hours); then take them out, peel and cut them in thin slices. Put them into a jar, and pour on sufficient cold spiced vinegar (*see No.* 1791) to cover them.

1798. Pickled Walnuts. Take 100 young walnuts, lay them in salt and water for 2 or 3 days, changing the water every day. (If required to be soon ready for use, pierce each walnut with a larding pin, that the pickle may penetrate.) Wipe them with a soft cloth, and lay them on a folded cloth for some hours. Then put them in a jar, and pour on sufficient hot spiced vinegar (*see No.* 1791) to cover them. Or they may be allowed to simmer gently in strong vinegar, then put into a jar with a handful of mustard seed, 1 ounce ginger, ½ ounce mace, 1 ounce allspice, 2 heads of garlic, and 2 split nutmegs, and pour on them sufficient boiling vinegar to cover them. Dr. Kitchener recommends the walnuts to be gently simmered with the brine, then laid on a cloth for a day or two, till they turn black, put into a jar, and hot spiced vinegar poured on them.

1799. Pickled White Cabbage. Cut white cabbage into thin slices, put it into an earthen pan, sprinkle with salt, and let it lie for 2 days; then drain and spread it out before the fire for some hours; put it into a stone jar, and add sufficient white vinegar, or pale white vinegar, to cover, with a little mace and a few white pepper-corns.

1800. Pickled Red Cabbage. Remove the outer leaves and stalks, and cut the cabbage in quarters, then shred them into a cullender, and sprinkle with salt; next day drain, put them into a jar, and pour on sufficient cold spiced vinegar to cover them. (*See No.* 1791.) Others hang up the cabbage for a few days to dry, then shred the leaves, and put them in layers in a jar with a little salt, pepper, and ginger, and fill up with cold vinegar. Others use vinegar without spice.

1801. Pickled Nasturtiums, French Beans, and other small green vegetables, are made in the same manner as directed for gherkins. (*See No.* 1793.)

1802. Pickled Mushrooms. Clean the mushrooms with water and flannel, throw them into boiling salt and water in a stewpan, and boil for a few minutes. Drain them in a cullender, and spread out on a linen cloth, covering them with another. Put into bottles with a blade or two of mace, and fill up with white vinegar, pouring some melted mutton fat on the top, if intended to be kept long.

1803. Pickled Tomatoes. Tomatoes are pickled in the same manner as cucumbers. (*See No.* 1793.)

1804. Imitation Pickled Mangoes. Large cucumbers, or small melons, are split so that a marrow-spoon may be introduced, and the seeds scooped out; they are then parboiled in brine strong enough to float an egg, dried on a cloth before the fire, filled with mustard seed and a clove of garlic, and then covered with spiced vinegar. (*See No.* 1791.) Real mangoes are pickled in the same way.

1805. Piccalilli, Indian, or Mixed Pickle. To each gallon strong vinegar put 4 ounces curry powder, 4 ounces good flour of mustard, 3 ounces bruised ginger, 2 ounces turmeric, 8 ounces skimmed shallots, and 2 ounces garlic, the last two slightly baked, ¼ pound salt and 2 drachms cayenne pepper. Digest these near the fire, as directed in No. 1791 for spiced vinegar. Put into a jar, gherkins, sliced cucumbers, sliced onions, button onions, cauliflower, celery, French beans, nasturtiums, capsicums, large cucumbers, and small melons. All except the capsicums to be parboiled in salt and water, drained, and dried on a cloth before the fire. The melons and large cucumbers to be prepared as directed in last receipt for mangoes. Pour on them the above pickle.

1806. Mixed Pickle. Take 1 pound ginger-root and ½ pound garlic (both previously salted and dried), 2 gallons vinegar, ½ ounce turmeric, and ¼ pound long pepper. Digest together for 2 or 3 days near the fire in a stone jar; or gently simmer them in a pipkin or enameled saucepan. Then put in almost any vegetables except red cabbage and walnuts, all previously salted and dried.

Yeast.

Yeast is either the froth or the deposit of fermenting worts, according to the character of the fermentation. According to Liebig, yeast is a substance in a state of putrefaction or fermentation, the atoms of which are in a continual motion, and this condition it communicates by contact, to fermentable substances. Lüdersdorff considers yeast an organic body, acting on the sugar contained in the saccharine solution, and not by mere contact and communication of its own condition. This view receives considerable support by examination of its particles by a microscope, and also from its fermenting power being destroyed by trituration or strong pressure. Cooley believes both views to a certain extent correct, and that the atoms in a state of continual motion or change, referred to by Liebig, are developed by the organs of vital yeast, when in contact with sugar under circumstances favorable to fermentation.

1808. Preparation of Brewers' Yeast. To do this, 72 pounds unkilned malt and a handful of hops are gradually stirred in a clean tub containing 7 gallons water of 170° Fahr.; and to this 5½ gallons water of 200° are added. The tub is then covered tightly and left quiet for 1 hour. Supposing this to be done at 6 P. M., the whole is left undisturbed till 7 o'clock next morning, when it must be cooled rapidly, which is done by setting in cans filled with cold water. When the temperature of the mash has reached 70°, the tub is covered again and left during the day till 6 P. M.; at this time 1½ gallons fresh beer yeast are to be stirred in. In 12 hours pierce a hole in the layer formed by the husks of the malt, and dip 3½ gallons of the liquor beneath, then stir the whole up and dip 1¾ gallons from it (husks and liquor). This is the mother-barm, from which you can generate yeast all the year round in using it in the way described instead of the ordinary beer leaven. To the remainder in the tub add 5 gallons wort of 90° (*see No.* 858), and make use of it in within 2 hours. The mother-yeast also must be used the same day for fermenting another portion.

1809. Yeast for Hot Climates. Boil 2 ounces of the best hops in 4 quarts water for ½ hour; strain it, and let the liquor cool down to new milk warmth. Then put in a small handful of salt and ½ pound brown sugar; beat up 1 pound best flour with some of the liquor, and mix all well together. The third day add 3 pounds potatoes boiled and mashed, and let it stand until the next day. Then strain, and it is ready for use. Stir frequently while making, and keep near a fire. Before using, stir well; it will keep 2 or 3 months in a cool place. This yeast is very strong; half the usual quantity necessary for a baking is sufficient. This yeast may be kept in a temperature as high as 104° Fahr.

1810. To Prepare Yeast without a Ferment. Common wheat flour is to be mixed with water into a thick paste, and kept, slightly covered, in a moderately warm place, for some time. About the third day it begins to emit a little gas, and to exhale a disagreeable, sour odor, like stale milk; after the lapse of a few days, that is, about the sixth or seventh day, the smell changes, much gas is evolved, accompanied by a distinct and agreeable vinous odor, and it is then in a state to excite the vinous fermentation. A quantity of wort is next to be prepared, and boiled with hops, in the same manner as in the brewing of beer (*see No.* 858), and when cooled to 90° or 100° Fahr., the decomposed dough, thoroughly mixed with tepid water, is to be added, and the whole kept in a warm situation. After the lapse of a few hours active fermentation takes place, carbonic acid is disengaged, and when the action is complete, and the liquor clear, a large quantity of yeast, of excellent quality, is found at the bottom of the vessel.

1811. To Make Yeast without a Ferment. Boil ¼ peck malt in 3 pints water; pour off 2 pints, and keep it in a warm place for 30 hours; add 4 pints of a similar decoction, stir it well in, again ferment, and repeat this addition of 4 pints until a sufficient quantity of yeast is obtained; 10 pints will yield yeast sufficient for a brewing of 40 gallons; it is preferable to brewers' yeast, particularly when used for raising dough.

1812. To Make Good Yeast without Ferment. Put 2 ounces best hops into 9 pints cold water; boil ½ hour, strain while hot, and add 2 ounces fine table salt and ½ pound sugar. When the mixture becomes blood-warm, put 1 pound sifted flour into a large basin, make a well in the centre with the hand, add the liquor by degrees, stirring with a spoon until the whole is thoroughly incorporated. Let it stand for 2 days in a warm place, stirring it 3 or 4 times a day; then boil and mash finely 3 pounds good potatoes, and mix them in. After standing 1 day more, there should be a heavy dark scum on the surface. Stir it thoroughly, strain through a sieve or cullender, put it into a stone jar, cork and tie down firmly, and keep in a cool cellar. This is a self-fermenting yeast, improves by keeping if not left uncorked, and will not make sour bread.

1813. To Make Yeast with a Ferment. Mix 2 quarts water with wheat flour, to the consistence of thick gruel; boil it gently for ½ hour, and when almost cold, stir into it ¼ pound sugar and 4 spoonfuls good yeast. Put the whole in a large jug or earthen vessel, with a narrow top, and place it before the fire, so that it may, by a moderate heat, ferment. The fermentation will throw up a thin liquor, which pour off and throw away; keep the remainder for use (in a cool place) in a bottle, or jug tied over. The same quantity of this as of common yeast will suffice to bake or brew with. 4 spoonfuls of this yeast will make a fresh quantity as before, and the stock may be always kept up, by fermenting the new with the remainder of the former quantity.

1814. Patent Yeast. Simmer 6 ounces hops in 3 gallons water for 3 hours; strain it, and in 10 minutes stir in ½ peck ground malt. Next re-boil the hops in water, and add the liquor to the mash already made, which must be well stirred up, covered over, and left for 4 hours; then drain off the wort, and when cooled down to 90° Fahr., set it to work with 1 pint yeast (patent is best); after standing for 20 to 24 hours, take off the scum, strain it through a coarse hair sieve, and it is ready for use. 1 pint is said to be enough for 1 bushel of bread.

1815. To Preserve Yeast. Ordinary beer yeast may be kept fresh and fit for use for several months, by placing it in a close canvas bag, and gently squeezing out the moisture in a screw press till the remaining matter becomes as stiff as clay, in which state it must be preserved in close vessels.

1816. To Remedy Bitterness in Yeast. Yeast is often so bitter as to communicate a most disagreeable taste to bread. This may be derived from an excess of hops. To rectify this, mix with the yeast a considerable quantity of water, and set it by to rest for some hours, when the thickest part will fall to the bottom. Pour off the water, which will have extracted part of the bitter principle, and use only the stiff portion that has fallen to the bottom. But yeast sometimes acquires a bitter taste from keeping, which is quite independent of that derived from the hops. To remedy this, throw into the yeast a few clean coals freshly taken from the fire, but allowed to cool a little on the surface. The operation appears to depend in principle upon the power of freshly burnt charcoal to absorb gases and remove offensive odors.

1817. Baking Powder. This is chiefly employed as a substitute for yeast. 1 or 2 tea-spoonfuls are mixed with the dry flour and other ingredients, which are then made into a dough, as quickly as possible, with cold water, and at once baked or boiled, as the case may be. By the addition of about ½ drachm turmeric powder to each pound of baking powder, it is converted into *egg powder*. These preparations should be kept in well corked bottles or tins, to prevent absorption of moisture.

1818. To Make Baking Powder. Powder and thoroughly dry separately, by gentle heat, ½ pound tartaric acid, ¾ pound pure bicarbonate of soda, and ¾ pound potato farina; mix them in a dry room, pass the mixture through a sieve, and at once put into packages, observing to press it hard, and to cover it with tinfoil or close-made paper, and to preserve it as much as possible from air and moisture. Or: Mix and pack, as just described, ¼ pound tartaric acid, ½ pound alum, ¾ pound pure bicarbonate of soda, 1 pound farina, and 3 ounces sesquicarbonate of ammonia. Or: 5 pounds tartaric acid, 8 pounds pure sesquicarbonate of soda, and 16 pounds farina. In using, 1 or 2 tea-spoonfuls are mixed with the dry flour, which is then made up quickly with cold water, and baked immediately. Any other flour or starch may be used instead of the potato flour.

Receipts for the Flower and Kitchen Garden.

The aim of the following receipts is to afford information for the treatment of ornamental in-door plants, and for the general requirements and improvement of the flower and kitchen garden, without entering into the principles of either agriculture or horticulture.

1820. To Dissolve Bones for Manure. Break the bones into small pieces, or pulverize them, if the means are available; put them into a hole in the ground, or, preferably, a stone tank. Pour upon them about 40 pounds oil of vitriol to 100 pounds bones. Work the mixture with long wooden poles until the mass is uniform. Allow it to remain 24 hours, by which time it will be perfectly dry. A couple of shovelfuls added daily to a dung-heap will form a fine compost.

Bones may also be dissolved by filling an old barrel with alternate layers of wood ashes and fresh bones, slightly wetting from time to time with hot water. This is a more economical plan than by the use of sulphuric acid, and is said to make a more soluble compound.

1821. Composts for Improving the Soil. Composts are mixtures of several earths, or earthy substances, or dungs, either for the improvement of the general soil under cultivation, or for the culture of particular plants. In respect to composts for the soil of the garden, their quality must depend upon that of the natural soil; if this be light, loose, or sandy, it may be assisted by heavy loams, clays, etc., from ponds and ditches, cleanings of sewers, etc. On the other hand, heavy clayey and all stubborn soils may be assisted by light composts of sandy earth, drift, and sea-sand, the shovelings of turnpike roads, the cleansing of streets, all kinds of ashes, rotten tanners' bark, rotten wood, sawdust, and other similar light opening materials that can be most conveniently procured.

1822. To Prepare Composts. The preparation necessary for heavy and light composts for general enrichment, and of the above different earths, consists in collecting each soil in the compost ground, in separate ridges of 3 or 4 feet broad, and as high, turning them every 6 weeks or 2 months for a year or a year and a half before they are used. Peat earth, being generally procured in the state of turf full of the roots and tops of heath, requires 2 or 3 years to rot; but after it has lain 1 year it may be sifted, and what passes through a small sieve will be found fit for use. Some nurserymen use both these loams and peats as soon as procured, and find them answer perfectly for most plants; but for delicate flowers, and especially bulbs, and all florists' flowers, and for all composts in which manures enter, not less than 1 year ought to be allowed for decomposition and sweetening.

1823. Universal Composts. The preparation of many separate kinds of composts may be obviated by the general use of the following mixture: Fibrous peat, 1 part; leaf-mould, 2 parts; thoroughly rotted dung, 1 part; light hazelly loam, 4 parts; and 1 part sharp sand. There is scarcely any flowering plant but will grow well in such a mixture, and if peat is not to be had, an additional part of leaf-mould may take its place.

1824. Liquid Manure. The principal materials now used for liquid manures are to be used in the following proportions for all ordinary purposes: Guano, dissolve 50 pounds weight in 10 gallons water, and of this strong solution, add 5 ounces to 10 gallons of water for use. Sheep's-dung, 1 peck to 30 gallons. Sulphate of ammonia, 1¼ ounces to every gallon.

1825. Liquid Guano to Hasten the Blowing of Flowers. To hasten the blowing of flowers the following liquid has been used with great advantage: Sulphate or nitrate of ammonia, 4 ounces; nitrate of potash, 2 ounces; sugar, 1 ounce; hot water, 1 pint; dissolve and keep it in a well-corked bottle. For use, put 8 or 10 drops of this liquid into the water of a hyacinth-glass or jar for bulbous-rooted plants, changing the water every 10 or 12 days. For flowering plants in pots, a few drops must be added to the water employed to moisten them.

1826. Artificial Manure for Clover. Mix together 10 parts each sulphate of ammonia, common salt, and oil of vitriol; 15 parts chloride of potassium; 17 parts each gypsum (plaster of Paris) and sulphate of potassa; 20 parts saltpetre; 25 parts crude Epsom salt (sulphate of magnesia); and 33 parts sulphate of soda (Glauber salts.)

1827. Artificial Manure for Wheat, Turnips, or Grass. Take 28 pounds crude potash, 1 cwt. common salt, 2 cwt. each bone dust and gypsum (plaster of Paris), and 15 bushels wood ashes. Mix them together.

1828. Artificial Guano. Mix 11 pounds dry sulphate of soda (Glauber salts) with 28 pounds wood ashes; 84 pounds common salt; 112 pounds crude sulphate of ammonia; and 7 bushels bone dust.

1829. Fertilizing Powder. To 18 parts very fine bone dust add 1 part each gypsum (plaster of Paris) and sulphate of ammonia. The seed should be steeped in the drainings from a dunghill; and after being drained, but while still wet, should be sprinkled with the powder and then dried.

1830. Phosphate for Manuring. Macerate for some days, with frequent stirring, 2 parts crushed bones in 1 part oil of vitriol and 3 parts water. This forms a superphosphate of lime, which, mixed with water, dry earth, or sand, forms an excellent manure.

1831. How to Select and Manage Cuttings. The choice of cuttings should be made from the side shoots of trees and plants, and, when possible, from such as recline towards the ground, observing to leave a little wood of a former year or season's growth attached to them, as such are found to take root more readily than when they are wholly composed of new wood. The time to take cuttings is as soon as the sap gets into full motion. Before setting them they should be cut across, just below an eye or joint, with as smooth a section as possible, observing not to injure the bud. The superfluous leaves may be removed, but a sufficient number should be left on for the purposes of vegetation. The practice of removing all or nearly all of the leaves of cuttings is injudicious. In some cases leaves alone will strike root. In the case of tubular stalked plants, it is said to be advantageous to insert both ends into the soil, each of which will take root, and may then be divided, when two plants will be produced instead of one. An equable temperature, a moist atmosphere, a shady situation, and a moderate supply of water, are the principal requisites to induce speedy rooting. Excess of any of these is prejudicial. When the size of the cuttings admits, it is better to place them under a hand or bell glass, which will preserve a constant degree of heat, and prevent evaporation from the surface of the leaves, which is the most common cause of their dying, especially in hot, dry weather. What the degree of heat ought to be is decided by the degree of heat requisite for the mother plant. Most species of the erica, dahlia, and geranium, strike better when supplied with rather more heat than is requisite for the growth of these plants in green-houses. Cuttings of the myrtle tribe, camellias, and most other plants, require rather less heat than the plants in their growing state.

1832. To Insert Cuttings. Cuttings, if inserted in a mere mass of earth, will hardly throw out roots, while, if inserted at the side of the pot so as to touch the pot in their whole length, they seldom fail to become rooted plants. The art is to place them to touch the bottom of the pot; they are then to be plunged in a bark or hot-bed and kept moist.

1833. The Color of Flowers Changed by Charcoal. A horticulturist in England purchased a rose-bush full of promising buds—the flowers, however, were of a faded hue. He covered the earth in the pot about an inch thick with pulverized charcoal, and was surprised, some days afterward, to find the blooms of a fine lively rose color. He then tried the powdered charcoal upon petunias, and found that both the white and violet colored flowers were equally sensitive to its action. It always gave great vigor to the red or violet color of the flowers, and the white petunias became veined with red or violet tints; the violets became covered with irregular spots of a bluish or almost black tint. Many persons who admired them thought they were choice new varieties from the seed. Yellow flowers appear to be insensible to the influence of charcoal.

1834. To Turn White Flowers Red. The juice of the Virginian pokeweed sprinkled on the white hyacinth will turn it red. The same effect is produced on many other white flowers.

1835. To Preserve Cut Flowers. Place a vase containing the cut flowers in the centre of a flat dish, into which a little water has been poured; invert a bell glass over the vase, so that the rim of the glass is covered by the water, thus forming an air-tight chamber. The air surrounding the flowers will be constantly moist, and will remain so as long as the supply of water in the dish is kept undiminished. We recommend those who love to see plenty of fresh flowers in their sitting-rooms in dry weather, to adopt this plan. The experiment can be tried by inverting a tumbler over a rose-bud in a saucer of water. If some charcoal has been previously steeped in the water, or a small piece of camphor dissolved, it will greatly assist in keeping the flowers fresh. Violets may be preserved for a long time by sticking them with short stems into a glass dish filled with damp silver-sand, and then inverting a tumbler over them.

1836. To Preserve Flowers. Flowers may be preserved for many months by dipping them carefully, as soon as gathered, in perfectly limpid gum water; after allowing them to drain for 2 or 3 minutes, arrange them in a vase. The gum forms a complete coating on the stems and petals, and preserves their shape and color long after they have become dry.

1837. Preservation of Flowers with their Natural Colors. The mode in which the operation is effected is this: A vessel with a movable cover and bottom is provided, and having removed the cover from it, a piece of metallic gauze of moderate fineness is fixed over it, and the cover replaced. A quantity of sand is then taken, sufficient to fill the vessel, and passed through a sieve into an iron pot, where it is heated, with the addition of a small quantity of stearine, carefully stirred, so as to thoroughly mix the ingredients. The quantity of stearine to be added is at the rate of ½ pound to 100 pounds of sand. Care must be taken not to add too much stearine, as it would sink to the bottom and injure the flowers. The vessel, with its cover on and the gauze beneath it, is then turned upside down, and, the bottom being removed, the flowers to be operated upon are carefully placed on the gauze and the sand gently poured in, so as to cover the flowers entirely, the leaves being thus prevented from touching each other. The vessel is then put into a hot place, such, for instance, as the top of a baker's oven, where it is left for 18 hours. The flowers thus become dried, and they retain their natural colors. The vessel still remaining bottom upwards, the lid is taken off, and the sand runs away through the gauze, leaving the flowers uninjured.

1838. To Preserve Flowers in Water. Mix a little saltpetre or carbonate of soda with water, and it will preserve the flowers for 2 weeks.

1839. To Restore Faded Flowers. Faded flowers may be generally restored by immersing them half-way up their stems in very hot water, and allowing them to remain in it until it cools, or they have recovered. They must then be removed, the coddled portion of the stems cut off, and placed in clean cold water. In this way a great number of faded flowers may be restored, but there are some of the more delicate kinds on which it proves useless.

1840. To Raise Hyacinths in Winter. Put the bulbs in glasses or earth, and set them in a dark closet to sprout. If in glasses, the water should not be higher than 1 inch below the bulb, until the roots have reached the water, when the glasses may be filled up, a piece of charcoal put in the water, and the plants set in the sun to grow.

1841. Soot Water for Roses. Put the soot obtained from the pipe or chimney of a wood fire, into a pitcher, and pour hot water upon it. When cool, use the liquid occasionally to water the rose plants. Its effects are extraordinary in strengthening the growth of the plants and flowers.

1842. To Make Hydrangea Flowers Blue. If they are grown in a tolerably strong maiden loam, which contains a portion of oxide of iron, the flowers will become blue without further trouble; but they will require to be potted in this said compost, and continually grown in the same, from the cutting pot, to ensure their flowers coming blue. If the soil itself will not make the flower blue, they should be watered with a solution of alum for some time previous to flowering. The solution may be made by mixing at the rate of 1 ounce alum to a gallon of rain water. The plants should be struck from small cuttings of the soft wood, from February till May, that are required to flower in those months the following year. They should be potted in time enough for their roots to fill them before winter. It is advisable to flower them the following spring in the pots, allowing the plants to produce only one cluster of flowers each, and taking off all the suckers and side shoots to strike for flowering the following spring, as old plants cannot be depended upon to produce blue flowers. If ⅙ part of iron filings be mixed with the earth in which the plant is grown, it will frequently, although not always, change from its original pink color to a light blue. A cutting, however, taken from the plant thus changed, and grown without iron filing, reverts to its previous color.

1843. To Prevent Damping or Fogging Off. Cuttings in heat, and seedlings pricked out, are very liable to damp off, if in a confined air, with too much moisture. The best mode of treatment is, as soon as evidences of damping appear, to give more air, and increase the temperature 5 degrees, and, at the same time, to sprinkle the surface of the soil with a mixture of silver-sand and powdered peat, crumbled to the fineness of snuff.

1844. To Remedy American Blight. Take ½ peck quicklime, ½ pound flowers of sulphur, and ½ pound lampblack. Mix with boiling water, enough to form a thick paint. With this, in the winter, when the leaves are off, paint the branches, having first removed all loose bark. In doing this, be sure to remove the soil from the bottom of the stem to the main roots, and paint all the underground part. February is a good time for this. If one application is not sufficient, repeat. Use the paint warm. When this has become dry, the trees should be looked over, and all cracks and holes stopped with well worked clay, and after frost the clay-stoppings should be dressed again, to close any cracks that may occur.

1845. To Destroy Aphides, and Other Insects on Plants. Take of quassia chips, 3½ ounces; larkspur seed, 5 drachms; boil these together in 7 pints water until the decoction is reduced to 5 pints. When the liquid is cooled it is to be strained, and used with a watering-pot or syringe, as may be most convenient. This is a most excellent method of destroying insects on plants, without injury to the latter. It is recommended by the highest authorities.

1846. Blight on Fruit Trees, Roses, and Fruit Bushes. When winter dressings have failed, and the pests appear in spring to such an extent as to endanger the crop, procure a quantity of ammoniacal liquor from the gas-works, and to every pailful of the liquor add 6 of water, and boil as soon as possible in a large copper. Apply this in the evening, hot, with a syringe, drenching every part of the trees, and letting not a leaf escape. It should be used as hot as can be borne by placing the hand in it, and thrown with as much force as possible into all the crevices in the bark, on the under sides of the leaves, and splashed vigorously against the wall on which espaliers are trained. It may be used also for roses and fruit bushes, with the most certain benefit. Two days after give another syringing with plain warm water. To clean the copper in which the mixture is prepared, fill it with water, throw in a shovel of cinder ashes and a pound of soda, and let it boil for half an hour.

1847. To Prevent Ants from Injuring Fruit Trees. Make a line of gas-tar round the stem of the tree, or if it be trained on a wall, make a horizontal line near the ground, on the wall, and one round the stem; this will prevent ants from ascending.

1848. To Destroy Black Ants. Boil 4 ounces quassia chips in 1 gallon water, for 10 minutes, and add 4 ounces soft soap. This is excellent to destroy black ants. Or: Sprinkle pulverized borax over the plants or places infested by these vermin. (*See No.* 1909.)

1849. To Prevent Mildew on Trees. The best preventive against mildew is to keep the plant subject to it occasionally syringed with a decoction of elder leaves, which will prevent the fungus growing on them.

1850. To Remove Mildew from Roses, Pelargoniums, Etc. Mildew has been successfully removed from roses and pelargoniums, by dissolving 1 ounce nitre to 1 gallon water, and watering the plants with it occasionally; another way is to wash the diseased parts with a decoction of elder leaves. But the most effectual remedy is flowers of sulphur dusted over the foliage, by means of a dredging-box with very fine holes.

1851. To Remove Green Fly. Choose a still evening, and let the plants be quite dry. Arrange them together in a close place; put into an iron pan, or a flower-pot, a few red-hot cinders that do not smoke, upon which lay the tobacco or tobacco-paper; a cloud of smoke will soon arise. When the frame is well filled with smoke, remove the pan, and be exceedingly careful that the tobacco does not break out into a flame.

1852. To Fumigate Plants with Tobacco Smoke. There are various modes of employing the smoke of tobacco for the destruction of insect pests in plant houses, but the best is as follows:—According to the size of the place to be fumigated provide one or more pieces of cast-iron 1 inch thick and 3 inches of surface. Make these red-hot and place each in a large-sized pot; and on them as much tobacco as may be considered necessary to completely fill the house with smoke. An ordinary eight-light house will require 3 heaters, and 1 pound of tobacco, divided into 3 equal parts. If the tobacco is previously soaked in a strong solution of saltpetre, its ignition is more rapid and complete, and a less quantity suffices.

1853. To Drive Worms out of Pots. Securely cork up all the drainage holes in the pot, and then flood it for several hours with clear lime-water.

1854. To Destroy Green Fly. Syringe the plants with tobacco water. One part ammoniacal liquor from the gas-works, mixed with 5 or more parts of water, according to its strength, will also destroy the insects.

1855. Wash to Prevent Cattle from Barking Trees. Take ½ cow-dung and ½ lime; mix with a little water, to the consistency of thick lime-wash, and lay this on the stems of the trees as far as the cattle can reach.

1856. To Prevent Grub in Onions. Make some strong lime-water, add to it as much soot as will make it into a thin paint, and water the crop with it the moment the maggot appears. This soot mixture is so stimulating a manure that it should always be used to increase the weight of the crop. House-slops mixed with lime and soot would be still more powerful, both to destroy maggot and improve the plant; but unless rain followed immediately, it would be advisable to drench the ground with pure water the day after application. Ground intended for a crop of large onions should be prepared in the autumn, and after being dug over, should be watered with a mixture of sulphuric acid and water, made so strong as to burn the tongue. This will destroy every animal in the soil, and the winter rains will wash it away entirely before spring.

1857. To Prevent Attacks of Red Spider. In cases where the infested plants can be well syringed, a few times repeating this operation will cause them to disappear. When this cannot be resorted to with safety, the flues or pipes may be washed over with sulphur, and should be kept warm to raise an effluvia in the house, which will soon eradicate these pests. If a little soft soap is mixed with the water to syringe with, it will prove obnoxious to many other insects as well as red spider, and will not injure the foliage of the plant, providing the plants are not syringed when the scorching hot sun is upon them.

1858. To Kill Thrips on Cucumbers and Melon Plants. To kill thrips on cucumbers and melon plants, they should be syringed with tobacco water, and a little sulphur added, or with a decoction of elder leaves; either of these repeated a few times will suffice; or the infested parts may be dusted over with flowers of sulphur, and allowed to remain on for 3 or 4 days, when it should be washed off thoroughly with a syringe. (*See No.* 1850.)

1859. To Destroy Maggot in Roses. A bushel of unslacked lime in powder, ½ pound sulphur also in powder; mix these well whilst dry, then add water to make it about as thick as molasses, and boil for 1 hour; then add just enough soot, moistened to the same consistence, to darken the color; lay this on with a brush all over, stock and head, in the latter part of March.

1860. To Destroy Moss on Fruit Trees. Every second year fruit trees should be well scrubbed with a scrubbing brush dipped in strong brine, so as to moisten every part of the bark of the stem and branches. This not only destroys the moss, but insects of all kinds, and is beneficial to all trees, whereas applications of lime choke up the respiratory pores, and sometimes produce canker.

1861. To Remove Moss on Gravel Walks. This may be kept down by the use of a broom made of wire; if the wire is made of iron the broom should be well dried and dipped in oil before and after being used.

1862. To Protect Lettuce and Strawberry Beds from Snails. If the beds are surrounded by a slate or board edging, made to stand 5 inches above the ground, and occasionally coated with a paste made of train oil and soot, it will form a barrier over which snails will not pass.

1863. To Prove Cucumber and Melon Seed. When the fruit is first cut, the seed should be put into a bowl of water, and that which swims on the surface is worthless; the good will sink to the bottom. This can only be depended upon at the time the fruit is first cut; if the seed has been dried and kept for any length of time, it will probably all swim, though it has not lost its vegetating properties.

