MECHANICS FOR YOUNG AMERICA

How to Build

BOATS, WATER MOTORS, WIND MILLS, SEARCHLIGHT, ELECTRIC BURGLAR ALARM, ICE BOAT, WATER BICYCLE, CABINS, CAMPS, CLOCKS, FISHING TACKLE, KITES, IMITATION STREET CAR LINE, ETC.,

The Directions are Plain and Complete

Reprinted from Popular Mechanics

POPULAR MECHANICS
CHICAGO

PRICE 25 CENTS

CONTENTS

How to Make a Paper Boat..... 5
How to Make a Barrel Boat..... 7
How to Make a Water Wheel..... 8
How to Make Your Own Fishing Tackle. 9
Temporary Camps and How to Build Them 12
Permanent Camps and How to Build Them 14
How to Build an Imitation Street Car Line 19
How to Make a Water Bicycle..... 20
How to Make a Miniature Windmill.... 22
How to Build an Ice Boat..... 23
A Novel Burglar Alarm 25
A Mechanical Ventriloquist and How to Make It 26
How to Make a Boot-Blacking Cabinet.. 26
Renewing Dry Batteries 26
How to Make Water Motors..... 27
How to Make "Antique" Clocks from Up-to-Date Materials 29
Lettering a Clock Dial..... 31
How to Make a Windmill of One or Two Horsepower 32
How to Make a Trap for Rabbits, Rats and Mice 34
How to Make a Small Searchlight..... 34
Kites of Many Kinds and How to Make Them—Jug Fishing 36
How to Do Ornamental Iron Work.... 39
Ornamental Metal Guards for Open Fireplaces 41
How to Make a Propelling Vehicle..... 43
How to Make a Water Telescope..... 44
How to Make Paper Balloons..... 44
How to Make a Hectograph..... 45
Useful Articles and Ornaments Made of Old Bicycle Parts 45
Devices for Winter Sports—How to Make and Use Them 47
Coasting Sleds, Chair Sleighs, Toboggan Slides and Skis 50
How to Make Rubber Stamps..... 52
How to Make a Baggage Carrier for Bicycles 54
A Water Candlestick 54
Boy's Hand-Power Auto—How Made... 55
How to Make a Pair of Dumb-Bells.... 55
How to Rid Your Yard of Cats..... 56
How to Make an Easel..... 56
To Light a Gaslight Without Matches.. 57
Things a Boy Can Make Out of Old Bicycle Parts 58
How to Make a Wind Propeller..... 59
Photographing from a Captive Balloon. 60
How to Make a Simple Burglar Alarm 62
To Make a Binder for Popular Mechanics 63
How to Make a Hammock..... 63
Electric Rat Exterminator 64
How to Make a Miniature Steam Turbine 65
How to See Through Your Hand..... 65
How to Make a Wood-Turning Lathe Out of an Old Sewing Machine.. ... 66
How to Remove Stains from Marble.... 67
How to Make a Turbine Engine..... 68
How to Make a Lead Cannon..... 70
How to Make a Wireless Telegraph System 71
How to Make a Toy Battery Motor Lift a 10-lb. Weight 72
To Renew Old Dry Batteries..... 72
Weatherproofing for Tents 72
How to Make an Electric Furnace Regulator 73
How to Make a Simple Fire Alarm..... 74
How to Make a Bell Tent..... 75
Enameling a Bicycle Frame..... 75
A Practical Camera for Fifty Cents.... 76
How to Make a Very Simple Turbine... 78
Power of Small Coils for Sending Wireless Messages 79
Ringing a Bell by Touching a Gas Jet. 79
How to Build an Electric Engine..... 80
Novel Electric Motor 80
How to Make a Sailomobile..... 81
How to Make a Novel Burglar Alarm.. 82
Simple X-Ray Experiment 82
To Build a Merry-Go-Round..... 82
Another Electric Motor 83
Use for an Old Clock..... 83
To Make an Electric Piano..... 84
How to Make a Telegraph Instrument and Buzzer 84
How to Build a Model Yacht..... 86
How a Boy Built a Complete Miniature Railroad 88

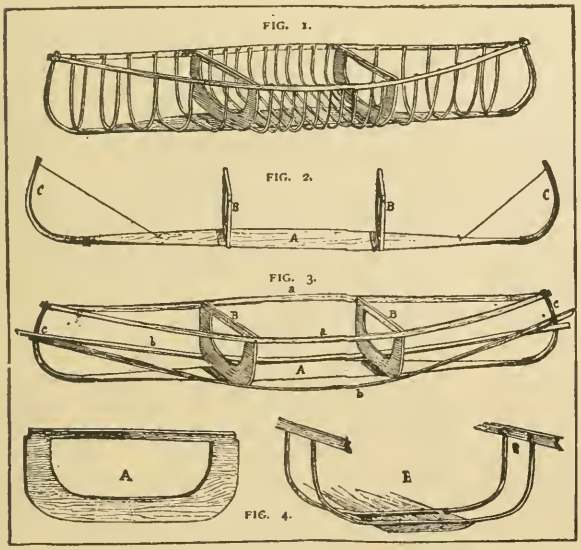
MECHANICS FOR YOUNG AMERICA

Rowing in a Paper Boat

How to Make a Paper Boat

It is Light and Can Easily Be Carried About.--A Barrel Sail Boat

Without a boat, successful fishing is nearly impossible under many conditions. Boats are expensive to buy, and they are heavy and bunglesome and often insubstantial. So why not have a perfectly successful boat suited to your own needs and one that is inexpensive, by making it yourself. It is difficult for an amateur boat-maker to obtain the right kind of lumber for the hull of a row boat, and after the lumber is obtained, it is still more difficult to cut it off and bend it in the proper shape for the boat. If you have not the facilities for making a wooden boat and if you want a light, serviceable boat, why not make it out of paper?



Now you might think it absurd to advise making a paper boat, but it is not, and you will find it in some respects and for some purposes better than the wooden boat. When it is completed you will have a canoe, probably equal to the Indian's bark canoe. Not only will it serve as an ideal fishing boat, but when you want to combine hunting and fishing you can put your boat on your shoulders and carry it from place to place wherever you want to go and at the same time carry your gun in your hand. The total cost of such a boat is $6.17. Here is how to make a paper boat:

Make a frame (Fig. 1) on which to stretch the paper. A board about a foot wide, an inch thick and say 11 feet 6 inches long is taken as a kind of keel, or backbone, and is cut tapering for about a third of its length, toward each

end, and beveled on the outer edges (A, Fig. 2). The cross-boards (B, B, Fig. 2) are next sawed from a pine plank one inch thick. Shape these as shown by A, Fig. 4, 13 inches wide by 26 inches long, and cut away in the center to avoid useless weight. Fasten them cross-wise to the bottom-board as shown in Figs. 1 and 2, with long stout screws, so as to divide the keel into three nearly equal parts. Then add the stem and stern pieces (C, C, Fig. 2). These are better, probably, when made of green elm. Screw the pieces to the bottom-board and bend them, as shown in Fig. 2, by means of a string or wire, fastened to a nail driven into the bottom. Any tough, light wood that is not easily broken when bended will do. Green wood is preferable because on drying it will retain, to a considerable extent, the shape into which it has been bent. For gunwales (a, a, Fig. 3), procure at a carriage factory, or other place, some light strips of ash, about 12 feet in length, 1½ inches wide, and ⅜ inch thick. Nail them to the cross-boards and fasten to the end-pieces (C, C,) in notches, by several wrappings of annealed iron wire or copper wire, as shown in Fig. 3. Copper wire is better because less apt to rust. For fastening the gunwales to the cross-boards use nails instead of screws, because the nails are not apt to loosen and come out. The ribs, which are easily made of long, slender switches of osier willow, or similar material, are next put in, but before doing this, two strips of wood (b, b, Fig. 3) should be bent and placed as in Fig. 3. They are used only temporarily as a guide in putting in the ribs, and are not fastened, the elasticity of the wood being sufficient to cause them to retain their position. The osiers may average a little more than a half-inch in thickness and should be cut, stripped of leaves and bark and put in place while green and fresh. They are attached to the bottom by means of shingle nails driven through holes previously made in them with an awl, and are then bent down until they touch the strips of ash (b, b, Fig. 3), and finally cut off even with the tops of the gunwales, and notched at the end to receive them (B, Fig. 4). Between the cross-boards the ribs are placed at intervals of two or three inches, while in other parts they are as much as five or six inches apart. The ribs having all been fastened in place as described, the loose strips of ash (b, b, Fig. 3) are withdrawn and the framework will appear somewhat as in Fig. 1. In order to make all firm and to

Boy Carrying a Paper Boat on His Shoulders While Hunting

prevent the ribs from changing position, as they are apt to do, buy some split cane or rattan, such as is used for making chair-bottoms, and, after soaking it in water for a short time to render it soft and pliable, wind it tightly around the gunwales and ribs where they join, and also interweave it among the ribs in other places, winding it about them and forming an irregular network over the whole frame. Osiers probably make the best ribs, but twigs of some other trees, such as hazel or birch, will answer nearly as well. For the ribs near the middle of the boat, twigs five or six feet long are required. It is often quite difficult to get these of sufficient thickness throughout, and so, in such cases, two twigs may be used to make one rib, fastening the butts side by side on the bottom-board, and the smaller ends to the gunwales, as before described. In drying, the rattan becomes very tight and the twigs hard and stiff.

The frame-work is now complete and ready to be covered. For this purpose buy about 18 yards of very strong wrapping-paper. It should be smooth on the surface, and very tough, but neither stiff nor very thick. Being made in long rolls, it can be obtained in almost any length desired. If the paper be one yard wide, it will require about two breadths to reach around the frame in the widest part. Cut enough off the roll to cover the frame and then soak it for a few minutes in water. Then turn

the frame upside down and fasten the edges of the two strips of paper to it, by lapping them carefully on the under side of the bottom-board and tacking them to it so that the paper hangs down loosely on all sides. The paper is then trimmed, lapped and doubled over as smoothly as possible at the ends of the frame, and held in place by means of small clamps. It should be drawn tight along the edges, trimmed and doubled down over the gunwale, where it is firmly held by slipping the strips of ash (b, b) just

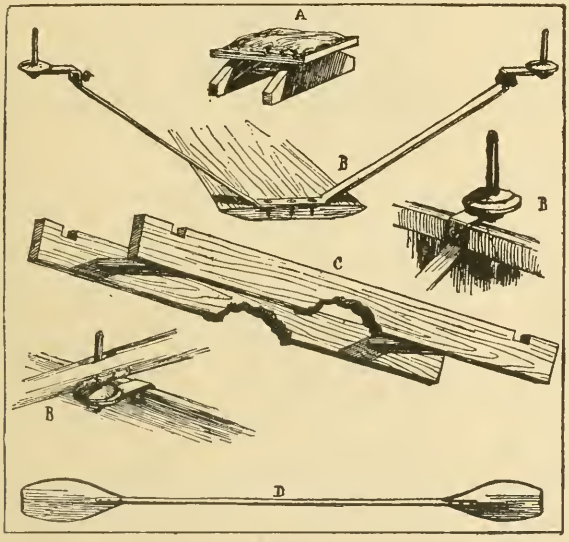


Fig. 5.

inside of the gunwales into notches which should have been cut at the ends of the cross-boards. The shrinkage caused by the drying will stretch the paper tightly over the framework. When thoroughly dry, varnish inside and out with asphaltum varnish thinned with turpentine, and as soon as that has soaked in, apply a second coat of the same varnish, but with less turpentine; and finally cover the laps or joints of the paper with pieces of muslin stuck on with unthinned varnish. Now remove the loose strips of ash and put on another layer of paper, fastening it along the edge of the boat by replacing the strips as before. When the paper is dry, cover the laps with muslin as was done with the first covering. Then varnish the whole outside of the boat several times until its presents a smooth shining surface. Then take some of the split rattan and, after wetting it, wind it firmly around both gunwales and inside strip, passing it through small holes punched in the paper just below the gunwale, until the inside and outside strips are bound together into one strong gunwale. Then put a piece of oil-cloth in the boat between the cross-boards, tacking it to the bottom-board. This is done to protect the bottom of the boat.

Now you may already have a canoe that is perfectly water-tight, and steady in the water, if it has been properly constructed of good material. If not, however, in a few days you may be disappointed to find that it is becoming leaky. Then the best remedy is to cover the whole boat with unbleached muslin, sewed at the ends and tacked along the gunwales. Then tighten it by shrinking and finally give it at least three coats of a mixture of varnish and paint. This will doubtless stop the leaking entirely and will add but little to either the weight or cost.

Rig the boat with wooden or iron rowlocks (B, B, Fig. 5), preferably iron, and light oars. You may put in several extra thwarts or cross-sticks, fore and aft, and make a movable seat (A, Fig. 5). With this you will doubtless find your boat so satisfactory that you will make no more changes.

For carrying the boat it is convenient to make a sort of short yoke (C, Fig. 5), which brings all the weight upon the shoulders, and thus lightens the labor and makes it very handy to carry.

The approximate cost of materials used in the construction of the canoe are as follows:

Varnish, 5 qts.	$1.90
Paper, 18 yds.	1.20
Cloth, 8 yds.	.72
Bottom-board	.60
Gunwales	.50
Cross-boards	.25
Paint	.50
Split rattan	.25
Nails, screws, wire, etc.	.25
Total	$6.17

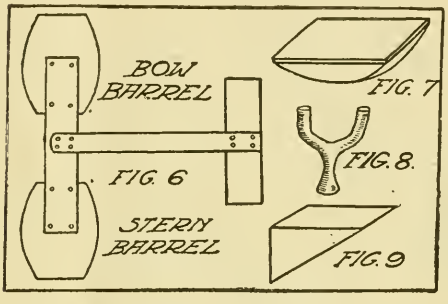
It may be that you are in position to get many of these materials for nothing and thus lessen the cost.

BARREL BOAT FOR SAILING.

For sailing the barrel boat is very easily constructed and it is one of the best devices known to instruct a young person in the art of managing sails. The barrel boat can be put together in one day, and the only part that needs to be bought is the material for the sail. Fig. 6 shows the hull of the barrel boat. It consists of a bow barrel and a stern barrel, joined together by one strong plank and a simple outrigger which extends

from the plank. In order that the barrels may not present a flat front, which would be difficult to push through the water, they are, as shown in the illustration depicting the completed boat, fastened to the plank at an angle. The angle is made by placing between each barrel and the plank a triangular shaped brace, such as shown in Fig. 9. Both barrels must be covered with tar and painted so that they will be absolutely water-tight.

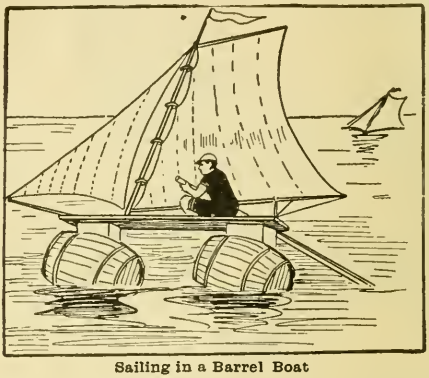
The outrigger (Fig. 7), is a small scow-



Rigging of Barrel Boat

shaped affair, about 2½ feet long and 1 foot wide. An ordinary oar or paddle is used for steering. A notched stick (Fig. 8) or an iron rowlock can be fastened over the stern barrel to hold the steering oar.

The barrel boat, when completed, will consist of two large air-tight compartments



Sailing in a Barrel Boat

and is, therefore, unsinkable, and because of the out-rigger is very difficult to tip over. Hence it is safe to carry quite a large spread of sail. In a stiff breeze the barrel boat is more seaworthy than rapid, because the waves slap against the ends of the barrels, but in a light breeze when the water is smooth, the barrel boat compares favorably in point of speed with the ordinary small sail boat.

HOW TO MAKE A WATER WHEEL.