1864. To Clean Cucumber and Melon Seed. Take all the seeds that sink in water and put them into a hair sieve; pour some warm water over them that has been heated to 90° or 95° Fahr., and then rub the seeds about in the sieve. The warm water will divest them of the glutinous matter, and it may be easily rubbed off them through the sieve, after which they may be laid to dry. Cucumber and melon seeds will vegetate after they have been kept for years.

1865. To Kill Moss on Lawns. Water the lawn with a weak solution of ammoniacal liquor (*see No.* 1854); 1 gallon of this liquor is sufficient to mix with 4 gallons of water, and should be put on with a rose water-pot. It will cause the grass to look brown afterwards for a while, but it will become green again. Another way is to procure some very fine siftings of coal-ashes, and sow them all over the parts where moss abounds. It will only be requisite to sow them very thinly, and if done just before a shower of rain, so much the better, as the rain will wash it in; this will kill the moss without injuring the grass. The presence of moss indicates that the soil is exhausted, and a top-dressing of nitrate of soda or soot will be found beneficial. If the grass is made to thrive, it will always choke the moss. (*See No.* 1876.)

1866. To Kill Moss on Meadow Land. The mossy parts of the meadow should be well manured with good well-rotted stable dung in the autumn; and, if practicable, the grass should be fed off the following spring with sheep. Nitrate of soda sown on the mossy parts of the field will also kill the moss, and is an excellent manure for the grass; but this should not be sown at the rate of more than 1½ cwt. per acre.

1867. To Kill Docks, Dandelions, etc. Cut the tops off in the spring or summer time, and pour some gas-tar, or sprinkle some salt on the wound. Either of these will kill the root, by eating to the very extremity.

1868. To Destroy Burdocks. Cut close to the ground with a sharp hoe, and apply a few drops of kerosene. The plant so treated will never appear again.

1869. To Prevent the Growth of Weeds in Garden Walks. A weak solution of carbolic acid applied with a watering-pot to garden walks will be an effectual mode of preventing the growth of weeds. The solution should not be stronger than 1 part pure carbolic acid to 1000 to 2000 parts water. Pure carbolic acid is a virulent poison. When applied in too strong a solution, larger plants may suffer; very weak solutions destroy only very small plants and animals, as parasites, miasma. Even flies and mosquitoes avoid its odor and may be driven away by it.

1870. To Destroy Thistles, Grass, and Weeds, in Gravel Walks. Sow coarse salt upon the plants; the thistles should be first cut to the ground, and the fresh roots be covered with the salt. The refuse article from the beef, pork, or salt fish barrel is quite good enough, and may be employed for this purpose.

1871. Cleanliness for Plants. Frequently the cause of the languishness of plants in rooms, arises from want of care in cleansing the leaves. Plants breathe by their leaves, which should be kept perfectly clean, otherwise their respiration is interfered with. The mere watering of the roots is not enough. Plants also perspire by their leaves, and any accumulation of dirt and dust retards this useful function. Plants also feed by their leaves, by absorbing the carbonic acid of the atmosphere; and, to speak familiarly, dirt destroys both their appetite and digestion. Let any one examine a sickly plant, long kept in a sitting-room, or draw a piece of white linen or leather over the surface of the leaves, and he will probably discover the cause of the plant's drooping.

1872. To Keep Cucumbers Fresh. When the cucumbers are at their best they should be cut, and laid in a box made just to fit them, and then bury the box in some dry sand, covering it over to the depth of a foot. There should not be any hay or moss put with them in the box, as it will cause them to turn yellow. If laid in the box without hay or moss, their color and bloom may be preserved for two weeks to look as fresh as the day they were cut. Melons may also be kept in the same way.

1873. To Cure Gumming in Fruit Trees. The place where the gum accumulates should be well washed and cleaned, and then stopped well up with a paste made of horse-dung, clay and tar. This will prevent the accumulation of the gum, and will assist the wound in healing over.

1874. To Prevent the Bottoms of Plant Sticks Rotting. Dip the bottoms of the plant sticks (as far as they are inserted into the ground) into hot asphalt three or four times, until the asphalt is the $\frac{1}{16}$ of an inch thickness on them; this will preserve them a long time. Those that have not the convenience of dipping them in asphalt, may substitute tar, and they will endure nearly as long as those that have been asphalted.

1875. To Destroy Weeds and Worms in Gravel Walks. Lay a coat of salt all over the walk, and then water it, using a rose water-pot; but this should not be done where there is a box edging, or it will kill that likewise. Where the edging is turf, slate, or tiles, there is nothing to fear.

1876. To Destroy Worms in Lawns, Grass Plots, etc. Mix at the rate of 10 pounds slacked lime to 30 gallons water; stir it up well together, and then let it stand for 2 or 3 days, in which time pour it off the sediment, and water the lawn with it by means of a rose water-pot; this will fetch the worms out on the top of the ground, and they will require to be swept up with a broom and carried away. The best time to do this is in damp weather, as the worms are then nearer the surface; and the lawn should be rolled the evening previous, which will not only assist in bringing the worms nearer the surface, but will fill up all the holes they have forsaken. The following night they will again open the holes in which they lie, and thereby afford the water greater facility to reach them the next day without wasting much by its soaking into forsaken holes. Diluted ammoniacal liquor will answer the same purpose, but it will make the grass look brown for some time afterwards. (*See No.* 1865.)

1877. Composition for Wounds on Rose-Bushes. Take 5 parts black pitch, 1 part each resin, tallow, and bees' wax; these should be mixed in a small pipkin, and dissolved over a slow fire. Apply it to the wounds with a brush, and it will heal them, as well as prevent their dying back.

1878. Bleeding in Vines. Work together 1 part calcined oyster-shells beaten to fine powder in a mortar, and 3 parts cheese, until they form a sort of paste. This mixture is to be forced into the pores of the wood where bleeding takes place, by means of the thumb and finger. A second application is sometimes necessary. (*See Nos.* 1880 *and* 1881.)

1879. Composition for Healing Wounds in Trees. Take 3 parts pounded chalk and 1 part common vegetable tar; mix thoroughly, and boil them with a low heat till the composition becomes of the consistency of bees' wax; it may be preserved for use in this state for any length of time. If chalk cannot conveniently be got, dry brick-dust may be substituted. After the broken or decayed limb has been sawed off, the whole of the saw-cut must be very carefully pared away, and the rough edges of the bark, in particular, must be made quite smooth; the doing of this properly is of great consequence; then lay on the above composition hot, about the thickness of half a dollar, over the wounded place, and over the edges of the surrounding bark; it should be spread with a hot trowel.

1880. New Grafting Wax. Melt 1 pound resin over a slow fire, add 1 ounce beef tallow, and stir with a perfectly dry stick or piece of wire. When somewhat cooled, add 1 table-spoonful spirits of turpentine, and lastly 5 ounces of 95 per cent. alcohol in small quantities, stirring the mass constantly. Should the alcohol cause it to lump, warm again until it melts. Keep in a bottle. Lay it on in a very thin coat with a brush. In a room of moderate temperature, the wax should be of the consistence of molasses. Should it prove thicker, thin it down with alcohol. It is always ready for use, is never affected by heat or cold, and heals up wounds hermetically.

1881. Grafting Wax. Take 4 ounces pitch, 4 ounces resin, 2 ounces hogs' lard, and 2 ounces bees' wax; put them all together into a pipkin, and dissolve them over a slow fire, and it will form an excellent grafting wax. By spreading some of this mixture on paper it makes the grafting paper. The French make very good grafting wax by mixing together equal quantities of bees' wax and resin, and adding as much tallow as will cause it to dissolve at a low temperature. For an application where limbs have been removed in pruning, nothing is better than coal tar.

1882. Grafting Clay. Take strong adhesive loam or clay, and knead it till of the consistency of soft soap. Take also some horse droppings, and rub through a riddle of half-inch mesh. Mix the two ingredients with fresh cow-dung, all in equal parts, to a uniform consistency. When grafting, the operator should have at hand some finely-riddled ashes, into which the hands should be dipped to prevent the clay from adhering, and enable him to give the whole a neat finish.

1883. To Propagate Marsh Plants. The best plan is by means of a stone trough 6 inches to a foot deep, and of any convenient length and breadth, with a hole for a tap at one corner. This is to be treated as a flower-pot; the bottom being covered with small stones, and the trough filled up with a compost of peat and light loam. The surface is then covered with any description of light moss that can be got, and watered till the whole is saturated to the brim.

1884. To Prepare Seeds for Exportation. Seeds intended for exportation should not be gathered until they have become perfectly ripe; they should then be laid in a stove, or exposed in the sun to dry, as getting them perfectly dry is the principal point. They may be packed in bags, papers, or boxes. If they are kept dry, they will bear a voyage of many months, without injury to their vegetating properties.

1885. To Prepare Nails for Wall-Trees. These should be of cast iron if they can be obtained. Before using, they should be heated red-hot, and then thrown into cold linseed oil. This gives them a varnish which preserves them from rusting, and prevents the mortar of the wall from sticking to them when they are drawn.

1886. Method of Covering a Bank of Earth With Grass. To cover a steep bank quickly with grass the following method is recommended by a German Horticultural Association: For each square rod to be planted, take ½ pound lawn grass seed, and mix it intimately and thoroughly with about 6 solid feet of good dry garden earth and loam. This is placed in a tub, and to it liquid manure, diluted with about ⅔ of water, is added and well stirred in, so as to bring the whole to the consistency of mortar. The slope is to be cleaned off and made perfectly smooth, and then well watered, after which the paste just mentioned is to be applied with a trowel, and made as even and thin as possible. Should it crack by exposure to the air, it is to be again watered and smoothed up day by day, until the grass makes its appearance, which will be in 1 or 2 weeks, and the whole declivity will soon be covered by a close carpet of green.

1887. Substitute for Glass for Hot-Houses. Apply, with a common painter's brush, boiled oil, or Canadian balsam, diluted with oil of turpentine, to the surface of white muslin previously stretched out and fastened in the position it is intended to occupy.

1888. To Preserve Potatoes and Other Roots. These are preserved in different ways, according to the object in view. Tuberous roots, as those of the dahlia, pæonia, tuberose, etc., intended to be planted in the succeeding spring, are preserved through the winter in dry earth, in a temperature rather under than above what is natural to them. So may the bulbous roots of commerce, as hyacinths, tulips, onions, etc.; but, for convenience, these are kept either loose, in cool dry shelves or lofts, or the finer sorts in papers, till the season of planting. Roots of all kinds may be preserved in an ice-house till the return of the natural crop. After stuffing the interstices with straw, and covering the surface of the ice with the same material, place on it boxes, casks, baskets, etc., and fill them with turnips, carrots, beet roots, and, in particular, potatoes. By the cold of the place, vegetation is so much suspended that all these articles may be thus kept fresh and uninjured till they give place to another crop in its natural season.

1889. To Dry Roots. They should be rubbed in water to get rid of the dirt and also some of the mucous substance that would otherwise render them mouldy; the larger are then to be cut, split, or peeled, but in most aromatic roots, the odor residing in the bark, they must not be peeled; they are then to be spread on sieves or hurdles, and dried in a heat of about 120° Fahr., either on the top of an oven, in a stove, or a steam closet, taking care to shake them occasionally, to change the surface exposed to the air. Thick and juicy roots, as rhubarb, briony, peony, water-lily, etc., are cut in slices, strung upon a thread, and hung in a heat of about 90° to 100°. Squills are scaled, threaded, and dried around the pipe of a stove, or in a hot closet. Rhubarb should be washed, to separate that mucous principle which would otherwise render it black and soft when powdered. Potatoes are cut in slices and dried.

1890. To Transplant Large Shade Trees. In the autumn, before the frost comes on, dig a trench around the tree and cut the roots, but not too near the tree. Remove the tree through the winter, when the ground is frozen. Raise it up with the frozen earth adhering to the roots. The whole mass is easily raised with levers on to a strong sled, and can then be drawn erect by means of oxen or horses. Trees from 20 to 30 feet high can be moved by this method, and they will grow in the spring.

1891. To Drain Land in Level Places, sink a well down to the first porous stratum. The water from the upper soil will flow readily into the well, especially if drain pipes or tiles be laid in its direction.

The Extermination of Vermin.

The following comparatively few receipts and directions for destroying, trapping and driving away insects and vermin of all kinds, have been selected as the most efficacious, from a large amount of information on the subject.

1893. To Catch Rats. Cover a common barrel with stiff, stout paper, tying the edge round the barrel; place a board so that the rats may have easy access to the top; sprinkle cheese parings or other feed for the rats on the paper for several days, until they begin to think that they have a right to their daily rations from this source; then place in the bottom of the barrel a piece of rock about 6 or 7 inches high, filling with water until only enough of it projects above the water for one rat to lodge upon. Now replace the paper, first cutting a cross in the middle, and the first rat that comes on the barrel top goes through into the water, and climbs on the rock. The paper comes back to its original position, and the second rat follows the first. Then begins a fight for the possession of the dry place on the stone, the noise of which attracts the others, who share the same fate.

1894. Rat Trap. Fill a barrel about half full of water. Make the cover ⅛ inch smaller all around than the inside of the top of the barrel. Drive a nail or wire on each side of the cover, exactly opposite each other, as a pivot, and fit in the barrel, so that a light weight will readily tip the cover. Put the bait on top, in a firm way, and place an empty barrel or box near by. This is a simple, but excellent trap.

1895. Bait to Catch Rats and Mice. If a drop of oil of rhodium be poured upon some bait in a common or wire spring trap, and the trap be set in an infested locality, in a short time the cage will be found occupied by vermin. Rats and mice possess a great liking for the oil, and will risk anything to obtain it.

1896. To Catch Muskrats. Take a steel trap with a single spring, set it 1½ inches under water, hang part of a sweet apple over the foot plate, and chain the trap to a stake or rush. The reason why the trap should be set under water is that when the muskrat sees the apple he will jump for it; when he comes down he gets his paws in the trap.

1897. Rat Poison. Recent experiments have shown that squills is an excellent poison for rats. The powder should be mixed with some fatty substance, and spread upon slices of bread. The pulp of onions is also good. Rats are very fond of either.

1898. To Drive Rats from a Building. Dissolve 2 ounces glue, 2 ounces tincture of assafœtida, and 2 ounces potash in water, and add ½ ounce phosphorus to the mixture. Then in a wire cage trap, baited with corn meal scented with oil of anise, catch two or three rats; if they are very numerous, more will be necessary; singe the hair partly off these in such a way as to hurt them as little as possible, then give them a slight coating with the above mixture, heated warm; let them loose into their holes, and there will be no more trouble with the rats for months to come. This mixture will last 2 years. Or: Take chloride of lime, and scatter it dry all around, and into their holes, and wherever they haunt, and they will leave at once.

1899. Phosphorus Paste for Vermin. Introduce 1 drachm phosphorus into a Florence flask, and pour over it 1 ounce rectified spirit. Immerse the flask in hot water until the phosphorus is melted, then put a well-fitting cork into the mouth of the flask, and shake briskly until cold. The phosphorus is now reduced to a finely divided state. This, after pouring off the spirit, is to be mixed in a mortar with 1½ ounces lard. 5 ounces flour and 1½ ounces brown sugar, previously mixed together, are now added, and the whole made into a paste with a little water. Cheese may be substituted for sugar when the paste is intended for rats or mice. There is said to be no danger whatever of spontaneous ignition, either during or after the preparation of this paste.

1900. An Insect Killer and Destroyer of Noxious Animals. The bisulphide of carbon seems to be useful in certain cases, when it may be applied without inconvenience to the human species. In an atmosphere containing $\frac{1}{75}$ of its volume, it has, according to

Cloëz, a very rapid action on the animal organism, more rapidly, apparently, upon rats, rabbits, &c., than upon birds and frogs. Cloëz introduced 1½ ounces bisulphide in a culvert, and found within 20 yards from the place some 40 dead rats.

1901. To Exterminate Cockroaches. Borax is one of the best of roach exterminators. There is something peculiar, either in the smell or touch of borax, which is certain death to them. They will flee in terror from it, and never appear again where it has once been placed. It has also the great advantage of being perfectly harmless to human beings; hence there is no danger from poisoning. The borax should be pulverized and sprinkled around the infested places.

1902. To Kill Cockroaches and Croton Bugs. Boil 1 ounce poke-root in 1 pint water until the strength is extracted; mix the decoction with molasses and spread it in plates in the kitchen or other apartments which are infested by these insects. Paris green sprinkled around the apartments will also exterminate them; but should be used with caution, as it is very poisonous.

1903. To Destroy Bed-bugs. Rub the bedsteads in the joints with equal parts of spirits of turpentine and kerosene oil, and the cracks of the surbase in rooms where there are many. Filling up all the cracks with hard soap is an excellent remedy. March and April are the months when bedsteads should be examined to kill all the eggs.

1904. To Destroy Bed-bugs in Papered Rooms. Clean the paint of the room thoroughly, and set in the centre of the room a dish containing 4 ounces of brimstone. Light it and close the room as tight as possible, stopping the keyhole of the door with paper, to keep the fumes of the brimstone in the room. Let it remain for 3 or 4 hours, then open the windows and air thoroughly. The brimstone will be found to have also bleached the paint if it was a yellowish white.

1905. Bed-bug Poison. Mix together 2 ounces camphor, 4 ounces spirits of turpentine, 1 ounce corrosive sublimate, and 1 pint alcohol.

1906. To Kill Bed-bugs. Benzine or gasoline will kill these pests as fast as they can be reached. By using a spring-bottom oiler, the fluid may be forced into cracks and crevices more thoroughly than by any other means. As this fluid is highly inflammable, contact with fire must be avoided. The room should be well aired and ventilated afterwards, until the gas passes away. (*See No.* 346.)

1907. To Exterminate Bed-bugs. Wash the article infested with a weak solution of chloride of zinc. This is an effectual banisher of these pests.

1908. Benzine as an Insect Destroyer. A mixture of 10 parts benzine, 5 parts soap, and 85 parts water, has been very successfully used to destroy the parasites which infest dogs. It has also been used with good results in veterinary practice, as an application in certain diseases of the skin; and thus diluted, is found to answer better than when used pure.

1909. To Disperse Black Ants. A few leaves of green wormwood, scattered among the haunts of these troublesome insects, is said to be effectual in dislodging them. (*See No.* 1813.)

1910. To Exterminate Red Ants. Grease a plate with lard, and set it where these insects abound. They prefer lard to anything else, and will forsake sugar for it. Place a few sticks around the plate for the ants to climb up on. Occasionally turn the plate bottom up over the fire, and the ants will fall in with the melting lard. Reset the plate, and in a short time you will catch them all. Powdered borax sprinkled around the infested places will exterminate both red and black ants. (*See No.* 1901.)

1911. To Kill Flies. Beat up the yolk of an egg with a table-spoonful each of molasses and black pepper finely ground; set it about in shallow plates and the flies will be rapidly killed. A sweetened infusion of quassia will answer the same purpose. Dissolve 1 drachm extract of quassia in a gill of water, mix with ¼ gill molasses and pour the mixture on a flat dish where the flies have access. The quassia acts on them like a narcotic.

1912. Fly Poison. Boil ½ ounce small chips of quassia in 1 pint water; add 4 ounces molasses. Flies drink this with avidity, and are soon destroyed by it.

1913. To Banish Fleas. The oil of pennyroyal will certainly drive them off; but a cheaper method, where the herb flourishes, is to dip dogs and cats into a decoction of it once a week. Mow the herb and scatter it in the beds of the pigs once a month. Where the herb cannot be got, the oil may be procured. In this case, saturate strings with it and tie them around the necks of dogs and cats, pour a little on the back and about the ears of hogs, which you can do while they are feeding, without touching them. By repeating these applications every 12 or 15 days, the fleas will leave the animals. Strings saturated with the oil of pennyroyal, and tied around the neck and tail of horses, will drive off lice; the strings should be saturated once a day.

1914. To Exterminate Fleas. Sprinkle chamomile flowers in the beds, and the fleas will leave.

1915. An Excellent Flea Trap. If you should happen to have the consciousness of having a flea about your person, you have but to introduce, before getting into bed, a piece of new flannel between the sheets, and you may depend on finding yourself forsaken for the flannel.

1916. To Prevent the Attacks of Gnats. The best preventive against gnats, as well as the best cure for their stings, is camphor.

1917. To Clear a Room of Mosquitoes. Take of gum camphor a piece about ⅓ the size of an egg, and evaporate it by placing it in a tin vessel, and holding it over a lamp or candle, taking care that it does not ignite. The smoke will soon fill the room, and expel the mosquitoes.

1918. To Keep Away Mosquitoes. Dip a piece of sponge or flannel in camphorated spirits, and make it fast to the top of the bedstead. A decoction of pennyroyal, or some of the bruised leaves, rubbed on the exposed parts, will effectually keep off those troublesome insects.

1919. To Destroy Vermin in Children's Heads. Take 1 ounce each vinegar and stavesacre, ½ ounce each honey and sulphur, and 2 ounces sweet oil. Make into a liniment, and rub the head with it. Insects are immediately suffocated by benzine. Those sometimes found in the heads of human beings are destroyed by it at once, without any inconvenient result being perceived. It has been employed very successfully in banishing the insects which infest domestic animals, etc. (*See No.* 1905.) The use of larkspur seed for the destruction of the insects infesting the human head is a time-honored application among country people—beds of the plant being cultivated frequently for the express purpose of furnishing material for the decoction. The efficiency of this remedy seems to depend on the presence of the alkaloid called delphine, which appears to be a poison especially fatal to insects.

1920. To Destroy Body Vermin. Apply stavesacre ointment or red precipitate.

1921. To Clean Canary Birds. These pretty things are often covered with lice, and may be effectually relieved of them by placing a clean white cloth over their cage at night. In the morning it will be covered with small red spots, so small as hardly to be seen, except by the aid of a glass; these are the lice, a source of great annoyance to the birds.

1922. Lice on Poultry. If infested with lice, damp the skin under the feathers with water, then sprinkle a little sulphur on the skin. If the bird be covered with insects or parasites, they will all disappear in the course of 12 hours.

1923. To Drive Flies from Stables. Scatter chloride of lime on a board in a stable, to remove all kinds of flies, but more especially biting flies. Sprinkling beds of vegetables with even a weak solution, effectually preserves them from caterpillars, slugs, &c. A paste of 1 part powdered chloride of lime and ½ part of some fatty matter placed in a narrow band round the trunk of the tree, prevents insects from creeping up it. Even rats, mice, cockroaches, and crickets flee from it.

1924. To Keep Flies from Horses. Procure a bunch of smartweed, and bruise it to cause the juice to exude. Rub the animal thoroughly with the bunch of bruised weed, especially on the legs, neck, and ears. Neither flies or other insects will trouble him for 24 hours. The process should be repeated every day. A very convenient way of using it, is to make a strong infusion by boiling the weed a few minutes in water. When cold it can be conveniently applied with a sponge or brush. Smartweed is found growing in every section of the country, usually on wet ground near highways.

Prepared Paper.

Paper frequently requires some special preparation to fit it for many purposes for which it would be useless in its original state. The following methods of preparing paper will be found useful, and in some cases indispensable, for reference.

1926. To Make Transfer Paper. To prepare transfer paper, take some thin post or tissue paper, rub the surface well with black lead, vermilion, red chalk, or any coloring matter; wipe this preparation well off with a piece of clean rag, and it will be ready for use.

1927. To Make Tracing Paper with Petroleum. Saturate ordinary writing paper with petroleum by means of a brush, then wipe it off until it is dry. This makes a tracing paper equal to the manufactured article, for all ordinary purposes. It was discovered by Mr. Häusel, an architect at Neustadt.

1928. To Make Tracing Paper with Benzine. If paper be damped with pure and fresh distilled benzine, it at once assumes a transparency, and permits of the tracing being made, and of ink or water colors being used on its surface without any running. The paper resumes its opacity as the benzine evaporates, and if the drawing is not then completed, the requisite portion of the paper must be again damped with benzine. This new discovery of the properties of benzine will prove of great service to many branches of the art profession, in allowing the use of stiff paper where formerly only a slight tissue could be used.

1929. To Make Transparent or Tracing Paper. Dissolve a piece of white bees' wax, about the size of a walnut, in ½ pint spirits of turpentine; then having procured some very fine white, woven tissue paper, lay it on a clean board, and, with a soft brush dipped in this liquid, go over one side, and then turn it over and apply it to the other; hang it up in a place free from dust to dry. It will be ready for use in a few days. Some add a small quantity of resin, or use resin instead of wax.

1930. To Make Tracing Paper. Lay open a quire of paper, of large size, and apply with a clean sash tool a coat of varnish, made of equal parts of Canada balsam and oil of turpentine, to the upper surface of the first sheet, then hang it on a line, and repeat the operation on fresh sheets until the proper quantity is finished. If not sufficiently transparent, a second coat of varnish may be applied as soon as the first has become quite dry.

1931. Iridescent Paper. Boil in water, 8 parts nut-galls, 5 parts sulphate of iron, 4 parts each sal ammoniac and sulphate of indigo, and ⅛ part gum-arabic. Wash the paper in this decoction, and then expose it to ammonia.

1932. To Powder Glass. Heat the glass red-hot, throw it into cold water; dry, and pulverize it, coarse or fine as required, in an iron mortar. It is used to filter acids; is glued upon paper or muslin for polishing; also to rub down corns upon the feet, after they have well soaked and dried.

1933. To Make Glass Paper or Cloth. Powder the glass (that with a greenish hue is the best), and sift it through a very fine wire sieve, to separate the finest portion of the powder; this is for the smoothest degree of glass paper; sift the remainder successively through sieves gradually increasing in coarseness, to suit the different degrees of the glass paper required; keep the result of each sifting separate. Then smooth on both sides, with pumice stone, any good tough paper, and tack it on a board; a tolerably fine quality of muslin is far preferable to paper. If large sheets are used it is better to glue the edges on a frame (similar to a small quilting frame), and when dry, damp the paper or muslin and stretch it, in the same manner as the muslin is strained for sized roller blinds. Give the surface a coating of strong glue size, and *immediately* dust the glass of the required fineness equally and thoroughly all over, using the same sieve that was used to separate it from the rest of the powdered glass. When dry, throw off the surplus glass for future use.

1934. To Make Stone Paper. As, in cleaning wood-work, particularly pine and other soft woods, one process is sometimes found to answer better than another, we may describe the manner of manufacturing a stone paper, which, in some cases, will be preferred to sand paper, as it produces a good face, and is less liable to scratch the work. Having prepared the paper as described in the last receipt, take a quantity of powdered pumice stone, and sift it over the paper through a sieve of moderate fineness. When the surface has hardened, repeat the process till a tolerably thick coat has been formed upon the paper, which, when dry, will be fit for use.

1935. To Make Emery Paper or Cloth. This is prepared in precisely the same manner as glass paper (*see No.* 1933), using emery instead of glass.

1936. Phenyl Paper. This article would be useful for packing meat and other substances liable to decay. (*See No.* 1614.) It can be prepared by fusing 5 parts stearic acid at a gentle heat, mixing well with 2 parts carbolic acid and 5 parts melted paraffine, and stirring until the whole has become solid, and applying it to paper in the same manner as waxed paper is made. (*See No.* 1938.)

1937. Solvent for Silk, Paper, &c. The ammonia-oxide of copper is a solvent for silk, paper, and the cellular tissue of plants. If its action be limited to a few moments it converts the surfaces into a gelatinous mass.

1938. To Make Waxed Paper. Take cartridge or other paper, place it on a hot iron and rub it with bees' wax, or make a solution of the wax in turpentine, and apply it with a brush. It is generally prepared on a large scale by taking a quire of paper and opening it flat upon a table, and then going over it quickly with a very hot smoothing-iron, against which is held a piece of wax, which, melting, runs down upon the paper and is absorbed by it. A little practice will soon determine the amount of wax that should be melted off from time to time. When the upper sheet is saturated it is taken off, and the one below is treated in a similar manner. Any excess of wax applied in the first instance readily penetrates through to the lower layers. Useful for making water or air-proof pipes, for chemical experiments, also for tying up the necks of bottles, covering preserve jars, and for enveloping tobacco and other substances that require to be kept from the air, replacing generally tin-foil and similar substances.

1939. To Make Oiled Paper. Brush sheets of paper over with boiled oil, in which dissolve a little shellac carefully over a slow fire, and suspend them on a line until dry. Waterproof. Employed to tie over pots and jars, and to wrap up paste blacking, &c.

1940. Oiled Paper as a Substitute for Oiled Silk. Boiled linseed oil is reboiled with litharge, acetate of lead, sulphate of zinc, and burnt umber, an ounce of each to a gallon. The sheet of paper being laid on a square board, it is well covered with this mixture. The first sheet is covered on both sides; the second, placed on this, receives one coating; and so on to 20 or 50. Separate and hang up to dry.

1941. To Make Paper Fire and Waterproof. Take 26 ounces alum, and 4 ounces white soap, and dissolve them in a quart of water; into another vessel dissolve 2 ounces gum-arabic and 1 ounce glue, in the same quantity of water as the former, and add the two solutions together, which is now to be kept warm, and the paper intended to be made waterproof dipped into it, passed between rollers, and dried; or, without the use of rollers, the paper may be suspended until it has perfectly dripped, and then dried. The alum, soap, glue, and gum, form a kind of artificial leather, which protects the surface of the paper from the action of water, and also renders it somewhat fireproof. A second immersion makes it still better.

1942. To Make Fireproof Paper. Take a solution of alum and dip the paper into it, then throw it over a line to dry. This is suitable to all sorts of paper, whether plain or colored, as well as textile fabrics. Try a slip of the paper in the flame of a candle, and if not sufficiently prepared, dip and try it a second time.

1943. To Make Fireproof Paper. Newspapers may be rendered fireproof by dipping into a solution of soluble glass of 25° Baumé; next neutralizing the alkali by diluted muriatic acid of 10° Baumé while hot, and drying by the atmosphere. Fire cannot then destroy the texture of the paper.

1944. To Make Paper Waterproof. Melt in 10 pints hot water, 30 ounces glue, gelatine or size, and 3 ounces gum-arabic. In another 30 pints hot water, melt 20 ounces soap and 4 pounds alum; mix both liquids together in one pot. This constitutes composition No. 1. In another pot heat ½ gallon benzole and 1 gallon paraffine, and melt in it 24 ounces resin; let it boil until it attains a moderate degree of consistency. To these materials, resin, oil, and copal or mastic varnish may, in some cases, be added. This is composition No. 2. First dip the article to be waterproof into the composition No. 1 in a heated state, and then dry it. Next apply composition No. 2, in a cooled state, with a brush, or in any other convenient manner.

1945. Papier-Maché. A plastic material, formed of cuttings of white or brown paper, boiled in water, beaten to a paste in a mortar, and then mixed with a solution of gum-arabic in size, to give tenacity. It is variously manufactured by being pressed into oiled moulds, afterwards dried, covered with a mixture of size and lamp-black, or otherwise ornamented, and varnished.

1946. To Detect the Presence of Plaster in Paper. Calcine the paper in a close vessel, and dilute the residue with vinegar, in a silver spoon; if sulphuretted hydrogen is disengaged, which blackens the spoon, the presence of a sulphate (plaster) will be shown. This adulteration has lately become very common among the paper-makers, with the view of increasing the weight.

1947. To Detect Woody Fibre in Paper. The paper is touched with ordinary strong nitric acid. If wood fibre is present the paper will be colored brown, especially on warming.

1948. Magic Copying Paper. To make black paper, take lamp-black mixed with cold lard. Red paper—Venetian red mixed with lard. Blue paper—Prussian blue mixed with lard. Green paper—chrome green mixed with lard. The above ingredients to be mixed to the consistency of thick paste, and applied to the paper with a rag. Then take a flannel rag, and rub until all the color ceases coming off. These sheets, alternated with writing paper and written on with a solid pen, produce 2 or 3 copies of a letter at once.

1949. Manifold Copying Process. This is a method patented by Mr. Underwood, of London, for taking copies of writing by pressure; by this means as many as twenty copies or more of a letter or other writing can be obtained.

The copying paper is prepared by being wetted with a solution of 200 grains of the yellow or neutral chromate of potash in 1 gallon of distilled water. This paper can be used immediately, or may be dried, and damped with water when required for use. The copying ink to be used for the original writing must be made by dissolving (in a water-bath) about 6 pounds pure extract of logwood in 1 gallon distilled water.

Damp 6 sheets of the prepared paper, and remove all superfluous moisture with good blotting paper, place the original writing on the upper sheet, and put in the copying-press for about half a minute; then remove the original and substitute in its place 6 more damp sheets of the paper, and press for a quarter of an hour. Then take the original again and lay it on the top of 5 more damped sheets of the paper, and press for about two minutes; finally remove the original, and in its place put 3 more sheets of the paper, then press for a quarter of an hour. This process will give twenty copies. If more than twenty copies are to be made, the writing of the original should, before the ink is quite dry, be dusted over with a powder composed of 5 parts extract of logwood, 1 part powdered gum-arabic, and 1 part powdered gum-tragacanth.

1950. Process for Copying Very Old Writings. Niepce St. Victor gives a new process for copying very old writings. Ordinary copying paper is used, but is wetted with a thin solution of glucose or honey instead of water. On coming out of the press the paper is exposed to strong ammonia, which brings out very clearly lines otherwise almost illegible.

1951. To Prepare Paper for Varnishing. To prevent the absorption of varnish, and injury to any color or design on the paper, it is necessary to first give it 2 or 3 coats of size. The best size for white or delicate colors is made by dissolving a little isinglass in boiling water, or by boiling some clean parchment cuttings until they form a clear solution; then strain through a piece of clean muslin. It may be applied with a clean soft paint-brush, the first coat, especially, very lightly. The best brush for this purpose is the kind used by varnishers for giving the finishing *flow* coats of varnish, wide, flat and soft; or, where there is much danger of injuring a design, and the paper article will allow of it, it is a good plan for the first coat, to pour the solution into a wide, flat dish, and pass the paper through it once, and back again, and then hang it up to dry. For less delicate purposes, a little light-colored glue, soaked over night in enough water to cover it, and then dissolved by heat, adding hot water enough to dilute it sufficiently, will make an excellent sizing.

1952. To Size Paper. The paper must be passed or steeped in a mixture of glue and alum water. For transparent or semi-transparent paper, a mixture of starch, or dextrine and alum.

1953. Albuminous Size. Beat up the white of an egg with twice its bulk of cold water, until well incorporated. Used as a varnish for leather binding and kid gloves; also to size drawing paper.

1954. Pounce. Powdered gum sandarac generally passes under this name; it is used to prepare parchment for writing on, and to prevent ink from spreading on paper after erasure. Powdered cuttle-fish bone is occasionally used in the same way. Packers rub the surface of porous and greasy wood with a pounce consisting of whiting or powdered resin, to make it bear the ink. The colored powders (usually ultramarine) used by pattern drawers, for sprinkling over pricked papers, are also called pounce.

1955. Lithographic Paper. In order to prevent the ink tracings or design from adhering to and sinking into the paper, which would render a perfect transfer to the stone impossible, the surface of the paper requires proper preparation.

1956. To Prepare Lithographic Paper. Lay on the paper 3 successive coats of sheep-foot jelly, 1 layer of cold white starch, and 1 layer of gamboge. The first layer is applied with a sponge dipped in a hot solution of the jelly, thinly, but very evenly, over the whole surface; the next 2 coats are laid on in succession, each previous coat being first allowed to dry. The layer of starch, and then the coat of gamboge, are each applied with a sponge in the same way as the jelly. When the paper is dry it must be smoothed by passing it through the lithographic press; the smoother it becomes, the better. The transfer of traces from the gamboge surface of paper thus prepared is perfect.

The gamboge must be dissolved the same day it is used, as it becomes oily by standing. The starch should be a day old, and the skin removed from its surface.

1957. Lithographic Paper. Take rather strong, unsized paper, and cover it with a varnish composed of 120 parts starch, 40 parts gum-arabic and 20 parts alum. Make a moderate paste of the starch by boiling, dissolve the gum and alum separately, and then mix all together. When well mixed, apply hot with a flat, smooth brush, to the leaves of paper. Then dry and smooth by passing under the scraper of the lithographic press.

1958. Bernard and Delarne's Lithographic Crayons. Melt 4 parts pure white wax over a slow fire; stir in by degrees 2 parts gum lac, broken into small pieces; next mix in 2 parts dried soap (made of tallow and soda), reduced to fine shavings; then stir in 1 part oil copal varnish into which 1 part lampblack has been previously ground. Continue to heat and stir until the paste has acquired a proper consistence, which can be ascertained by forming a crayon with it in a mould, and allowing it to become cold. The mould should be first wiped with a greased rag.

Lasteyrie adopts a somewhat different formula for his crayons: Dried white tallow soap, 6 parts; white wax, 6 parts; lampblack, 1 part. The soap and tallow are to be put into a small goblet and covered up. When the whole is thoroughly fused by heat, and no clots remain, the black is gradually sprinkled in with careful stirring.

1959. Rouget's Method of Preserving Pencil Drawings. This invention consists in fixing drawings, tracings, or sketches, by directly projecting on these latter any suitable adhesive liquid reduced to a fine spray, or in what is commonly called the atomized or pulverized state, by causing the liquid to pass rapidly under pressure through one or more capillary tubes or openings. By this method the defects of the transudation process are entirely done away with, besides which the operation is executed in less time, and may be performed at once by the artist without the slightest difficulty. For the fixing liquid, any colorless, or nearly colorless liquid, which allows of being atomized, and which, after becoming dry, causes the particles of the charcoal, or other drawing materials made use of, to adhere sufficiently firmly to the paper or other drawing surface, may serve for the purpose. Thus, for instance, a liquid which has given the most satisfactory results is obtained by adding to a solution of 3 ounces white sugar candy and 2 ounces white shellac, in about 2 pints spirits of wine, a decoction of about 1 ounce fucus crispus (Irish moss) in 1 pint distilled water.

1960. To Fix Pencil or Chalk Drawings. Lay the drawing on its face, stretch it tightly on a board with drawing pins, and give the back 2 or 3 coats of a solution of 5 parts isinglass, or gum-arabic, in 12 parts water, using a varnisher's flow brush, and allowing each coat to dry before laying on the next. When dry, turn the drawing over, face upwards, and give it 1 or 2 coats in the same manner. This will usually be sufficient to fix the drawing, but the addition of 1 or 2 coats of a solution of 4 parts Canada balsam, in 5 parts turpentine, will afford still further protection.

1961. To Fix Pencil or Crayon Drawings. A convenient method of fixing pencil or crayon drawings consists in moistening the back of the sheet with a solution of bleached shellac in alcohol, care being taken not to have the solution either too concentrated or too thin, but such as will flow readily on the paper, making it transparent when moist, and leaving no spots behind on evaporation. In this way the drawings will become permanently fixed, and may afterward be painted in water-colors so as to produce a very excellent effect.

1962. To Fix Pencil Drawings. A simple method, and sufficient for general purposes, is to put into a large flat dish, a mixture of equal parts milk and water. The back of the drawing should be floated over the surface of the milk and water once or twice, according to the thickness of the paper, sufficient to wet it through, but not enough to allow any of the liquid to run on the surface of the drawing. Pin it on a line to dry. Some prefer using pure milk.

1963. To Take Creases out of Drawing Paper or Engravings. Lay the paper or engraving, face downwards, on a sheet of smooth, unsized white paper; cover it with another sheet of the same, very slightly damped, and iron with a moderately warm flat iron.

1964. To Make Parchment Transparent. Soak a thin skin of parchment in a strong lye of wood ashes, often wringing it out till you find it becomes transparent; then strain it on a frame, and let it dry. This will be much improved if, after it is dry, it receives a coat, on both sides, of clear mastic varnish, diluted with spirits of turpentine.

1965. To Make Artificial Parchment. De la Rue's patent. Strong unsized paper is immersed for a few seconds in oil of vitriol, diluted with half its volume of water. It is then washed in pure water or weak ammonia water. It strongly resembles animal parchment, and is used for the same purposes. The acid solution must be exactly of the strength indicated, and not warmer than the surrounding atmosphere.

1966. To Paste Parchment Paper. Thick, smooth paper does not generally hold long when pasted together or on wood. This difficulty is easily overcome. If the surface of that part of the paper which is to be joined be first moistened with alcohol or brandy, and the glue or paste then be applied, the union will be perfect. A piece of very thin paper inserted between the surfaces of the parchment paper will also make a firm joint. Glue or paste should be used, as gum-arabic will not answer.

1967. New Method of Making Parchment Paper. An improved method of preparing this substance, consists in using the commercial oil of vitriol in an undiluted state.

The paper is first passed through a solution of alum, and thoroughly dried, previous to its immersion, thus preventing any undue action of the corrosive principle of the vitriol. After the application of the acid, the paper is passed into a vat of water, and then through an alkaline bath, to be again washed. Written and printed paper may undergo this improved process without materially affecting the clearness and distinctness of the letters, and the paper retains all its qualities, even after being wetted several times in succession, while paper prepared in the usual manner loses, to a great extent, its pliancy, and becomes hard and stiff.

1968. Papyrine. Dip white unsized paper for ½ a minute in strong sulphuric acid, and afterwards in water containing a little ammonia. When dried it has the toughness and appearance of parchment.

1969. To Color Parchment. The only color given to parchment is green. Boil 8 parts cream of tartar and 30 parts crystallized verdigris, in 500 parts water; when this solution is cold, pour into it 4 parts nitric acid. Moisten the parchment with a brush, and then apply the above liquid evenly over its surface. The necessary surface finish is given with white of eggs, or mucilage of gum-arabic.

1970. Composition for Drawing Crayons. Take 6 parts shellac, 4 parts spirit of wine, 2 parts turpentine, 12 parts of coloring powder, such as Prussian blue, orpiment, white lead, vermilion, &c., and 12 parts clay. The clay must be thoroughly washed, passed through a hair sieve and dried; it is then well incorporated by trituration with the shellac (previously dissolved in the spirits of wine), the turpentine and the coloring pigment. The doughy mass is pressed in proper moulds so as to acquire the desired shape, and then dried by stove heat.

1971. Charcoal Crayons. Saw the finest-grained, softest, and blackest pieces of charcoal, into slips of the size required, put them into a pipkin of melted wax, and allow them to macerate over a slow fire for half an hour, then take them out and lay them on blotting-paper to dry. The above process may also be employed for red and black chalk. Drawings made with these crayons are very permanent, and if warmed slightly on the wrong side, the lines will adhere and become as durable as ink. These crayons may also be made by simply shaping the charcoal with a knife. Willow charcoal should be used for this purpose.

1972. To Clean Engravings. Secure the engraving with drawing pins on a smooth board, and cover it thinly with common salt, finely powdered; pour and squeeze lemon juice upon this salt, so as to dissolve a considerable portion of it. Now elevate one end of the board, that it may form an angle of about 45° with the horizon. Pour lastly on the engraving boiling water from a tea-kettle, until the salt and lemon juice be all washed off; the engraving will then appear perfectly clean, and free from stains. It must be dried gradually, on the same board, or on some smooth surface. (*See Nos.* 411, *&c.*)

1973. To Clean Printed Paper and Picture Prints. Septimus Piesse gives the following receipt for that purpose: Fasten the paper to a board with button drawing pins, then wash it with water in which is dissolved an ounce of carbonate of ammonia to every pint of water. This do with care, employing a camel's-hair brush for the purpose. Then rinse the paper well with plenty of fresh water. When dry, repeat the same process for the reverse side of the paper. Now wet the paper with water made sour with white vinegar. Finally wet the paper with water containing a little bleaching powder, and again rinse with clean water; then dry it by exposure to air and sunshine. It will become white, excepting where printed. To stiffen the print give it a coat of parchment size. Most valuable prints have been thus restored.

1974. To Transfer Engravings to Paper. Place the engraving a few seconds over the vapor of iodine. Dip a slip of white paper in a weak solution of starch, and, when dry, in a weak solution of oil of vitriol. When again dry, lay a slip upon the engraving, and place both for a few minutes under a press. The engraving will be reproduced in all its delicacy and finish.

1975. To Print Engravings on Plaster. Cover the engraved plate with ink, and polish its surface in the usual way; then put a wall of paper round it, and, when completed, pour in some finely-powdered plaster of Paris mixed in water; jerk the plate repeatedly, to allow the air bubbles to fly upwards, and let it stand 1 hour; then take the cast off the plate, and a very perfect impression will be the result.

1976. Hydrographic Paper. This is a name given to paper so prepared, that, when written upon with water, or some other colorless fluid, instead of ink, the characters will become visible.

1977. To Write Black Characters with Water. Thoroughly dry and reduce to a very fine powder a mixture of 4 parts nut-galls, and 1 part calcined sulphate of iron; rub it over the surface of the paper, then forcing it into the pores by powerful pressure; brush off the loose portion, and a pen dipped in water will write black.

1978. To Write Blue Characters with Water. Prepare the paper with a mixture of sesquisulphate of iron and ferrocyanide of potassium, by the same method as the last receipt. Write with water as before, and the characters will appear blue.

1979. To Produce Brown Writing with Water. Instead of the sulphate of iron in the last receipt, use sulphate of copper; and characters written with water will be reddish-brown.

1980. To Write Blue with a Colorless Fluid. Wet the paper with a solution of ferrocyanide of potassium, and dry it again; write on it with a pen dipped in a solution of sesquisulphate of iron, and the writing will be blue.

Ivory, Alabaster, &c.

The following receipts relate to the manipulation of ivory, bone, alabaster, meerschaum, horn, tortoise-shell, pearl, and marble.

1982. To Color or Dye Ivory or Bone. With regard to dyeing ivory, it may in general be observed, that the colors penetrate better before the surface is polished than afterwards. Should any dark spots appear, they may be cleared up by rubbing them with chalk; after which the ivory should be dyed once more, to produce a perfect uniformity of shade. On taking it out of the boiling hot dye bath, it should be plunged immediately into cold water, to prevent the chance of fissures being caused by the heat. Ivory may be dyed by any of the ordinary methods employed for woolens, after being freed from dirt and grease; but more quickly as follows:

1983. To Dye Ivory Black. The ivory, being well washed in an alkaline lye, is steeped in a *weak neutral solution* of nitrate of silver, and then exposed to the light, or dried and dipped into a *weak* solution of hydrosulphuret of ammonia.

1984. To Dye Ivory Deep Black. A still finer and deeper black may be obtained by boiling the ivory for some time in a strained decoction of logwood, and then steeping it in a solution of red sulphate, or red acetate of iron.

1985. To Dye Ivory Red. Make an infusion of cochineal in water of ammonia, then immerse the pieces therein, having previously soaked them for a few minutes in water *very slightly acidulated* with aquafortis.

1986. Fine Red Dye for Ivory. A beautiful red color may be imparted to ivory thus: Take 4 parts, by weight, picric acid, and dissolve in 250 parts boiling water; add, after cooling, 8 parts liquid ammonia. Dissolve also 2 parts crystallized fuchsine (magenta) in 45 parts alcohol, dilute with 375 parts hot water, and next add 50 parts ammonia. As soon as the red color of the magenta solution has disappeared, the two solutions are mixed together. Ivory and bone should be placed in very weak nitric or hydrochloric acids before being immersed in the ammoniacal liquid; wood cannot be dyed by this liquid unless it has been previously painted over with paste made from flour. When to the ammoniacal liquid some gelatine solution be added, it may serve as a red ink which does not attack steel pens. By varying the proportions of the magenta and picric acid, the tints obtained may be varied from a bluish red to a bright orange-red. The colors do not appear until the ammonia is evaporated.

1987. To Dye Ivory Blue. Steep it in a weak solution of sulphate of indigo which has been nearly neutralized with salt of tartar; or in a solution of Prussian blue. A still better plan is to steep in the dyer's green indigo vat; or, insert the ivory for 15 to 20 minutes in diluted muriatic acid (¼ ounce of acid for 1 pound of water, having the taste of a good vinegar), and from this acidulated water transfer the ivory into a more or less concentrated solution of indigo-carmine (soluble indigo), and keep it in that solution until the ivory has assumed a uniform blue color; then dry and polish.

1988. To Dye Ivory Purple. Steep in a weak *neutral* solution of terchloride of gold, and then expose it to the light. Or, soak the ivory in a solution of sal ammoniac into 4 times its weight of nitrous acid.

1989. To Dye Ivory Green. Dissolve verdigris in vinegar, and steep the pieces therein for a short time, observing to use a glass or stoneware vessel; or in a solution of verdigris, 2 parts, and sal ammoniac, 1 part, in soft water; or, dye the ivory blue by the third receipt for that purpose, and then insert in a solution of picric acid, as prescribed for the dark lemon color. (*See No.* 1991.)

1990. To Dye Ivory Yellow. Steep the ivory in a bath of neutral chromate of potash, and afterwards in a boiling solution of acetate of lead.

Or: Steep the pieces for 24 hours in a solution of sugar of lead, then take them out, and when dry, immerse them in a solution of chromate of potassa.

Or: Dissolve as much of the best orpiment in water of ammonia or hartshorn as it will take up, then steep the pieces therein for some hours; lastly, take them out and dry them, when they will turn yellow.

1991. To Dye Ivory Dark Lemon. Dissolve ½ ounce picric acid in ½ ounce boiling water. Dilute ½ ounce strong sulphuric acid with ½ ounce hot water, by pouring the acid gradually into the water. Insert the ivory in the acidulated water, turn it around repeatedly, in order to admit the acid to all parts, remove the ivory from the fluid and dry it. Then insert the dried ivory in the boiling solution of picric acid, turn it also around, and leave it in the solution until all parts appear of a uniform yellow color. Then remove it from the solution of picric acid, dry, and polish the ivory with soap water and finely levigated chalk. After the polishing the ivory possesses a permanent dark lemon-yellow color.

1992. To Dye Ivory Violet. Dye red, and afterwards blue; or place the ivory in a highly diluted solution of tin, and boil in the logwood bath.

1993. Aniline Dyes for Ivory. Any of these colors give a fine and permanent color to ivory by immersion.

1994. To Make Ivory Flexible. Ivory is rendered flexible by immersion in a solution of pure phosphoric acid (specific gravity 1.13) until it loses, or partially loses its opacity, when it is washed in clean cold water, and dried. In this state it is as flexible as leather, but gradually hardens by exposure to dry air. Immersion in hot water, however, restores its softness and pliancy. The following method may also be employed: Put the ivory to soak in 3 ounces nitric acid mixed with 15 ounces water. In 3 or 4 days the ivory will be soft.

1995. To Dye Ivory when Softened. If it is desired to dye ivory when thus softened, dissolve, in spirits of wine, such color as may be desired to use. When the spirits of wine is sufficiently tinged with the color, plunge in the ivory, and leave it there till it is dyed to suit.

1996. To Harden Ivory. To harden ivory after it has been softened, wrap it up in a sheet of white paper, cover it with dry, decrepitated salt, and lay it by for 24 hours, when it will be restored to its original hardness.

1997. To Bleach Ivory. Ivory is whitened or bleached by rubbing it with finely powdered pumice-stone and water, and exposing it to the sun whilst still moist, under a glass shade, to prevent desiccation and the occurrence of cracks; observing to repeat the process until a proper effect is produced. Ivory may also be bleached by immersion for a short time in water holding a *little* sulphurous acid, chloride of lime, or chlorine in solution; or by exposure to the fumes of burning sulphur, largely diluted with air. In many cases where, as in piano keys, the ivory cannot be removed, the polishing process will be found partially successful.

1998. To Restore Yellow Ivory to its Original Whiteness. A thin lime-paste is prepared in a pot and heated over a stove; the ivory is placed in this and left until white, when it is taken out, dried, and polished.

1999. To Bleach Articles made of Ivory. This process is recommended by Dr. J. Artus. The objects made of this substance are first placed into a solution containing 11¼ ounces carbonate of soda in crystals, and 45¼ ounces water. After having been left in this fluid for 2 days, the ivory objects are well washed in pure water, and then immersed into a solution composed of 17 ounces sulphite of soda, and 45¼ ounces water, and kept therein for 5 or 6 days, after which time there is added to the liquid, yet containing the ivory objects, 1 ounce hydrochloric acid diluted with 5¼ ounces water. After the acid has been added, the vessel (glass or porcelain) containing the liquid and ivory should be covered and left standing for from 24 to 36 hours, after which time the ivory is taken out, washed in clean water, and dried. The quantities of ingredients herein specified suffice for 22¼ ounces of ivory.

2000. To Polish Ivory. If ivory be polished with putty-powder and water, by means of a rubber made of hat, it will in a short time produce a fine gloss. Or, set the ivory in the turner's wheel, and, after having worked it, take some rushes and pumice-stone, mix a subtle powder with water, and rub till it becomes perfectly smooth; then heat it by turning it over a piece of linen or sheepskin, and when hot rub it with a little whitening diluted with olive oil; then rub it with a little dry whitening alone, and finally with a piece of soft white rag, and the ivory will look remarkably white.

2001. Fluid for Marking Ivory. Take nitrate of silver, 2 parts; nitric acid, 1 part; water, 7 parts; mix.

2002. Etching Fluid for Ivory. Take of diluted sulphuric acid and diluted muriatic acid, equal parts. Mix.

2003. Etching Varnish for Ivory. White wax, 2 parts; tears of mastic, 2 parts. Mix.

2004. To Etch on Ivory. Cover the ivory to be etched with a thin coating of bees' wax, then trace the figure you desire to present through the wax. Pour over it a strong solution of nitrate of silver. Let it remain a sufficient length of time, then remove it, with the wax, by washing in warm water. The design will be left in dark lines on the ivory.

2005. To Gild Ivory. Immerse it in a solution of nitro-muriate of gold, and then, while yet damp, expose it to hydrogen gas. Wash it afterwards in clean water. Another plan of gilding ivory is by immersing it in a fresh solution of protosulphate of iron, and afterwards in a solution of chloride of gold.

2006. To Silver Ivory. Immerse the ivory in a weak solution of nitrate of silver, and let it remain till the solution has given it a deep yellow color; then take it out and immerse it in clear water, and expose it in the water to the rays of the sun. In about 3 hours the ivory acquires a black color; but the black surface, on being rubbed, soon becomes changed to a brilliant silver.

2007. To Clean Ivory Ornaments. When ivory ornaments get yellow or dusky-looking, wash them well in soap and water with a small brush, to clean the carvings, and place them, while wet, in full sunshine; wet them for 2 or 3 days, several times a day, with soapy water, still keeping them in the sun; then wash them again, and they will be beautifully white.

2008. Bone for Ornamental Purposes is treated in a similar way to ivory, but less carefully, owing to its inferior value. The bones of living animals may be dyed by mixing madder with their food. The bones of young pigeons may thus be tinged of a rose color in 24 hours, and of a deep scarlet in 3 or 4 days; but the bones of adult animals take fully 2 weeks to acquire a rose color. The bones nearest the heart become tinged soonest. In the same way logwood and the extract of logwood will tinge the bones of young pigeons purple.

2009. Ivory Size or Jelly. The dust or shavings (ivory dust, ivory shavings) of the turner, form a beautiful size or jelly when boiled in water.

2010. Artificial Ivory for Photography. Tablets for photography are made by mingling finely pulverized sulphate of baryta or heavy spar with gelatine or albumen, compressing the product into sheets and drying it.

2011. Artificial Ivory. The process by which the most successful imitation of natural ivory is obtained appears to consist in dissolving either india-rubber or gutta-percha in chloroform, passing chlorine through the solution until it has acquired a light yellow tint, next washing well with alcohol, then adding, in fine powder, either sulphate of baryta, sulphate of lime, sulphate of lead, alumina, or chalk, in quantity proportioned to the desired density and tint, kneading well, and finally subjecting to heavy pressure. A very tough product, capable of taking a very high polish, is obtainable in this way.

2012. Horn. For practical purposes, the horns of the goat and sheep are preferred for their whiteness and transparency.

2013. To Dye Horn. Horn is dyed with the same dyes, and in the same manner, as ivory. (*See Nos. 1982, &c.*)

2014. To Prepare Horn. Horn is softened by sawing it into plates or sheets, and then exposing it to powerful pressure between hot iron plates. Before pressing, the pith has to be removed, and the texture softened, first by soaking for some days, and then boiling in water.

2015. To Unite Horn. The surfaces and edges of pieces of horn may be united or cemented together by softening by the heat of boiling water, then placing the parts in contact under strong pressure in a vise, and again exposing to the heat of boiling water.

2016. To Dye or Stain Horn Tortoise-shell Color. The horn to be dyed must be first pressed into proper plates, scales, or other flat form, and the following mixture prepared: Take of quicklime 2 parts, and litharge 1 part; temper them together to the consistence of a soft paste, with soap lye. Put this paste over all the parts of the horn, except such as are proper to be left transparent, in order to give it a near resemblance to the tortoise-shell. The horn must remain in this manner covered with the paste till it is thoroughly dry; when, the paste being brushed off, the horn will be found partly opaque and partly transparent, in the manner of tortoise-shell, and, when put over a foil of Dutch gold metal, will be scarcely distinguishable from it. It requires some degree of fancy and judgment to dispose of the paste in such a manner as to form a variety of transparent parts, of different magnitudes and figures, to look like the effect of nature; and it will be an improvement to add semi-transparent parts, which may be done by mixing whiting with some of the paste, to weaken its operation in particular places, by which spots of a reddish-brown will be produced, which, if properly interspersed, especially on the edges of the dark parts, will greatly increase the beauty of the work, and its similitude to real tortoise-shell.

2017. To Stain Horn in Imitation of Tortoise-shell. Mix an equal quantity of quicklime and red lead with strong soap lees, lay it on the horn with a small brush, in imitation of the mottle of tortoise-shell; when dry, repeat it two or three times.

2018. To Join or Weld Tortoise-shell or Horn. Provide a pair of pincers or tongs, constructed so as to reach 4 inches beyond the rivet; then have the tortoise-shell filed clean to a lap-joint, carefully observing that there is no grease about it; wet the joint with water, apply the pincers hot, following them with water, and the shell will be joined as if it were one piece. The heat must not be so great as to burn the shell, therefore try it first on a piece of white paper.

2019. To Polish Tortoise-Shell or Horn. Having scraped the work perfectly smooth and level, rub it with very fine sand-paper or Dutch rushes; repeat the rubbing with a bit of felt dipped in very finely powdered charcoal with water, and, lastly, with rotten-stone or putty-powder; and finish with a piece of soft wash-leather, damped with a little sweet oil; or, still better, rub it with sub-nitrate of bismuth by the palm of the hand.

2020. Alabaster. Oriental alabaster is a substance of a pure, semi-translucent whiteness, occasionally found variegated with undulating veins of yellow, red and brown. The common alabaster, usually met with in ornaments &c., is made of gypsum (plaster of Paris), and prepared so as to imitate the genuine. The following receipts are for the gypsum imitation, and not the real alabaster. By using any of the hardening processes, beautiful imitations of marble may be produced, but they require great care and skill.

2021. To Engrave or Etch on Imitation Alabaster. Cover every part of the surface, except those portions to be etched, with a solution of 1 part white wax in 4 parts oil of turpentine, thickening with a little finely powdered white lead; immerse the cast in water for from 20 to 50 hours, according to the effect desired. Then wash off the covering solution with oil of turpentine, and brush over carefully the etched parts with powdered gypsum (plaster of Paris). The etching is produced by the solvent action of the water on the gypsum.

2022. To Harden Alabaster. Expose the unpolished articles for from 12 to 24 hours to a heat about equal to that of a baker's oven; withdraw from the heat, and when considerably cooled, immerse them for from 2 to 5 minutes in pure river water. The operation may be repeated a second time, and 3 or 4 days are allowed to elapse before polishing them. A weak solution of alum in water may be substituted for the river water.

2023. To Dress Plaster of Paris with Wax in Imitation of Alabaster. Dip the cast or model, previously warmed, and suspended by a fine silken cord or wire into the purest white wax, melted in any suitable vessel. The operation should be repeated until the liquid wax begins to rest unabsorbed on the surface of the plaster, when the article must be placed aside (suspended) until the next day, when it may be polished with a clean brush. None but the hardest, purest, and whitest wax will do for the above purpose. That commonly sold is mixed with spermaceti, stearine, or tallow, and not unfrequently with Japanese wax and potato starch. (*See No.* 1582.)

2024. To Render Plaster Figures Durable. First thoroughly dry the plaster figure in a warm dry atmosphere; place it in a vessel and cover it with the clearest linseed oil, just warm. After 12 hours, take it out, drain, and let it dry in a place free from dust. When dry it will look like wax, and can be washed without injury.

2025. To Harden Plaster. Mix up the plaster of Paris with a weak solution of gum arabic (1 ounce to 1 pint of water); or, for common purposes, a weak solution of size. This not only renders the plaster harder, but gives the surface a pleasing smoothness.