Considerable power can be developed with an overshot water wheel erected as in Fig. 1. This wheel is made with blocks of wood cut out in sections as indicated by the lines, so as to form the circle properly. The wheel can be about 24 inches in diameter with

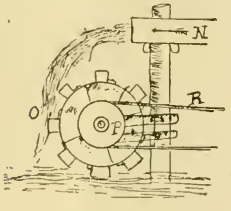


Fig 1

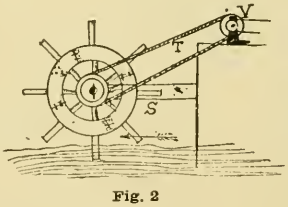


Fig. 2

good results and about 10 inches wide. Get some tin cans and attach them around the wheel as shown. Bore the wheel center out and put on the grooved wood wheel P and a rope for driving R. This rope runs to a wooden frame in the manner illustrated and the water is carried in a sluice affair N to the fall O, where the water dippers are struck by the volume and a power equal to two to four horsepower ordinarily generated. This power can be used for running two or three sewing machines, fans, fret-saws, and the like. Another form of water wheel is shown in Fig. 2. This is driven by an underflow of current. This type of wheel can be made on lines similar to the other, only that the paddles are of wood and extend outward as shown. The wheel is supported in a bearing on the piece S. A belt T communicates the power to the wheel V and from here the power is carried to any desired point.

To find the horsepower which a belt can safely transmit, multiply the diameter of the driving pulley in inches by the revolutions per minute, and by the width of the belt in inches. Divide the resulting product by 3,300 for single belting, or 2,100 for double belting.

A Hungarian inventor claims to have solved the smoke difficulty by employing porous plates or bricks made of a composition containing lime and fuel of different degrees of combustibility arranged behind or between portions of the fuel in a furnace. These serve as desulphurizing or purifying filters for the furnace gases.

MECHANICS FOR YOUNG AMERICA

How To Make Your Own Fishing Tackle

Hurrah! it is fishing time. In April the fish bite better and they taste better than in any other month. So get out your fishing tackle, boys, and ho for the lakes and streams. This year don't spend so much of your parents' money for fishing paraphernalia. Make it yourself and you will feel prouder of it and the old folks will feel prouder of you, and you will be the envy of all the boys around.

If you want to fish and engage in some other sport at the same time, you should by all means have a fishing semaphore. This instantly shows from a distance when a fish is on the hook, and any boy can make it. The line may be baited and set, and the fisher can give his attention to other things, with only an occasional glance at the signal. To make the semaphore take a piece of board about 12 inches square and 2 inches thick. If a single piece cannot be obtained, build a block of this size out of small stuff. Bore a hole in the center one inch in diameter and in this drive a scantling 2 inches square, 12 or 15 inches long and pointed at the lower end. Now take a piece of wood 2 inches wide and 5 inches long for the semaphore and round two of the corners, as shown in the cut. Bore a small hole 2½ inches from the tapered end and fasten the board to the scantling by driving a small round nail at A (Fig. 1). Drive another nail at B, leaving the nail head protrude one-half inch from the scantling to serve as a rest for the semaphore. The board should be made to turn easily on the pivot nail. At C fasten a strip of thin sheet iron, bent flat at the top, so as to support the semaphore in place when it is sprung—that is, when it raises to indicate a fish is caught. The free end of this strip or spring rests on the outside of the semaphore when it is down, and supports it when it is up. It should not press too tightly against the signal. At D drive a small nail and attach the fishing line. When the fish takes the hook it will throw the signal up to a horizontal position and the spring C will hold it there. The semaphore may be painted red, or white, or to bear the word "Fish."

In the January issue of Popular Mechanics were described methods of winter fishing that may very easily be applied to spring and summer fishing, with slight alterations which any boy with a bit of mechanical ingenuity can figure out for himself. For instance, the "jumping-jack" fisherman can be built on a big floating board with a 2-inch hole under the jumping-jack for the line to pass through, just as easily, if not easier, than on the ice. The "tip-up" is also of great amusement in spring and summer, and can be erected by aranging the "tip-up" between two logs or heavy timbers.

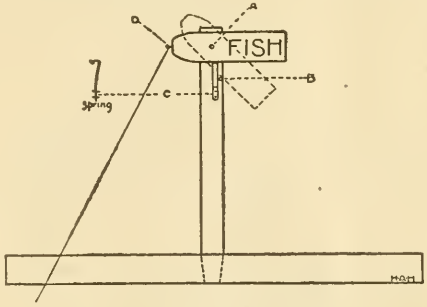


Fig. 1.—The Fishing Semaphore

Bass and pickerel have an irresistible hankering for bait on a hook trolled by toy boats. These boats serve the purpose, however rudely made, and one boy can operate a whole fleet of them if he have a large boat by which he can row to any one of the small boats immediately when he notes a fish is hung. The boats can be made of a piece of plank, say 2½ feet long. The board should be sharpened at one end and rigged up with a couple of cloth masts (Fig. 2). The most important part of the craft is the rudder. This should be very long, to prevent the boat from making lee way and to keep it from changing its course. Drive a couple of nails in the stern of the boat, to which tie the fish lines, hooked with spoon or live bait. The small boat does not

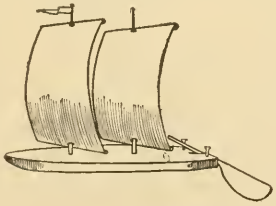


Fig. 2. Toy Fishing Boat

scare the fish as a large one does, and the bait pulled along by it is wonderfully attractive to members of the finny tribe, especially when trolled before the wind.

If proper fishing tackle is not accessible, it is very easy to manufacture it yourself.

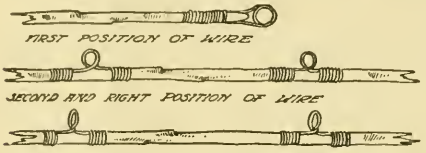


Fig. 3.—Method of Making a Trout Rod

To make a trout rod first secure a long, straight, elastic pole, such as can be found in nearly any wood. Then secure some pins and a small piece of wire. File off the heads of the pins and bend them in the shape of the letter U and drive them in the rod on the same side at regular intervals, beginning at about 2½ feet from the butt end of the pole. Drive the pins just far enough in to permit the line to pass freely under the loop. To make the tip bend a circular loop in the center of a piece of wire and knot or bind the wire to the end of the pole, as shown in the illustration (Fig. 3). If you have plenty of wire, it will make better loops than the pins. Cut the wire into short pieces about 3 inches long, loop each piece in the center. Then with more wire or with strong, waxed thread bind the ends lengthwise on the rod, as shown in the illustration (Fig.3). After the binding is secure, twist each loop around to its proper position.

A large wooden spool, an old tin can and a thick wire will serve to make an A 1 reel. Run the wire through the spool and

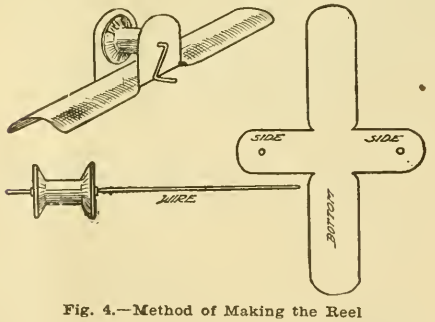


Fig. 4.—Method of Making the Reel

wedge it tightly so that one inch protrudes at one end and three inches at the other. From a tin can cut a piece of tin of the shape shown in Fig. 4. Two protruding parts are left on each side to be bent up for side pieces, to serve as rests for the axle tree. After the side pieces are bent up in the proper shape, punch a hole in each and insert the ends of the wires through the holes. See that the spool revolves freely, and then bend the long end of the wire in the shape of a crank. Hammer the tin over the rod until it takes the exact curve of the rod and fits snugly. Then bind it firmly to the rod with strong twine. It is difficult to make a fish hook, though many good perch and cats have been caught with bent pins. A strong steel wire can be bent and filed to a point and a notch filed above the point for the barb. Fish hooks have been made of birds' claws. The claw is bound to a piece of shell by vegetable fiber. None of these home-made hooks are satisfactory, however, and it is better to carry a good supply with you.

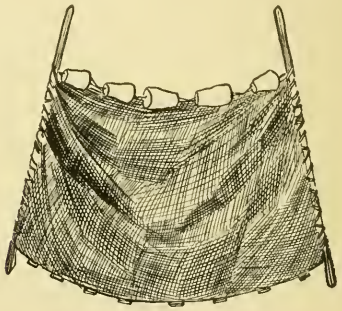


Fig. 5.—Simple Minnow Net.

Inside the hat band is a good place to carry small hooks.

Live minnows are the best bait for black bass, pickerel and many other kinds of fish, and to catch live minnows you need a net. One of the simplest minnow nets is made by fastening two sticks to the ends of a stout piece of mosquito bar. If desired, the net may be provided with floats at the top edge and sinkers at the bottom, as in the illustration (Fig. 5). Old sieves and pieces of meshed wire can often be transformed into ideal minnow nets.

A good landing net may be made from a forked stick and a piece of strong mosquito bar, or preferably a ball of twine. Bend the two ends of the fork until the ends overlap each other and bind them tightly together, as shown in the cut (Fig. 6). Waxed twine serves best in all such binding work in making reels, nets and other tackle. Now, if the net is to be made of mosquito bar, sew the mosquito bar into the shape of a bag and fasten the mouth to the sides of

the loop described by the connected forks of the stick. A better net is made from twine. Fasten the pole in a handy place, with the hoop suspended vertically a little higher than your neck. Cut a number of

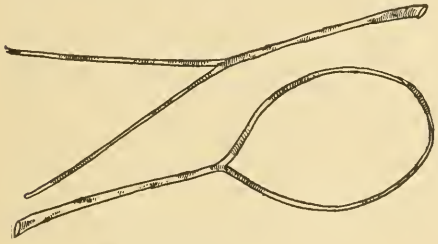


Fig. 6.—Frame for a Scoop Net

pieces of twine each about eight feet long. Double each piece and slip it on the loop with the loose ends hanging down. Arrange the double strings this way all around the loop. Now begin from a convenient point, take a string from each adjoining pair and make a simple knot of them, as shown in the diagram (Fig. 7). Continue all the way around the loop, knotting the strings together in this manner. Now begin on the next lower row, and so on until a point is reached where you believe the net ought to commence to narrow or taper down. This is accomplished by knotting the strings a little closer together and cutting off one string of a pair at four equidistant points in the same row. Knot as before until you

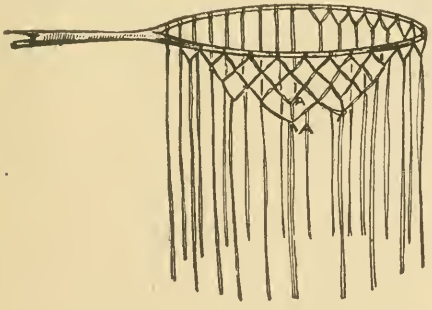


Fig. 7.—Showing Method of Weaving the Scoop Net

come to a clipped line; here take a string from each side of the single one and knot them, being careful to make it come even with others in the same row. Before tightening the double knot pass the single string through, and after tying a knot close to the double one, cut the string off close (Fig. A).

Continue as before until the row is finished, only changing from the first plan when a single string is reached. Proceed in the same manner with the next and the next rows, diminishing the number of strings remaining until the remaining ones meet at the bottom. Be careful not to let one drop mesh come directly under another of the same kind.

A bucket or old tin can with the top and sides perforated by means of a nail and hammer (Fig. 8), will serve as a minnow bucket. The illustration (Fig. 9) shows the proper way to bait a hook with a live minnow. The cartilaginous mouth of the minnow has little or no feeling in it, and when thus baited the minnow is not killed and swims about promiscuously, thus standing a much better chance of catching

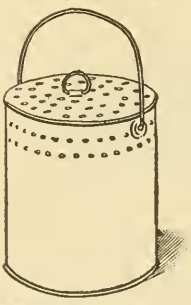


Fig. 8.—Minnow Bucket

Fig. 9.—How to Fasten a Minnow on a Hook

a fish than when cruelly mangled by the hook of the ignorant fisherman.

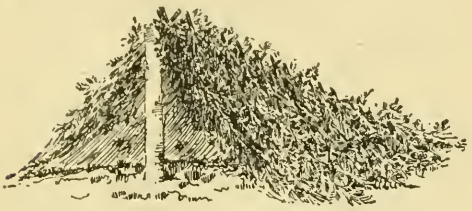
BRITISH SAFETY-LAMP DEVICE.

A recent English invention is believed to give absolute safety to oil lamps. The device consists of a circular metal box in the bottom of which is a deposit of salt over which is placed a layer of specially prepared cotton waste. Running through the waste is an asbestos wick, woven by hand. The box, which is pierced with numerous small holes, is then immersed in the oil until the cotton waste will absorb no more. The box is then wiped dry and is ready to use. The lamp may be overturned or thrown about with perfect safety. The device is adaptable to all kinds of oil burning lamps, and is said to yield more light from the same amount of oil.

Navigation on the great lakes will open late this year. In January Lake Michigan was frozen from shore to shore and even now at points on the west shore the pack ice is piled up 40 feet deep from the bottom.

Temporary Camps and How to Build Them

For a short camping excursion, or for use while the permanent camp is being built, nothing is more novel and delightful than the temporary camp built of the materials ever ready in the woods.



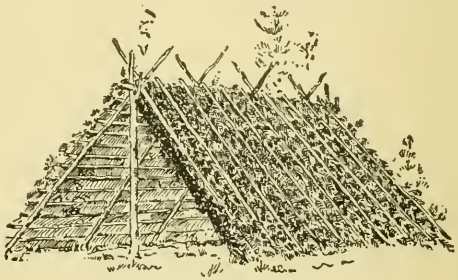
The Indian Camp

The simplest form of all perhaps is the Indian camp. To build this, cut an evergreen tree nearly through about five feet above the base of the trunk, so that when the top falls the butt will still be attached to the stump. Hollow out the under side of the treetop by removing boughs and branches. Use the trunk of the fallen part as a ridge pole and bank boughs and branches from it to the ground on either side. The shelter thus formed will be very comfortable, but there are other kinds better calculated to protect from heavy rainstorms. A wigwam sheds rain well because its sides are so steep. Set up three long poles in the form of a pyramid and tie their tops together. Fill the open spaces with poles set at the same slant about one foot apart at the ground and fastened at the top as before. Thatch the outside closely with branches and brush.

There are several ways to build a brush camp, but they all have many similar points. The ridge pole for such a camp (about 8 feet long) may be placed between two trees at a height of about 6 feet, or between two crotched poles set firmly in the ground for the purpose. Long branches may be used to form the sides, but the best method is to lay straight poles on slant from the ridgepole to the ground, about eight inches apart. Begin at the bottom and thatch the sides to the top to a depth of about one foot with hemlock or cedar boughs, laying them with the feather side down; by means of poles weight down the thatch. Such a shelter carefully made will withstand heavy rains.

The Wigwam

Another camp in high favor among campers for temporary shelter is the lean-to; this may be an open lean-to—that is,. without ends—or closed as desired and may be



The Brush Camp

thatched with either bark or brush. Select two crotched poles about 7 feet long and set in the ground. Lay another pole across these, with its ends resting in the crotches of the other poles. From this pole slant three other poles to the ground. Push the ends of them well into the earth and fasten securely by means of crotched sticks placed over them and driven into the ground. Across these last three poles lay cross sticks, on which pile brush and weight it down with other poles. Build up the sides in the same way. Where bark is used to

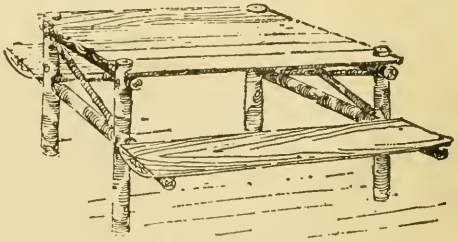
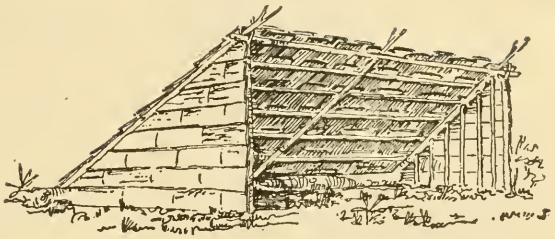


Table and Chairs Combined

thatch the lean-to the top side of the rafters should be flattened so the bark can be nailed

to them. Bark may also be used to thatch the wigwam, laying it in overlapping courses, beginning at the bottom, and securing it by means of cord.

To remove bark from trees, cut two circles six feet apart completely around the tree and join the cuts thus made by a vertical cut and pry away the bark by means of an axe. It is most readily removed in the early summer. Lay the bark on the ground to dry for a few days, weighting it down with stones, after which it is ready for use.



A Closed Lean-to, Thatched with Bark

Hemlock, spruce or cedar boughs, having all large boughs removed so that only fine branches are left, piled to a depth of two feet, and with the blankets or sleeping bag on these, make the best bed for the temporary shelter. Another form of bed can be made by sewing deep hems in each side of a piece of heavy duck canvas about 40

Tongs

inches wide and 6 feet long. Set four forked poles in the ground, run poles 7 feet long and 2 inches in diameter through the hems of the canvas and set up on the forked poles so it is about a foot above the ground.

In selecting a site for a camp always remember that above everything else fresh water within easy reach is essential. Shade for the hottest part of the day should be considered also. Other considerations vary

Broom of Hemlock Twigs

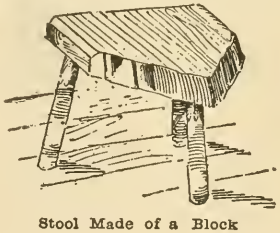
with the party, the duration of the outing, the country surrounding, etc.

To make a crane set two green sticks 2 inches thick and 3 feet long into the ground a foot from either end of the fire. Split the top ends with an axe and provide another stick as a support. A pair of tongs may be made from a piece of tough green wood, which should be 1½ inches in diameter, 3 feet long and of some wood, such as elm, or hickory, which will bend easily. Cut it half way, a distance of one foot in the center, heat the center over a bed of coals until it will bend together without breaking, whittle into shape and fasten the two arms in position by means of a cross-piece. Shape the ends so they will catch hold of anything that has dropped into the fire. A round stick several feet long will serve as a poker.

To make a broom bind hemlock twigs around one end of a stick, using wire or stout cord to hold them in place. Stools are easily made by sawing a 3-inch block from a log a foot thick. Bore three holes in one side of the block, into which drive pegs. A back may be added if desired.

For a rude table set four posts in the ground, nail cross-pieces on top, and cover with slabs cut from soft wood logs. At the right height for seats nail pieces on the legs to extend out on each side and receive slabs which will serve as seats.

Many other articles of use about the temporary camp can be made from such materials as the timber affords. Such things as



Stool Made of a Block

nails, cord, an axe, etc., are indispensable to the camping outfit.

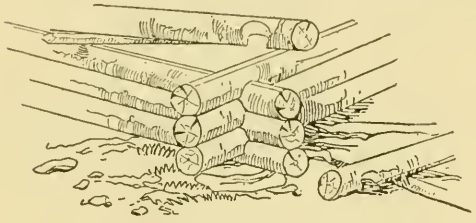
[Next month full details with 17 illustrations "How to Build a Permanent Cabin."]

UNITED STATES OSTRICH FARM.

Ostriches imported from South Africa to Arizona 11 years ago are thriving. At first the birds did not do well, but the last five years have shown a marked difference in them. They are some inches taller than their African ancestors, standing 8 feet high, and weigh 200 pounds. There are now 1,000 birds in the Salt River valley, each yielding about a pound of feathers every eight months.

Permanent Camps and How to Build Them

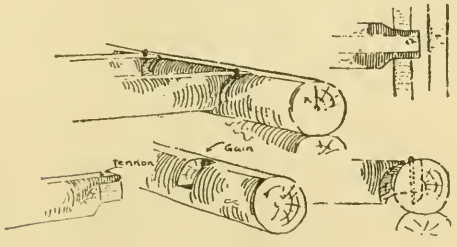
No place could be more picturesque and cozy than the log cabin camp, especially where care in choosing its site has been exercised.



How the Logs Lock at the Corners

Aside from the boating, hunting and fishing advantages of the camp's location, the scenery surrounding it should be considered; it should not be near a swamp, but on high dry ground and, if possible, near a running stream, but always near pure, fresh water. Plan the building to harmonize with its site.

Clear away all decayed trees which might fall on the cabin, stake out the structure according to the plans and clear off the place it is to occupy. For foundation posts use cedar if possible; if not, tamarack, pine or hemlock. Select sound timber about 12 inches in diameter and 5 feet long. Dig post holes down to solid ground or rock, or about 3 feet deep; set the posts, tamping the earth firmly around them. There should be a post under each angle and corner of the building and where these are quite a distance apart, as many in between as necessary. In a distance of 20 feet there

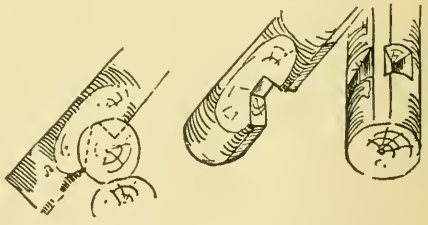


Framing the Joists

should be four posts, including those at the corners, and in 12 feet, three posts. After the posts are set, mark the one in highest ground 10 inches above the ground and cut off squarely. Cut all the others, save those at the ends between the corner posts, on a level with the first one. Those at the ends between the corner posts cut 4 inches higher.

Stone foundation piers, instead of posts, may be made by digging pits 3 feet deep and 2 feet in diameter, filling them up with small stones to ground level and laying large cobble-stones on top of these, chinking up with small stones any places that may remain open.

For building the cabin use straight, sound timber from 6 to 10 inches in diameter. Tamarack, balsam, pine, spruce and hemlock are all good for the purpose. Each log should be cut two feet longer than the side of the building in which it is to be used is to be. Where the tops of the trees are straight and sound they may be used for rafters, joists, etc. If the timber is brought



Framing and Beveling the Rafters

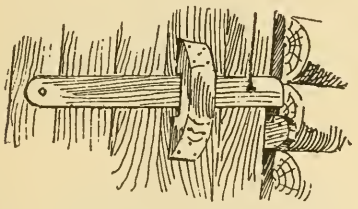
some distance to the building site, it should be placed on skids (two logs) and thus hauled to camp.

For the first tier of logs select the strongest, best shaped and largest of all. These sills, as they are called, should be flattened on the upper side from end to end and in a straight line, and at the narrowest part of the log the flattened space should be 3 inches wide. Place them on the foundation piers so that the flattened surfaces are level with each other. All the other logs for the walls flatten on both sides. When the sills are laid cut notches in the logs and lay the floor sleepers.

To join the logs at the corners, on the under side a foot from each end cut a hollow which will fit over the round side of the log beneath. Place the logs so the large and small ends of them come alternately. Lay the logs carefully, being sure that each log is properly laid before proceeding with

another. Continue laying the tiers until the height of the tops of the windows and doors is reached. At this point saw out the top log the proper width of each window and door to be made, lay the next tier of logs and then resume sawing out the openings for windows and doors.

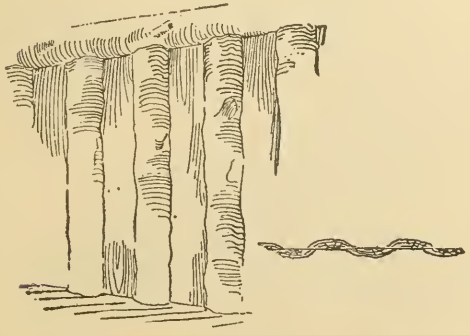
Have ready door and window frames made of boards 1 inch thick and planed on one side. Nail them in the openings to



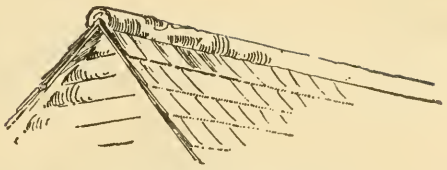
The Door Latch

hold the loose ends of the logs. Make the window sills slanting so they will shed water.

If there are to be two floors to the cabin, at the height of the second floor lay peeled joists, which should be of straight sound timber 6 inches in diameter if the span is 12 feet; thicker if the span is longer. Always place them so they will have the shortest span possible and about three feet apart. Flatten their upper sides from end to end, using a chalk line and a broad axe for the purpose. To place the joists cut gains, as shown in cut, in the logs that receive the joists and make tenons on the ends of the logs Use spikes to fasten them. Where partitions are to run the same way of the joist, place a strong joist under each one. At openings for stairs cut



Partition Made of Halved Logs

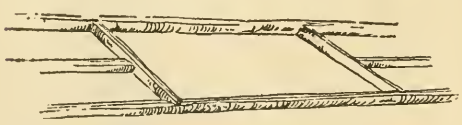


How the Roof Should Look

the joists at the proper places and put a crosspiece between two joists across the cuts, joining by means of gains and tenons as before.

In putting up the rafters raise the gable rafters first. The best roof is a steep one. Select and flatten the rafters just as you did the joists. Frame their lower ends to fit the plate-logs and bevel their tops according to the slant of the roof. Use a ridge-pole to fasten the rafters to at the top. Lay them about three feet apart, spike them to the ridge-pole at the top. Select small timber about 4 inches in diameter, flatten one side and halve them on to the rafters, letting them extend over the gable ends about 6 inches. Nail them in place.

If shingles cannot be procured for a covering, bark will do very well. The bark



Crosspieces Where Joists Are Cut for Openings

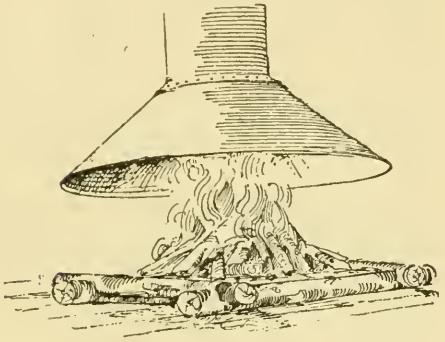
should be removed from large trees and laid on in long strips, overlapping 6 inches.

For floors use matched and planed pine boards 1 inch thick and 6 inches wide. For the second story floor they should be planed on both sides, unless two thicknesses are used, in which case the boards should be put on with the rough surfaces facing.

To make partitions saw logs in longitudinal halves, and nail them in form with their flat sides facing and overlapping just enough to hold firmly when nailed together. This will make each side of the partition consist of a round log surface and a flat one alternately. Place a log on top of the partition and spike into place.

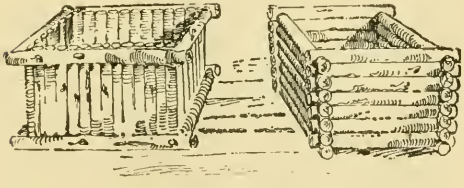
Window sash must be procured from some outside source of supply and they should be placed in the frames so they

will be waterproof. Windows that swing out are most convenient. Straps of old leather will do for hinges and a hardwood bar on the sash, having holes bored



A Funnel Fireplace

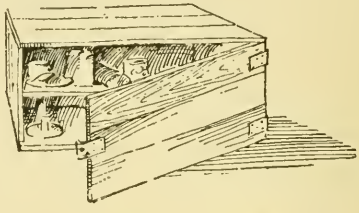
in it to fit over iron pins in the frame will be convenient for holding it open, while a a leather strap to button over the nail will hold it closed. Make doors of matched boards and use braces and crosspieces on them, nailing them securely. If hinges are not to be had, bore a large deep hole at one side of the door in the upper part of the frame, and another directly opposite in the lower part of the frame. In these holes slip the ends of a strong round stick which will turn in them easily. Nail the door on one side of the pole. To fasten the door make a wooden catch and provide a strong bar to work as a latch. Fasten a string to



Two Ways of Building a Wood Box

the latch on the inside and pass it through a hole in the door to the outside. Screens add much to the comfort of a cabin and may be provided if desired.

The fireplace should be built up with the cabin, laying stone foundations for it at the time the other foundations are laid, using cement mortar. The fireplace should be of firebrick, but may have a stone face. The opening should not be larger than 3 feet high and 5 wide and be arched at the top. The fireplace should have a deep throat and the smoke flue should be about 16 inches by 16 inches. Build the chimney of brick, and to prevent the roof from leaking around it lay pieces of tin in the brick work, letting one edge extend under the shingles at the top side of the chimney and over them at the lower and at the sides let the tin turn down against other pieces laid with the shingles. If the chimney reaches above the ridge-pole it will have a good draft without capping it over, but if below the ridge-pole it should be capped. The fireplace may be built up in a ledge to support a mantel, or wooden brackets may be made. A crane may be made by bracing an iron bar to an upright piece. Sockets for

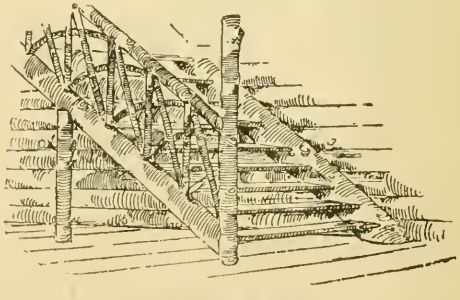


A Packing Box Cupboard

the crane should be built in with the brick and the vertical piece should have pins to fit into them. The arm should be provided with hooks, on which to hang vessels, etc.

Another kind of fireplace consists of a huge inverted sheet-iron funnel 3 feet wide at its lower part and tapering up to fit the smoke pipe about 12 inches in diameter. The top of the pipe extends above the roof; the funnel is suspended over a foundation of stone, brick or clay 8 inches deep and which supports the firebed which is held together by a frame of green logs. This is a good arrangement for warmth.

In building a stairway the frame is built of poles, and as to the work put on it, one

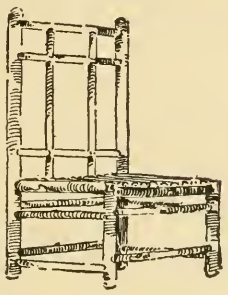


A Rustic Stairway

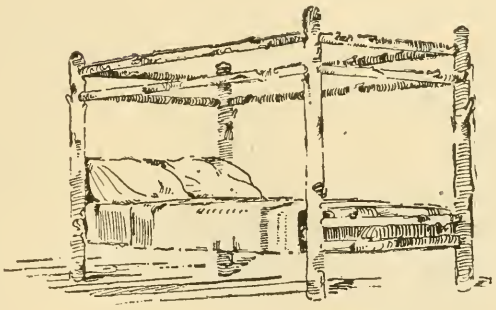
may suit his fancy. Halved logs may be used for steps and are convenient for many other purposes.

a cupboard by hinging its cover and furnishing with a few shelves.

For furnishings for the cabin there is a wide range for suiting individual tastes. Many articles, such as chairs, beds, wood boxes, tables, etc., may be built of poles and nails. Window seats add to the appearance of comfort and rustic seats can be built for the veranda.