2026. To Harden Imitation Alabaster with Alum. Suspend the article by a fine silken cord or wire in a strong and perfectly clear solution of alum, letting it remain until the alum crystallizes on the surface; then polish with a wet cloth.

2027. To Make Hard Plaster of Paris. Mix with weak alum water, instead of water, for casting; or, a solution of 1½ or 2 ounces of gum-arabic to the pint of water; or, for common purposes, a weak solution of size may be used.

2028. To Harden Plaster with Sulphate of Potassa. If equal parts of common calcined plaster of Paris and of sulphate of potassa be mixed together, they will harden in a moment with less than an equivalent weight of water; so much so, indeed, that the mixture cannot be poured out of the vessel. If, however, 1 part of each of the salts and 2 of water be used, they form a mass which cannot be poured out, and the surface of which will be found coated with a crust of sulphate of potash. The rapidity of hardening, therefore, can be made to vary with the percentage of water, the mass solidifying even if 6 parts of water be used.

2029. To Stain or Color Alabaster. This is effected by mixing with the water used for working the gypsum, any of the ordinary pigments or colored solutions that are not decomposed by contact with sulphate or carbonate of lime. A little sienna in very fine powder, or ground with water, imparts a good color for busts, medallions, &c. For rough and architectural purposes, the colors are commonly added to a solution of clear size, which is then made into a paste with plaster. In this manner colored stucco of great hardness and durability is produced. Objects formed from the solid alabaster may be stained in the same way, and with the same materials, as marble. (*See Nos.* 2036, *&c.*)

2030. To Polish Alabaster. The object, received in the rough state from the hands of the sculptor or turner, is rubbed with finely-powdered pumice-stone, or dried shave-grass (equisetum) and water, and afterwards with a paste formed of finely-powdered and sifted slacked lime and water. The rough polish thus produced is then brought up and finished off by friction with finely-powdered talc, or French chalk, until a satiny lustre is produced.

2031. To Prevent Expansion or Shrinkage in Casting Plaster. Use lime water instead of plain water to mix the plaster of Paris. ½ an ounce of sulphate of potassa dissolved in each quart of water will have the same effect, but weakens the plaster.

2032. To Make Artificial Marble for Paper Weights or other Fancy Articles. Soak plaster of Paris in a solution of alum; bake it in an oven, and then grind it to a powder. In using, mix it with water, and to produce the clouds and veins, stir in any dry color you wish; this will become very hard, and is susceptible of a high polish.

2033. To Polish Mother-of-Pearl. Go over it with pumice stone, finely powdered (first washed to separate the impurities and dirt), with which you may polish it very smooth; then apply putty powder as directed for ivory, and it will produce a fine gloss and a good color. (*See No.* 2000.)

2034. To Clean Alabaster. Soap well and wash with hot water. If stained, apply fuller's earth, pipe-clay, or whiting, for 3 or 4 hours, then wash off. If very dirty and stained, first wash with aquafortis diluted with water. Or: Take ground pumice stone of the finest quality, and mix it up with verjuice; let it stand for 2 hours, then dip in a sponge and rub the alabaster with it; wash with a linen cloth and fresh water, and dry with clean linen rags. Any kind of marble may be done in the same manner.

2035. To Polish Marble. With a piece of very fine sandstone, rub the slab backward and forward, using very fine sand and water, till the marble appears equally rough, and not in scratches; next use a finer stone and finer sand, till its surface appears equally gone over; then, with fine emery-powder and a piece of felt or old hat wrapped round a weight, rub it till all the marks left by the former process are worked out, and it appears with a comparative gloss on its surface. Afterward finish the polish with putty powder and fine clean rags. As soon as the face appears of a good gloss, do not put any more powder on the rags, but rub it well, and in a short time it will have a fine polish. Defects may also be brought up with tripoli, followed by putty powder; both being used along with water.

2036. To Dye or Stain Marble. Marble may be stained or dyed of various colors by applying their solutions to the stone made sufficiently hot to make the liquid just simmer on the surface. Success in the application of the colors requires considerable experience. By their skillful use a pleasing effect, both of color and grain, may be produced. The following are the substances usually employed for this purpose:

2037. Blue Stain for Marble. Tincture or solution of litmus, or an alkaline solution of indigo. (*See No.* 2036.)

2038. Brown Stain for Marble. Tincture of logwood. (*See No.* 2036.)

2039. Crimson Stain for Marble. A solution of alkanet root in oil of turpentine. (*See No.* 2036.)

2040. Flesh Color Stain for Marble. Wax tinged with alkanet root, and applied to the marble hot enough to melt it. (*See No.* 2036.)

2041. Gold Color Stain for Marble. A mixture of equal parts of white vitriol, sal ammoniac, and verdigris, all in fine powder, carefully applied. (*See No.* 2036.)

2042. Green Stain for Marble. An alkaline solution or tincture of sap green, or wax strongly colored with verdigris, or stain the stone first blue, and then yellow. (*See No.* 2036.)

2043. Red Stain for Marble. Tincture of dragon's blood, alkanet root, or cochineal. (*See No.* 2036.)

2044. Yellow Stain for Marble. Tincture of gamboge, turmeric, or saffron. (*See No.* 2036.)

2045. Acids Injurious to Marble. Marble being a carbonate of lime, and the two substances not having a very great affinity, care should be taken in the use of marble furniture and ornaments, as tables, mantels, statuary, etc. Acids of any kind will more or less affect marble, and they should not be allowed to touch it. The slabs on which acids are allowed to stand soon lose their polish, and are liable to a degree of disintegration which impairs their beauty. Fruits, sauces, vinegar, etc., should not be allowed to come in contact with a marble-topped table or shelf.

2046. To Polish Meerschaum. The dust of meerschaum is the best article for this purpose.

2047. Artificial Meerschaum. Artificial meerschaum may be made by immersing carbonate of magnesia in a warm solution of silicate of soda or potash for some time, or by precipitating from a solution of epsom salts by means of the silicates.

Boiler Incrustations.

In a lengthy article on the subject, which appeared in the "Scientific American," Professor Chandler gives the substances referred to in the four following receipts, as having been recommended by practical men, for the purpose of preventing incrustations in boilers:

2330. Wood Chips, Bark, &c., as a Preventive of Incrustation. Catechu, nut-galls, oak bark, shavings and sawdust, tan bark, tormentilla root, mahogany, logwood, etc. These substances all contain more or less tannic acid, associated with soluble extractive and coloring matters. When they are introduced into the boiler, the soluble constituents are dissolved by the water, and basic tannate of lime is formed, which separates as a loose deposit, and does not adhere to the sides of the boiler. It is preferable to use the aqueous extract, as sawdust, chips, etc., are liable to find their way into the cocks and tubes, although they act mechanically, receiving incrustations which would otherwise fasten themselves on the sides of the boiler. In selecting one of these substances, the principal object is to secure the largest quantity of tannic acid and soluble extractive matter for the lowest price. Some of these substances are said to be very effective, ¼ pound of catechu being sufficient for 100 cubic feet of water. From 2 to 6 pounds of oak chips have been recommended per horse power, or ½ bushel mahogany chips for every 10 horse power.

2331. Mucilaginous Substances as Preventives. Potatoes, starch, bran, linseed meal, gum, dextrine, Irish moss, slippery elm, marshmallow root, glue, etc. These substances form, sooner or later, a slimy liquid in the boiler, which prevents more or less completely the settling and hardening of the deposits. Some of them may even hold the lime and magnesia in solution. Potatoes have been used for many years, wherever steam engines are employed; half a peck or a peck are thrown into the boiler weekly. Linseed meal mixed with chopped straw was employed on a German railway, a peck at a time being introduced into each boiler. Some writers object to these organic substances, on the ground that they are liable to cause frothing.

2332. Saccharine Matter as Preventives. Sugar, molasses, corn or potato syrup. Both cane and grape sugar form soluble compounds with lime salts, and consequently prevent their separation as incrustations. One engineer found that 10 pounds of brown sugar protected his boiler for two months; another, that 6 pounds of corn starch syrup had a similar effect. Another used molasses with success, introducing a gallon at a time.

2333. Fatty Substances as Preventives. One writer used whale oil to prevent incrustations, 2 or 3 gallons at a time. Others smear the inside of the boiler with various mixtures of a fatty character. Stearine, mixed with wood ashes, charcoal and tar, has been recommended, or tallow, with soap and charcoal diluted with oil or tar, or tallow and graphite. This plan could not well be applied to a locomotive boiler with its numerous tubes, even though it should prove effective in cylinder boilers.

2334. Anti-Incrustation Powders, &c., for Boilers. Regarding incrustation powders in use, Professor Chandler makes the following suggestions and recommendations: Incrustation powders, bearing generally the names of their proprietors, are extensively advertised and sold; they are either worthless or are sold at such extravagant prices as to make their use extremely ill-advised. I have examined several of them. Those which are at all valuable consist of one or more of the substances already mentioned, and the only novel result of their use is the payment of many times the commercial value for a fair article. One which is put up in tin boxes, containing about one pound, at $2.50 each, contains carbonate of lime, 96.36 parts; carbonate of magnesia, 0.67 parts; and oxide of iron, 4.15 parts. It differs little from some of the incrustations in composition, and is of no value whatever. Another contains logwood, 75.00 parts; chloride of ammonia, 15.00 parts; chloride of barium, 19.00 parts. This is a very good article, but at the price for which it is sold it cannot be used in quantities sufficient to produce much effect. In fact, chloride of barium is too expensive to be used in this country at all.

2335. To Guard Against Incrustation in Boilers. Professor Chandler recommends the following precautions: The use of the purest waters that can be obtained, rain water wherever possible. Frequent use of the blow-off cock. That the boilers never be emptied while there is fire enough to harden the deposit. Frequent washing out. Experiments on the efficacy of zinc, lime-water, carbonate of soda, carbonate of baryta, chloride of ammonium, some substance containing tannic acid, linseed meal, and the electromagnetic inductor.

2336. Management of the Water to Prevent Boiler Incrustation. Blowing off. The frequent blowing off of small quantities of water, say a few gallons at a time, is undoubtedly one of the most effective and simple methods for removing sediments and preventing their hardening on the sides of the boiler. The water entering the boiler should be directed in such a way as to sweep the loose particles toward the blow-off cocks, that when these are open they may be carried out with the water. This blowing off should take place at least two or three times daily, perhaps much oftener.

2337. Incrustation in Boilers. The only effectual remedy is to blow out frequently. Blow out once a week at least ten per cent. of the water in the boilers. It should be done while the water is at rest, that is, before starting in the feed water. A practical engineer says: Our boilers were badly incrusted. We loosened the scale with chisels and kerosene oil, and after running them a year as above, they came out as clean and bright as could be.

2338. Scale in Boilers. A practical engineer recommends the following: Get some cow or ox feet, just as they are cut off in the slaughter house, put them in a wire net fine enough to detain the small bones from getting from the boiler into the blow-off pipe. Use 5 of the feet to a 6-horse power boiler, and no further trouble with scale in the boilers will be experienced. They must be replaced every two or three months, according to the quality of the water. They do not make the water foam.

Foils.

These are leaves of polished metal, put under stones or pastes, to heighten the effect. Foils were formerly made of copper, tinned copper, tin, and silvered copper, but the latter is used for superior work at the present day. There are two descriptions of foils employed, viz.: white, for diamonds and mock diamonds, and colored, for the colored gems. The latter are prepared by varnishing the former. By their judicious use the color of a stone may be often modified. Thus, by placing a yellow foil under a green stone that turns too much on the blue, or a red one turning too much on the crimson, the hues will be brightened. By the skillful use of the following varnishes, good imitations of the gems may be cheaply made from transparent white glass or paste, and when applied to foils set under colored pastes, (factitious gems), a superior effect may be produced. The colors must be reduced to the finest state possible by patient grinding, as without this precaution, transparent and beautiful shades cannot be formed. The palest and cleanest mastich, and lac dissolved in alcohol, and also the palest and quickest drying oil, should alone be employed, when these substances are ordered. In every case the colors must be laid on the foils with a broad soft brush, and the operation should be performed, if possible, at once, as no part should be crossed, or twice gone over while wet.

2448. White or Common Foil. This is made by coating a plate of copper with a layer of silver, and then rolling it into sheets in the flatting mill. The foil is then highly polished or varnished.

2449. Colored Foils. These are made by coloring the preceding foil, highly polished, with certain transparent solutions or varnishes. The following produce beautiful colored effects, when judiciously employed.

2450. Blue Foil. Prussian blue, ground with pale, quick-drying oil. Used to deepen the color of sapphires. It may be diluted

2451. Green Foil. Pale shellac, dissolved in alcohol (lacquer), and tinged green by dissolving verdigris or acetate of copper in it. Or: Sesquiferrocyanuret of iron and bichromate of potassa, of each ¼ ounce; grind them with a stone and muller to a fine powder, add gum mastich (clean and also in fine powder), 2 ounces; grind again, add a little pyroxilic spirit, and again grind until the mass becomes homogeneous and of a fine transparent green; the beauty increases with the length of the grinding. The predominance of the bichromate turns it on the yellowish green; that of the salt of iron, on the bluish green. For use it is to be thinned with pyroxilic spirit. This is used for emeralds. It may be brightened by adding a little yellow varnish.

2452. Yellow Foil. Various shades of yellow may be produced by tinging a weak alcoholic solution of shellac or mastich, by digesting turmeric, annotto, saffron, or socotrine aloes therein. The former is the brightest and most fit for topazes. Or: Digest hay saffron in 5 or 6 times its weight of boiling water, until the latter becomes sufficiently colored; filter, and add a little solution of gum or isinglass. When dry, a coating of spirit varnish should be applied.

2453. Red Foil. Carmine dissolved in spirits of hartshorn, or a weak solution of salt of tartar, and gum added as above.

2454. Garnet Foil. Dragon's blood dissolved in rectified spirit of wine. *(See No. 2449.)*

2455. Vinegar Garnet Foil. White foil *(see No. 2449)* varnished with orange lake finely tempered with shellac varnish.

2456. Amethyst Foil. Lake and Prussian blue, ground fine in pale drying oil.

2457. Eagle Marine Foil. Verdigris tempered in shellac varnish (alcoholic), with a little Prussian blue. With this varnish white foil. *(See No. 2449.)*

2458. Ruby Foil. Lake or carmine, ground in isinglass. Or: Lake ground in shellac varnish. Used when the color turns on the purple. Or: Bright lake ground in oil; used when the color turns on the scarlet or orange. Either of these are applied to white foil. (*See No.* 2449.)

2459. To Make an Imitation Diamond more Brilliant. Cover the inside of the socket in which the stone or paste is to be set with tin foil, by means of a little stiff gum or size; when dry, polish the surface, heat the socket, fill it with warm quicksilver, let it rest for 2 or 3 minutes, after which pour it out and gently fit in the stone; lastly, well close the work round the stone, to prevent the alloy being shaken out. Or: Coat the bottom of the stone with a film of real silver, by precipitating it from a solution of the nitrate in spirits of ammonia, by means of the oils of cassia and cloves. (*See* SILVERING GLASS.) Both these methods vastly increase the brilliancy both of real and factitious gems.

Preservation of Leather.

The extreme heat to which most men and women expose boots and shoes during winter deprives leather of its vitality, rendering it liable to break and crack. Patent leather particularly is often destroyed in this manner. When leather becomes so warm as to give off the smell of leather, it is singed. Next to the singeing caused by fire heat, is the heat and dampness caused by the covering of rubber. Close rubber shoes destroy the strength of leather. The practice of washing harness in warm water and with soap is very damaging. If a coat of oil is put on immediately after washing, the damage is repaired. No harness is ever so soiled that a damp sponge will not remove the dirt; but, even when the sponge is applied, it is always useful to add a slight coat of oil by the use of another sponge. All varnishes, and all blacking containing the properties of varnish should be avoided. Ignorant and indolent hostlers are apt to use such substances on their harness as will give the most immediate effect, and these, as a general thing, are most destructive to the leather.

3066. To Restore the Lustre of Leather. When harness loses its lustre and turns brown, which almost any leather will do after long exposure to the air, the harness should be given a new coat of grain black. Before using this grain black, the grain surface should be well washed with potash water until all the grease is killed, and after the application of the grain black, oil and tallow should be applied to the surface. This will not only fasten the color, but make the leather flexible. Harness which is grained can be cleaned with kerosene or spirits of turpentine.

3067. To Restore Softness to Leather. To restore the softness and pliancy of leather which has become hard by having been wet, apply neat's foot oil and rub it in. Castor oil is a good substitute for neat's foot oil for softening leather belts, boots and harness. But the best oil for harness, is 1 quart neat's foot oil, 4 ounces beef's tallow, and 3 table-spoonfuls lampblack; add 4 ounces bees' wax for use in summer weather.

3068. To Restore the Lustre of Morocco. The lustre of Morocco is restored by a varnishing with the white of an egg. Apply with a sponge.

3069. To Make Boots Waterproof. Beef tallow, 4 ounces; resin, 1 ounce; bees' wax, 1 ounce; melt together. Add, when cold, a quantity of neat's foot oil equal to the mass. Apply with a rag, warming the boots before a fire, to the soles as well as uppers, and rub in well with the hand. Two applications will make the boots thoroughly waterproof and still keep them soft. We, however, do not approve of such preparations, as the feet generally perspire more than any other portions of the body, and any waterproof preparations applied to boots prevent the perspiration from escaping, and keep the feet wet and cold. The New England fishermen preserve their boots waterproof by this method, which, it is said, has been in use among them above 100 years.

3070. To Make Boots Water-Tight. In a pint of best winter-strained lard oil, dissolve a piece of paraffine the size of a hickory nut, aiding the solution with a gentle heat, say 130° or 140° Fahr. The readiest way to get pure paraffine is to take a piece of paraffine candle. Rub this solution on your boots about once a month; they can be blacked in the meantime. If the oil should make the leather too stiff, decrease the proportion of paraffine, and vice versa. A gentleman who has tried this says:—I have used this for 8 years past, and boots have lasted me two winters, the uppers always remaining soft, and never cracking. I have tried bees' wax, resin, tar, etc., but never found any other preparation half so good.

3071. Sportsmen's Waterproof Composition for Boots. Dissolve by heat 1 ounce pure bottle India-rubber shavings in 1 quart neat's foot oil, and add 2 ounces tallow. This makes a fine waterproof composition for boots, and is recommended to sportsmen.

3072. Polish for Patent Leather Goods. Take ¼ pound molasses or sugar, 1 ounce gum-arabic, and 2 pounds ivory black; boil them well together, then let the vessel stand until quite cooled, and the contents are settled; after which, bottle off. This is an excellent reviver, and may be used as a blacking in the ordinary way, no brushes for polishing being required.

3073. Glycerine Composition for Leather. As is well known, glycerine has found extensive application in tanning, as it has been discovered that it adds materially to the elasticity and strength of the leather. Especially has it been found of great value in protecting leather bands of machinery from cracking and drying. The partially tanned leather is immersed for considerable time in a bath of glycerine, by which the pores are filled and such an elasticity and softness is imparted that objects manufactured from it are much less liable to break. In order to prepare a neutral gutta-percha composition with glycerine, take 3 to 4 pounds lampblack, ¼ pound burnt bones (burnt ivory), cover up in a suitable vessel with 5 pounds glycerine and 5 pounds common syrup, and stir well until the whole is intimately mixed and free from lumps. 4 or 5 ounces of gutta-percha, finely cut, are to be put into a kettle, and after melting must be mixed with 20 ounces of sweet oil and dissolved, and 2 ounces of stearine added. While still warm the gutta-percha solution must be incorporated with the syrup and lampblack, and after this is done, 10 ounces of Senegal gum dissolved in 1½ pounds of water is also added. In order to impart an agreeable odor to the mass a small quantity of rosemary or lavender oil may be introduced. In using, the glycerine gutta-percha paste must be diluted with 3 or 4 parts of water. It gives a fine lustre, and, as it contains no acid, it does not injure the leather, but makes it soft and elastic and adds very much to its durability.

3074. To Preserve and Clean Harness. In the first place, subject the harness to 1 or 2 coats (as the leather may need) of lampblack and castor oil, warmed sufficiently to make it penetrate the leather readily. Then make about 2 quarts of warm soap-suds, and with a sponge wash the harness. When dry, rub it over with a mixture of oil and tallow, equal parts, with sufficient lampblack to give it color; or, what is better, Prussian blue, which gives it a new and fresh look. This compound should be applied sparingly and well rubbed in, which can be quickly done and will leave a smooth and clean surface.

3075. Harness Polish. Take 2 ounces mutton suet, 6 ounces bees' wax, 6 ounces powdered sugar candy, 2 ounces soft soap, and 1 ounce indigo or lampblack. Dissolve the soap in ½ pint of water; then add the other ingredients; melt and mix together; add a gill of turpentine. Lay it on the harness with a sponge, and polish off with a brush.

3076. To Clean Leather. Uncolored leather may be cleaned by applying a solution of oxalic acid with a sponge. Dissolve in warm water.

3077. To Take Oil Out of Leather. Use strong (F. F. F. F.) aqua ammonia, which will take oil out without injury to the leather. It must be used 2 or 3 times in order to get it all out. First use it and let the leather stand until more comes out, and apply again. This is the only thing that will take it out and not hurt the leather.

3078. Dubbing for Leather. Mix 2 pounds black resin, 1 pound tallow with 1 gallon train oil.

3079. Jet for Harness and Boots. Dissolve 3 sticks of the best black sealing-wax in ½ pint spirits of wine; keep in a glass bottle, and shake well previous to use. Applied with a soft sponge. This gives the leather a fine black surface, which, however, is apt to crack more or less.

3080. Shoemakers' Black. A solution of green copperas (sulphate of iron) in about 12 times its weight in water. It is used to black leather which has been tanned with bark or other astringent matter, and to the edges of the soles etc., with a feather or brush.

3081. Harness Liquid Blacking. Dissolve by heat, 4 ounces glue or gelatine and 3 ounces gum arabic in ⅝ pint water; add 7 ounces molasses and 5 ounces ivory black in very fine powder; gently evaporate until of a proper consistence when cold, stirring all the time. Keep in corked bottles.

3082. Harness Waterproof Paste Blacking. Melt together 2 ounces mutton suet and 6 ounces bees' wax; add 6 ounces sugar candy, 2 ounces soft soap, 2½ ounces lampblack, and ½ ounce indigo in fine powder; when thoroughly mixed add ½ pint of oil of turpentine; put into pots or tins.

3083. Harness Waterproof Cake Blacking. Melt 1 pound bees' wax, 1 ounce Prussian blue ground in 2 ounces linseed oil, ½ pound ivory black, 3 ounces oil of turpentine and 1 ounce copal varnish; mix well together and form into cakes whilst warm.

3084. Harness Waterproof Blacking. Mix the same ingredients as in the last receipt, and while hot add 4 ounces soft soap and 6 ounces more oil of turpentine; put the paste into pots or tins. None of the above blackings will injure the leather.

3085. To Apply Harness Blacking. Spread a very little of the blacking evenly on the surface of the leather, and polish by gentle friction with a brush or an old handkerchief. Paste blacking is thinned with water.

Boot and Shoe Blacking.

The manipulations required for paste and liquid blacking are the same, the difference in the two being the quantity of liquid added. Thus, by diluting paste blacking with water or beer bottoms, it may be converted into liquid blacking of a similar quality, and, by using less fluid matter, the ingredients of liquid blacking will produce paste blacking. One thing must, however, be observed, and that is, that the ivory-black used for liquid blacking must be reduced to a much finer powder than for paste blacking, as, if this be not attended too, it will settle to the bottom, and be with difficulty diffused again through the liquid. For those persons who do not like the use of blacking containing oil of vitriol, the first of the forms given below, either for paste or liquid, may be adopted. The vitriol, however, greatly contributes to promote the shining properties of the blacking, and in small quantities is not so injurious to the leather as has been falsely represented, as it wholly unites itself to the lime of the phosphate contained in the ivory-black, and is thus partly neutralized. This is the reason why lampblack should never be employed for blacking, as it has no earthy base to absorb or neutralize the acid, which would then prove very hurtful to the leather. Oil of vitriol is now employed in the manufacture of all the most celebrated shining blackings. The addition of white of eggs, isinglass, gum-arabic, and similar articles to blacking, always proves injurious, as they tend to stiffen the leather and to make it crack.

3087. Liquid Blacking. Ivory-black, in fine powder, 1 pound; molasses, ¾ pound; sweet oil, 2 ounces; beer and vinegar, of each 1 pint. Rub together the first three until the oil be perfectly killed, then add the beer and vinegar.

3088. Fine Liquid Blacking. Ivory-black and molasses, of each 1 pound; sweet oil and oil of vitriol, of each ¼ pound. Mix the first three as before, then gradually add the vitriol, diluted with thrice its weight of water; mix well, and let it stand for 3 hours, when it may be reduced to a proper consistence with water or sour beer.

3089. Liquid Jet Blacking. Ivory-black and molasses, of each ½ pound; oil of vitriol, 1 ounce; sweet oil, 2 ounces; sour beer, 1 pint; finish as last receipt.

3090. Good Liquid Blacking. Ivory-black, 7 pounds; molasses, 6 pounds; sweet oil, 1 pound; oil of vitriol, ½ pound; sufficient water; finish as in No. 3088.

3091. Liquid Blacking. Ivory-black, 3 cwt.; crude molasses, 2 cwt.; linseed oil, 3 gallons; oil of vitriol, 20 pounds; sufficient water to finish as in No. 3088.

3092. Bryant and James' Patent Liquid Blacking. 18 ounces caoutchouc are to be dissolved in about 9 pounds hot rape oil. To this solution 60 pounds of fine ivory-black and 45 pounds molasses are to be added, along with 1 pound finely-ground gum-arabic, previously dissolved in 20 gallons vinegar. These mixed ingredients are to be finely triturated in a paint-mill till the mixture becomes perfectly smooth. To this varnish 12 pounds sulphuric acid are to be now added in small successive quantities, with powerful stirring for half an hour; at the end of which time 3 pounds of finely-ground gum-arabic are added; after which the stirring is repeated half an hour every day for 14 days longer, when the liquid blacking is ready for use.

3093. Paste Blacking. Molasses, 1 pound; ivory-black, 1½ pounds; sweet oil, 2 ounces; rub together as before (*see No.* 3088); then add a little lemon juice or strong vinegar.

3094. Brilliant Paste Blacking. Ivory-black, 2 pounds; molasses, 1 pound; olive oil and oil of vitriol, of each ¼ pound; sufficient water, as before.

3095. Fine Paste Blacking. Ivory-black, 28 pounds; molasses, 21 pounds; common oil, 1 quart; oil of vitriol, 3 pounds; sufficient water, as before.

3096. Fine Oil Paste Blacking. Ivory-black, 3 cwt.; common molasses, 2 cwt.; linseed oil and vinegar bottoms, of each 3 gallons; oil of vitriol, 28 pounds; sufficient water, mix as before.

3097. Oil Paste Blacking. Ivory-black, 2 pounds; molasses, 4 or 5 ounces; oil of vitriol, 2 ounces; tanners' oil, 5 ounces (if this cannot be obtained, then use 4 ounces best tallow); gum-arabic, 1 ounce. Mix the oil and vitriol together, and let it stand 24 hours; dissolve the gum in a cupful of warm water; then add 3 tablespoonfuls of best vinegar; heat it and mix with the oil, &c., and then add the ivory-black, molasses, and white of 2 eggs.

3098. Real Japan Paste Blacking. Take 3 ounces ivory-black, 2 ounces coarse sugar, 1 ounce sulphuric acid, 1 ounce muriatic acid, 1 lemon, 1 table-spoonful sweet oil, and 1 pint vinegar. First mix the ivory-black and sweet oil together, then the lemon and sugar, with a little vinegar to qualify the blacking; then add the sulphuric and muriatic acids, and mix them all well together. The sugar, oil, and vinegar, prevent the acids from injuring the leather, and add to the lustre of the blacking.

3099. Bryant and James' Patent Paste Blacking. In making the paste blacking, the patentees prescribe the same quantity of India-rubber oil, ivory-black, molasses, and gum-arabic as in their liquid blacking, the latter being dissolved in only 12 pounds vinegar. These ingredients are to be well mixed, and then ground together in a mill till they form a perfectly smooth paste. To this paste 12 pounds sulphuric acid are to be added in small quantities at a time, with powerful stirring, which is to be continued ½ hour after the last portion of the acid has been introduced. Ready for use in 7 days.

3100. New Blacking. The lustrous qualities of blacking are frequently derived from ingredients which are most deleterious and destructive to leather. Herr Artus publishes a new formula, and claims several advantages for it, to which we may add its cheapness and accessibility. 3 or 4 pounds vegetable black, 1½ pounds ivory-black, 5 pounds molasses, and 5 pounds glycerine, mixed thoroughly together. 6 ounces gutta-percha, cut in small pieces, are then melted, and when fluid, 20 ounces olive oil are added, and subsequently, 2 ounces stearine. The second mixture, while quite hot, is stirred into the first; and then a further addition of 10 ounces gum Senegal, dissolved in about 3 quarts water, is added. This compound is the stock; for use, it should be diluted with about 3 times its quantity of warm water.

3101. Day and Martin's Blacking. According to Mr. W. C. Day, the method of making the famous "Day and Martin's Blacking" is as follows: Bone-black in a state of powder, is mixed with sperm oil until the two are thoroughly incorporated. Sugar or molasses is then mixed with a small portion of vinegar and added to the mass. Oil of vitriol is next added, and when all effervescence has ceased, more vinegar is poured in until the mixture is of a proper consistency. This constitutes the liquid blacking of the above-named manufacturers.

Miscellaneous Receipts.

These consist mainly of such receipts as could not be properly included in any division of the work; embracing also a few additional general receipts, whose merits demanded their insertion, obtained too late for classification under their proper headings.

6168. To Prepare Skeleton Leaves. The object in view is to destroy what may be called the fleshy part of the leaf, as well as the skin, leaving only the ribs or veins. The most successful, and probably the simplest way to do this, is to soak the leaves in rain-water till they are decomposed. For this purpose, when the leaves are collected, they should be placed in an earthenware pan or a wooden tub, kept covered with rain-water, and allowed to stand in the sun. In about 2 weeks time they should be examined, and if found pulpy and decaying, will be ready for skeletonizing, for which process some cards, a camel's-hair brush, as well as one rather stiff (a tooth-brush, for instance), will be required. When all is prepared, gently float a leaf onto a card, and with the soft brush carefully remove the skin. Have ready a basin of clean water, and when the skin of one side is completely removed, reverse the card in the water, and slip it under the leaf, so that the other side is uppermost. Brush this to remove the skin, when the fleshy part will most likely come with it; but if not, it will readily wash out in the water. If particles of the green-colored matter still adhere to the skeleton, endeavor to remove them with the soft brush; but if that is of no avail, the hard one must be used. Great care will be necessary to avoid breaking the skeleton, and the hard brush should only be used in a perpendicular direction (a sort of gentle tapping), as any horizontal motion or brushing action will infallibly break the skeleton. Never attempt to touch the leaves or the skeleton in this state with the fingers, as when they are soft their own weight will often break them. Well-grown leaves should always be chosen, and be thoroughly examined for flaws before soaking. Leaves containing much tannin cannot be skeletonized by this process, but are generally placed in a box with a number of caddis worms, which eat away the fleshy parts, when the skeletons can be bleached by the method given in the next receipt. Holly leaves must be placed in a separate vessel, on account of their spines, which would be apt to damage other leaves; they make beautiful skeletons, and are sufficiently strong to be moved with the fingers. (*See No.* 6170.)

6169. To Bleach Skeleton Leaves. A good way of bleaching skeleton leaves is to prepare a solution of chloride of lime, which must be allowed to settle, and the clear liquid poured into a basin, in which the skeletons may be put by floating them off the card. It is as well to have half a dozen ready to bleach at once, as they require watching, and if allowed to remain in the liquid too long will fall to pieces. From 2 to 4 hours will generally suffice to bleach the skeleton of all ordinary leaves, after which they should be washed in several changes of water, and finally left in clean water for ½ hour. After the leaf has been sufficiently washed it should be floated onto a card and dried as quickly as possible, care being taken to arrange the skeleton perfectly flat, and as near as possible to the natural shape. This can be done with the assistance of the soft brush. When dry the skeleton should be perfectly white, and may be mounted on dark backgrounds, as black velvet or paper. (*See No.* 6171.)

6170. Quick Method of Preparing Skeleton Leaves. A solution of caustic soda is to be made by dissolving 3 ounces washing soda in 2 pints boiling water, and adding 1½ ounces quicklime previously slacked; boil for 10 minutes, decant the clear solution, and bring it to the boil. During ebullition add the leaves; boil briskly for about an hour, occasionally adding hot water to supply the place of that lost by evaporation. Take out a leaf, put it into a vessel of water, and rub it between the fingers under the water. If the skin and pulpy matter separate easily, the rest of the leaves may be removed from the solution, and treated in the same way; but if not, then the boiling must be continued for some time longer. (*See No.* 6168.)

6171. To Bleach Skeleton Leaves. To bleach the skeleton leaves, mix about 1 drachm chloride of lime with 1 pint water, adding sufficient acetic acid to liberate the chlorine. Steep the leaves in this until they are whitened (about 10 minutes), taking care not to let them stay in too long, as they are apt to become brittle. Put them into clean water, and float them out on pieces of paper. Lastly, remove them from the paper before they are quite dry, and place them in a book or botanical press. They look best when mounted on black velvet or paper. (*See No.* 6169.)

6172. To Stain Dried Grass. There are few prettier ornaments, and none more economical and lasting, than bouquets of dried grasses, mingled with the various unchangeable flowers. They have but one fault; and that is, the want of other colors besides yellow and drab or brown. To vary their shade, artificially, these flowers are sometimes dyed green. This, however, is in bad taste, and unnatural. The best effect is produced by blending rose and red tints, together with a very little pale blue, with the grasses and flowers, as they dry naturally. The best means of dyeing dried leaves, flowers, and grasses, is to dip them into the spirituous liquid solution of the various compounds of aniline. (*See Nos.* 2552, *&c.*) Some of these have a beautiful rose shade; others red, blue, orange, and purple. The depth of color can be regulated by diluting, if necessary, the original dyes, with spirit, down to the shade desired. When taken out of the dye they should be exposed to the air to dry off the spirit. They then require arranging, or setting into form, as, when wet, the petals and fine filaments have a tendency to cling together. A pink saucer, as sold by most druggists, will supply enough rose dye for two ordinary bouquets. The pink saucer yields the best rose dye by washing it off with water and lemon juice. The aniline dyes yield the best violet, mauve, and purple colors.

6173. Artificial Coral. Melt together yellow resin, 4 parts; vermilion, 1 part. This gives a very pretty effect to glass, twigs, raisin stalks, cinders, stones, &c., dipped into the mixture and dried.

6174. To Copy Ferns. Dip them well in common porter, and then lay them flat between white sheets of paper, with slight pressure, and let them dry out.

6175. To Preserve Natural Flowers. Dip the flowers in melted paraffine, withdrawing them quickly. The liquid should be only just hot enough to maintain its fluidity, and the flowers should be dipped one at a time, held by the stalks and moved about for an instant to get rid of air bubbles. Fresh-cut flowers, free from moisture, make excellent specimens in this way.

6176. To Collect and Preserve Specimens of Plants. To form what is called the *hortus siccus*, or *herbarium*, various methods are employed, but the following is recommended as the most simple. The articles requisite for the purpose consist of a dozen quires of smooth soft paper of a large size, 6 boards of about an inch in thickness, and 4 iron or lead weights, two of them about 20 pounds, and the two others about half that weight, and a botanical box of tin, and of such dimensions as shall be most convenient for the collector. The plants to be preserved ought, if possible, to be gathered in dry weather; but if the weather be wet they should be laid out for some time on a table till partially dried, and when the roots are taken up along with the stems, they must be washed and then exposed to the air for the same purpose.

6177. To Preserve Plants. Lay over one of the boards two or three sheets of the paper described in the last receipt. On the uppermost sheet spread out the specimen to be preserved, unfolding its parts so as to give it as natural an appearance as possible, laying out the leaves and flowers with particular care. Over the specimen thus disposed of place several sheets of paper; on the uppermost sheet spread out another specimen, and so proceed till all the plants intended to be preserved are laid down; and having put over the whole some more sheets of paper, place a board over them with the weights upon it, which may be a number of clean bricks, if iron or lead weights cannot conveniently be procured. As some plants are delicate and flexible, and others comparatively thick and hard, the former class will require less weight to be placed over them, and the latter considerably more.

6178. To Preserve the Color and Shape of Plants when Drying. To preserve the color of flowers when drying, the greatest care is required in changing the papers every second day, which papers ought first to be well dried at the fire. With regard to keeping the shape of flowers, the utmost care and attention is necessary when arranging them on the paper; this can be done by having another piece of paper and gently laying it on part of the flower; the part of the flower so covered with the paper ought to have a small book placed on it. Then begin and lay out the other leaves of the flower, and also press it, and so on, until each part has had the gentle pressure necessary to keep it in position. Let them remain so for a short time, and then put some heavy weight on them; look at them next day, and change the damp paper. Ferns may be kept for years quite fresh in color by this simple mode of drying. In 3 or 4 days the plants thus treated should be taken out, together with the paper in which they have been deposited, and laid in fresh paper with 3 or 4 sheets between every 2 plants, and the board and weights laid upon them as before. This process must be continued till the plants are perfectly dried. Each specimen is then to be placed on a sheet of dry paper, along with a memorandum of the name of the plant, the place and time at which it was gathered, the character of the soil from which it was taken, and any other particulars tending to illustrate its character and history.

6179. To Mount Small Insects for the Microscope. Mounting small insects for the microscope, such as parasites and acari from birds, beetles, &c., may be performed by placing the live insect on the inside of a sheet of tolerable good note paper, folded, and when in the act of running, closing the paper and pressing it tightly in a book. By this means the legs and antennæ may be nicely extended, all the expressed moisture absorbed by the paper, and the skin left apparently unbroken. It should be allowed to remain in the book about 2 days, when it may be carefully removed from the paper, put in a turpentine bath, and afterwards mounted in balsam in the usual way. (*See No.* 6180.)

6180. To Mount Microscopic Objects in Canada Balsam. Warm the glass slips, &c., to a temperature just below the boiling heat of water. If there is any doubt of the balsam penetrating all the interstices and readily adhering to the specimens, it will be well to pour a few drops of clear turpentine upon the specimens, which will greatly facilitate the taking of the balsam; the latter, however, must not be used until the turpentine has nearly evaporated. The moment when the balsam is to be added with the best effect can only be known by experience. Clear old Canada balsam is the best suited for these purposes. When used it must also be heated to a temperature just below boiling water, and then poured upon the object, previously arranged upon a slip of glass. The top slip of glass, which is usually smaller and thinner than the under one, is now to be placed upon it; one end of each slip being brought into contact first, and then the other allowed to fall upon it. By this means no air-bubbles will be enclosed. The exact quantity of balsam must be learned by practice. Of two faults, namely, too much or too little, the former is to be preferred. Be careful not to press the glasses together too hard, otherwise, on the removal of the pressure, the air will enter between the glasses, and the preparation will be spoilt. Having thus mounted the object, it must be slowly dried in a warm situation. This will take 1 or 2 days; after which the slide is to be cleaned by scraping off the surplus balsam with a strip of plate glass. Finally, wipe it clean, using first a linen rag moistened with turpentine, and then a piece of dry clean leather.

6181. Marvels of the Microscope. A beautiful and easily produced exhibition of crystal formation may be seen under the microscope as follows: Upon a slip of glass, place a drop of liquid chloride of gold or nitrate of silver, with a particle of zinc in the gold and copper in the silver. A growth of exquisite gold or silver ferns will vegetate under the observer's delighted eye.

6182. To Prepare a Skeleton. After cutting off as much flesh and cartilage from the bones as possible, boil them in water till the remainder easily separates. The French still further prepare their skeletons by bleaching for a short time in a weak solution of chloride of lime.

6183. Phial Barometer. Take a common phial and cut off the rim and part of the neck with a file. This may also be effected by means of a piece of cord passed round it, and moved rapidly to and fro, in a sawing direction; the one end being held in the left hand and the other fastened to any convenient object, while the right hand holds and moves the phial; when heated, dip it suddenly into cold water, and the part will crack off. (*See Nos.* 2368, *&c.*) Then nearly fill the phial with clean water, place your finger on the mouth, and invert it; withdraw your finger, and suspend it in this position with a piece of wire or twine. In dry weather the under surface of the water will be level with the neck of the bottle, or even concave; in damp weather, on the contrary, a drop will appear at the mouth and continue until it falls, and is then followed by another in the same way.

6184. The Chemical Barometer, or Storm Glass. Take a long narrow bottle, such as an old-fashioned eau-de-Cologne bottle, and put into it 2½ drachms of camphor and 11 drachms of spirit of wine; when the camphor is dissolved, which it will readily do by slight agitation, add the following mixture: Take water, 9 drachms; nitrate of potassa (saltpetre), 38 grains; and muriate of ammonia (sal ammoniac), 38 grains. Dissolve these salts in the water before mixing with the camphorated spirit; then shake the whole well together. Cork the bottle well, and wax the top, but afterwards make a very small aperture in the cork with a red-hot needle. The bottle may then be hung up, or placed in any stationary position. By observing the different appearances which the materials assume as the weather changes, it becomes an excellent prognosticator of a coming storm or of a sunny sky.

6185. To Teach a Parrot to Speak. The quickest way is to send the bird, if possible, where there is another parrot who can speak. They should be placed near enough to hear, but not see each other, and the one will soon imitate the other. A good way is to speak to the bird at night; just when his cage has been covered over (which must always be done with a woolen rug in winter) repeat over several times in the same tone the sentence you wish him to learn. He may not appear to notice at first, but some day, quite unexpectedly, he will repeat the sentence exactly in the same tone that he has heard it. He should at once be rewarded with a bit of sugar, or fruit, or any little dainty that he is fond of. They are very quick at understanding that rewards are given for obedience. Never allow a parrot to be startled or teased, or permit it to be fed indiscriminately by visitors. Keep the cage extremely clean; let it be wiped out and fresh sand given every day. Some birds drink very little, but they should always be able to get a drink of fresh water if they wish. It is also a good plan to let a small quantity of canary seed be in the seed can; it is possible that the morning bread and milk may be forgotten, and the seed will thus prevent the bird being starved.

6186. Etching Shells. This is done by means of acid. The parts not to be acted upon must be protected by a so-called etching-ground, which consists of a thin layer of varnish blackened in a flame so as to see plainly the figures afterward drawn on it. Be careful, when doing this, to make a clear drawing or writing in which the shell is exposed at the bottom of every line, as any remaining varnish would protect those parts, and the writing would not be brought out. The acid, either strong acetic, diluted nitric, or muriatic, is then applied, and when its action is sufficient it is washed off with water, the varnish is rubbed off with turpentine or alcohol, when the drawing or lettering will appear, and look as if cut in with an engraver's tool. The design may also be drawn with varnish on the shell by means of a fine brush, then the acid will dissolve the surface around the lines drawn, and the writing will appear in relief, the letters being elevated in place of being sunk in as by the former process. The latter is the more common way in which these shells are treated. This method is applied to many other objects; all that is wanted being a liquid dissolving the material to be acted upon, and a varnish to protect some parts from its action.

6187. To Clean Shells. Make lye by boiling strong ashes, allow it to settle; pour the lye over the shells, and boil them 6 or 7 hours, or longer if they are large; then soak, and wash often in fresh water.

6188. To Color Shells. Dissolve a little lac dye in a solution of chloride of tin; and having made the shells thoroughly clean, dip them in this preparation until they are of the desired color. The dye should be first boiled, and then allowed to stand to settle.

6189. To Keep Gold-Fish. Gold-fish must be kept in a vessel of sufficient capacity, and be given fresh water every day, or at least every other day. It is best to clean the vessel then, by washing it inside with a cloth. The fresh water ought to be clean, and not too hard. It is not good to feed them, as the food will only serve to render the water unfit for their existence, and if renewed every day, the water itself furnishes them with enough material for their sustenance. Fish kept in this way generally perish from want of oxygen. Anything, therefore, which consumes it ought to be avoided, and this is a reason for not giving them any food. Green leaves of living plants have an opposite effect, and they may be kept for this purpose in fish-bowls; they absorb the carbonic acid in the water exhaled by the fish, giving off oxygen, which is in turn taken up by the fish and reconverted into carbonic acid.

6190. Food for Mocking-Birds. Mix together 2 parts corn-meal, 2 parts pea-meal, and 1 part moss-meal; add a little melted lard, but not sufficient to make the mixture too greasy, and sweeten with molasses. Fry in a frying-pan for ½ hour, stirring constantly, and taking care not to let it burn; this makes it keep well. Put it in a covered jar. The *moss-meal* is prepared by drying and grinding the imported German moss-seed.

6191. German Paste for Feeding Singing-Birds. Blanched sweet almonds, 1 pound; pea-meal, 2 pounds; butter, 3 ounces; saffron, a few grains; honey, a sufficient quantity. Form the whole into a paste, and granulate it by pressing it through a cullender. Some add the yolks of 2 eggs.

6192. How to See Under Water. The Indians of North America do this by cutting a hole through the ice, and then covering or hanging a blanket, in such a manner as to darken or exclude the direct rays of the sun, when they are enabled to see into the water, and discover fish at any reasonable depth. Let any one who is anxious to prove this, place himself under the blanket, and he will be astonished when he beholds with what a brilliancy everything in the fluid world is lighted up. A correspondent of the Scientific American says: "I once had occasion to examine the bottom of a mill pond, for which I constructed a float out of inch boards, sufficient to buoy me up; through the centre of this float I cut a hole, and placed a blanket over it, when I was enabled to clearly discover objects on the bottom, and several lost tools were discovered and picked up. I am satisfied that, where water is sufficiently clear, this latter plan could be successfully used for searching for lost bodies and articles."

6193. To Prepare Soap for Bubbles. Dissolve castile soap in strong alcohol; let it settle, or filter, and take the clear solution, from which evaporate the alcohol. The solid residue is oleate of soda. To this add half its weight of glycerine and sufficient water to give the proper consistency. The beauty of the experiments will compensate for all the trouble.

6194. To Produce Large and Long-lasting Soap-Bubbles. For the production of unusually large soap-bubbles that will last for hours, and exhibit splendidly the beautiful colors of the rainbow, a fluid may be employed that can easily be prepared in the following way: Fine shavings of palm-oil soap are shaken in a large bottle with distilled water, until a concentrated solution of the soap is obtained; this is filtered through gray filtering paper, and then mixed with about one-third its bulk of pure glycerine. The fluid is to be shaken up before use. By means of a small glass funnel, of two inches diameter, connected with a tube of india-rubber, soap-bubbles may be prepared with this fluid, that will vie in beauty of color with the rainbow itself, and which may be kept for a long while by putting them carefully upon an iron ring which is slightly rusty and thoroughly wet with the soap solution. Bubbles of 1 foot and more in diameter will keep from 5 to 10 minutes; those of 2 or 3 inches in diameter will retain their form for 10 or 12 hours.

6195. To Transfer Ornaments for Carriages, Wagons, &c. This beautiful art is now practiced by many painters, for the sake of economy of time and labor. Decalcomine pictures expressly designed for carriages are now sold at the leading stationers' stores, and the amateur painter is enabled thereby to finish a job of carriage painting in fine style. These pictures may be stuck on, and the dampened paper carefully removed, leaving the picture intact upon the panel, requiring no touching with the pencil.

6196. To Apply Decalcomine Pictures. The proper way to put on decalcomine pictures is to varnish the picture carefully with the prepared varnish (which can be obtained with the pictures), with an ornamenting pencil, being sure not to get the varnish on the white paper. In a few minutes the picture will be ready to lay on the panel, and the paper can be removed by wetting it; and when thoroughly dry, it should be varnished like an oil painting. Be particular to purchase only those transfer pictures which are covered with gold leaf on the back, for they will show plainly on any colored surface, while the plain pictures are used only on white or light grounds. They may be procured at any stationery store, and the cost is trifling.

6197. Lead for Pencils. The easiest way of producing not only black lead, but all sorts of pencils, is by the following process, which combines simplicity, cheapness, and quality. Take white or pipe clay, put it into a tub of clear water, to soak for 12 hours, then agitate the whole until it resembles milk; let it rest 2 or 3 minutes, and pour off the supernatant milky liquor into a second vessel; then allow it to settle, pour off the clear water, and dry the residue on a filter. Then add black lead in any quantity. Powder it, and calcine it at a white heat in a loosely covered crucible; cool, and most carefully repulverize; then add prepared clay and prepared plumbago, equal parts. Make into a paste with water, and put into oiled moulds of the size required; dry very gradually, and apply sufficient heat to give the required degree of hardness—the pieces to be taken carefully from the moulds and placed in the grooves of the cedar. The more clay and heat employed, the harder the crayon; less clay and heat produce a contrary effect. The moulds must be made of 4 pieces of wood, nicely fitted together.

6198. Artificial Sea Water for Aquaria. A rough imitation of sea water is formed by mixing 100 ounces of fresh water with 3 ounces common salt, 1 ounce Epsom salts, 200 grains chloride of magnesium, and 40 grains chloride of potassium. Or, more precisely, the real constitution of sea-water may be imitated in the following manner: Mix with 970,000 grains rain water 27,000 of chloride of sodium, 3600 of chloride of magnesium, 750 of chloride of potassium, 29 of bromide of magnesium, 2300 of sulphate of magnesia, 1400 of sulphate of lime, 35 of carbonate of lime, 5 of iodide of sodium. These all being finely powdered and mixed first, are to be stirred into the water, through which a stream of air may be caused to pass from the bottom until the whole is dissolved. On no account is the water to be boiled, or even heated. Into this water, when clear, the rocks and sea-weed may be introduced. As soon as the latter are in a flourishing state, the animals may follow. Care must be taken not to have too many of these, and to remove immediately any that die. The loss by evaporation is to be made up by adding clean rain water. The aquarium, whether of fresh or of salt water, will require occasionally artificial aeration. This may be done by simply blowing through a glass tube which reaches to near the bottom, or, better still, in the following way: Take a glass syringe which can be easily worked. Having filled it with water, hold it with the nozzle about 2 inches from the surface of the water in the aquarium, into which the contents are to be discharged quickly, and with a sort of jerk. By this means a multitude of small bubbles are forced down into the fluid. This operation should be repeated for a considerable number of times.

6199. To Prevent Stair Carpets from Wearing. Stair carpets should always have a slip of paper put under them, at and over the edge of every stair, which is the part where they wear first, in order to lessen the friction of the carpet against the boards beneath. The strips should be within an inch or two as long as the carpet is wide and about 4 or 5 inches in breadth. A piece of old carpet answers better than paper if you have it. This plan will keep a stair carpet in good condition for a much longer time than without it.

6200. To Make an Æolian Harp. Of very thin cedar, pine, or other soft wood, make a box 5 or 6 inches deep, 7 or 8 inches wide, and of a length just equal to the width of the window in which it is to be placed. Across the top, near each end, glue a strip of wood ½ inch high and ¼ inch thick, for bridges. Into the ends of the box insert wooden pins, like those of a violin, to wind the strings around, two pins in each end. Make a sound-hole in the middle of the top, and string the box with small cat-gut, or blue violin strings. Fastening one end of each string to the wooden pin in one end of the box, and carrying it over the bridges, wind it around the turning-pin in the opposite end of the box. The ends of the box should be increased in thickness where the wooden pins enter, by a piece of wood glued upon the inside. Tune the strings in unison and place the box in the window. It is better to have 4 strings, as described, but a harp with a single string produces an exceedingly sweet melody of notes, which vary with the force of the wind.

6201. To Remove the Disagreeable Taste from New Wooden Vessels. First scald them with boiling water, then dissolve some pearlash or soda in lukewarm water, adding a little lime to it, and wash the inside of the vessel well with the solution. Afterwards scald it well with plain hot water before using.

6202. To Preserve Ribbons and Silks. Ribbons and other silks should be put away for preservation in brown paper; the chloride of lime used in manufacturing white paper frequently produces discoloration. A white satin dress should be pinned in blue paper, with brown paper outside, sewn together at the edges.

6203. To Make Feather Brushes. Boil the wing feathers of a turkey or chicken for 5 or 10 minutes, then rinse them in tepid water, dry them and tie them up in bunches to use in greasing pans and for brushing egg over tarts or pastry.

6204. Remedy for Frozen Potatoes. In time of frost, potatoes that have been affected thereby should be laid in a perfectly dark place for some days after the thaw has commenced. If thawed in open day they rot; but if in darkness, they do not rot; and they lose very little of their natural properties.

6205. To Make Fire Kindlers. Take a quart of tar and 3 pounds of resin, melt them, bring to a cooling temperature, mix with as much coarse sawdust, with a little charcoal added, as can be worked in; spread out while hot upon a board; when cold, break up into lumps of the size of a large hickory nut, and you have, at a small expense, kindling material enough for a household for one year. They will easily ignite from a match and burn with a strong blaze, long enough to start any wood that is fit to burn.

6206. To Loosen Ground Glass Stoppers. Sometimes the ground glass stoppers of bottles become, from one cause or another, fixed in the neck, and cannot be removed by pulling or twisting. An effectual method is to wrap a rag wet with hot water around the neck and let it remain a few seconds. The heat will expand the neck of the bottle, when the stopper can be removed before the heat penetrates the stopper itself. Or, wind a string once or twice around the neck, and, holding the bottle between the knees, pull alternately on one and the other end, thus creating friction, and consequently heat. Or a little camphene dropped between the neck and stopper of the bottle will often relieve the stopper.

6207. To Remove a Glass Stopper. The most effectual mode of removing stoppers, especially those of small bottles, such as smelling-bottles, is as follows: Take a piece of strong cord, about a yard or 4 feet in length, double it at the middle, and tie a knot (*Fig.* 1, *b*) so as to form a loop (*a*) of about 4 inches

Fig. 1.

in length; at the doubled end, bring the knot close to one side of the stopper, and tie the ends tightly together on the opposite side, as at *Fig.* 2 (*c*) so as to fasten the string securely round the neck of the stopper; now pass one of the ends through the loop (*a*), and then tie it firmly to the other end; the doubled cord is then to be placed over a bar or other support, then if the bottle is surrounded by a cloth, to prevent accident in case of fracture, and pulled downwards with a jerk, the force of which is gradually increased, it will be found that in a short time the stopper is liber-

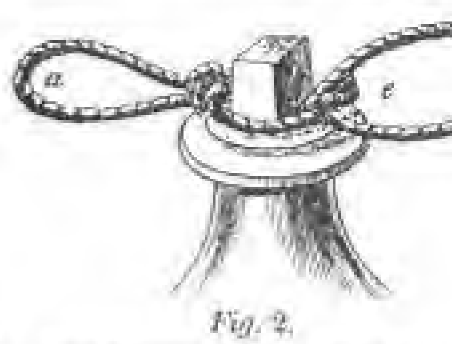

Fig. 2.

ated. Two precautions are requisite—one is, that the strain on both sides of the stopper is equal; the other, that care be taken that when the stopper is liberated, it is not dashed by the rebound against any hard substance, which would cause its fracture.

6208. To Keep Up Sash Windows. This is performed by means of cork, in the simplest manner, and with scarcely any expense. Bore 3 or 4 holes in the sides of the sash, into which insert common bottle-cork, projecting about the sixteenth part of an inch. These will press against the window frames along the usual groove, and by their elasticity support the sash at any height which may be required.

6209. How to Treat a Burning Chimney. If it is desired to extinguish the fire in a chimney which has been lighted by a fire in the fireplace, shut all the doors of the apartment so as to prevent any current of air up the chimney, then throw a few handfuls of common fine salt upon the fire in the grate or stove, which will immediately extinguish the fire in the chimney. The philosophy of this is, that in the process of burning the salt, muriatic acid gas is evolved, which is a prompt extinguisher of fire.

6210. To Prevent Glass from Cracking by Sudden Heating. Probably more articles of glass in daily use are broken by being suddenly heated than by blows or other acts of carelessness. Glass is a very poor conductor of heat, and when hot water is poured suddenly into a tumbler or goblet, it is almost certain to break unless the glass itself is quite warm. Tepid water should be first used, or a little cold water be poured into the glass on which the hot water may be drawn. Lamp chimneys frequently crack when placed upon the lighted lamp, especially if taken from a cold room. The proper remedy is to turn up the flame slowly or by degrees; this will gradually heat the glass, and prevent its fracture.

6211. To Restore the Color of Window Glass. Window glass constantly exposed to the action of the sun and rain soon deteriorates, as the potash or soda it contains combines with the carbonic acid of the air. A whitish opaqueness is the result of this action; and in order to restore the pane to its original clearness, rub it with dilute muriatic acid, and then clean with moistened whiting. It is said that glass in an extreme state of decomposition may be restored by this means.

6212. To Clean Discolored Glass. Glass that appears smoky may be cleaned by applying dilute nitric acid, when soap, turpentine, alcohol, or scouring with whiting would make no impression on it. Water of ammonia is also effective.

6213. To Remove a Ring from a Swollen Finger. A thread should be wound evenly around, beginning at the extremity of the finger, and bringing each coil close to the preceding, until the ring be reached. A needle is then threaded on and passed under the ring, and the thread is carefully unwound from the finger. The ring follows each coil as it is successively unrolled, and by almost imperceptible degrees is brought over the knuckle and removed. Care must be taken that the thread is wound on evenly, particularly over the swollen knuckle, or an entanglement will occur in the unwinding. A curved needle will pass under the ring more easily than a straight one.

6214. To Prevent Gas Meters from Freezing. Half a pint (or less) of *good* glycerine is said to prevent the freezing of a gallon of water, though at least double the proportion is preferable in the country, whatever the temperature in the winter may happen to be. Water containing about 40 per cent. of glycerine is but little inclined to freeze. Glycerine in a pure state is perfectly inert, and exercises no influence upon the metals of which the meter is composed. Whiskey, on the contrary, undergoes the acetous fermentation, by which the alcohol is converted into acetic acid, which corrodes the meter, and soon wears it out.

6215. To Prevent the Creaking of Doors. Apply a little soap to the hinges. Or: Take lard, soap, and black lead, equal parts, and apply.

6216. To Keep Kerosene Oil. This oil should be kept for use in air-tight closed vessels. A large quantity is best kept in a well-corked can provided with a faucet an inch or two from the bottom, so that the oil can be drawn off as required, without disturbing the sediment which usually collects on the bottom of the vessel; by this means the oil will be always clear and bright. The small cans used for filling lamps should be kept closely corked both at the neck and spout. If either cork be left out for a day or two, the oil will burn dull, and cake on the wick; this is more especially the case when the can is kept in a warm place.

6217. Management of Brooms. If brooms are wetted in boiling suds once a week, they will become very tough, will not cut a carpet, last much longer, and always sweep like a new broom.

6218. To Wash White Dogs. Make a good lather of white soap with a little spirit of turpentine; wash the dog as quickly as possible in this while it is warm, but not hot, taking care not to let the soap lather get into its eyes. Have a tub with clean tepid water in which a little blue has been dissolved ready; when the coat is clean dip the dog into the blue-water and rinse out the soap. Then rub it well in a clean sheet before a fire; if the hair is long comb it out and brush it as it dries. The turpentine will kill fleas unless the dog is much infested with them.

6219. To Paint an Iron Bath Tub. Mix the paint to a proper consistency with best coachmakers' Japan varnish. For white lead paint, use half turpentine and half coachmakers' Japan. It will not darken much. Venetian red is best for a first coat, for any color but white.

6220. To Raise Old Veneers. In repairing old cabinets, &c., workmen are often at a loss to know how to get rid of those blisters which appear on the surface. We will describe how the operation may be performed without difficulty. First wash the surface with boiling water, and with a coarse cloth remove dirt or grease; then place it before the fire; oil its surface with linseed oil, place it again to the fire, and the heat will make the oil penetrate quite through the veneer and soften the glue underneath; then, whilst hot, raise the edge gently with a chisel, and it will separate completely from the ground. Be careful not to use too much force, or you will spoil the work. If the work should get cold during the operation, apply more oil, and heat it again. When you have entirely separated the veneer, wash off the glue, and proceed to lay it again as a new veneer.

6221. To Take Bruises out of Furniture. Wet the part with warm water; double a piece of brown paper 5 or 6 times, soak it in warm water, and lay it on the place; apply on that a warm, but not hot, flat iron, till the moisture is evaporated. If the bruise be not gone, repeat the process. After two or three applications the dent or bruise will be raised to the surface. If the bruise be small, merely soak it with warm water, and hold a red-hot iron near the surface, keeping the surface continually wet; the bruise will soon disappear.