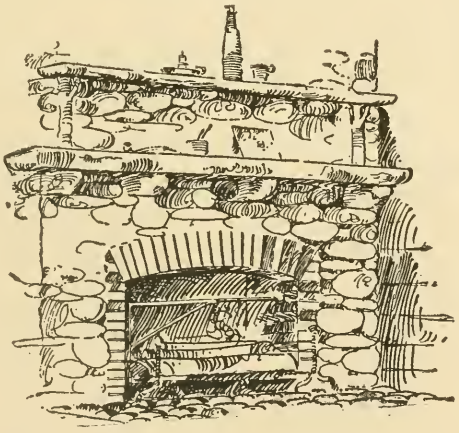


Made of Green Saplings



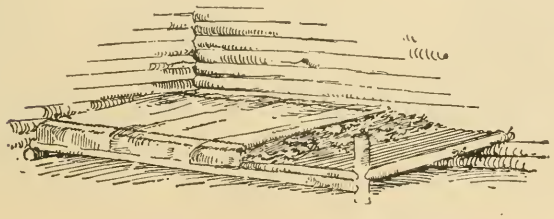
A Canopied Couch Built of Small Poles

Bunks may be made by placing small straight even poles on a frame work of poles at least a foot above the floor and laying even-sized boughs and fine twigs to the depth of two feet, laying pieces at sides, head and foot to hold the boughs in place and on these laying the blankets or sleeping bag. A packing box can be used for

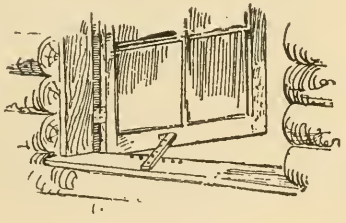


The Fireplace with Rustic Mantel

For the disposal of garbage it is well to dig a hole a little distance from the camp,



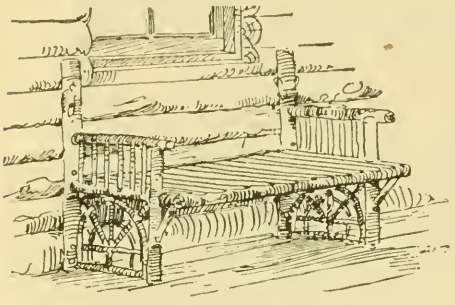
Bunk With a Mattress of Springy Boughs



To Hold the Window Open

sprinkling a little of the excavated material over any refuse that is placed in it.

The cabin may be finished more inside if thought best, but this detracts rather



A Cozy Window Seat

than adds to its appropriateness. Calking should be done as late as possible, so the logs can dry out a little. For calking use oakum or moss, pressing it in between the logs from both sides, using a wooden chisel and a mallet to force it in. Care in the details of the camp will afford a place as inviting and comfortable as can be desired.

"PUSH-BALL ON HORSEBACK," A NEW ENGLISH GAME.

"Push-ball on horseback" is a new game which was in high favor at the Royal Military Tournament held in England recently. The game was played with an enormous ball by troopers of the Royal Horse Guards splendidly mounted on black horses, three mounted men on each side of the ball. The game consists in the horses pushing the ball about with chests and knees, but the interesting feature of the game is the admirable horsemanship of the participants which has room for fine play. After a time the horses enter into the sport with great zest and appear to enjoy it as much as the men. The game originated with a circus in Germany. The ball, which is four feet in diameter, is covered with leather and inflated like a football.

OILED ROADS IN CALIFORNIA.

A single county in California has 145 miles of oiled highways. The location is near oil fields and the country is quite level. In constructing the roads the roadbed is first graded and rounded slightly and then it is sprinkled with the oil. An ordinary wagon tank is used for this purpose and is provided with a piece of 4-inch gas pipe 10 feet long and having half-inch holes drilled in it two inches apart to serve as a distributer. The oil is applied to a width of about 10 feet. It is then gone over with a harrow and thoroughly mixed. It is applied in hot weather and about 100 barrels per mile are used in the first application. It is then allowed to stand two weeks and then a second application of about 50 barrels per mile follows.

About 50 barrels per mile are used annually to keep these roads in repair at about 25 cents per barrel for the oil and from 30 to 45 cents per barrel for applying it. These roads are fine for driving, but the odor is disagreeable.

Pushball on Horseback

MECHANICS FOR YOUNG AMERICA

How To Build An Imitation Street Car Line

An imitation street car line may sound like a big undertaking, but, in fact, it is one of the easiest things a boy can construct, does not take much time and the expense is not great. A boy who lives on a farm can find many fine places to run

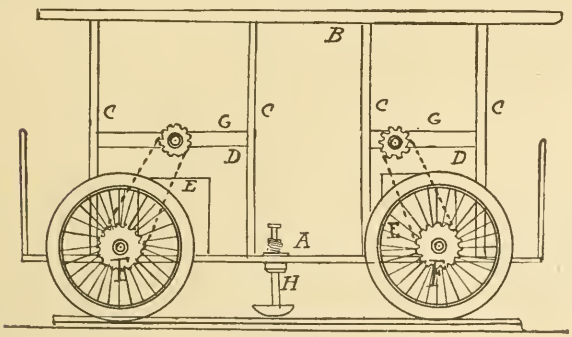


Fig. 1

such a line, and one in town can have a line between the house and the barn, if they are some distance apart.

Often all the boards and blocks required can be had for helping a carpenter clear away the rubbish around a new building. Wheels and parts of old bicycles, which can be used in so many ways, can be found at a junk shop at very low prices, wheels in good repair costing about 25 cents each. For the car for the street car line try to find a set of wheels having axles, but if you cannot find such, make shafts of hard wood, about 3 inches by 2½ inches and by

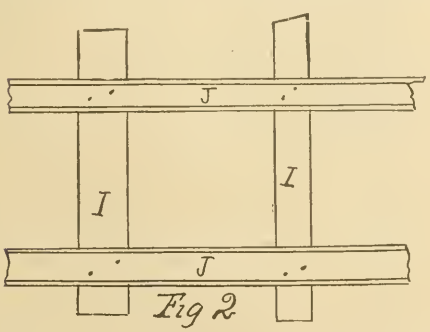


Fig 2

means of a jackknife turn, or shave down the ends to receive the hub bearings of the wheels. Fasten the wheel hubs securely over the ends of the wood with pins or little bolts, or if the wheel bearing is of such a nature that it revolves on its own journal, the journal can be fastened to the end of the wood piece. Each of the wheels should be provided with a sprocket; any chain sprocket of a bicycle may be used. Fasten these sprockets on the outside of the wheels as at F, F, Fig. 1. They can be set on over the bearing end and secured with a set screw, or the original key can be employed. It is best in cases like this to use the original parts. Make the floor of the car of pieces of boards placed on the axles and nailed, screwed or bolted, as shown at A. To erect the frame, place uprights C, C, C, C in position as shown, fastening the ends to the base-boards, and making the roof line as at B, then put in the cross pieces G, G. Seats E, E, are simply boxes. The drive of the car is effected by using the driving sprockets D, D, fitted to the crosspieces G, G, with the original bearings. The parts are thereby secured to the car and the chain placed on.

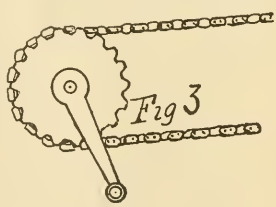


Fig 3

Key the cranks for turning to the upper sprocket's shaft and all is ready. If there are sprocket gears and cranks on either side, four boys may propel the car at one time. Considerable speed can be made on smooth roads, but it is the best amusement to run a car line on wooden tracks with a brake consisting of a piece of wooden shaft, passing through a bore in the car floor, and fitted with a leather covered pad as at H. A spiral spring holds up the brake until pressure is applied by foot power, when the brake contacts with the wooden track and checks the car.

The track plan is illustrated in Fig. 2. Get some boards and place them end for end on other pieces set as ties. The main

boards or tracks J, J can be about 6 inches wide, to the edges of which nail strips about ¾ of an inch wide and about the same height. The ties I, I can be almost any box boards. Wire nails are the best to use in putting the tracks together. The sprocket connection with the chain is shown in Fig. 3. This consists of the sprocket gear on the propelling shaft, and the crank. The pedals may be removed and a chisel handle, or any tool handle, substituted, so as to afford means for turning the crank by hand power. Great fun can be had with the road, and, furthermore, it can be made renumerative, as boys and girls can be given rides for a penny each.

How To Make a Water Bicycle

Water bicycles afford fine sport, and, like many another device boys make, can be made of material often cast off by other people as rubbish. The principal material necessary for the construction of a water

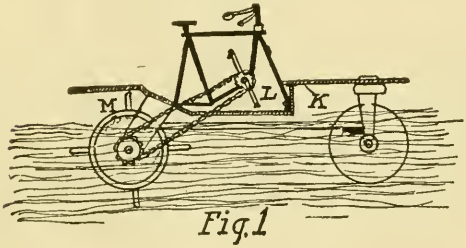


Fig. 1

bicycle is oil barrels. Flour barrels will not do—they are not strong enough, nor can they be made perfectly airtight. The grocer can furnish you with oil barrels at a very small cost, probably let you have them for making a few deliveries for him. Three barrels are required for the water bicycle, although it can be made with but two. Figure 1 shows the method of arranging the barrels; after the manner of bicycle wheels.

Procure an old bicycle frame and make for it a board platform about 3 feet wide at the rear end and tapering to about 2 feet at the front, using cleats to hold the board frame, as shown at the shaded portion K. The construction of the barrel part is shown in Fig. 2. Bore holes in the center of the heads of the two rear barrels and also in the heads of the first barrel and put a shaft of wood through the rear barrels and one through the front barrel, adjusting the side pieces to the shafts, as indicated.

Next place the platform of the bicycle frame and connections thereon. Going back to Fig. 1 we see that the driving chain passes from the sprocket driver L of the bicycle frame to the place downward between the slits in the platform to the driven sprocket on the shaft between the two barrels. Thus a center drive is made. The rear barrels are fitted with paddles as at M, consisting of four pieces of board nailed and cleated about the circumference of the barrels, as shown in Fig. 1.

The new craft is now ready for a first voyage. To propel it, seat yourself on the bicycle seat, feet on the pedals, just as you would were you on a bicycle out in the street. The steering is effected by simply bending the body to the right or left, which causes the craft to dip to the inclined side and the affair turns in the dipped direction. The speed is slow at first, but increases as the force is generated and as one becomes familiar with the working of the affair. There is no danger, as the airtight barrels cannot possibly sink.

Another mode of putting together the set of barrels, using one large one in the rear

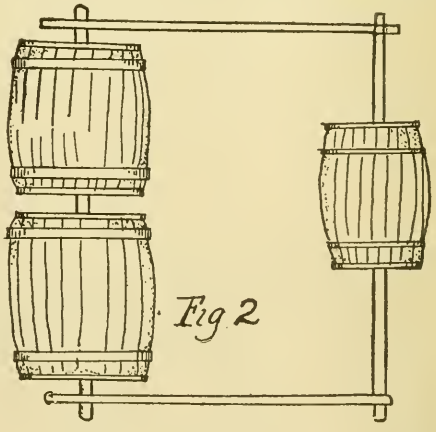
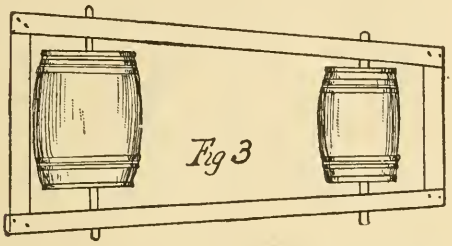


Fig 2

and a small one in the front is presented in Fig. 3. These two barrels are empty oil barrels like the others. The head holes are bored and the proper wooden shafts are inserted and the entrance to the bores closed tight by calking with hemp and putty or clay. The ends of the shafts turn in the wooden frame where the required bores are made to receive the same. If the

journals thus made are well oiled, there will not be much friction. Such a frame can be fitted with a platform and a raft to suit one's individual fancy built upon it, which can be paddled about with ease and



safety on any pond. A sail can be rigged up by using a mast and some sheeting; or even a little houseboat, which will give any amount of pleasure, can be built.

SUBMARINE BOAT WINS IN ENDURANCE TEST.

The submarine boat "Fulton," which has been undergoing some severe endurance tests, has demonstrated fully the wonderful ability of these crafts to weather the rough seas during a gale.

On the night of June 6 this boat remained submerged to a depth of from four to ten feet throughout the night. Once during the night the foul air within the ship was pumped out and fresh air pumped in. The test was entirely without incident. On June 10 the torpedo boat made an endurance run of 60 miles from Newport, R. I., to New Suffolk, L. I., in eight and one-half hours. This was a half-hour longer than the scheduled time, but was caused by the heavy sea lashed into a fury by recent gales. Its ballast tanks were pumped out and it had just a few feet freeboard for the trip and it showed itself to be remarkably buoyant and able to hold its own on the storm-swept waters, although the men had to be lashed to the deck and much of the time the great rollers hid it from the view of those watching from the shore. How important these experiments are is readily comprehended in the light of the fact that each of these tiny boats carries a weapon against which the strongest warship of the world's navies is not proof, and in time the Navy Department may expend more money in constructing these than in building battleships.

A fuel test was also made on the trip, the boat being driven by a gasoline engine.

WHY THE AMERICAN BOY DOES NOT GO TO SEA.

Why has the American boy stopped going to sea? This is a question that has been answered in various ways, but Frithiof H. Buryeson, a seaman of the old school, gives a new version of it in the Coast Seaman's Journal, that is possibly worthy of consideration. Because he can't stand social ostracism, he gives as the main reason—a condition that is brought about by the change of the times. And then Capt. Buryeson hints strongly that these changes have caused the American boy to become timorous and our marine suffers as a result. The American ship, he says, in all material respects has undergone no changes worth speaking of during a century past. The old time captain says:

"There is Dr. Lingeron, who lives on health foods and dispepsia tablets, and who thinks American boys don't take kindly to Old Briny because they can't digest the salt junk and the maggots in hardtack. Prof. Coffin, who wears a chest protector, and is the inventor of a brand new theory on the nature of colds in the head, is quite sure that a ship is altogether too draughty a structure to be a healthy abode for a young growing lad. The president of a 'Woman's Congress' declared, when informed of the fact, that it was simply outrageous that sailors should have their pie served cold to them during the night watches.

"The day has gone by forever when the sons of 'quality folks' run away from home to go to sea. The dreams and aspirations of the young millionaire hopeful of today usually run more to automobiles and to chorus girls than to ships. Prior to the Civil War the personnel of our merchant marine was mostly recruited from the backwood hamlets of New England. The New England boy of that day was a sturdy shoot of a sturdy civilization. His bringing up if applied to the pampered molly-coddles of this age, would land them in a graveyard inside of a year. His food was simple and wholesome, as were his pastimes. Stimulants, cigarettes and poisonous dime novels were unknown to him. He worked hard, but his work was all done in the open air, summer or winter, and it toughened him into a healthy animal, blessed with a good digestion and the ability to sleep on a clothes line with his head on a bucket of water if he had to."

MECHANICS FOR YOUNG AMERICA

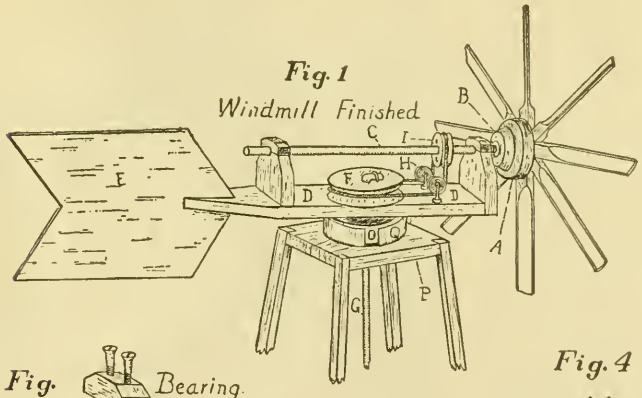
HOW TO MAKE A MINIATURE WINDMILL.

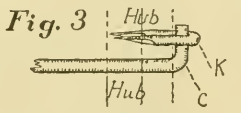
By A. Sheldon Pennoyer..

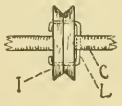
The following description is how a miniature windmill was made, which gave considerable power for its size, even in a light breeze. Its smaller parts, such as blades and pulleys, were constructed of 1-inch sugar pine on account of its softness.

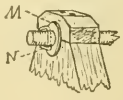
The eight blades were made from pieces 1x1½x12 inches. Two opposite edges were cut away until the blade was about ⅛ inch in thickness. Two inches were left uncut at the hub end. They were then nailed to the circular face plate A, Fig. 1, which was 6 inches in diameter and 1 inch thick. The center of 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-inch iron rod, 2 feet 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 inches wide, 1 inch thick and 3 inches high without the upper half. Both bearings were made in this manner.

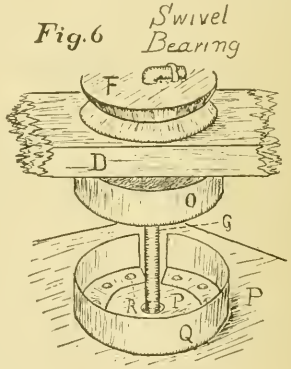
Shaft C was keyed to the hub of the wheel, by the method shown in Fig. 3. K, a staple, held the shaft from revolving in the hub. This method was also applied in keying the 5-inch pulley F, to shaft (G, Fig. 1) which extended to the ground. The 2½-inch pulley, I, Fig. 1, was keyed to shaft C, as shown 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. M, the washer, 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 feet long, 3 inches wide and 1 inch thick and was tapered from the rear bearing to the slot in which the fan E was nailed. This fan was made of ¼-inch pine 18 x 12 inches and was cut the shape shown.

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 inches. 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.

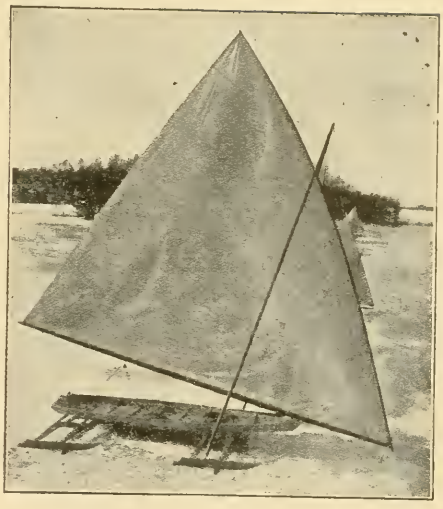
The point for the swivel bearing was determined by balancing the bed plate, with all parts in place, across the thin edge of a board. There a ¼-inch hole was bored in which shaft G turned. To lessen the friction here, washers were placed under pulley F. The swivel bearing was made from two lids of baking 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-inch hole for shaft G was in the center. The other lid, G, 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 inch in diameter, but to keep it from rubbing against the board P, a ½-inch hole was bored for it, through the latter.

The tower was made of four 1 x 1 inch strips, 25 feet long. They converged from points on the ground forming an 8-foot square to the board P at the top of the tower. This board was 12 inches 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 shaft G were placed 5 feet apart in the tower. The power was put to various uses.

HOW TO BUILD AN ICE BOAT.

The season of the ice boat has arrived and this exciting sport is each year becoming more popular. Any one with even small experience in using tools can construct such a craft, and the pleasure many times repays the effort. One of the easiest ice boats to build is described in Sail and Sweep for November, as follows:

Take two pieces of wood 2x6, one 6 feet and the other 8 feet long. At each end of the 6-foot piece and at right angles to it, bolt a piece of hardwood 2x4x12 inches. Round off the lower edge of each piece to fit an old skate. Have a blacksmith bore holes through the top of the skates and screw one of them to each of the pieces of hardwood. These skates must be exactly



A Four-Runner Ice Yacht

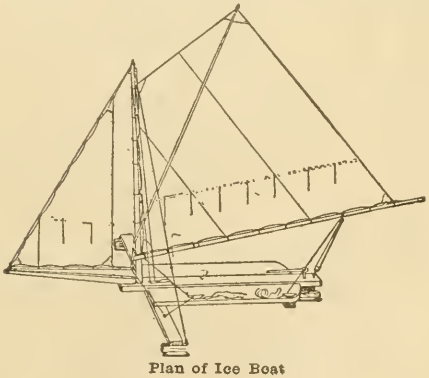
parallel or there will be trouble the first time the craft is used.

Over the middle of the 6-foot piece and at right angles to it, bolt the 8-foot plank, leaving one foot projecting as in Fig. 1.

The rudder skate is fastened to a piece of hardwood 2x2x12 inches as the runners were fastened. This piece should be mortised 3x3x4 inches in the top before the skate is put on. Figure 2 shows the rudder post.

A piece of hardwood 1x6x6 inches should be screwed to the under side of the 8-foot plank at the end with the grain running crosswise. Through this bore a hole 1½ inches in diameter in order that the rudder post may fit nicely. The tiller, Fig. 3, should be of hardwood, and about 8 inches long.

To the under side of the 8-foot plank



Plan of Ice Boat

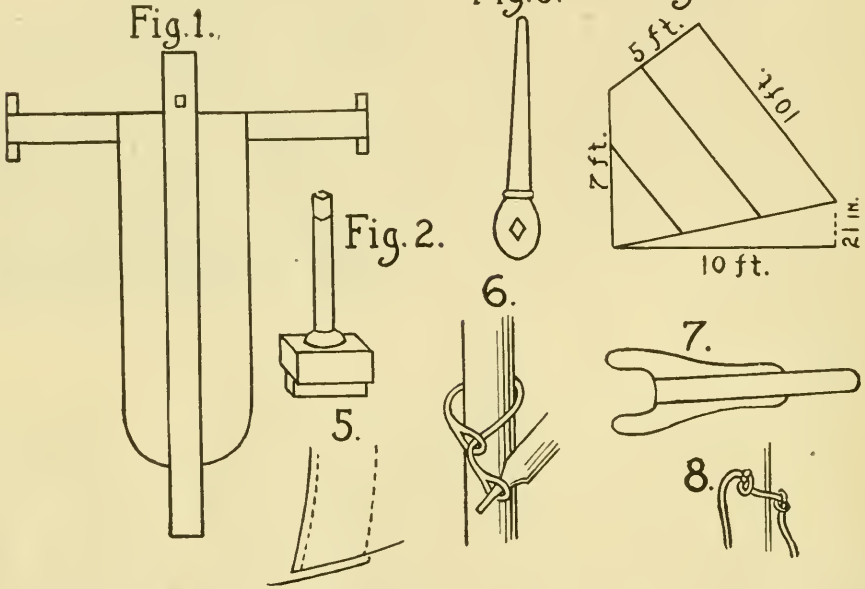
bolt a piece of timber 2x4x22 inches in front of the rudder block, and to this crosspiece and the 6-foot plank nail 8-inch boards to make the platform.

The spar should be 9 feet long and 2½ inches in diameter at the base, tapering to an inch and a half at the top. This fits in the square hole, Fig. 1. The horn should be 5½ feet long, 2x3 at the butt and 1 inch at the end.

Figure 4 gives the shape and dimensions of the mainsail which can be made of muslin. Run the seam on a machine, put a stout cord in the hem and make loops at the corners.

Figure 6 shows the way of rigging the gaff to the spar. Figure 7 shows the method of crotching the main boom and Fig. 8 a reef point knot, which may come in handy in heavy winds.

Make your runners as long as possible, and if a blacksmith will make an iron or steel runner for you, so much the better will be your boat.



Telegram From New York to Chicago Travels 24,000 Miles

Who Can Tell How Long This Message Was in Going from Its Starting Point to Its Destination?

During the first terrific storm of the season which swept the East and cut off all communication between New York and western points, a little message, two words only, was sent from the New York stock exchange to LaSalle St., Chicago, by a new route, to be sure, but one which was wonderful in that every section of it was equal to the emergency. The message, "Market higher," first crossed the Atlantic from New York to London by cable, was wired to Suez, sent to Bombay, hurried to Hong-Kong and then to Yokohama, was again cabled under a mighty ocean, this time the Pacific, via Honolulu to San Francisco, where the telegraph again took up its brief story and rushed it on to Chicago. By the same route the answer, "Give us something," was sent back. And on the two little messages there was more than $50 cable tolls.

The message left the New York stock exchange at just 10 a. m. and arrived at LaSalle street, Chicago, at 11:45 a. m.. Allowing for differences in time, how much time did its trip occupy?

A NOVEL BURGLAR ALARM.

Will Ring An Electric Bell, Flash An Electric Light, Shoot a Pistol Five Times and Call the Police

By W. H. Matthews.

A burglar alarm which will do all of these things may be made at small cost and with very little labor. Secure a piece of hard wood, a part of a tobacco box is best, about 8 or 10 in. square. Cut a round piece like Fig. 1 out of it and on one edge cut a notch as at C. Take a strip of hardwood about 1 in. thick, shape it like B, Fig. 1, and

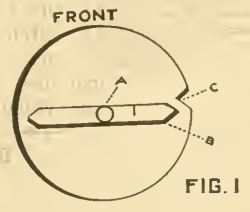


FIG. 1

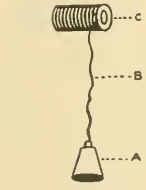


FIG. 3.

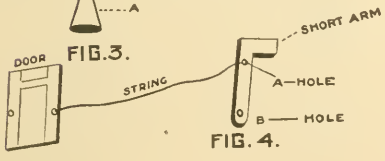


FIG. 4.

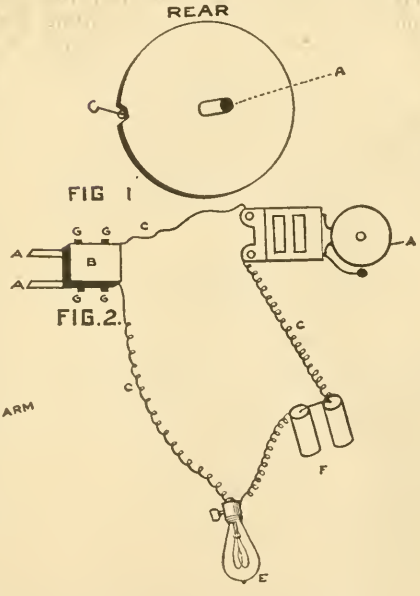


FIG. 2.

nail it securely to the round piece. At A make a hole large enough to run a 20-penny nail through.

Saw off 3 or 4 in. of the large end of an old baseball bat, make a hole through this also and nail it to the back of Fig. 1. The 20-penny nail should pass through the hole at A, through the hole in the bat and project far enough to drive into the wall. It should be fastened either to the wall in the room or the back hall.

Fig. 3 consists of a piece of ball bat, C, fastened to a strong cord, B, which has a weight, A, fastened to the other end. This is to be wound up on the piece of bat, C.

Shape a piece of wood like Fig 4, about 6 in. long. Make two holes A and B in it. The short arm of this piece is to project over the end of B, Fig. 1, and act as a trigger to keep the weight, A, Fig. 3, from dropping until wanted. The lower end of Fig. 4 is to be securely fastened to a piece of wood projecting from the wall so the short arm will slip over the end of B, Fig. 1. Now fasten a string in the hole, A, Fig. 4, and run the string to the doors and windows. You can run a dozen or more strings to the hole, A. The best way is to put a hook, or eye, in the door facing on one side of the door and a hook on the other side. Make a short hook out of a piece of hay wire and attach it to the end of the string. At night hook the end of string attached to trigger in eye on one side of door facing, draw it in front of door and put through the eye on other door facing. Leave the screen or other door unlocked and if any one attempts to go through the door he will put the machinery to work and get a "warm reception." The string should be about 2 ft. above the floor.

Remove the trigger guard from a double-acting cheap revolver, and fasten it so when the weight, A, runs down, the piece, B, Fig. 1, will strike the trigger and fire the pistol. BLANK cartridges ONLY should be used. They will prove effectual as the burglar will hardly stop to investigate.

Take a small block of wood, B, Fig. 2, and fasten two springs on it so that they will nearly touch. Fasten this block of wood so when the weight is wound up the springs will be in the notch, C, Fig. 1. When the weight falls the springs will be pressed together thus ringing the electric bell and furnishing an electric light. If you have no electric lights in the house, get a

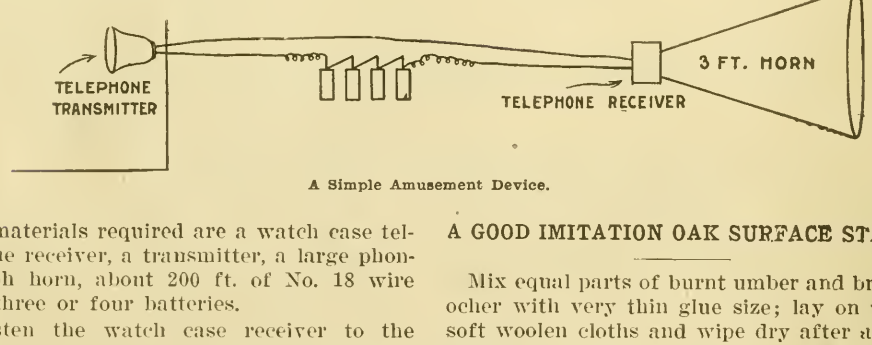
small electric hand lantern. The bell and light may both be connected on the same circuit. Fig. 2 shows how this is done: A, A, are the springs; B, block of wood; C, C, C, C, wires; D, bell; E, lamp; F, batteries; G, G, G, G, screws to which the wires are attached.

Now in addition, if you want to call the police, get a small, cheap phonograph and a record with, "Police," "Fire," "Murder," or anything else on it you wish. Make anything you please on it. Place it directly in front of your telephone transmitter and connect it with Fig. 1, and also connect the receiver of the phone with Fig. 1, so that when the weight falls it will start the phonograph and at the same time will drop the receiver off its hook, consequently calling the police. Any one with a little ingenuity can connect the phonograph, and the receiver of the telephone so that when the weight falls they will do their part.

It will cost very little to make this and it will prove a sure protection. If you wish you can leave off calling the police, ringing the bell and flashing the light and only have it fire the pistol.

A MECHANICAL VENTRILOQUIST AND HOW TO MAKE IT.

An apparatus rigged up as shown in our illustration will afford any amount of amusement to the boy who cares to try it.



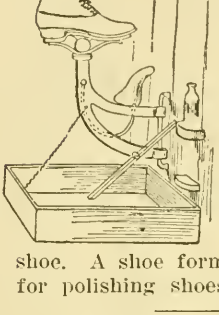
A Simple Amusement Device.

The materials required are a watch case telephone receiver, a transmitter, a large phonograph horn, about 200 ft. of No. 18 wire and three or four batteries.

Fasten the watch case receiver to the horn, being careful not to let it touch the diaphragm of the receiver. Run the line and attach the transmitter at its opposite end. When one talks into the transmitter a person 200 ft. distant from the receiver can plainly hear what is said. If the receiver and horn end is hidden in a clump of bushes near a road, people passing will be greatly puzzled at hearing a voice seemingly out of uninhabited space.—Contributed by W. J. Slattery, Emsworth, Pa.

HOW TO MAKE A BOOT-BLACKING CABINET.

The boy or man who shines his own shoes will find a cabinet like the one shown in the sketch very handy.



This cabinet folds to the wall and projects only about 2 in. into the room. When dropped down a chain pulls the foot rest out into position and a hinged arm supports the box underneath to catch all dust which may drop from the shoe. A shoe form may be provided, also, for polishing shoes when not on the feet.

RENEWING DRY BATTERIES.

Dry batteries, if not too far gone, can be renewed by simply boring a small hole through the composition on top of each carbon and pouring some strong salt water or sal ammoniac solution into the holes. This kink is sent us by a reader who says that the process will make the battery nearly as good as new if it is not too far gone beforehand.

A GOOD IMITATION OAK SURFACE STAIN.

Mix equal parts of burnt umber and brown ocher with very thin glue size; lay on with soft woolen cloths and wipe dry after application. Be careful to have the colors well pulverized and strain the liquid before using.

In our "Mechanics for Young America" next month will appear among other things an article on "How to Make a Small Search Light," and "How to Make a Rabbit Trap." Both stories will give the young mechanic something interesting and practical to make.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE WATER MOTORS.