6222. To Dissolve Gum-Shellac in Ammonia. The vessel containing the shellac is put into a large vessel with hot water. Boiling water is then poured on the gum, after which ammonia is added slowly, but continuously, stirring all the while with a glass rod, until solution is effected. An excess of ammonia will color the solution brown. After cooling, the fluid is filtered, and may be kept in this state a long while.

6223. To Manage Water-Pipes in Winter. When the frost begins to set in, cover the water-pipes with hay or straw bands, twisted tight round them. Let the cisterns and water-butts be washed out occasionally; this will keep the water pure and fresh. In pumping up water into the cistern for the water-closet, be very particular in winter time. Let all the water be let out of the pipe when done; but if this is forgotten, and it should be frozen, take a small gimlet and bore a hole in the pipe, a little distance from the place where it is let off, which will prevent its bursting. Put a peg into the hole when the water is let off.

6224. To Protect Lead Water-Pipes. Dr. Schwarz, of Breslau, notes a simple method of protecting lead pipes from the action of water, by forming on the inside surface of the pipes an insoluble sulphide of lead. The operation, which is a very simple one, consists in filling the pipes with a warm and concentrated solution of sulphide of potassium or sodium: the solution is left in contact with the lead for about 15 minutes, and then poured out.

6225. Blowing Out Steam Boilers. Steam boilers should never be blown out under steam pressure. The safety valve should first be raised until the pressure is all removed by letting the steam escape as rapidly as possible; then the hand hole plate or other device should be opened, and the dirt and sediment will run out with the water. If the boiler is allowed to cool off, the dirt will settle to the bottom and be fastened on by the heat. The dirt is always on the top of the water when there is any pressure of steam on it.

6226. Substitute for a Corkscrew. A convenient substitute for a corkscrew, when the latter is not at hand, may be found in the use of a common screw, with an attached string to pull the cork. Or, stick two steel forks vertically into the cork on opposite sides, not too near the edge. Run the blade of a knife through the two, and give a twist.

6227. To Remove a Cork from the Inside of a Bottle. With a stout string projected into the bottle, turn the bottle around until the cork is caught in a loop of the string, and with force pull out the cork.

6228. To Remove Starch or Rust from Flat-Irons. To remove starch or rust from flat-irons, have a piece of yellow beeswax tied in a coarse cloth. When the iron is almost hot enough to use, but not quite, rub it quickly with the beeswax, and then with a clean, coarse cloth.

6229. To Prepare New Linen for Being Embroidered. New linen may be embroidered more easily by rubbing it over with fine white soap; it prevents the threads from cracking.

6230. To Shell Beans Easily. Pour upon the pods a quantity of scalding water and the beans will slip very easily from the pod. By pouring scalding water on apples, the skin may be easily slipped off, and much labor saved.

6231. To Improve the Wicks of Candles. First steep the wicks in a solution of lime-water in which saltpetre has been dissolved. To 1 gallon water add 2 ounces saltpetre and ¼ pound lime. Dry well the wicks before using. It improves the light, and prevents the tallow from running.

6232. Adhesive for Leather Belts. Printers' ink is a good adhesive for leather belts. One application will keep a leather belt in running order for 12 months.

6233. Ajutage of Fountains. M. Francois, in his work, "Art des Fontaines," estimates the decrease in the height of the jet to be 1 foot below the level of the source for every 100 yards distance. He considers the ajutage or opening of the pipe should be ¼ of the size of the pipe itself. Where pipes are already laid down, and the power of the head not very accurately known, it is well, by means of a leaden nozzle, the orifice of which may be readily increased or diminished, to test the amount of force, so that the ajutage may be adapted to throw the highest and fullest jet the head is capable of.

6234. To Make Composition Ornaments for Picture Frames or Other Purposes. Mix as much whiting as you think will be required for present use with thinnish glue, to the consistence of putty; and having a mould ready, rub it well all over with sweet oil, and press your composition in it; take it out, and you will have a good impression, which you may set by to dry; or, if wanted, you may, before it gets hard, apply it to your work with thick glue, and bend it into the form required.

6235. To Stop Leaky Skylights. Leaky skylights may be stopped and cured with Dutch rushes, bedded in, caulked, and covered with good white lead. On wet making its appearance it quickly attacks the rush, which swells up so tight and firm that all progress of wet and droppings is effectually stayed.

6236. To Thicken and Strengthen Muslin. Dip the muslin in dilute sulphuric acid. According to Professor Calvert, of Manchester, England, this very much increases its thickness and strength. The cotton thus prepared is technically known as

6237. To Develop the Inscription on Worn Coins. By heating these gradually, the inscription will, in almost all cases, make its appearance.

6238. To Preserve Copper Coins and Medals from the Action of the Air. Immerse them for a moment in melted paraffine, and then wipe off the excess of paraffine with a clean dry cloth.

6239. To Prepare Bladders. These articles are prepared by cutting off the fat and loose membranes attached to them, and washing them first in a weak solution of chloride of lime, and afterwards in clear water; they are then blown out and submitted to pressure by rolling them under the arm, by which they become considerably larger; they are next blown quite tight, dried, and tied up in dozens for sale. Or, dip them in warm water, dry and rub them well in with a little glycerine; they will keep soft and pliable. They are employed by druggists and oil and colormen to tie over pots, bottles, and jars, and to contain pill masses, and other similar substances. Never buy bladders unless they are perfectly dry and tight, as, if the reverse be the case, they will neither keep nor prove sound.

6240. To Obtain Herbs of the Finest Flavor. When herbs are to be kept for flavoring dishes, it is obviously of the first importance that they should be gathered at the right time, and dried in the best manner. The seasons when the various herbs have in their fullest flavor, are as follows: Basil, from the middle of August to the middle of September; marjoram, during the month of July; winter savory, the latter end of July and throughout August; summer savory, the same; thyme, of various kinds, during June and July; mint, the latter end of June, and during July; sage, August and September; tarragon and burnet, June, July, and August; chervil, parsley, fennel, elder flowers, and orange flowers, May, June, and July. As the seasons vary in different localities, a good general rule is to gather the herbs when they first blossom. Herbs should be gathered on a dry day, before the sun has been long upon them. When intended for preservation, they should be cleaned from dirt and dust, and dried gradually upon a warm stove, or in a Dutch oven, after which they may be tied up in bags made of old newspaper. Or, the leaves may be picked off, pounded in a mortar, passed through a hair sieve, and the powders be preserved separately in well-stoppered bottles.

6241. To Remove Clinker from Fire Brick. When the fire bricks have become covered with clinkers which have fused and adhered, they may be cleaned by throwing oyster or clam shells into the fire box when the fire is very hot, and allowing the fire to go out. The clinkers will generally cleave off without the use of much force the next morning. From 2 quarts to ½ peck will be sufficient for most stoves, and the operation can be repeated if some of the clinkers still adhere. Salt sprinkled on clinker adhering to fire brick will also loosen it.

6242. To Preserve Carpets. It is very advisable in laying down carpets at first, to cover the floor beneath them with large sheets of paper, so as to prevent the dust from rising between the boards. A carpet lasts longer by adopting this precaution.

6243. To Prevent Injury to Kid Gloves from Excessive Perspiration. Persons who wear kid gloves in hot weather, and who perspire freely, will find that injury to the gloves will be prevented by applying ordinary corn starch to their hands (dry) before drawing on their gloves. Pulverized soap-stone will answer the same purpose.

6244. The Art of Easy Shaving. The following is the substance of the instructions of the celebrated Mr. Mechi on this subject: Never fail to well wash your beard with soap and cold water, and to rub it dry, immediately before you apply the lather, of which the more you use, and the thicker it is, the easier you will shave. Never use warm water, which makes a tender face. In cold weather, place your razor (closed of course) in your pocket, or under your arm, to warm it. The moment you leave your bed (or bath) is the best time to shave. Always wipe your razor clean, and strop it before putting it away; and put your shaving-brush away with the lather on it. The razor (being only a very fine saw) should be moved in a sloping or sawing direction, and held nearly flat to your face, care being taken to draw the skin as tight as possible with the left hand, so as to present an even surface, and to throw out the beard.

6245. To Hone a Razor. The surface of the hone must be perfectly level. The razor should be held flat on the hone, and the back never raised, or it will induce a round or thick edge. Draw the razor from heel to point, alternating the sides at each stroke, and the action always against the edge. When the edge is wiry and thin enough to turn, strop it on a coarse strop, drawing the edge occasionally over the thumb nail, until the edge is smooth, then finish on a fine strop, and the palm of the hand.

6246. Strop for Razors. There are many kinds of razor strops formed of leather glued on a wooden holder. These are apt, in time, to round the edge of the razor, by allowing the blade to bed itself or sink in the leather. The best is a strip of Russia leather, strained as tight as a drum on a curved or bowed piece of wood.

6247. Paste for Razors. Emery very finely levigated (washed) in the same manner as prepared chalk (*see No.* 1292), mixed with lard or tallow, or a mixture of these with neat's-foot oil. Or: equal parts of jewelers' rouge, black lead, and prepared suet.

6248. Pradier's Paste for Razors. Best putty powder, 1 ounce; jewelers' rouge, 1 ounce; scales of iron, ¼ ounce; levigated Turkey stone, 3 ounces; beef suet, 1½ ounces. Or: Mix equal parts of dried sulphate of iron and salt, and apply a gradually increased heat, in a closed vessel. Pulverize, elutriate (*see No.* 14), and mix with lard or tallow.

6249. To Strop a Razor. The practice of pressing on the edge of a razor in stropping soon rounds it; the pressure should be directed to the back, which should never be raised from the strop. If you shave from heel to point of the razor, strop it from point to heel; but if you begin with the point in shaving, then strop it from heel to point. If you only once put away your razor without stropping it, or otherwise perfectly cleaning the edge, you must no longer expect to shave well and easy, the soap and damp so soon rust the fine edge. A piece of soft plate-leather (chamois leather) should always be kept with razors, to wipe them with.

6250. To Sharpen a Razor. The simplest method of sharpening a razor is to put it for half an hour in water to which has been added $\frac{1}{20}$ of its weight of muriatic or sulphuric acid, and after a few hours set it on a hone. The acid acts as a whetstone, by corroding the whole surface uniformly, so that nothing further than a smooth polish is necessary.

6251. To Sharpen Edge Tools. Proceed as directed in the last receipt.

6252. To Grind Cutlery and Edge Tools. For grinding, the stone should be dipped in water to prevent the heating of the tools; and careful cutlers use oil for polishing, instead of water, when using grindstones of small diameter.

6253. Caution in Grinding Cutlery. Never follow the example of the street knife-grinder. He does much work, and cheap work. He uses as little water as possible. Give him a good razor or a good knife, and he gives it back well sharpened, but a spoiled tool, which needs to be hardened anew. Therefore, when sharpening tools, take large stones with much water, and make slow and good work.

6254. To Sharpen and Set a Saw. First, run a file along the edge of the teeth till you see them range in a direct line; then lay the blade on a smooth piece of lead, or on the end of a trying-plane, and with a square steel punch and a hammer, give a gentle tap on every alternate tooth. Reverse the saw and punch the alternate teeth on the other side, and look down the saw to see that the teeth are all equally set. Then begin with your file at that part of the saw nearest the handle. To sharpen or file the teeth to a good point, hold the file so that it makes an angle with the saw-blade of about 30 degrees, or ⅓ that of a mitre angle. Then file every other tooth to a very sharp point, sharpening only those teeth which are *set away* from the operator. Turn the saw round, and repeat the operation on the remaining teeth. The file used for sharpening saws should be triangular, and in fine order. A dull file will never make a sharp saw.

6255. To File a Flat Surface. In filing a flat surface on a piece of iron, unless there is some skill or care used in the operation, the exterior edges are apt to be greatly pared away, so that that part of the surface about midway between them will be the least filed down. The work should be held in a bench vise, in such a position that the file will run in a horizontal direction nearly level with the workman's elbow; but should the work be of a very light nature, it may be held in a more elevated position; or, if it be very heavy, it may be held a little lower. In filing flat surfaces, a 'surface-plate' is used, to enable the operator to finish the work with accuracy. The surface-plate is a cast-iron plate planed and carefully reduced to a true surface. Some red lead is rubbed on this plate before being used; then this piece of work is rubbed on the plate, and wherever the work is reddened it shows that that part of the work is above the level, and has to be filed down; and this process of testing and filing is carried on until the work is reduced to a perfectly true surface. It saves the file to draw it back at each stroke as lightly as possible. There is also economy in using the files first on brass or cast iron, and afterwards on wrought iron.

6256. Recutting Files with Acids. There are many receipts for converting old files into new by means of acids, and among the latest is that recently patented by Albert I. Ferguson, of Sharon, Pa. The files must be thoroughly cleansed in warm water containing a small quantity of potash, which readily removes any grease or dirt from them. After the files are thus cleansed, they must be washed with warm water and dried by artificial heat. Next, place 1 pint warm water into a wooden vessel, and put into it as many files as the water will cover. Then add 2 ounces blue vitriol (sulphate of copper) finely pulverized, and 2 ounces borax, well mixed, taking care to turn the files over, so that each may come in contact with the mixture. To the above mixture now add 7 ounces sulphuric acid and ½ ounce cider vinegar, which will cause the files to assume a red appearance at first, but they will in a short time resume their natural color. Then they must be removed, washed in cold water, and dried by artificial heat. When dry, they must be sponged with olive oil, wrapped in porous paper, and laid aside for use.

6257. Re-Sharpening Files. A very interesting and economical process has been exhibited before the Société d'Encouragement of Paris, by M. Werdermann. Well-worn files are first carefully cleaned by means of hot water and soda; they are then placed in connection with the positive pole of a battery, in a bath composed of 40 parts sulphuric acid, 80 parts nitric acid, and 1000 parts water. The negative pole is formed of a copper spiral surrounding the files, but not touching them; the coil terminates in a wire which rises towards the surface. This arrangement is the result of practical experience. When the files have been 10 minutes in the bath they are taken out, washed, and dried, when the whole of the hollows will be found to have been attacked in a very sensible manner; but should the effect not be sufficient, they are replaced for the same period as before. Two operations are sometimes necessary, but rarely more. The files thus acted upon are, to all appearance, like new ones, and are said to be good for sixty hours' work.

6258. To Clean Files. The occasional cleaning of files in the machine shop by means of oil, heat, and the card (wire brush) will save dollars to the owner and annoyance to the worker.

6259. To Cut Good Steel Scrapers. Part of the blade of a broken saw makes the best scrapers; but, as it is hard, it is very difficult to cut it into the required form. The best and most expeditious way is to mark it out to the size wanted, and then to place the blade or steel plate in a vise which shuts very close, placing the mark even with the face of the vise, and the part to be cut to waste above the vise. Then with a cold-chisel, holding it close to the vise and rather inclined upwards, begin at one end of the steel plate, and with a sharp blow of the hammer it will cut it. Keep going on by degrees, and it will with ease be cut to the shape required; then grind the edges of the scraper level, and finish by rubbing it on a Turkey-stone.

6260. Knots. It is not a very difficult thing to tie a neat and secure knot, yet comparatively few persons know how to accomplish it. Below we give all the knots necessary for ordinary purposes, with illustrations and directions for making them.

6261. The Sheet Bend or Weaver's Knot. This knot is usually employed by netters, and is called by sailors "the sheet bend." It is readily made by bending one of the pieces of cord into a loop (*a*, *b*, *Fig.* 1), which is to be held between the finger and thumb of the left hand; the other cord, *c*, is passed through the loop from the further side, then round behind the two legs of the loop, and lastly under itself, the loose end coming out at *d*. In the smallness of its size, and the firmness with which the various parts grip together, this knot surpasses every other; it can, moreover, be tied readily when one of the pieces, *viz.* *a*, *b*, is exceedingly short; in common stout twine, less than an inch being sufficient to form the loop.

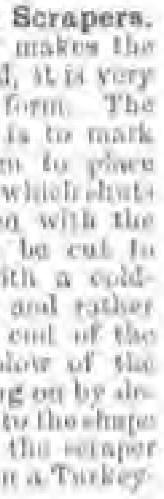

Fig. 1.

The above method of forming it is the simplest to describe, although not the most rapid in practice; as it may be made in much less time by crossing the two ends of cord (*a*, *b*, *Fig.* 2) on the tip of the forefinger of the left hand, and holding them firmly by the left thumb, which covers the crossing; then the part *a* is to be wound round the thumb in a loop, as shown in the figure, and passed between the two ends, behind *a* and before *b*; the knot is completed by turning the end *b* downwards in front of *d*, passing it through the loop, securing it under the left thumb, and tightening the whole by pulling *d*. As formed in this mode, it is more rapidly made than almost any other knot; and, as before stated, it excels all in security and compactness; so firmly do the various turns grip each other, that, after having been tightly pulled, it is very difficult to untie; this is the only drawback to its usefulness,

Fig. 2.

and in this respect it is inferior to the reef-knot, *Fig.* 3, which is made in precisely the same manner that a shoe-string is tied, only pulling out the ends instead of leaving them as bows.

6262. The Reef Knot. The only precaution necessary in making a reef-knot is to observe that the two parts of each string are on the same side of the loop; if they are not, the ends (and the bows, if any are formed) are at right angles to the cords. The knot is less secure than the weaver's knot, and is termed by sailors a granny-knot. Other knots are occasionally used to connect two cords, but it is unnecessary to describe them, as every useful purpose may be answered by those above mentioned.

Fig. 3.

6263. The Binding Knot. The binding knot, (*Figs.* 4, 5,) is exceedingly useful in connecting broken sticks, rods, &c., but some difficulty is often experienced in fastening it at the finish; if, however the string is placed over the part to be united, as shown in *Fig.* 4, and the long end *b*, used to bind around the rod, and finally passed through the loop *a*, as shown in *Fig.* 5, it is readily secured by pulling *d*, when the loop is drawn in, and fastens the end of the cord.

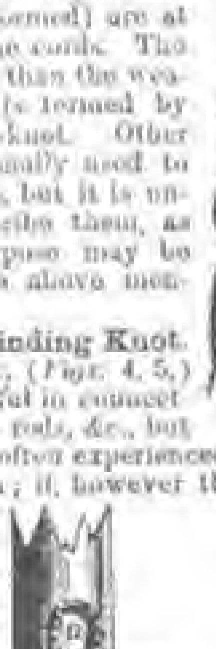

Fig. 5

Fig. 4.

6264. The Double Half Hitch or Clove Hitch. For fastening a cord to any cylindrical object, one of the most useful knots is the clove hitch, which, although exceedingly simple and most easily made, is one of the most puzzling knots to the uninitiated. There are several modes of forming it, the most simple being perhaps as follows: make two loops, precisely similar in every respect, as *a* and *b*, *Fig.* 6, then bring *b* in front of *a*, so as to make both loops correspond, and pass them over the object to be tied, tightening the ends; if this is properly done, the knot will not slip, although surrounding a tolerably smooth cylindrical object, as a pillar, pole, &c. This knot is employed by surgeons in reducing dislocations of the last joint of the thumb, and by sailors in great part of the standing rigging. The loop which is formed when a cable is passed around a post or tree to secure a vessel near shore, is fastened by what

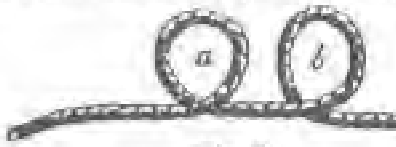

Fig. 6.

sailors term two half hitches, which is simply a clove hitch made by the end of the rope which is passed around the post or tree, and then made to describe the clove hitch around that part of itself which is tightly strained. (*See Fig.* 7.)

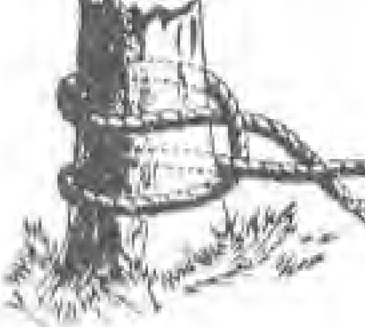

Fig. 7.

6265. The Bowline. This knot is used in slinging heavy bodies; it cannot slip, and will never jam under the heaviest strain. It is difficult to understand at first, but with a little practice can be made very rapidly. Take the fixed or standing part of the rope in the left hand (this should be done in making all knots), lay the free end over it, and then by a twist of the wrist make a loop in the

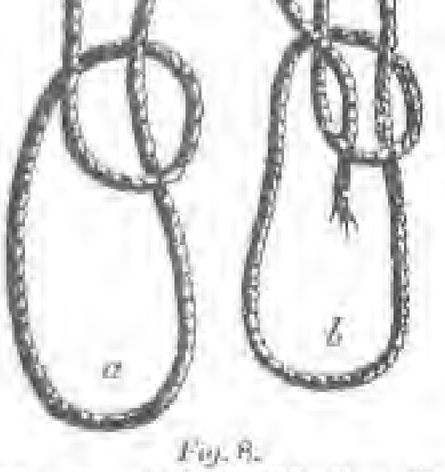

Fig. 8.

standing part which shall inclose the free end (*a*, *Fig.* 8); then carry the free end behind the standing part and through the loop, parallel with itself (*b*, *Fig.* 8). This knot will well repay the trouble spent in learning it.

6266. How to Tie a Parcel. The tying up of parcels in paper is an operation which is seldom neatly performed by persons whose occupations have not given them great facilities for constant practice. Let a single knot be made in the end of the cord, which is then passed around the box or parcel. This knotted end is now tied by a single hitch around the middle of the cord (*Fig.* 9) and the whole pulled tight. The cord itself is then carried at right angles round the end of the parcel, and where it crosses the transverse cord on the bottom of the box (*Fig.* 10) it should, if the parcel is heavy and requires to be firmly secured, be passed over the cross cord, then back underneath it, and pulled tightly, then over itself; lastly, under the cross cord, and on around the other end of the box. When it reaches the top it must be secured by passing it under that part of the cord which runs lengthways (*a*, *Fig.* 9), pulling it very tight, and fastening it by two half hitches round itself. The great cause of parcels becoming loose is the fact of the cord being often fastened to one of the transverse parts (as *b*, *Fig.* 9), instead of the piece running lengthways, and in this case it invariably becomes loose. The description may perhaps be rendered clearer by the aid of the figures, which exhibit the top and bottom of a box corded as described. The cords, however, are shown in a loose state, to allow their arrangement to be perceived more easily.

Fig. 9.

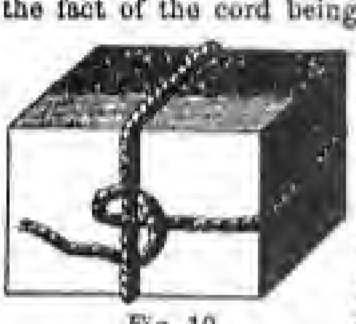

Fig. 10.

6267. Artificial Grindstones. Washed silicious sand, 3 parts; shellac, 1 part; melt, and form it into the proper shape while warm. The fineness of the sand must depend on the work the stone is intended for. Powdered emery may be substituted for sand. The same composition is formed upon pieces of wood, for the purpose of sharpening knives, and cutting stones, shells, &c.

6268. To Make an Emery Wheel for Grinding Tools. Provide a solid wheel, made of pine, or any other soft wood, and of the size required for the purpose. Turn the wheel true, and then turn rounds or hollows in its face, to suit the tools you wish to grind, gouges, rounds, &c. Then prepare some best glue, and, using it hot and thin, put it on the face of the wheel with a brush. The first coat of glue should be a light one, and when it is dry a second one should be applied, and, as quickly as possible, as much emery should be sifted upon the wet surface as the glue will hold. When this is dry another coat of glue and emery should be applied in the same way. This will make a wheel that will last for months, and grind faster than anything else. No. 0 emery is best for this purpose. *(See last receipt.)*

6269. To Cement Emery to Wood. The following cement is wonderfully tough. Melt together equal parts of shellac, white resin, and carbolic acid in crystals; add the last after the others are melted. The effect of the carbolic acid is surprising.

6270. Kerosene Oil for Whetstones. Kerosene oil on whetstones is superior to any other liquid for the purpose, as it keeps the stone in better condition and assists the operation of sharpening.

6271. How to Use a Grindstone. Do not waste the stone by running it in water; but if you do, do not allow it to stand in water when not in use, as this will cause a soft place; it is much better to wet the stone by dropping water on it from a pot suspended above the stone, and stop off the water when not in use. Do not allow the stone to get out of order, but keep it perfectly round by use of gas pipe, or a hacker. Clean off all greasy tools before sharpening, as grease or oil destroys the grit. Observe: when you get a stone that suits your purpose, send a sample of the grit to the dealer to select by; a half ounce sample is enough, and can be sent in a letter by mail.

6272. Soap in Place of Oil on Arkansas Stones. The employment of oil for the purpose of keeping Arkansas and other stones in proper condition for sharpening instruments is so general as to be almost, if not entirely, to the exclusion of every other substance. The tendency, however, to become gummy, and clog the surface of the stone after it has been on a short time, and the liability of soiling the fingers and imparting an unpleasant odor to them, make the use of oil objectionable. All this can be readily obviated, however, by using soap in place of oil, as follows:—Rub a piece of toilet soap and a little water over the surface of the stone until a thick lather is formed, and then allow this to dry. When occasion arises for putting an edge on a tool, a few drops of water will moisten the soap and place the stone in proper condition for use at once. This plan is one that has been successfully employed for years.

6273. Drill Lubricator. In drilling wrought iron, use 1 pound soft soap, mixed with 1 gallon boiling water. This is a cheap lubricator; it insures working with great ease, and clean cutting by the drill.

6274. To Face Oil Stones. Take a piece of iron with even or straight face (it ought to be planed); scatter a little emery or fine sand about as coarse as No. 1½ sand paper on the iron plate, add a little water and rub the face of the stone, renewing the emery or sand and water as requisite, finishing with an addition of water without emery or sand. This is the quickest and truest way, making the stone perfectly straight and occupying from 5 to 10 minutes time.

6275. To Make Plain Chocolate. Roasted cocoa or chocolate beans or nuts are made into paste by trituration in a heated mortar; then poured into tin moulds and left till cold. In this form it is cake chocolate. By grinding this is reduced to chocolate powder. Sweetened and flavored chocolate is made in this way: the sugar and aromatics being added during the trituration; the proportions of these used for the various kinds of chocolate are given below. Vanilla, &c., must be ground before adding to the paste. *(See No. 6279.)*

6276. French Chocolate. Grind together as in last receipt, 3 pounds best cacao nuts, 1 pound refined sugar, and 2 vanilla beans. *(See No. 6279.)*

6277. Spanish Aromatic Chocolate. Grind together 11 pounds Caracca nuts, 3 pounds white sugar, 1 ounce vanilla, ½ ounce cinnamon, and ¼ drachm cloves. *(See No. 6279.)*

6278. Spanish Almond and Vanilla Chocolate. Take 10 pounds Caracca nuts and 3 pounds sugar (or 8 pounds Caracca nuts and 2 pounds island cacao and 10 pounds sugar), and 3 ounces vanilla. Prepare as in the last receipt.

6279. To Grind Vanilla Beans. Vanilla is pulverized by triturating with a little sugar.

6280. Molasses Candy. Take 1 quart molasses, 1½ pounds brown sugar, the juice of a large lemon and 12 drops oil of lemon; mix the molasses and sugar together, butter the inside of a kettle and put it in. Let it boil over a moderate fire for 2 hours, then add the lemon juice and boil ½ hour; stir it often, to prevent it from burning; when thoroughly done it will cease boiling; then butter a pan and put it in to cool; if sufficiently done it will be crisp and brittle, if not it will be tough and ropy. Nuts of any kind may be added just before it is put in the pan; they must be well stirred in. The candy may be worked by keeping the hands well covered with flour, or by greasing them well with butter. The working must be done as soon as it is cool enough to handle. It may be made of molasses only—in this case it requires longer boiling—and other flavoring may be used instead of lemon.

6281. To Make Taffee. Mix ½ cup butter with 2 of sugar, and, when well stirred together, put it in a china lined saucepan over the fire. Let it boil steadily and gently until, by dropping a little on a plate and cooling it, you find it sufficiently stiff.

6282. To Make Molasses Taffee. To 1 quart of molasses put 1 gill of cold water, and set it over a moderate fire; let it boil steadily until nearly stiff enough, then add 1 table-spoonful butter and 1 tea-spoonful brown sugar. Boil 10 minutes longer, then pour into buttered pans.

6283. Everton Taffee. To make this favorite and wholesome candy, take 1½ pounds moist sugar, 3 ounces butter, 1½ teacups water, and 1 lemon. Boil the sugar, butter, water, and half the rind of the lemon together, and when done (which will be known by dropping into cold water, when it should be quite crisp) let it stand aside till the boiling has ceased, and then stir in the juice of the lemon. Butter a dish, and pour it in about ¼ inch in thickness. The fire must be quick, and the taffee stirred all the time.

6284. To Make Cream Rise. Cream cannot rise through a great depth of milk. Therefore, if milk is desired to retain its cream for a time, it should be put into a deep narrow vessel; but if it be desired to free it almost completely of cream, it should be poured into a broad flat dish, not much exceeding one inch in depth.

6285. To Clear all Kinds of Sugar. Take a little gum arabic, and a little isinglass dissolved in hot water; pour it, when dissolved, in your sugar, when it is boiling, and it will clear all the sediment to the top of the pan, which must be skimmed off as soon as it rises. Loaf sugar may be cleared with the white of an egg, isinglass, or gum arabic. A little of each will do. *(See No. 1357.)*

6286. To Keep a Churn from Frothing Over. Take the body of the churn and cut a groove around the inside of the mouth, about 3 inches from the top and ½ inch deep, and then remove half the thickness of the wood, making a shoulder all around; then take the cover and cut it to fit nicely inside, and you have now done away with the necessity for cloths, tubs, pans, &c., heretofore required to save the cream flowing over.