To make the pattern of a water motor shown in Fig. 1, first get a disk constructed like A, about 20 in. in diameter. This disk can be cut out of sheet metal, or it may be made of pine wood, using common boards. The sheet metal will have to be cut at the tinsmith's. You can make the wood disk yourself if you mark out the shape on the boards in pencil and cut the material accordingly. After the disk is ready, the hub should be designed. This consists of the wooden wheel B. This wheel can be purchased ready made at a hardware or a general tool and machinery store. The wheel is grooved, about 5 in. in diameter, and of ample width to fit the shaft and carry the rope C. The wheel is fitted to the wood shaft with a key or screw. Next comes the application of the water wings or paddles. These are made of curved sheet metal of the design shown. They should be of sufficient width to receive the full blast of the jet of water from the nozzle or discharge pipe D. If the disk is of metal, the edge of the disk must be turned, so as to provide a shoulder to secure the paddles to either by soldering or by using little bolts passed through holes bored for the purpose. If there is a wooden disk used, the paddles are set-screwed to the rim direct. Thus we have the paddles in place, so that the discharge of water plays into each as it comes around the circuit as at E. Considerable speed can be developed with the common hose pipe. The power generated in this way is used for running sewing machines, fan wheels, dust wheels, etc. The entire affair fits in a boxed framework of wood, so that the water will be kept in. The water is drawn off through the base of the framework to the drain pipe. These devices may be seen in use for mechanical service in connection with running automatic contrivances in show windows.

The skeleton-like arrangement in Fig. 2 is made with the hub of small size as shown, to which the large wings or paddles are secured with set-screws. This hub is metal. It can be made by hack-sawing the same from a section of metal 3 to 4 in. in diameter and boring for the hole. Sometimes a common cart wheel hub can be used for the purpose. The wings have to be of wrought or other stiff metal, so that they will retain their form under the pressure of the water. These paddles are about 3 in. wide. Common 3-16 or ⅛-in. metal will answer the purpose. The wheel is set upon its shaft and the plan is made for the volume of water to fall upon the paddles from an outlet as at F. The water force contacts with the paddle at G, as shown. The shaft which carries the wheel also carries

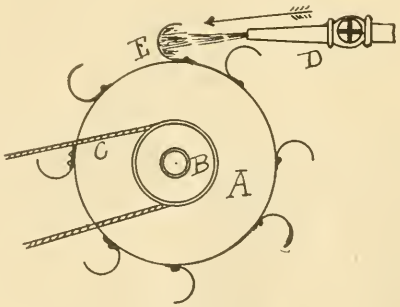


Fig. 1

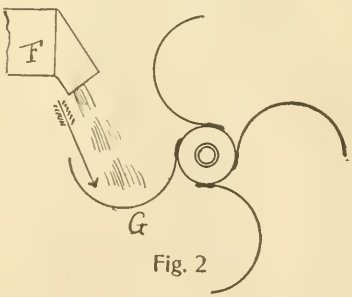


Fig. 2

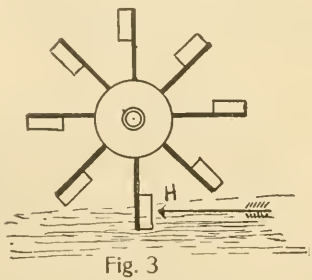


Fig. 3

the driving wheel, which is for a flat belt or round belt, as the case may be. It is quite easy to get from ½ to 3 hp. from these various types of home-made wheels.

The wheel in Fig. 3 is calculated for use in direct contact with the water. A running stream of water is selected and the wheel is adjusted on its shaft so as to drop

the lower portion of the wheel into the moving currents as shown. The water contacts with each box-paddle, as at H, in turn, and keeps the wheel revolving according to the velocity of the water. First we make the hub or center of two pieces of hardwood bolted together and protected with flanges on either side. The two pieces can be sawed from boards and fitted together with the hole for the shaft bored through. The hub is applied to the shaft. The spokes for the

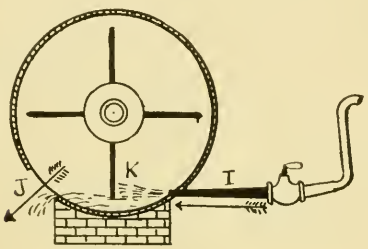


Fig. 4

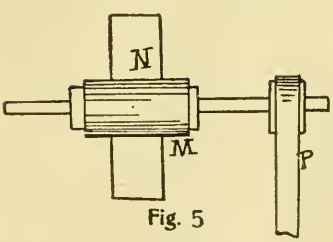


Fig. 5

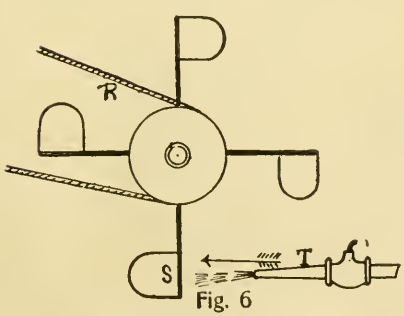


Fig. 6

paddle boxes are adjusted into holes bored around the circuit of the hub, same as spokes are fitted to the common wheel hub. Then the paddle boxes of tin or of wood are secured to the end of each spoke. These boxes are about 4 in. square with sides about 2 in. deep. Sometimes it is necessary to run the wheel within a case of sheet metal, as in Fig. 4. The case has an opening to let the water discharge in, as at I, and an opening to let the used water out, as at J. The case is usually set up on the brick masonry, as indicated. The affair is usually in the basement. The wheel is made with four plain paddles and the power is generated by the water striking the paddle, as at K. The hub is of wood, or as before, a discarded carriage or wagon wheel hub will do. The paddles are wooden, about 4 in. wide and 30 in. long. They are mortised into the hub.

Fig. 5 is another view of this wheel. The hub is marked M. The section of paddles shown is marked N. The shaft extends through the hub, and is secured to the hub with pins or a key. To one end of the shaft there is fixed the pulley for carrying the belt P. The journals for supporting the shaft are adjusted between the wheel center and the shaft ends. Several who have made this pattern of wheel have been able to get satisfaction from it. It is simple and is capable of generating quite a degree of power, which may be transmitted to some device through the agency of the belt P.

In Fig. 6 is shown another design, which can be constructed with materials usually easily collected. The hub is made first as in the case of the other wheels, and this may again be a common wheel hub, with the belt wheel fixed on the shaft adjoining it. Or in case that a wheel hub is not at hand, the hub can be made of a hardwood block, bored and rounded to suit the conditions. Then the spokes are inserted into holes made in the hub for the purpose. These spokes are of hardwood and a good way to get them is to secure spokes of an old carriage wheel. In fact, a good way to do is to get a wheel from a blacksmith or wheelwright and use it as it is, removing the rim, cutting the spokes to right length, and if necessary sawing off every other spoke. Or perhaps it will be necessary to saw off two of every three spokes. This gives you a very strong base to work with. The wheels can be bought for a very little money after they are cast to the junk heap. Many times they are given away. Thus if we were making the pattern of wheel in Fig. 6, all the spokes of the wheel would be sawed off except the four shown. To these spokes, at the ends, the bowl-shaped tins are fixed. They are fastened so that the spoke crosses direct over the front of the opening. Screws or rivets are used to make fast with. The water force is from the pipe T, and the discharge contacts with force against the bowl S, causing the wheel to revolve, bringing the next bowl in position, and so on. The rope belt is marked R, and is extended to the device to be driven.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE "ANTIQUE" CLOCKS FROM UP-TO-DATE MATERIALS.

Ten years ago the antique clock was the only kind wanted, and it was of no value unless there were evidences of cobwebs and ages about it. The genuine old-timer

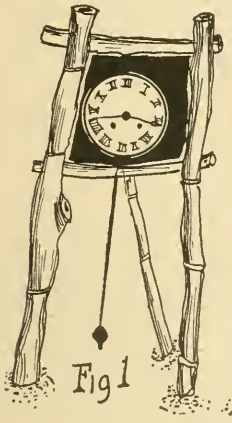


Fig 1

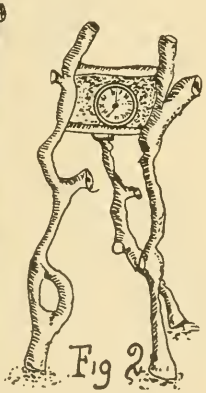


Fig 2

was the only kind desired. There were men in the junk business and men in the antique furniture business who made a specialty of buying the old clocks from the remote farming districts, or wherever any one had an old clock for sale. The clocks of our great grandfathers were in demand at good and remunerative prices to the original owners. Many were loth to part with the heirlooms, but the dazzling prices offered caused many of the people to sacrifice the timepieces. These good old days passed away some years since, and today the modern wood-worker and cabinet-maker supplies the deficiency by putting on the market some home-made, up-to-date forms of "antique" clocks that are far cheaper, more attractive and useful than the old styles.

The first innovation occurred when the antique furniture men began employing cabinet-makers to manufacture fraudulent old clocks. Men who could produce imitations closely, and then apply the proper stains for making the materials appear aged, were in request. These men manufactured numbers of the "copy" clocks, and for a time the sale was active. Then people suspected the genuineness of the undersold clocks, and discovered the fraud. The papers published articles about the fraudulant antiques, and the people no longer were deceived. But the advent of these "built-up" antiques, or "made-to-order" antiques, led to the manufacture of the rustic wooden clocks we are about to describe. The makers of clocks and novel effects in furniture began to produce clocks entirely new, and sold as new, but constructed on the lines of the old-fashioned corner piece of the farmhouse of a century ago. These clocks sold wonderfully well at good prices to the makers, and the demand commenced.

The cheapest and simplest constructed clocks are of the pine and rustic woods order, in which a framework is erected, a base or foundation for the clock fixed thereon, and the affair finished. Clocks of this order can be turned out at ridiculously low prices. Some sell for little over a dollar each, aside from the cost of the clock. The clock proper is usually a separate portion,

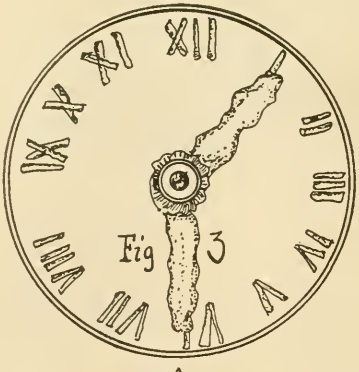


Fig 3

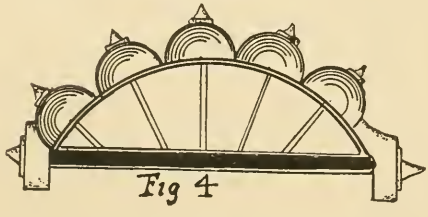


Fig 4

often not fixed to the framework until the entire combination is sold. Some of the unfinished pine clock frames are unique and rustic and appropriate for use in the summer homes. Figure 1 is a sketch of one of the cheaper forms of clocks of this style.

in which the framework is made from sections of bamboo, the joints being made with pins and wiring. The bamboo surfaces are merely rubbed with polishing compositions until a gloss is obtained. When well treated, the gloss retains its glaze and finish for a long time.

The manufacturer of the clock of this description usually makes a number of the rustic frames at the same time, say a dozen. These he erects and then places his order with a clock-maker for the clock faces, works and hands. The pendulums are likewise supplied by the clock-maker. The maker of the wooden clock portion knows little concerning the mechanism of the metallic parts of the clock, and therefore he obtains the clocks in running order and prepared for placing in position in the clock frame. Figure 2 is one of the rustic styles frequently seen in the clock-maker's works for service on porches, or for the house, if so desired. These clocks are made with frames constructed entirely from woods with the bark still on, and the effect is very pleasing. Goodly numbers of this pattern sell. The values run low, and for two or three dollars, counting expense of frame only, a very good outfit can be secured. The cost of the clock, of course, varies with what is desired. Dollar clocks may be fixed in the frame without pendulums and a good effect obtained.

When people purchase the big corner clocks for the hallway or the studio, they like to have something special in the line of faces and hands. Figure 3 is a sketch of one selection. The faces of the clocks are usually decorated in some way and are specially designed for the service they are intended for. The hands likewise are often mounted or ornamented.

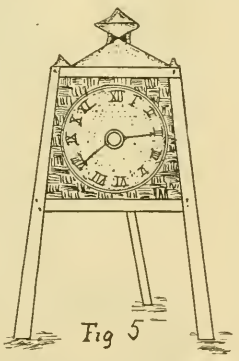


Fig 5

The crown work of the modern antique design in clocks forms another feature of interest. The crowns, as a rule, are separate portions, and since the opening of the "new" old clock industry in the country one is able to find men who make a specialty of the different parts of the clocks. In one city where there were several "old clock" manufacturers and designers one man is devoting his energies and ingenuity

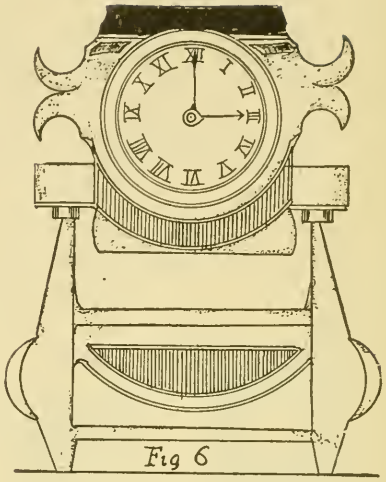


Fig 6

to the designing of clock crowns. Figure 4 is a drawing of one of his crowns. He makes only the crown portion, and this is for fitting over the top of the clock disk, and attached to the clock base. The crown usually has in it some artistic wood engraving and is otherwise decorated to assist in developing the idea of the artist.

The modern maker of the antique clock is capable of grinding out clocks for the chimney corner at rates astonishingly low, providing the customer furnishes the clock proper for insertion in the wood work. On the other hand, if one desires elaborateness, he may get it to the extent of his purse. If he desires to have his clock rendered "old" by treating with chemicals that age the woods and deceive people, he may have it done at a cost of a few dollars. It is pleasing to relate, however, that nearly every old clock-maker states that as a rule the buyers purchase the clocks simply because of their novel appearance, and intend to ornament their homes as such, without any intent at making their guests believe that the clock is an "antique" with a "history." One of the clocks of the more expensive order is shown in Fig. 5.

During the past few years the "old" clock-makers have had demands from advertisers for the service of imitation clocks for placing in railway stations, hotel offices, etc., to advertise products of big firms. The advertising wood clock is usually built up on elaborate lines, as suggested in Fig. 6, and the advertising material is marked thereupon. The advertising is usually made in plain letters. Some of these clocks are being made up to use in

connection with the penny-in-the-slot machines. The clocks can be made to look well and attractive for any place, and as they are usually freely ornamented, they are really part of the furnishings.

One of the best lines of patronage these manufacturers have is from the raffling off of goods at the church fairs, in stores and other places. Often there is a system of "guessing" of numbers and the right number wins, etc. The clocks are conspicuous, and can be liberally advertised in a store or other place where it is desired that the raffle take place. In some of the cabinet-makers' places men are employed at odd times on this line of work. Whenever regular work runs slow, the extra time is converted into money by making the clocks and a considerable profit is derived from the work.

LETTERING A CLOCK DIAL.

Painting Roman characters on a clock dial is not such a difficult task as might at first be imagined. In fact, if one has a set of drawing instruments and properly proportions the letters, it is really very simple.

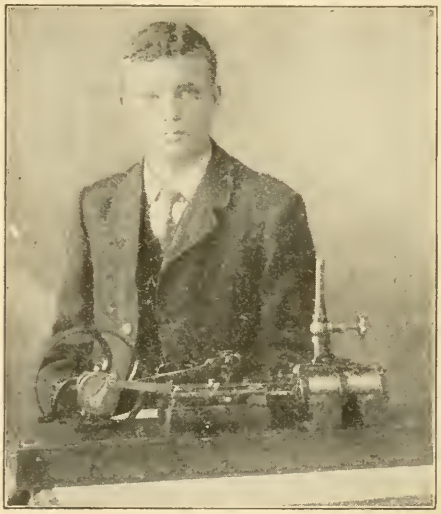
The letters should be proportioned as follows: The breadth of an "I" and a space should equal one-half the breadth of an "X," that is, if the "X" is one-half inch broad, the "I" will be three-sixteenths inch broad and the space between letters one-sixteenth inch, thus making the "I" plus one space equal to one-quarter inch or half the breadth of an "X." The "V's" should be the same breadth as the "X's." After the letters have been laid off in pencil, outline them with a ruling pen and fill in with a small camel's hair brush, using gloss black paint thinned to the proper consistency to work well in the ruling pen. Using the ruling pen to outline the letters gives sharp straight edges which would be impossible with a brush in the hands of an inexperienced person.—Contributed by S. L. Hatfield, Wagoner, Ind. Ter.

FOCUSING SCREENS.

To make a focusing screen, superior to the finest that can be bought, fix a dry plate, then flood it with a 10 per cent solution of chlorid of barium, and follow this with a 10 per cent solution of chlorid of magnesium. Allow to dry, and a perfect focusing screen results, says Photo-Beacon.

HOW A BOY BUILT A STEAM ENGINE, WITH FEW TOOLS.

A boy who possesses natural mechanical and inventive genius can build himself a steam engine even though he does not have access to a small machine shop and though his materials be crude. Howard Burr of Leon, O., built for himself a one-half horsepower engine which will operate a sewing machine. He cut his own patterns, then molded the various parts in sand. The castings were made of babbitt metal, which he heated in a ladle in a cook stove. The engine works perfectly. It is shown in the



Howard Burr and His Engine

photograph together with its inventor.

In response to our inquiry the young engine builder replies as follows: "I have your letter asking for a description of how I built my steam engine. The castings are made of babbitt metal; such parts as the connecting rod, eccentric rod, and slide bars were sawed out of iron and brass. The cylinder is brass. The piston was made by casting solid and then turning a deep groove in it and then made steam tight by winding with packing. The valve seat and valve was made true and steam tight by grinding with emery and oil. I built the engine with tools that may be found about any house, and worked at it mostly at night. One engine the cylinder is 2 x 2 in.; the smaller one has a cylinder 1¼ x 1¾ in. Patience and keeping at it is more than anything else." HOWARD BURR.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A WINDMILL OF ONE OR TWO HORSEPOWER FOR PRACTICAL PURPOSES.

A windmill for developing from one-half to two horsepower 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 4 in. high and made of the tin also. Form the shoulder by soldering the piece on. Thus we get a smooth surfacing 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

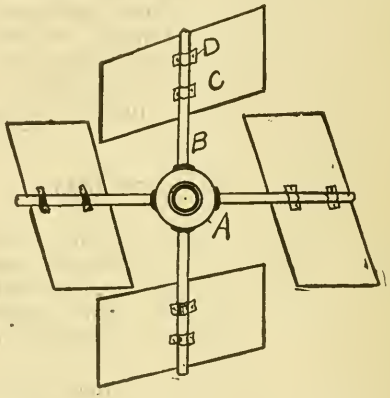


Fig. 1

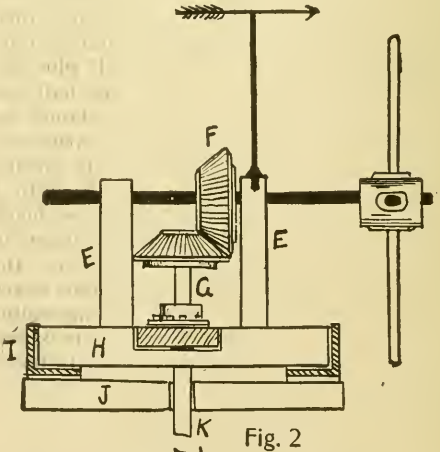


Fig. 2

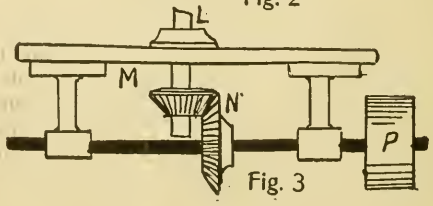


Fig. 3

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 4x4-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

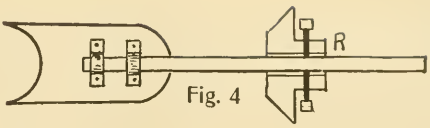


Fig. 4

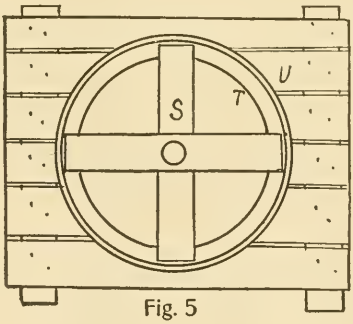


Fig. 5

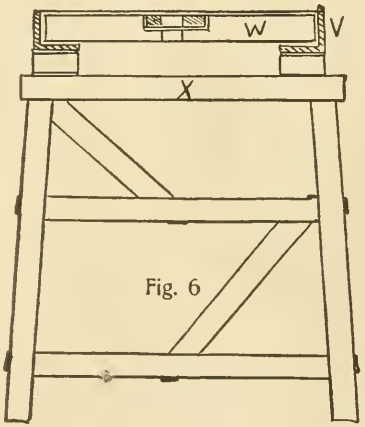


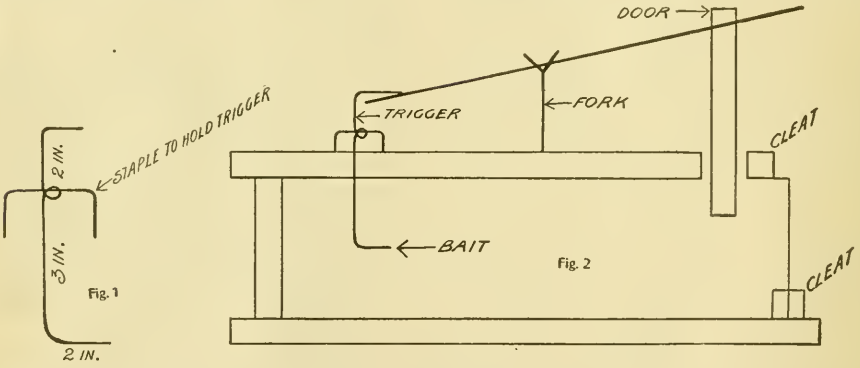
Fig. 6

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 2x4-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.

HOW TO MAKE A TRAP FOR RABBITS, RATS AND MICE.

From an old 6-in. pine fence board cut off four pieces 2½ ft. long and one 6 in. square for the end of the trap and another 4 in. by 8 in. for the door. Use old boards, as new boards scare rabbits.



A Good Rabbit Trap

Fig. 1 shows how the box is made. It should be 4 in. wide and 6 in. high on the inside. The top and bottom boards project 1 in. beyond side boards at the back and end board is set in. The top board should be 2 in. shorter than the sides at the front. Nail a strip on the top board back of door and one on the bottom board so game cannot push the door open from inside the trap and get out.

In the middle of the top board bore a hole and put a crotched stick in for the lever to rest on. Bore another hole in the top of the door for the lever to pass through. Two inches from the back of the box bore a hole for the trigger, which should be made out of heavy wire in the manner shown in Fig. 2. The door of the trap must work easily and loosely.—Contributed by Carl Baum, Valparaiso, Ind.

On June 1st we shall issue in book form the articles printed in "Mechanics for Young America." It will be a gold mine of "Things a Boy Can Do."

HOW TO MAKE A SMALL SEARCHLIGHT.

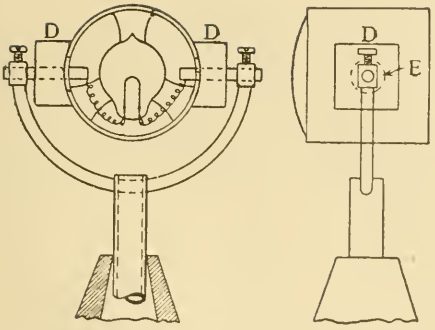
The materials required for a small searchlight are a 4-volt lamp of the loop variety, thin sheet brass for the cylinder, copper piping and brass tubing for base. When completed the searchlight may be fitted to a small boat and will afford a great amount of pleasure for a little work, or it may be put to other uses if desired.

Make a cylinder of wood of the required size and bend a sheet of thin brass around it. Shape small blocks of boxwood, D, Fig. 1, to fit the sides and pass stout pieces of brass wire through the middle of the blocks for trunnions. Exactly through the middle of the sides of the cylinder drill holes just so large that when the blocks containing the trunnions are cemented to the cylinder there is no chance of contact between cylinder and trunnion, and so creating a false circuit.

The trunnion should project slightly into the cylinder, and after the lamp has been placed in position by means of the small wooden blocks shown in Fig. 1, the wires from the lamp should be soldered to the trunnions. It is best to solder the wire to the trunnions before cementing the side blocks inside the cylinder.

Turn a small circle of wood, A, Fig. 2, inside the cylinder to fit exactly and fasten to it a piece of mirror, C, Fig. 2, exactly the same size to serve as a reflector. Painting the wood with white enamel or a piece of brightly polished metal will serve the purpose. On the back of the piece of wood fasten a small brass handle, B, Fig. 2, so that it may readily be removed for cleaning.

In front of cylinder place a piece of magnifying glass for a lens. If a piece to fit cannot be obtained, fit a glass like a linen tester to a small disc of wood or brass to fit the cylinder. If magnifying glass can



Front View Side View.

Fig. 1

not be had, use plain glass and fit them as follows:

Make two rings of brass wire to fit tightly into the cylinder, trace a circle (inside diameter of cylinder) on a piece of cardboard; place cardboard on glass and cut out glass with a glass cutter; break off odd corners with notches on cutters and grind the edge of the glass on an ordinary red brick using plenty of water. Place one brass ring in cylinder then the glass disc and then the other ring.

For the stand fill a piece of copper piping with rosin or lead and melt lead out. Bend the pipe with a piece of curved wood or use some of the many methods of pipe bending which have appeared in the Shop Notes department of Popular Mechanics. Make an incision with a half-round file in the under side of the tube for the wires to come through. Make the base of wood as shown in Fig. 1. One-half inch from the top bore a hole large enough to admit the copper pipe and a larger hole up the center to meet it for the wires to come down.

If it is desired to make the light very complete, says the Model Engineer, London, make the base of two pieces of brass tube,—one being a sliding fit in the other and with projecting pieces to prevent the cylinder from going too far. The light may then be elevated or lowered as wished. On two ordinary brass terminals twist or solder

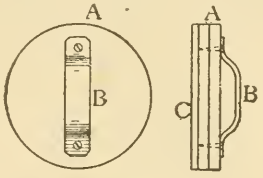


Fig. 2

some flexible wire, but before doing so fix a little bone washer on the screws of the terminal so as to insulate it from the tube. When the wires have been secured to the terminals cover the joint with a piece of very thin india rubber tubing, such as is used for cycle valves. The two wires may now be threaded down the copper tube into the base, and pulled tight, the terminals firmly fixed into the tubes; if too small, some glue will secure them. To get the cylinder into its carriage, put one trunnion into the terminal as far as it will go and this will allow room for the other trunnion to go in its terminal.

FRENCH MOTOR FOR SMALL BOATS.

A French engineer has constructed a portable propelling outfit which one can carry with him, and apply to any small boat he may borrow or rent.

A small gasoline engine furnishes the power, driving a small propeller, which also serves as rudder. The same plan, using an electric motor driven by batteries, was attempted in this country some years ago, but has never been wholly satisfactory.

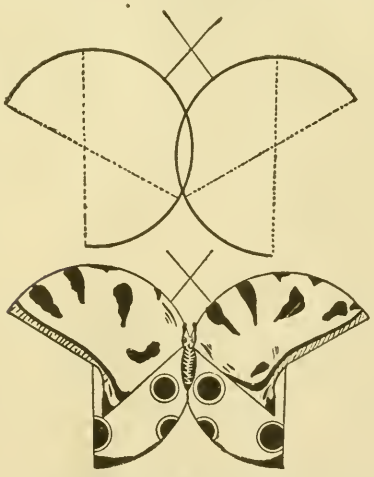
Any Boat a Motorboat

MECHANICS FOR YOUNG AMERICA

Kites of Many Kinds and How to Make them Jug Fishing

Get your kites ready, boys, for March is here. Don't waste your time on the old style kites your father and your grandfather used to fly; surprise your playmates with a kite of new design, one that will make all the boys, and even the grown folks, look on in wonderment. Kites can be made of nearly any shape. Just bend the sticks right and paste on the paper and then paint the paper with any kind of caricature you desire.

One of the prettiest of all is the butterfly kite. To make this get two thin kite sticks of equal length. Bend each in an arc, tying one end of a strong string to one

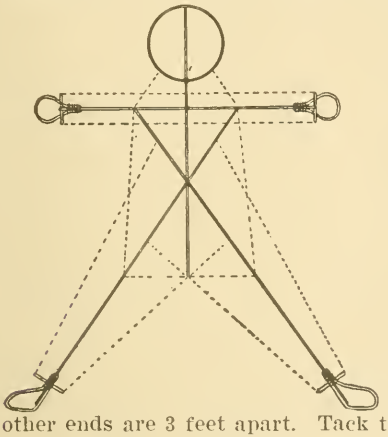


end of each stick and the other end of the string to a point about three inches from the other end of the stick. This leaves one end of each stick free, hooking over the hemisphere described by the thread and the stick. Now tie another thread to each of these free ends and tie the other end of the thread to a point near the other end of the stick, corresponding with the distance from the end at which the first strings were tied on the opposite side. This done, you should have two arched frames, each an exact counterpart of the other in size, curvature and weight. Now fasten the two frames together so that the arcs will overlap each other as shown in the sketch. Bind the intersecting points securely with thread. To make the butterfly's head, secure two heavy broom straws or two short wires, and attach them to the top part of the wing frames near where the sticks intersect, so that the straws or wires will cross. These form the antennae, or the "smellers." Then select the color of paper you want, yellow, brown, blue, white or any other color; lay it on a flat surface and place the frame on top of it, holding the frame down securely with a weight. Then with a pair of scissors cut the paper around the frame, leaving about a half-inch margin for pasting. Cut slits in the paper about two inches apart around the curves and at all angles to keep the paper from wrinkling when it is pasted. Distribute the paste with a small brush and make the overlaps a little more than ¼-inch wide and press them together with a soft cloth. When the kite is dry decorate it with paint or strips of colored paper in any design you may fancy. The best effects are produced by pasting pieces of colored paper on top of the other paper. Black paper decorations show up to fine advantage when the kite is in flight. Attach the "belly-band" to the curved sticks by punching a hole in the paper in the same manner as it is attached to the common hexagonal or coffin-shaped kite. With a tail, your kite is ready to fly.

Another interesting design is the boy kite. With light colored coat and vest and gay striped trousers, the kite standing high in the air always attracts attention and affords splendid sport for the American youth in springtime.

In making a boy kite it should be remembered that the larger the boy is the better he will fly. To construct the frame, two straight sticks, say 3½ feet long, should serve for the legs and body; another straight stick forms the spine and should be about 2 feet 4 inches long. For the arms, get a fourth straight stick about 3 feet 3 inches long. Make the frame for the head by bending a light tough stick in a circle about 7 inches in diameter. Bind

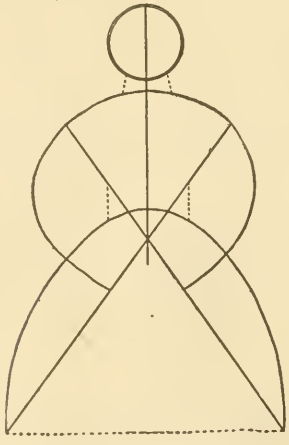
it tightly with a strong thread and through its center run the spine. Then tack on the arm stick three inches under the circle so that the spinal column crosses the arm stick exactly in the center. Wrap tightly with strong thread and tack on the two sticks that are to serve for the legs and body. The leg sticks should be fastened to the arm stick about 6 inches on either side of the spinal column, and crossed so that



the other ends are 3 feet apart. Tack them and the arm stick together at the point where they intersect. Small hoops and cross stick of the same material as the head frame should be fastened to both extremities of the arm stick and the lower ends of the leg stick for the hands and feet. See that both hand frames are exactly alike and exercise equal caution regarding the foot frames; also see that the arm stick is at exact right angles with the spine stick and that the kite joints are all firmly tied and the kite evenly balanced; otherwise it may be lopsided. Fasten on the strings of the frame, beginning at the neck at equal distances from the spine and, as indicated by the dotted lines in Fig. 2. Extend a string slantingly from the arm-stick to the head on both sides of the spinal column, and run all the other strings as shown in the cut, being careful that both sides of the frame correspond in measurements.