6287. To Make French Coffee. A French coffee pot consists of two tin vessels, one on top of the other. In the upper one is a strainer, and a tin plate pierced with holes. The coffee, ground almost as fine as gunpowder, is poured into the strainer, and the plate with the holes put over it. Boiling water is then poured in and filters through into the bottom vessel or pot. The pot should be kept on the range or stove, a few moments, until scalding hot, and the fluid which has filtered through poured in at the top again, which will extract all the flavor of the berry, and make a cup of coffee far superior to that boiled. Liebig says, however, that a portion of the coffee should be kept out, thrown into the bottom of the vessel, and there permitted to steep, like tea. This, he says, gives the flavor, while the infiltrated portion gives the strength. We have tried this experiment with great success, and find it a vast improvement over the method of simply pouring boiling water on the top; it is, moreover, economical, because the ground coffee is exhausted more completely than by simple immersion in hot water. After standing a few moments, it is as clear as spring water, and as deep colored as claret. A still better plan, in making coffee by the filtering method, is thus: place the ground coffee in the filter, cover it closely; then pour sufficient boiling water in the coffee-pot (*not into the filter*) to cover the bottom about ¼ inch. Place the filter in the coffee-pot, and set the whole on the stove or fire, so that the water will boil and its steam rise and soften the coffee in the filter. In about 5 minutes, empty out the water, and pour boiling water through the filter as usual. The ground coffee will be so thoroughly exhausted of its strength and aroma that it will not bear twice watering. Coffee should never be brought in contact with iron. Tinned coffee-pots that have been used for some time are apt to get worn on the surface, so that the iron the tin plate is made of comes through. When this occurs the coffee will be bitter and black, for it attacks iron, forming an acid very quickly. This any one can see by putting a few drops on a case-knife. Above all, to have good coffee, the pot must be scrupulously clean.

6288. To Keep Suet. Suet chopped fine and mixed with flour, if tied down tight in a jar will keep 10 days or 2 weeks, and is very nice to use for puddings or pastry. If there be more suet than will be used while fresh, throw it into a pickle made in the proportion of 4 ounces salt to 1 quart cold water. It must be freshened by laying it in fresh water an hour or two before using it, and will then be as nice as fresh suet. Or the suet may be rendered down, and poured into a pan containing about an inch of cold water. When cold, take off the suet (the impurities will have fallen to the bottom of the water), and pack it away in jars for future use. Do not put in salt, if it is intended to use for frying, as salt prevents articles from browning easily.

6289. Imitation Asses' Milk. The following preparations are used freely as substitutes for asses' milk, and may be administered in cases of consumption and general debility, a tea-cupful 3 or 4 times a day, either plain or with a spoonful of rum.

Mix the whites of 2 eggs with ½ pint new cow's milk, and 1 ounce sugar; add ½ ounce syrup of tolu.

6290. Factitious Asses' Milk. Boil 1 ounce hartshorn shavings to a jelly in 1 pint water, adding 2 ounces white sugar; when cool add 1 pint new cow's milk and ½ ounce syrup of tolu. Used as in the last receipt.

6291. Liqueur de la Grande Chartreuse. According to Dr. Chevalier, this celebrated liqueur, made at the Abbey of the name, near Grenoble, is composed of essence of melissa citrata, 31 grains; essence of hyssop, 31 grains; essence of angelica root, 154 grains; essence of best mint, 309 grains; essence of nutmeg, 31 grains; essence of cloves, 31 grains; and 4½ pints rectified spirits of wine, of best quality. The liquid is artificially colored, either with turmeric or any other suitable material.

6292. Doppel Kummel. To 5 gallons 94 per cent. alcohol, add 4 ounces oil of caraway, ½ drachm (30 drops) oil of anise, 5 drops oil of coriander, 5 drops oil of bitter almonds, and 10 drops oil of calamus. Add 20 gallons French proof spirit, and 15 gallons water in which 10 pounds white sugar have been dissolved. This will make 40 gallons kummel of a strength of 36¼ per cent. If for cordial, more sugar may be added.

6293. To Improve Cheap Bourbon. Inferior Bourbon whiskey may be much improved in quality by the addition of the peach flavoring given in No. 6294. From 1 to 1½ gallons of the flavoring should be added to 40 gallons of whiskey. This will give it a fruity taste.

6294. Peach Flavoring for Whiskey by a New Method. Take a 50-gallon pipe; at 4 or 5 inches from the bottom place a false bottom, perforated with ½-inch holes. Cover this false bottom with a thin layer of straw, laid uniformly; this again covered by a thin even layer of straw laid at right angles across the lower layer. Then pack 10 gallons dried peaches regularly, without pressing them; add 5 pounds black tea evenly sprinkled over the peaches, and cover the whole with a cloth. Next pack 10 gallons oak sawdust evenly, and cover it also with a cloth. Place some pieces of lath over the cloth, with some middle-sized stones to keep the sawdust down. Insert a faucet in the side of the pipe, between the bottom and the false bottom. Now add 20 gallons proof spirit, and draw off, three times every day, 15 gallons of the tincture, and pour it back immediately. As the sawdust acts as a filter, the tincture will be ready for use and bright in 10 or 15 days. If a greater quantity is required, double the above proportions and use a gin cask.

6295. To Improve Wine by Electricity. The process consists in plunging into the vat containing the wine, two plates of platinum or of silver, having attached to them two wires of the same metal, which are connected with the poles of an electric battery. The Bunsen and Daniell's batteries are much used in France for this purpose. The time necessary to transform a low grade wine to one of an agreeable and superior quality, is from two to three weeks, with the battery continually working. By this method, wines which were considered only fit for making vinegar, are changed to such an extent that they are used as good, and in some cases superior table wines. (*See No.* 726.)

6296. Pharaoh's Serpents Eggs are made in the following way: Take mercury and dissolve it in moderately dilute nitric acid by means of heat, taking care, however, that there be always an excess of metallic mercury remaining; decant the solution, and pour it into a solution of sulpho-cyanide of ammonium or potassium, which may be bought at a good drug store, or of a dealer in chemicals. Equal weights of both will answer. A precipitate will fall to the bottom of the beaker or jar, which is to be collected on a filter and washed two or three times with water, when it is put in a warm place to dry. Take for every pound of this material 1 ounce gum tragacanth which has been soaked in hot water. When the gum is completely softened it is to be transferred to a mortar, and the pulverized and the dried precipitate gradually mixed with it by means of a little water, so as to present a somewhat dry pill mass, from which pellets of the desired size are formed by hand, put on a piece of glass, and dried again; they are then ready for use.

6297. Pharaoh's Serpents Eggs. A substitute, nearly as good as the original mercury compound, and superior in not being poisonous, is prepared in the following way: Take bichromate of potassa, 2 parts; nitrate of potassa, 1 part; white sugar, 3 parts. Pulverize each of the ingredients separately, and then mix them thoroughly. Make small paper cones of the desired size, and press the mixture into them. They are now ready for use, but must be kept from moisture and light.

6298. Solidified Glycerine for Toilet Use. Transparent soap, 1 ounce; water, 4 ounces; inodorous glycerine, 24 ounces. Dissolve the soap in the water by heat, adding an equal weight of glycerine. When dissolved, add the remaining portion of glycerine, and sufficient water to make up the weight. When nearly cold, add any suitable perfume and pour in glass jars. It has a very pale amber color, is transparent, melts easily on the skin, and leaves no residue.

6299. To Remedy a Scattering Gun. To prevent a gun from scattering, insert a ring about half an inch in width in the nozzle of the gun, beveling from the outer edge to nothing at the inward. It can be fastened in with rivets. It should be made of metal about 1/16 of an inch in thickness, and be fitted very neatly.

6300. Preservation of Stone. Doctor Eugene Robert, of Paris, recommends copper salts as being the best preservatives of stone in a damp climate. These salts prevent the formation of lichens, to the action of which M. Robert attributes the destruction of stone. This is, without doubt, true for granite, but its efficiency for sandstone is questionable. The latter deteriorates by exfoliation, without the development of any vegetation.

6301. Ground Tea. A French chemist asserts that if tea be ground like coffee before hot water is poured upon it, it will yield nearly double the amount of its exhilarating qualities.

6302. To Impart a Fine Flavor to Tea. To impart a fine flavor to ordinary tea, place rose leaves in the tea-canister, or add one drop of the attar of roses on a piece of soft paper to every pound of tea, and keep the canister closely covered.

6303. To Prevent Stoves From Rusting. Kerosene applied with a rag to stoves will keep them from rusting during the summer. It is also an excellent material to apply to all iron utensils used about a farm.

6304. To Remove Pin-Spots from Steel. Get a small iron box with a sliding top to it, fill it with pulverized charcoal, and imbed the pieces of steel in it, put in the top, and lute with fire-clay. Heat it in a slow fire, to a red heat, then take out and let it cool off.

6305. Remedy Against the Cracking of Wooden Taps and Faucets. This is best prevented by putting the taps and faucets in melting paraffine, and heating them there at a temperature of 212° Fahr., until bubbles of air cease to escape from the wood. The whole is then allowed to cool to about 120° Fahr., when the taps are taken from the bath and cleaned from the adhering paraffine by rubbing with a dry coarse piece of cloth.

6306. French Composition for Washing. Dissolve 1 pound hard soap in 6 gallons of water, then add ¼ ounce spirits of turpentine and ½ ounce spirits of hartshorn.

6307. Cheap Family Soap. Add to 10 quarts of water, 6 pounds of quicklime (shell lime is best), and 6 pounds common washing soda. Put all together and boil for half an hour, and let it stand all night to clear. Draw off the lye, and add to it 1 pound common resin and 7 pounds of fat (any fat will do).

Boil this for half an hour, then let it stand till cool, and cut into bars.

6308. To Make a Bad Yellow Soap Good and Hard. Heat a solution of 28 pounds hyposulphite of soda in 4 gallons water, with 250 pounds of bad yellow or brown soap, and the result will be a good hard soap. This is Desborough's patent.

6309. To Preserve Soap Grease. Fill a cask half full of good strong lye and drop all refuse grease therein. Stir up the mixture once a week.

6310. Waterproof Starch. This is a French patent, and consists in passing the goods, after being properly starched, through a bath of chloride of zinc at a temperature of about 60° Fahr. The starch will then remain in the clothes after several successive washings.

6311. Cement to Resist Sulphuric Acid. Melt caoutchouc by a gentle heat, add from 6 to 8 per cent. of the weight of tallow, taking care to keep the mass well stirred; add dry slacked lime, so as to make the fluid mass the consistency of soft paste; and lastly add 20 per cent. of red lead, whereby the mass, which otherwise remains soft, becomes hard and dry. This cement resists, according to Dr. Wagner, boiling sulphuric acid. A solution of caoutchouc in twice its weight of raw linseed oil, aided by heating, and the addition thereto of an equal weight of pipe-clay, yields a plastic mass which also resists most acids.

6312. Cement for Fixing Glass Letters. A thick solution of marine glue in wood naphtha will answer perfectly if color is no object. But the glass must be chemically clean, and this is not always easy. The least trace of soap or grease will spoil the adhesion of any cement. Try soda or ammonia, followed by whiting and water, clean cloths, and plenty of rubbing, and let the cement dry on the letters till the surface just begins to be "tacky" before you apply them.

6313. New Process for Rendering Cloth Waterproof. This is a method for rendering fabrics waterproof without destroying their ventilating qualities. Place in a metal vessel of about 6 gallons capacity, 20 pounds sulphate of alumina cut in thin slices; and in another similar receptacle 8 pounds oleic acid and 6 quarts alcohol. Thoroughly dissolve the latter compound, and stir it with a wooden stick for 20 minutes, gradually adding the sulphate of alumina. Leave the whole for about 24 hours to settle. The oleic acid and the spirit will then be at the surface, and can be decanted; the remaining deposit should be filtered through flannel, and pressed into a cake. This can be dried by heat, and ground to a powder. For use on silken or linen clothes, 1½ pounds to 20 gallons of water will be ample; wool will not require more than 1 pound. It is as well to strain these solutions, and the fabrics require only to be thoroughly saturated and dried in the air.

6314. To Clarify Quills. Cut off the small top of the quills, tie them loosely in bundles, fix them nearly upright in a saucepan of water in which a small piece of alum has been dissolved, about the size of a walnut of alum to a quart of water; let them boil slowly until they become clear; add a little turmeric or a small pinch of saffron to the water, to give them the yellow color; dry them in the sun. Tie paper round the feather part of the quills, to keep them from dust. The quantity of alum may be increased according as you wish the quills more or less brittle.

6315. New Glazing for Frescoes. Dr. Vohl announces that paraffine, mixed with benzole or Canada balsam, affords a glazing for frescoes much superior to soluble glass. By covering the interior of wine casks with a film of pure white paraffine, poured in melted, he has effectually prevented the spoiling of the wine and its evaporation through the wood.

6316. To Bend Gas Pipe. This may be done by filling the pipe with melted resin. When the resin hardens, bend the pipe, and it will retain its round form. Remove the resin by heating.

6317. Chewing Gum is made as follows: Take of prepared balsam of tolu, 2 ounces (*see second receipt in No. 5102*); white sugar, 1 ounce; oatmeal, 3 ounces. Soften the gum in a water-bath and mix in the ingredients; then roll in finely-powdered sugar or flour, to form sticks to suit.

6318. Chewing Gum from Paraffine. This article may be made by dissolving paraffine at a gentle heat in a very little olive oil and glycerine. It is stirred on cooling, and afterwards compressed. The amount of glycerine depends on the consistency to be desired, and must be determined by the character of the paraffine employed. This latter consists of mixtures of various carbo-hydrides, and is by no means always of the same composition and properties. The glycerine will keep it soft and make it sweet at the same time.

6319. Boot Powder. Scraped or powdered French chalk is used by bootmakers to make new boots or shoes go on easily, by rubbing or dusting a little of it on the inside of the heel and instep of the boot.

6320. Electric Tissue. Steep linen or cotton 1 hour in a mixture of 1 part strong sulphuric acid and 3 of pure nitric acid; squeeze out the acid, wash with water until no sensible acidity remains, plunge it in a weak alkaline solution, then in water, and dry. By friction it yields a large quantity of resinous electricity.

6321. To Make Modeling Clay. Knead dry clay with glycerine instead of water, and a mass is obtained which continues moist and plastic for a length of time, thus removing one of the greatest inconveniences experienced by the modeler.

6322. To Remove Stains from Knives. The very best way to clean a stained steel knife is to cut a solid potato in two, dip one of the pieces in brick dust (such as is usually used for knife-cleaning), and rub the blade with it.

6323. To Prevent Ivory Knife Handles from Cracking. When the blades of knives require washing or standing in water, it should be done in a pitcher, with water enough to cover the blades, but not to touch the handles; and the water no hotter than is absolutely necessary. Soaking the handles in water makes them crack.

6324. To Cleanse Goose Feathers. Feathers are prepared by exposing them to the sunshine or in a stove until perfectly dry, and then beating them to remove dust and loose dirt. When carelessly collected and dirty, they may be cleansed with lime-water; or, still better, with a weak solution of carbonate of soda, or with water containing a little solution of chloride of lime; after which they are rinsed in clean water, and dried as before. (*See No. 659.*) Old feathers are purified and cleansed in the same way.

6325. Coloring Castor Oil. Make a strong tincture of turmeric root with strong alcohol, and add a few drops to the oil until you have the desired color. Rather than being a disadvantage, it will prove a benefit, tending to prevent griping.

6326. Labels for Damp Situations. Write on the back of adhesive plaster. Labels made of this substance are not affected by damp, and adhere strongly.

6327. To Reproduce a Beautiful White on Flannel Goods Turned Yellow by Age. For the restoration of old flannels to their original color, Professor Artus recommends the following method: Dissolve 2¼ pounds white Marseilles soap in 75 pounds soft water, and to the solution add, under constant stirring, 1 ounce liquor ammonia. The goods are soaked in this fluid, and afterwards well washed with water. The object may be accomplished, however, more quickly, by putting the goods for 1 hour in a dilute solution of bisulphite of soda, and adding, under constant stirring, some dilute hydrochloric acid, when the vessel has to be covered and the goods left in it for 15 minutes longer. They are then thoroughly washed in water.

6328. Sizing for Holland Linen. The sizing or dressing employed for the Holland used for window shades is prepared as follows: Take 1 part crystallized carbonate of soda; 4 to 6 parts each white wax, stearine, and pure white soap; 20 parts carbonate of magnesia or fine Paris white; 40 parts potato starch, and 160 parts fine wheat starch. Boil these together with sufficient water to make 1000 parts altogether. A little ultramarine is added, if needed, to counteract the yellow tint of the linen, which is starched with this preparation, passed between rollers, and dried. It is then sprinkled with soap water, placed in a stamping mill, and afterwards steamed and calendered.

6329. Starch Lustre is a substance used for washing purposes, which, when added to starch, causes the linen to which it is applied to assume not only a high polish, but a dazzling whiteness. A piece of lustre of the size of a copper cent added to ¼ pound starch, and boiled with it for 2 or 3 minutes, will produce the best results. The starch lustre consists of stearine, colored by a slight addition of ultramarine blue, the essential ingredient being the stearine; and, with or without the coloring matter, will be found to add very much to the beauty of linen articles to which it is applied. (*See Nos. 497, &c.*)

6330. To Clean Windows and Mirrors. Tie up some finely powdered whiting in a small piece of muslin. Dab it over the glass thoroughly; the dirtier the glass the more whiting will adhere to it. Next smear it evenly with a damp rag, and let it remain until perfectly dry; then rub it off with a leather. This is an easy, clean, and thorough plan. If alcohol be used instead of water, it will dry in much less time, and polishes the glass fully better. The corners of the window-panes should receive particular attention; they are too often left dirty, and spoil the appearance of the window.

6331. To Wash Mirrors or Windows. For washing finger-marks from looking-glasses or windows, put a few drops of ammonia on a moist rag, and make quick work of it.

6332. Ganteine. A composition for cleaning kid gloves; sometimes improperly termed *Saponine*. Dissolve 3 troy ounces soap by heat in 2 ounces water, and when nearly cold add 2 ounces javelle water and 1 drachm water of ammonia; form a paste, whi h is to be rubbed over the glove with flannel till sufficiently clean.

6333. To Clean and Preserve Brewing Utensils. In cleaning them before being put away, avoid the use of soap, or any greasy material, and use only a brush and scalding water, being particularly careful not to leave any yeast or fur on the sides; then place them away in a clean and moderately dry situation. Should they become tainted or mouldy, take a strong lye of pearlash, which spread over the bottoms of the vessels scalding hot, and then with the broom scrub the sides and other parts. Or: Take common salt and spread it over the coolers, &c., and strow some on their wet sides, pour in scalding water and scrub them with a broom. Or: Throw some quicklime into water in the vessel, and scrub over the bottom and sides with it; in each case well washing afterwards with clean water. Or: Wash well first with oil of vitriol diluted with 8 times its weight of water, and afterwards with clean water.

6334. To Restore the Color of an Acid Stain on Violet Silk. Acid dropped on violet-colored silk destroys the color; to restore it, brush the discolored stain with tincture of iodine; then, after a few seconds, saturate the spot well with a solution of hyposulphite of soda, and dry gradually; the color will be perfectly restored.

6335. To Transfer Engravings onto Glass. First coat the glass with copal varnish, then press on the picture, face downwards, smoothly and tightly; let it dry. Next damp the paper slightly, and rub it off with the finger, leaving the picture to be looked at through the glass.

6336. To Transfer Engravings on Wood, Stone, &c. Take a saturated alcoholic solution of potash, pour the solution on the engraving, and immediately remove all the superfluous liquid by means of blotting paper. Lay the engraving, while damp, upon the wood or other material to which it is to be transferred, and place it in a press. (A copper-plate press is the best.) The transfer will be obtained immediately. The engraving must be immersed in clear, cold water, after removal from the potash bath. (*Orr.*)

6337. How to Wash Printing Rollers. Avoid all grit, sand, and dirt; simply use strong ley to loosen the ink, and quickly, with a soft sponge, wash the ley off with water (in winter blood-warm) squeezing the sponge dry, face up the roller, so that no moisture remain thereon. Let it then stand exposed to the air one hour, machine rollers two hours, before distributing ink on its surface. The time for exposure must be guided by the state of the weather, as shorter time will do in dry or windy weather. Be careful to ink the roller as soon as possible after exposure, to keep it tacky. (*See No.* 2542.)

6338. Gelatine Capsules. A strong solution is made of 6 parts gelatine and 1 part sugar; the extremity of a rod of bulbous shape is oiled, and dipped into the solution; when the rod is withdrawn it is rotated, in order to diffuse the fluid jelly equally over its surface; as soon as the gelatinous film has partially hardened, it is removed from the mould and placed on pins furnished with suitable heads, and fixed on a cork table. When dry, the capsules are placed upright in little cells made in the table to receive them, and the liquid with which they are to be filled is introduced by means of a small glass tube. They are then closed by dropping some melted gelatine on the orifice of each. Ricord recommends that capsules containing copaiba be coated with extract of rhatany, which is easily done by immersing the capsule for an instant in a mixture of 3 parts newly prepared extract of rhatany, 1 part syrup of moist sugar, and 1 part mucilage of gum arabic, melted together in a water-bath. Capsules thus prepared are said to act with greater certainty, as well as improving the tone of the stomach.

6339. To Remove Nitrate of Silver Stains. A solution of iodide of potassium will freely dissolve iodine. Silver stains moistened for a while with this solution will be converted into iodide of silver, which is soluble in iodide of potassium. The stains will therefore have disappeared when the cloth, after the foregoing treatment, is washed in water. (*See No.* 385.) Perhaps the best method of removing these stains is as follows: The stained cloth is washed with a concentrated solution of sulphate or chloride of zinc and then touched with a piece of metallic zinc. This same process may be used for the removal of ink stains in both cases without danger to the fabric. After the color has disappeared, they are washed first with pure water and then with water and soap. No visible traces of the stains are left behind. (*See No.* 3141.)

6340. To Remove Nitrate of Silver Stains from Woven Tissues. According to M. Grimm, chloride of copper completely removes, even from colored woven cotton tissues, stains occasioned by nitrate of silver; the tissue is to be afterwards washed with a solution of hyposulphite of soda, and next thoroughly washed with water. From white cotton and linen tissues, nitrate of silver stains are more readily and effectually removed by applying dilute solution of permanganate of potassa and hydrochloric acid, followed by washing with hyposulphite of soda solution, and rinsing in plenty of fresh water. By these means the use of the highly poisonous cyanide of potassium is rendered unnecessary. (*See Nos.* 385 *and* 3141).

6341. To Dissolve Old Blood Stains. Dr. Helwig recommends a solution of iodide of potassium in four times its weight of water.

6342. Silk Cleaner. Mix well together ½ pound soft soap, a tea-spoonful of brandy, ½ pint proof-spirit, and ½ pint water. It is to be spread with a sponge on each side of the silk without creasing it; the silk is then rinsed out 2 or 3 times, and ironed on the wrong side. (*See No.* 460.)

6343. Fluid for Removing Grease Stains from Silk, &c. A fluid for removing greasy stains from silk, &c., may be prepared by mixing 2 ounces rectified spirits of turpentine, ½ ounce absolute alcohol, and ½ ounce sulphuric ether.

6344. To Remove the Stains of Benzine. In removing grease spots from fabrics by means of benzine or petroleum it often happens that a colored and stained outline of the portion moistened is left. This can be prevented by the application of a layer of gypsum extending a little beyond the moistened region. When dry, the powder is to be shaken and brushed off, when no trace of the spot will remain.

6345. To Clean Silver. To clean silver utensils, blackened by sulphuretted hydrogen, Boettger recommends a boiling saturated solution of borax, or a solution of caustic potash, with some fragments of metallic zinc.

6346. To Clean a Wedgwood Mortar. A solution of caustic potash will usually be effectual; this may be triturated in the mortar with fine sand or powdered pumice-stone. Sometimes sulphuric acid will serve a better purpose. Chlorinated lime (chloride of lime) will sometimes remove the color where it is a stain merely.

6347. To Dye Gutta-Percha. Dissolve 1 ounce gutta-percha in chloroform, and add ½ grain of pure carmine, previously mixed with a little powdered gum and water; then distill off the chloroform and knead well the remaining gutta-percha. In the same way ultramarine, ochre, oxide of chrome, &c., may be used.

6348. To Clean Gutta-Percha. This can be done by using a mixture of soap and powdered charcoal, polishing afterwards with a dry cloth with a little of the charcoal on it.

6349. To Dye Straw Hats Black. The following is given as a black color for straw hats. The quantities of material are intended for 25 hats or bonnets. They are kept for 2 hours in a boiling decoction of 4 pounds logwood, 1 pound sumach, and 5 ounces fustic; and afterwards dipped into a solution of nitrate of iron of 4° Baumé, then well rinsed with water, and, when dry, are painted over with a solution of lac or dextrine.

6350. To Dye Leather Yellow. Picric acid gives a good yellow without any mordant; it must be used in very dilute solution, and not warmer than 70° Fahr., so as not to penetrate the leather.

6351. To Dye Leather Green. Aniline blue modifies picric acid to a fine green. In dyeing the leather, the temperature of 85° Fahr. must never be exceeded.

6352. To Dye Leather Green. Aniline green is well adapted to dyeing leather, and its application is quite simple. Whether used in paste or as powder, we must make a concentrated aqueous solution. The leather is brushed over with a solution of sulphate of ammonia, mixed with water, the dye solution applied at 95° Fahr., and it must be endeavored, by rapid manipulation, to prevent the dye from penetrating through the leather. By the addition of picric acid, the bluish shade of this dye-stuff is modified to leaf green, and it becomes faster; but the picric acid must not be added to the color solution; it must be applied to the leather before or after the dyeing with aniline green. (*Springmuhl.*)

6353. Slating for Black-Boards. The imitations of slate are of two kinds, real imitations, consisting of pulverized slate or quartz rock moistened to the consistency of a thick fluid with silicate of soda (water-glass of commerce), and applied to the boards by means of a brush; or merely paints, such as asphaltum or Grahamite dissolved in petroleum naphtha. The first one will produce slates that are very similar to the natural slates, less expensive than those, and last a good while.

6354. Asphalt for Walks. Take 2 parts very dry lime rubbish, and 1 part coal-ashes, also very dry, and both sifted fine. In a dry place, on a dry day, mix them, and leave a hole in the middle of the heap, as bricklayers do when making mortar. Into this pour boiling hot coal-tar; mix, and when as stiff as mortar put it 3 inches thick where the walk is to be; the ground should be dry, and beaten smooth. Sprinkle over it coarse sand. When cold, pass a light roller over it; in a few days the walk will be solid and waterproof.

6355. To Make Gravel Walks. The bottom should be laid with lime-rubbish, large flint stones, or any other hard matter, for 8 or 10 inches, to keep weeds from growing through, and over this the gravel is to be laid 6 or 8 inches thick. This should be laid rounding up in the middle, by which means the larger stones will run off to the sides, and may be raked away; for the gravel should never be screened before it is laid on. It is a common mistake to lay these walks too round, which not only makes them uneasy to walk upon, but takes off from their apparent breadth. 1 inch in 5 feet is a sufficient proportion for the rise in the middle; so that a walk 20 feet wide should be 4 inches higher at the middle than at the edges, and so in proportion. As soon as the gravel is laid, it should be raked, and the large stones thrown back again; then the whole should be rolled both lengthwise and crosswise; and the person who draws the roller should wear shoes without heels, that he may make no holes, because holes made in a new walk are not easily remedied. The walks should always be rolled 3 or 4 times after very hard showers, which will bind them more firmly than could be accomplished by any other method.

6356. Polishing Powder for Specula. Precipitate a dilute solution of sulphate of iron by ammonia in excess; wash the precipitate, press it in a screw press till nearly dry, then expose it to heat until it appears of a dull red color in the dark. (*Lord Ross.*)

6357. To Make a Voltaic Pile. Take disks of copper, zinc, and woolen cloth of any size, soak the cloth in a solution of sal-ammoniac, then pile them up in the following order: Copper, zinc, cloth, and so on. The relative position of the metals in each pair must be observed throughout the whole series, so that, if the pile commences with a copper plate, it shall terminate with a zinc one. These two extremes are called the poles. Zinc is called the positive pole, and copper the negative pole. The outer disks are connected with copper wire, that the electric or galvanic stream which is excited in the pile may be conveyed to any place desired. When the two ends of the wires are brought very near to each other, sparks are seen to dart from one to the other; this is a token of the galvanic current, manifesting itself in the same manner as the current of the electrical machine. The larger the disks and the greater their number, the greater is the intensity of the current.

6358. To Make a Cistern. A good cistern can be made in a solid clay soil, if not in an exposed situation, by cementing against the sides of the ground. Where the ground freezes we would not recommend such a practice, but lay a wall of cobblestones in a mortar of cement, and face the wall with a thick coating of clear mortar. Great care must be exercised to get good cement, and mix it with coarse sand. Fine sand will not do at all. 1 part cement and 3 parts sand is the usual proportion, to be used as soon as mixed. Every part of the wall must be laid below the reach of the frost. This can be done, and an iron or wooden pipe or throat lead to the surface, through which the pump can pass. A cheap and excellent cistern can be constructed of wood, in the form of a large cask, or a tank made of pine or cedar plank. When sunk into the ground, and kept constantly wet, it will last for years. A better way is to place the tank or cask in one corner of the cellar, with a faucet in the bottom, from which the water is easily drawn when it is desirable to clean it out and when water is required in the cellar. An open cistern in a cellar will rarely freeze.

6359. To Purify Water. Chloride of iron and carbonate of soda, in the proportion of 10 parts by weight of the former salt and 26½ of the latter to a quantity of water equal to 20,000 parts, has been found a most valuable and quite innocuous means of purifying water, even such as is otherwise quite unfit for drinking purposes, and could not be rendered fit by alum. The salts alluded to are best previously dissolved in some pure water, and the solutions, that of iron first, poured into the tank containing the water intended to be operated upon. The soda solution is not added until after a few moments, the water being first vigorously stirred. The soda solution having been added, the fluid is stirred again, and then left quiet for the purpose of allowing the very bulky and flocculent sediment to deposit; this takes considerable time—from 24 to 36 hours.

6360. Gutta-Percha Tissue. If a solution of gutta-percha in chloroform be mixed with 3 parts of ether and exposed for some time to a temperature below 15° Fahr., the gutta-percha will be precipitated as a white powder, forming, when washed and dried, a soft white mass. If some of this solution be spread on a plate of glass, a skin is formed, resembling kid-glove leather, which becomes transparent on the application of heat. These films are beautifully white if carefully prepared, and have been employed in the manufacture of the finest kinds of artificial flowers.

6361. Mosaic Silver. Take 2 parts each pure tin and purified bismuth, melt them together by a moderate heat, and add 1 part purified mercury. When cold reduce the mass to a fine powder. (*Hager.*)

6362. Mosaic Gold. Melt 12 ounces pure tin, by a gentle heat, add 6 ounces mercury, and reduce to powder; when cold, add 6 ounces muriate of ammonia, and 7 ounces flowers of sulphur; mix thoroughly. Place the compound in a glass flask, and gradually heat to redness in a sand-bath, continuing the heat till all white fumes cease; during this operation bisulphuret of mercury, muriate of tin and sal-ammoniac are sublimed, leaving the mosaic gold at the bottom of the flask in soft, brilliant, gold-colored flakes. Mosaic gold, also called *Aurum Musivum*, is therefore the *bisulphuret of tin*. (*Cooley.*)

6363. To Preserve Pencil and Indian Ink Sketches. To a solution of collodion of the consistency used by photographers, add 2 per cent. of stearine. The drawing is then spread on a board or plate of glass and the collodion poured over it as in photography. (*See No.* 3143.) It dries in 10 to 20 minutes, and so thoroughly protects the drawing that it may be washed without fear of injury.

6364. Golden Compound. Melt anhydrous tungstate of soda in a porcelain crucible, over a spirit lamp, at a temperature not more than sufficient to fuse it. Add small pieces of pure tin to the melted mass, and cubes of a golden color instantly form. The process should not be continued too long, or they acquire a purple hue.

6365. Ink for Writing on Tin Plates. Mix together without heat, 1 part pine soot, with 60 parts of an aqueous solution of nitrate of copper. (*Hager.*)

6366. Black Stencil Ink. Triturate together 1 part pine soot and 2 parts Prussian blue with a little glycerine, then add 3 parts gum arabic, and sufficient glycerine to form a thin paste.

6367. Factitious Beef Marrow. Mix together, by dissolving at a gentle heat, 2 parts fresh hogs' lard and 1 part cacao butter.

6368. To Obtain Absolute Alcohol. A German savant has recently improved on the well-known method employed by Mendelejeff, for obtaining absolute alcohol. Strong alcohol is boiled with quicklime, the pieces of the latter projecting above the surface of the liquid for ½ hour or more, with a condenser inverted so that the liquid may return by its own gravity to the flask. The condenser is then reversed, and the alcohol redistilled. If the alcohol contains more than 5 per cent. of water, the process must be repeated 2 or 3 times. The vessel should only be half filled with the pieces of lime, as the rapid formation of hydrate of lime may break it to pieces. (*See No.* 1442.)

6369. Bougie. A long slender instrument, introduced into the urethra, œsophagus, or rectum, to overcome strictures of those canals. Add 3 parts boiled linseed oil to 1 part melted amber, and when mixed add 1 part oil of turpentine; spread the mixture at 3 successive intervals upon loose spun silk cord or web, dry in a heat of 150° Fahr., and repeat the process until the instrument has acquired the proper size, then polish, first with pumice-stone, and afterwards with tripoli and oil. This is the original receipt of the French Professor Pickel, and is still generally used in Europe, slightly modified as follows: Add to the oil and amber, melted together as last, caoutchouc in the proportion of $\frac{1}{16}$ of the weight of the oil employed; when dissolved, remove the vessel from the fire and proceed as before.

6370. Hunter's Bougie. Boil slowly together, until combination takes place, 2 parts yellow wax, 3 parts red lead, and 6 parts olive oil; strips of soft linen, rather wider at one end than the other, are then dipped into the composition, rolled up firmly, and finished on a polished slab.

6371. Catheters, or Hollow Bougies. These are made of the same composition as the ordinary bougies, but a piece of polished metallic wire is introduced into the axis of the silk; or tinfoil is rolled round the wire and the composition applied as before.

6372. Caoutchouc, or Elastic Gum Bougies. These are made by applying an ethereal solution of india-rubber to the silk or foil prepared as in the foregoing methods. Where ether is expensive naphtha is employed, but it furnishes a very inferior product. Sometimes slips of india-rubber previously boiled in water, or that have had their edges softened with ether, are wound round the wire or foil, and kept in their place by a piece of tape applied over them, as in making elastic tubes. They are afterwards carefully smoothed off and polished.

6373. To Prevent Lamp Chimneys from Cracking. Put the chimneys into a kettle of cold water, and gradually heat it until it boils, and then let it as gradually cool; the chimneys will not be broken by the ordinary fluctuation of the flame of the lamp.

6374. To Mend Rubber Overshoes, &c. Rub the patch and shoe thoroughly with sharp sand paper. Smear both with liquid rubber 5 times, every time letting them dry. Do this once more, and, before they dry, apply the patch, with pressure if possible, and the boot is mended. If liquid rubber is not obtainable, dissolve small pieces of pure rubber (not vulcanized), in warm spirits of turpentine, to the consistence of syrup.

6375. To Preserve and Restore Oil Paintings. Many valuable paintings suffer premature decay from the attacks of a microscopic insect of the mite class. The best method of preventing this species of decay is to add a few drops of creosote to the paste and glue used to line the picture, as well as to make a similar addition to the varnish. If it has already commenced, the painting should be at once carefully cleaned and relined, observing to employ a little creosote in the way just mentioned. Paintings should be kept in as pure an atmosphere as possible, and in a moderately dry situation; as it is the presence of sulphuretted hydrogen in the air that blackens the "lights," and causes most of the middle tints and shades to fade; and it is exposure to damp that produces mouldiness and decay of the canvas. For this reason valuable paintings should not be kept in churches, nor suspended against heavy walls of masonry, especially in badly ventilated buildings. Excess of light, particularly the direct rays of the sun, also acts injuriously on paintings. The blackened lights of old pictures may be instantly restored to their original hue by touching them with deutoxide of hydrogen, diluted with 6 or 8 times its weight of water. The part must be afterwards washed with a clean sponge and water.

6376. Compressed Leather. A new process for using the clippings and refuse from saddlers' and shoemakers' shops is as follows: The leather shavings are washed clean, cut up fine, and soaked in water and sulphuric acid, 1 per cent. of the acid being sufficient. The immersion must continue till the shavings become plastic, and the leather then can be pressed into moulds with only a moderate amount of pressure. It can be rolled into thin sheets, and will be useful for many purposes; it will not, however, resist moisture. A little glycerine rubbed in will prevent its cracking.

6377. To Render Walls Water-tight. It is proposed by *Mr. F. Ransome*, of London, to render stone and brick walls waterproof by coating them to saturation with a solution of silicate of soda, which is superficially decomposed by the further application of chloride of calcium. The surface thus obtained consists of silicate of lime, which is perfectly insoluble, and therefore water-tight, while it does not alter the appearance of the wall. *(See No.* 2171.*)*

6378. To Wash Silks. No person should ever wring or crush a piece of silk when it is wet, because the creases thus made will remain forever if the silk is thick and hard. The way to wash silk is to spread it smoothly upon a clean board, rub white soap upon it, and brush it with a clean hard brush. The silk must be rubbed until all the grease is extracted, then the soap should be brushed off with clean cold water, applied to both sides. The cleansing of silk is a very nice operation. Most of the colors are liable to be extracted with washing in hot suds, especially blue and green colors. A little alum, dissolved in the last water that is brushed on silk, tends to prevent the colors from running. Alcohol and camphene, mixed together, are used for removing grease from silk.

6379. To Extinguish Fires. Dr. Clanny's solution consists of 5 ounces sal-ammoniac to 1 gallon water. The compound used in Phillip's Fire Annihilator is said to consist of dried prussiate of potash, sugar, and chlorate of potash.

6380. To Prevent Mouldiness. The best preventive is any of the essential oils, as the oil of lavender, cloves, peppermint, &c. Russia leather, which is scented with the tar of the birch tree, is not subject to mouldiness, and books bound in it will even prevent mouldiness in other books bound in calf, near which they happen to lie.

6381. To Keep Gum-Arabic from Moulding. Solutions of gum-arabic soon mould and sour, and finally lose their adhesive property. It is said that sulphate of quinine will prevent this, while it imparts no bad odor of its own. The addition of a solution of a few crystals of this salt to gum-arabic will prevent the formation of mould quite as effectually as carbolic acid, and by analogy it is safe to suppose that the same salt could be used in writing ink, mucilage, and, possibly, glue.

6382. To Prevent the Formation of a Crust in Tea-kettles. Keep an oyster-shell in your tea-kettle. By attracting the stony particles to itself, it will prevent the formation of a crust.

6383. Bird Lime. Boil the middle bark of the holly 7 or 8 hours in water; drain it, and lay it in heaps in the ground, covered with stones, for 2 or 3 weeks, till reduced to a mucilage. Beat this in a mortar, wash it in rain water, and knead it till free from extraneous matters. Put it into earthen pots, and in 4 or 5 days it will be fit for use. An inferior kind is made by boiling linseed oil for some hours, until it becomes a viscid paste.

6384. Substitutes for Lenses. Procure a piece of thin platinum wire, and twine it once or twice round a pin's point, so as to form a minute ring with a handle to it. Break up a piece of flint glass into fragments a little larger than mustard seed; place one of these pieces on the ring of wire, and hold it in the point of the flame of a candle or gas-light. The glass will melt and assume a complete lens-like or globular form. Let it cool gradually, and keep it for mounting. Others are to be made in the same manner; and if the operation be carefully conducted but very few will be imperfect. The smaller the drop melted, the higher in general will be its magnifying power. It may be mounted by placing it between two pieces of brass which have corresponding circular holes cut in them, of such size as to hold the edge of the lens. They are then to be cemented together. A perfectly round glass globe filled with pure water also makes a powerful lens.

6385. Ether Glue. An excellent liquid glue is made by dissolving glue in nitric ether. The ether will only dissolve a certain amount of glue, consequently the solution cannot be made very thick. The glue thus made is about the consistency of molasses, and is doubly as tenacious as that made with hot water. If a few bits of india-rubber, cut into scraps the size of buck-shot, be added, and the solution be allowed to stand a few days, being stirred frequently, it will be all the better, and will resist dampness twice as well as glue made with water.

6386. Brick-Dust Cement. Ordinary brick dust, made from hard burned, finely-pulverized bricks, and mixed with common lime and sand, is a good substitute for hydraulic cement. The proportions used in general practice are 1 part brick-dust and 1 of lime to 2 of sand, mixed together dry, and tempered with water in the usual way.

6387. Cement for a Crack in a Cast-iron Pot. If the crack be in the bottom of the pot, drill a hole at each extreme end of the crack, to stop further cracking, plug rivet the holes with copper, and, with fine iron filings saturated with urine, caulk the crack. This method has been tried on oil-pots on board whale-ships with success.

6388. The Drummond Light. This brilliant light is produced by directing a stream of oxygen gas, passing through the flame of a spirit lamp, upon a small ball of quicklime of about ¼ inch in diameter. It gives an intense light; and, placed in the focus of a parabolic mirror, has been distinctly seen at a distance of 60 miles.

6389. Doebereiner's Self-Igniting Lamp. Take an ordinary fruit jar, with a cork stopper or leaden cover; procure any old bottle that will go into the jar, at least two thirds as tall as the jar. Cut off the bottom of the bottle either with a file or by wrapping a piece of candle-wick soaked in alcohol around it, burning the wick, and dipping in water while hot. *(See Nos.* 2367, *&c.)* A hole is cut in the cork or lead cover, to admit the neck of the bottle and prevent it resting on the bottom of the jar. The bottle is closed with a cork fitted with a short glass tube bent at right angles and drawn to a fine opening. Some pieces of zinc are suspended in the bottle by a wire or little basket of lead. The jar is then filled to about one-half with dilute sulphuric acid. The acid, coming in contact with the zinc, generates hydrogen gas, which escapes from the glass tube. The mixture of air and gas being highly explosive, the lamp should not be ignited until all the air has been expelled. After the air has escaped, a piece of spongy platinum may be placed a little distance from the point of the tube. The gas, impinging on the platinum, heats it sufficiently to ignite itself. The escape of gas may be cut off by slipping a rubber tube closed at one end over the glass tube, or a tube with a stop-cock may be used. As soon as the escape of gas is cut off, its pressure drives the acid out of the bottle into the jar, and no more gas is generated. Pieces of spongy platinum mounted on wires suitable for this use may be obtained of dealers in chemical apparatus. The lamp may also be purchased complete from the same parties.

6390. Pencils for Writing on Glass. Take 4 parts stearic acid, 3 parts mutton suet, and 2 parts wax; melt them together and add 6 parts red lead and 1 part purified carbonate of potassa, previously thoroughly triturated together. Set the mixture aside for an hour in a warm situation, stirring frequently, then pour it into glass tubes or hollow reeds.

6391. Elastic Cement. Dissolve 1 drachm gutta-percha in 1 ounce or more bisulphide of carbon, so as to make a fluid that will easily pass through coarse filtering paper. After filtering, add about 15 grains pure india-rubber, and let it dissolve; or, when it has become soft and gelatinous, quickly rub the whole smooth with a palette knife on a slab.

6392. To Mend a Balloon or Gas-Bag. Paint 4 or more coats of the varnish described in the last receipt, around the hole in the bag, allowing each coat to dry before the application of the next. Treat a piece of fine strong muslin in the same way. The last coat on each should be pretty thick, and, when nearly dry, apply the patch to the bag, and press evenly and quite firmly together. When at last the whole is dry, press with a warm iron, and then paint the surface of the new piece with a coat or two of the varnish. If nicely done, the bag will be as strong as ever. Chloroform may be used in place of the bisulphide of carbon.

6393. Improvement in Ink-Erasers. The Great Lightning Ink-Eraser may be used instead of a knife or scraper for erasing ink, in order to rectify a mistake or clean off a blot without injury to the paper, leaving the paper as clean and good to write upon as it was before the mistake or blot was made, and without injury to the printer's ink upon any printed form, or the ruling upon any first-class paper. Take of chloride of lime 1 pound, thoroughly pulverised, and 4 quarts soft water. The above must be thoroughly shaken when first put together. It is required to stand 24 hours to dissolve the chloride of lime; then strain through a cotton cloth; after which add a tea-spoonful of acetic acid (No. 8 commercial) to every ounce of the chloride of lime water. The eraser is used by reversing the pen-holder in the hand, dipping the end of the pen-holder into the fluid, and applying it, without rubbing, to the word, figure, or blot required to be erased. When the ink has disappeared, absorb the fluid with a blotter, and the paper is immediately ready to write upon again. Chloride of lime has before been used with acids for the purpose as above proposed; but in all previous processes the chloride of lime has been mixed with acids that burn and destroy the paper. (Patented, Jan. 16th, 1872.)

6394. To Preserve Clothes Pins. Clothes pins boiled a few moments and quickly dried, once or twice a month, become more flexible and durable. Clothes lines will last longer and keep in better order if occasionally treated in the same way.

6395. To Fasten Loose Window Sashes. The most convenient way to prevent loose window sashes from rattling unpleasantly when the wind blows is to make four one-sided buttons of wood, and screw them to the beading which is nailed to the casings of the window, making each button of proper length to press the side of the sash outwards when the end of the button is turned down horizontally. The buttons operate like a cam. By having them of the correct length to crowd the stiles of the sash outwards against the outer stop of the window frame, the sash will not only be held so firmly that it cannot rattle, but the crack which admitted dust and a current of cold air will be closed so tightly that no window strips will be required. The buttons should be placed about half way between the upper and lower end of each sash.

6396. To Detect a Counterfeit Bank of England Note. The Bank of England possesses no security which may not be known by any person who will make himself acquainted with the following characteristics of the paper, the plate printing and the type printing of the note. The paper is distinguished: By its peculiar color, such as is neither sold in the stores nor used for any other purpose. By its thinness and transparency, qualities which prevent any portion of the printing on the note being washed or scratched out without a hole being made. By its characteristic feel, which consists of a singular crispness and toughness, owing to the fact that the bank paper is made from new linen and cotton, not from rags. By the peculiar wire-mark or water-mark, which can only be produced when the paper is in a state of pulp; consequently the forger must procure a mould, and make his own paper, both requiring the skill of such first-rate artisans as are not likely to be met with in the haunts of crime. By the three deckle or rough edges. These edges are produced when the paper is in pulp; two notes being placed in the mould, and divided lengthways, hence the top and bottom, or *long* edges, are both rough. The deckle is the raw edge of the paper, and cannot be imitated by cutting. By the strength of the paper—a bank note will lift a hundred weight if carefully adjusted. The printing is of two kinds, type and plate; the paper is moistened by water driven through its pores by the pressure of the atmosphere; 30,000 double notes are thus moistened in the space of an hour. The ink used is made at the bank, from linseed oil and the charred husks and vines of Rhenish grapes; this gives a peculiar velvety black to the mark in the left-hand corner of the note. The notes are numbered by a machine which cannot err; and, lastly, are authorized by the signature of the clerk. The bank notes are printed on the side of the paper which receives the water mark, so that, if the paper be split, the unprinted surface only retains the slightest trace of that mark.

6397. To Flatten Engravings or Paper that has been Rolled Up. To succeed in this, take a roll of paper, wall-paper for instance, unroll a portion of it, and insert the paper or card-board, which is to be flattened, in such a manner that when the whole is rolled up again, the card-board will be bent the opposite way to which it was originally rolled. Roll up closely and evenly, and let it remain for about 15 minutes. If this be carefully done, the card-board will be flattened without danger of breaking, and free from the creases inevitably made if rolled backwards in the hands. If wall-paper be used, it should be as thick as can be obtained, and the larger the diameter of the roll, the better. Collectors of engravings will find it worth their while to obtain a straight roller, say 3 inches in diameter, and 5 or 6 yards of the stout paper sold in rolls or by the yard under the name of "pattern paper. The cost is trifling, and it will last for years.

6398. To Remove Water Stains from Engravings or Paper. Fill a sufficiently large clean vessel with pure water; dip the engraving in, waving it backward and forward until wet through. Then fasten it to a flat board with drawing pins, and let it dry in the sunshine.

6399. To Bleach Engravings, &c. Old engravings, wood cuts, and all kinds of printed matter, that have turned yellow, are completely restored by being immersed in this preparation for only one minute, without the least injury to the paper, if the precaution is taken to thoroughly wash the article in water containing a little hyposulphite of soda. Undyed linen and cotton goods of all kinds, however soiled or dirty, are rendered snowy white in a very short time by merely placing them in the liquid mentioned. For the preparation of Javelle water, take 4 pounds bicarbonate of soda, and 1 pound chloride of lime; put the soda into a kettle over the fire, add 1 gallon boiling water, let it boil from 10 to 15 minutes, then stir in the chloride of lime, avoiding lumps. When cold, the liquid can be kept in a jug ready for use. (*See No.* 4787.)

6400. To Clean Soiled Engravings. Lay the engraving, face downwards, in a perfectly clean vessel, sufficiently large to allow the engraving to lay flat; pour clean boiling water upon it, and allow it to stand until the water is cold; take it out carefully and remove as much of the moisture as possible with clean blotting paper, then place the engraving in a press between clean white paper. If very much soiled, a repetition of the operation may be necessary.

6401. Fine Black Hair Dye. This is composed of two different liquids, No. 1, called the *mordant*, which is employed to give permanency to the dye, and No. 2, which is the dye itself. Take ¾ ounce pyrogallic acid, 6 ounces alcohol, and 18 ounces water; shake them well together, and put the mixture in a glass-stoppered bottle. This is the *mordant*, and must be labeled *Solution No.* 1. To prepare the dye, take 1 ounce nitrate of silver, 2 ounces ammonia, and 8 ounces distilled water; dissolve in a stoppered bottle, and mark it *Solution No.* 2. This is a very fine article. (*See No.* 1201.) Directions for using the above dye may be found in No. 1202.

6402. Fire Kindlings. In France, a very convenient and economical kindling is made by dipping corn-cobs for about one minute in a bath composed of 60 parts melted resin and 40 parts tar. They are next spread out to dry on metallic plates heated to the temperature of boiling water. (*See No.* 6205.)

6403. To Convert Sized Paper into Blotting Paper. Common paper may be converted into blotting paper by immersing it for a few seconds in hydrochloric acid. Some recommend for this purpose a mixture of hydrochloric acid and water; but in experiments that have been made, the paper was immersed in a bath of the ordinary undiluted acid, removing it, after a few seconds, to a vessel in which it was treated to several changes of water.

6404. Rother's Soap Liniment. Take of soap (genuine castile, mottled or white), dry and in No. 12 powder, 24 troy ounces; camphor, 12 troy ounces; oil of rosemary, 3 fluid ounces; water, 3 pints; strong alcohol, 10½ pints. Mix the water with half a pint of the alcohol in a capacious vessel; add the soap and apply heat until solution has occurred; to this add 4 pints of alcohol. In the remaining 6 pints of alcohol dissolve the camphor and oil; to this add the solution of soap; mix. Let the impurities (coloring matter of the soap) subside, and filter. This is vastly superior to the officinal process. (*See No.* 4869.)

6405. Coating for Black-Boards. Incorporate flour-emery with shellac varnish, adding sufficient lampblack to give the required color. If too thick, reduce its consistency with alcohol. This varnish, applied to the surface of wood with a camel's hair varnish brush, produces an excellent black facing, and may also be used for preparing smaller writing tablets.

6406. Beautiful Black Ink. Take a sufficient quantity of elder berries, bruise and keep them for 3 days in an earthen vessel; then press out and filter the juice. To 12½ pints of the filtered juice, add ½ ounce each of sulphate of iron, and crude pyroligneous acid. The ink that results has, when first used, a violet color, but when dry is an indigo blue-black. In writing, it flows easily from the pen without gumming, and does not thicken as soon as common ink. These are no small advantages, and ought to recommend it for general use. (*See No.* 2460.)

6407. To Mount Prints. Make a thin size of fish glue or isinglass. Take a good sized flat varnish brush, wet the brush with the size just sufficiently to moisten the surface of the print to the extent of the width of the brush and the whole length of the print. Commence at one side and continue in this way until you have gone over the whole surface. Draw the brush with a light, quick stroke, as closely each time to the part previously wet as possible, without lapping or going twice in one place. When dry, go over it again in the same way, only at right angles to the first stroke. Let this dry, then proceed to mount as follows: Stretch, as tightly as it will bear, to a frame of the required size, a piece of new, smooth, fine muslin or factory cloth. Rub over the whole surface of this, with a good paste-brush, a sufficient quantity of well-cooked paste, made of equal parts of wheat-flour and starch, to thoroughly wet the cloth. Lay the print onto it, and, covering it with a piece of clean paper, rub it down both back and front, until smooth and fast. When thoroughly dry, varnish with white copal varnish.

6408. Varnish to Imitate Ground Glass. Dissolve 90 grains sandarac and 20 grains mastic in 2 ounces washed methylated ether, and add, in small quantities, sufficient benzine to make it dry with a suitable grain, too little making the varnish too transparent, and excess making it crapy. The quantity of benzine required depends upon its quality, from ½ ounce to 1½ ounces or even more; but the best results are got with a medium quality. It is important to use pure washed ether, free from spirit.

6409. Xylol, the New Remedy for Small-Pox. Xylol, xylene, or ethyl-benzine, as it has been respectively called, is one of the hydrocarbons formed from coal-tar naphtha. It was first procured by Hugo Müller, but its nitro-compound had previously been discovered by Warren De la Rue, in 1856. Coal-tar naphtha is submitted to fractional distillation until the part which boils at 141° is separated; this is submitted to the action of fuming sulphuric acid, which dissolves the xylol and leaves the other hydrocarbons. The xylol is then separated by distillation from this mixture. Xylol is said to have been used by Dr. Zuelzer, the Senior Physician at the Charité Hospital at Berlin, with great success in cases of small-pox. The theory of its action would appear to be that xylol is taken up by the blood, and acts as a disinfectant. Its boiling point is variously stated at 139° to 140°. The specimens examined by the writer generally commenced to boil at about 135°. The specific gravity was .866. It is said that the purity of xylol is of importance, but there is no very ready method for testing its purity. It should be soluble in fuming sulphuric acid, but it is not soluble in the ordinary sulphuric acid of the Pharmacopœia. It has a faint odor something like benzole, and an aromatic taste. The doses are 3 to 5 drops for children; 10 to 15 drops for adults, every hour to every 3 hours. It is quite harmless in reasonable doses. In Berlin it is given in capsules. As it is very insoluble, the best method of giving it would be in an emulsion of almonds. (*Tichborne.*)

6410. To Examine Wells or Chimneys. In case the bottom of a well needs examining, hold a mirror in such a position as to reflect the sun's rays in the water, so that anything floating on the surface can then be plainly seen. If the contents of the well are not turbid, the smallest object on the bottom can also be distinguished. In this way objects dropped in wells of 60 feet in depth, and which contained more than 20 feet of water, have been traced and recovered. When the objects are small, or a minute examination of the bottom is required, an opera-glass may be used. If the top of the well is not exposed to sunlight, a mirror may be placed outside, even at a great distance, to reflect the light over its top, where a second mirror may reflect it downward. Letting a lamp, candle, or lantern down gives by no means as successful a result, as the light is very weak compared with sunlight, and its glare, even when the eyes are shaded from its direct rays, prevents distinct vision. The method of employing two mirrors, one outside reflecting the solar rays in a room, and a second small mirror in its path to reflect these rays into a dark cavity, is employed by physicians, for the examination of cavities of the body; for instance, to explore the tympanum in the human ear, the throat, etc. To examine a straight chimney a piece of looking-glass is to be held, inclined at an angle of 45°, in the hole in the chimney wall, into which the stove-pipe is to go, or in the open fireplace. If the observer can see the light of the sky, he will also see the whole interior of the chimney, and any obstruction in the same. As most chimneys are straight, the top will be clearly visible.

6411. To Clean Furniture. Mix together 1 pint cold drawn linseed oil, 1 pint best vinegar, and ½ pint spirits of wine. Dip a soft cloth into the mixture and rub over the furniture, and then wipe thoroughly with a clean soft cloth. Always shake the mixture before using. We do not know any article for cleaning furniture equal to this. (*Trent.*)

6412. To Wash Ladies' Summer Suits. Summer suits are nearly all made of white or buff linen, piqué, cambric or muslin, and the art of preserving the new appearance after washing is a matter of the greatest importance. In the first place, the water should be tepid, the soap should not be allowed to touch the fabric; it should be washed and rinsed quickly, turned upon the wrong side, and hung in the shade to dry, and when starched (in thin-boiled, but not boiling starch) should be folded in sheets or towels, and ironed upon the wrong side, as soon as possible. Linen should be washed in water in which hay or a quart-bag of bran has been boiled. This last will be found to answer for starch as well, and is excellent for print dresses of all kinds; a handful of salt is also very useful to set the colors of light cambrics and dotted lawns; and a little beef's gall will not only set, but brighten, yellow and purple tints, and has a good effect upon green. No soda, or other washing compound should on any account be used.

6413. To Dissolve Wool Out of Mixed Fabrics. Boil the rags in a mixture of 1 part nitric acid and 10 water, or a little stronger. The cotton fibre, after drying, can be shaken out as dust in a willowing machine, leaving the wool behind ready for dyeing. This is the plan adopted in England and Germany for making "extract," and is used for mixing with wool in many manufactures. This prepared wool, however, will be found to have lost, to a great extent, its felting property.

6414. Javelle Water. Many persons keep on hand a supply of Javelle water, small quantities of which are sufficient to render the most soiled linen perfectly white. It is prepared by taking 4 pounds sal-soda to 1 pound chloride of lime in 1 gallon water. Put the sal-soda into a vessel over the fire, add 1 gallon boiling water; let it boil for 10 or 15 minutes, then add the chloride of lime by throwing it, free from lumps, into the soda water. When cold, pour into a jug or large bottle and cork tightly. Where it is desirable to have a larger quantity, the following mixture can be taken: Stir 5 pounds chloride of lime into 2 pails warm water; dissolve 10 pounds glauber salt (sulphate of soda) in 1 pail water; also 4 pounds sal-soda in 1 pail water. The contents of the 4 pails can be poured together and kept in any suitable tight vessel. Such a quantity as the above ought to last a long time, as a dipperful of it would bleach a large quantity of linen or other goods. The materials are cheap, and the mixture easily made. (*See No.* 4787.)

6415. To Detect Blood-stains. It is said by Professor Bloxam, of London, that a mixture of tincture of guaiacum and a solution of peroxide of hydrogen in ether produces instantly, with blood or blood stains, a beautiful tint of blue. He had taken a single lint fibre, on which was a stain of blood scarcely perceptible, that had been made twenty years before, and he found that the test produced immediately the characteristic blue color, which was easily detected on a microscopic examination. (*See No.* 4393.)

6416. Artificial Honey. Put 10 pounds white sugar in 2 quarts water, and gradually heat it, stirring it occasionally until brought to the boiling point. Then remove from the fire and add 1 pound real honey. When half cooled, add ½ pound more honey, and, when only blood warm, add another ½ pound honey. When nearly cold, add 10 drops good essence of peppermint. This makes 16 pounds in all of a very good sweetening. Its flavor can be varied to the liking by adding more or less peppermint essence. (*See Nos.* 1572, *&c.*)

6417. Grape Champagne. Gather the grapes when they are just turning, or about half ripe; pound them in a tub, and to every quart of pounded fruit add 2 quarts water. Let it stand in the mash-tub for 14 days, then draw it off, and to every gallon of liquor add 3 pounds loaf sugar. When the sugar is dissolved, cask it; and, after it has done working, bring it down. In 6 months it should be bottled, and the corks tied down or wired. This produces a domestic real champagne, in no way inferior to the genuine imported article.

6418. Imitation White Frontignac Wine. Boil 18 pounds white powdered sugar, with 6 gallons water, and the whites of 2 eggs well beaten; then skim it, and put in ½ peck elder flower from the tree that bears white berries; do not keep them on the fire. When nearly cold, stir it, and put in 6 spoonfuls lemon juice, 4 or 5 of yeast, and beat well into the liquor; stir it every day; put 6 pounds best raisins, stoned, into the cask, and tun the wine. Stop it close, and bottle in 6 months. When well kept, this wine is an excellent imitation of Frontignac.

6419. Imitation Red Frontignac Wine. This is made in the same manner, and with the same ingredients as the white wine (*see No.* 6418), except that dark elder-flowers are used instead of white.

6420. Cure for Fever and Ague and Intermittent Fever. Take 40 grains sulphate of quinine, 30 grains powdered liquorice, and 10 grains gum myrrh. Make into 40 pills. Take 2 pills every 2 hours for the first 24 hours; 2 pills every 4 hours for the second 24 hours; and the remainder, 1 at night on going to bed, and 1 in the morning, first thing. This performs an effectual cure if the directions are *implicitly* followed. (*Trent.*)

6421. To Remove Tar or Pitch from the Skin. Mix together pulverized extract of liquorice, and oil of aniseed to the consistency of thick cream; rub it on the part thoroughly with the hand, then wash off with soap and warm soft water.

6422. To Remove Tar, &c., from Glass. It is not easy to remove tar, pitch, Venice turpentine, and other sticky substances from the graduated glasses used for measuring them. A mixture formed of the same ingredients as in the last receipt, combines with the sticky matter so completely as to allow of the whole being rubbed off dry and clean with a piece of cotton.

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