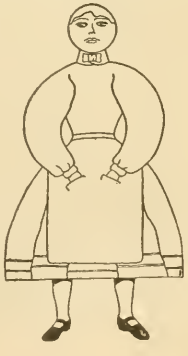
To cover the kite, select different colors of paper to suit your taste, and after pasting them together, lay the paper on the floor and placing the frame on it, cut out the pattern. Leave an edge of ½ inch all around and make a slit in this edge every six inches and at each angle; make the slits two inches apart around the head. After the kite is pasted and dry, paint the buttons, hair, eyes, hands, feet, etc., as you desire. See Fig. 3. Arrange the "belly band" and tail band and attach the kite string in the same manner as in the ordinary coffin-shaped kite.

The "lady kite" is made on the same principle as the boy kite. The frame may be made exactly as the boy kite and then "dressed" with tissue paper to represent a girl, or it may be made as in Fig. 4. Remember the dotted lines represent the



strings or thread, and the other lines indicate the kite sticks. Be careful with your measurements so that each side of the kite corresponds exactly and is well balanced. Also see that every point where the sticks intersect is firmly tacked and bound.

To cover the kite, first paste together pieces of tissue paper of different color to suit your taste. The paste should be made of flour and water and boiled. Make the seams or overlaps not quite 1-3 of an inch wide. Lay the paper on the floor, using weights to hold it down, and place the frame of the kite upon it. Then cut out the paper around the frame, leaving an edge of ½ inch. Don't forget to make a slit in the edge every 6 or 7 inches and at each angle. Around the head the slits are two inches apart, as in the case of the boy kite. After the kite is dry, paint the paper as your fancy dictates.

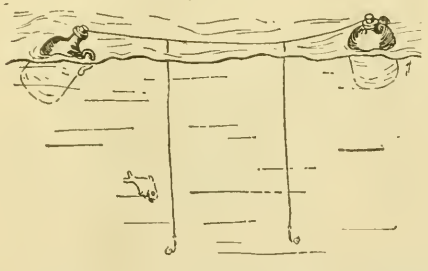


To make the breast band, punch holes through the paper, one upon each side of the leg sticks, just above the bottom, and one upon each side of the arm sticks at the shoulder. Run one end of the string through the hole at the bottom of the left limb and tie it to the leg stick; tie the other end at the right shoulder. Fasten one end of another string of the same length at the bottom of the right leg; pass the string up across the first band and tie the other end at the left shoulder. Attach the kite string to the breast band at the point where the two strings intersect. Tie the knot so that you can slide the kite string up or down until it is properly adjusted. The tail band is made by tying a string to the leg sticks at the bottom of the breast band. Let the string hang slack below the skirt and attach the tail to the center. The same general rules apply in attaching the string and tail to the boy kite.

You can make the lady look as if dancing and kicking in the clouds by making the feet of stiff pasteboard and allowing them to hang loose from the line which forms the bottom of the skirt. The feet will move and sway with each motion of the kite.

FISHING TIME COMING SOON.

Fishing time will soon be here and this year you want to have some new and effect-



ive methods of catching fish. Popular Mechanics will describe different processes in a later issue, but will tell of the "jug line" now because it is especially adapted for early fishing. Fasten two jugs to a strong line about 30 feet long. Be sure that each jug is securely corked. To the long line attach a couple or more of short fish lines equipped with proper sinkers and baited hooks. This done, place the outfit in the water and watch it, ready to follow with a row boat, or let it float down stream attached to a line held in the hand. When one of the jugs sinks or commences to bobble, you can row out to the line and pull in the fish. On the Mississippi river dozens of jugs are often thus tied together and the fisherman follows them in a row boat until he has a good boat load.

STEAM LOCOMOTIVES TO BURN ELECTRICITY.

Startling Innovation Proposed on Swiss Railways

The Swiss proposed to burn electricity under their locomotive boilers instead of coal. Switzerland does not own a pound of coal of her own; it is all imported at great expense. But she does possess the most valuable water powers in the world. The boundless snows of her lofty mountains furnish a never ending source of energy. The water falls are rapidly being harnessed and made to turn generators whence come enormous electric powers for driving the wheels of her factories and lighting her cities.

Recently some daring mind conceived the idea of placing a great white mass of electric fire under the boilers of the steam locomotives. The result will be tremendous heat without any smell, smoke or cinders. The plan is not feasible except where electric power costs practically nothing to produce. This Switzerland is doing with her water power plants.

A small wire stretched overhead in the middle of the track will carry the current which will be conducted to the locomotive by a trolley, on the principle of our own trolley cars. The prime reason which suggests this bold conception was not only to save the cost of coal now used, but also to avoid the expenditure of the millions of dollars necessary to build electric locomotives and throw out the steam engines. The changes required will be few, and the present force of engineers will need but little instruction. The "fireman" will have only to pull a lever and his work is done for the trip.

POSTAL CAMERA CLUBS THE FAD.

Postal camera clubs are becoming a fad in this country, as they have already been for several years in England and Europe. The members are made up of amateur photographers residing in different parts of the country who forward to each other interesting pictures they have taken. The prints are made from the negatives directly onto postal cards, and the collection thus secured in a few months gives glimpses of scenes from widely separated localities.

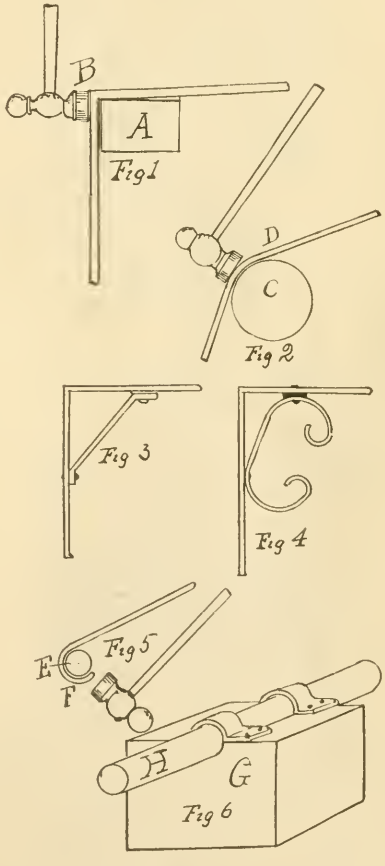
MECHANICS FOR YOUNG AMERICA

SOMETHING FOR BOYS TO MAKE.

Many an industrious lad has made money manufacturing the common forms of wood brackets, shelves, boxes, stands, etc., but the day of the scroll saw and the cigar-box wood bracket and picture frame has given way to the more advanced and more profitable work of metal construction. Metal brackets, stands for lamps, gates, parts of artistic fences for gardens, supporting arms for signs, etc., are among the articles of modern times that come under the head of things possible to construct of iron in the back room or attic shop. The accompanying sketches present some of the articles possible to manufacture.

First, it is essential that a light room be available, or a portion of the cellar where there is light, or a workshop may be built in the yard. Buy a moderate sized anvil, a vise and a few other tools, including bell hammer and this is all required for cold bending. If you go into a forge for hot bending, other devices will be needed. Figure 1 shows how to make the square bend, getting the shoulder even. The strip metal is secured at the hardware shop or the iron works. Often the strips can be secured at low cost at junk dealers. Metal strips about half an inch wide and one-eighth of an inch thick are preferable. The letter A indicates a square section of iron, though an anvil would do, or the base of a section of railroad iron. The bend is worked on the corner as at B, cold. If a rounded bend is desired, the same process is applied on the circular piece of iron. This is shown in Fig. 2 at C. This piece of iron can be purchased at any junk store, where various pieces are always strewn about. A piece about 20 inches long and 4 inches in diameter is handy. The bend in the metal begins at D and is made according to the requirements. Occasionally where sharp bends or abrupt corners are needed, the metal is heated previous to bending.

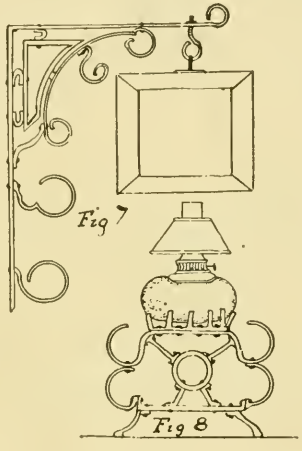
Although the worker may produce various forms of strip-metal work, the bracket is, as a rule, the most profitable to handle. The plain bracket is shown in Fig. 3, and is made by bending the strip at the proper angle on form A, after which the brace is adjusted by means of rivets. A rivet hole boring tool will be needed. A small metal turning or drilling lathe can be purchased for a few dollars and operated by hand for the boring, or a common hand drill can be used. Sometimes the bracket is improved in design by adding a few curves to the end pieces of the brace, making the effect as shown in Fig. 4. After these brackets are made they are coated with asphaltum or Japan; or the brackets may be painted or stained any desired shade.

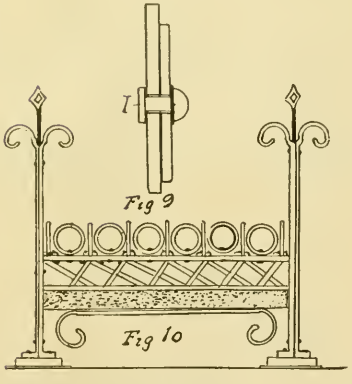


In some of the work required, it is necessary to shape a complete loop or circle at the end of the piece. This may be wrought out as in Fig. 5. The use of a bar of iron or steel is as shown. The bar is usually about 2 inches in diameter and several feet in length so that it will rest firmly on a base

of wood or stone. Then the bending is effected as at F, about the bar E, by repeated blows with the hammer. After a little practice, it is possible to describe almost any kind of a circle with the tools The bar can be bought at an iron dealers for about 40 cents. From the junk pile of junk shop one may get a like bar for a few cents.

A convenient form for shaping strip-metal into pieces required for brackets,





fences, gates, arches, and general trimmings is illustrated at Fig. 6. First there ought to be a base block, G, of hard wood, say about 2 feet square. With a round point or gouging chisel work out the groove to the size of the bar, forming a seat, by sinking the bar, H, one half its depth into the wood as shown. In order to retain the bar securely in position in the groove, there should be two caps fitted over it and set-screwed to the wooden base. These caps may be found in junk dealers' heaps, having been cast off from 2-inch shaft boxes. Or if caps are not available, the caps can be constructed from sheet metal by bending to the form of the bar, allowing side portions or lips for boring, so that the caps can be set-screwed to the wood. Thus we get a tool which can be used on the bench for the purpose of effecting series of bends in strips of metal.

Since the introduction of the laws requiring that signs of certain size and projection be removed from public thoroughfares in cities, there has been quite a call for short sign brackets, so termed, of the order exhibited in Fig. 7. These sign-supporting brackets do not extend more than three feet out from the building. A boy can take orders for these signs in almost any city or large town with a little canvassing. The sign supporting bracket shown is merely a suggestion. Other designs may be wrought out in endless variety. A hook or eye is needed to sustain the ring in the sign.

The young man who undertakes to construct any sort of bracket, supports, frames or the like, will find that he will get many orders for lamp-supporting contrivances, such as shown at Fig. 8. It is hardly necessary to go into details for making these stands as every part is bent as described in connection with the bending forms, and the portions are simply riveted at the different junctures. Both iron and copper rivets are used as at I, in Fig. 9, a cross sectional view.

The best way is to bore straight through both pieces and insert the rivet. In some cases the rivet is headed up in the bore and again washers are used and the heading effected on the washer. Copper rivets are soft and easily handled, but are costly as compared with iron rivets.

Good prices are obtained for the guards for open fireplaces made in many varieties in these days. The return of the open fireplace in modern houses has created a demand for these guards and in Fig. 10 we show a design for one of them. The posts are made sufficiently stiff by uniting two sides with rivets. The ends at top are looped as shown, while the ends or butts at the base are opened out to make the feet. Rings are shaped on forms and are then riveted to the base cross-piece as illustrated. Crosses are made to describe to central design and the plan is worked out quite readily with the different shapes.

Bologna sausage is now being adulterated with corn meal. The meal is harmless, of course, the imposition consisting in paying 12 cents a pound for meal.

ORNAMENTAL METAL GUARDS FOR OPEN FIREPLACES AND HOW TO MAKE THEM.

The making of metal fire grate fronts has proven to be a very interesting and profitable occupation for boys in recent times. Not long ago it was sufficient for the ingenious youth to turn out juvenile windmills, toy houses and various little knickknacks for amusement. The modern lad wants more than this. He desires to turn some of his product into cash. Therefore we present some of the patterns of fire grates which boys have made and can make again from scrap iron, with few tools and devices, and find a ready market for the same as soon as they are made. Fig. 1 is a sketch of a form of fire grate bar or front that is constructed with a series of circles of strip metal. The best way is to go to the hardware store or iron dealers and buy a quantity of ¼-inch, ½-inch and ¾-inch iron, about an ⅛ to 3-16-inch thick. In fact, 1-16-inch metal would do in many cases where the parts are worked out small in size. The ⅛-inch metal is very strong. Then after getting the supply of strip metal in stock, procure the usual type of metal worker's hammer, a cheap anvil, a 9-pound vise, a cold chisel, a file or two, and a round piece of shaft iron, about 3 inches diameter and 2 to 3 feet long. This piece of iron is represented at B, Fig. 2.

The iron is held in position by means of the straps of metal C, C, which are bent over the shaft tightly and grip the board base with set or lag screws as shown. The wooden base should be about 2 inches thick and large enough to make a good support for the iron shaft. The process of bending the rings in this way is as shown. The piece of strip iron is grasped at D. Then with the hammer the iron is gradually worked cold about the mandrel as at E until the perfect form is acquired. After the form is finished, the strip at the terminus of the ring is cut off. In order to get a steady base the wooden part may be bolted to a bench. In Fig. 3 is shown the method of clipping off the completed ring. The cold chisel is held upright, and by delivering several blows with the hammer upon the same, the point is caused to chip through the metal and release the ring. The shaft or mandrel is marked G. The cold chisel is indicated at I and the position where the hand grasps the strip is at H. The final operation in shaping the ring is by driving the protruding cut, lip down, to the common level of the opposite point, thus giving us the finished ring with the lips closed on the mandrel as at J, Fig. 4. These rings can be turned out in this way very speedily. The next operation involves the process of uniting the rings in the plan to shape the design. The design work is often worked out ahead and followed. Some become so proficient that they can develop a design as they proceed.

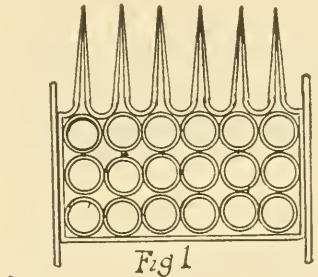


Fig 1

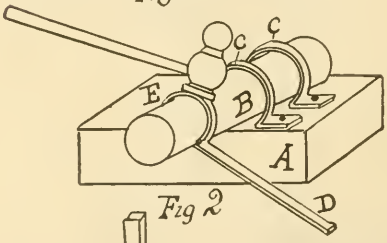


Fig 2

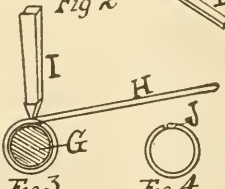


Fig 3. Fig 4

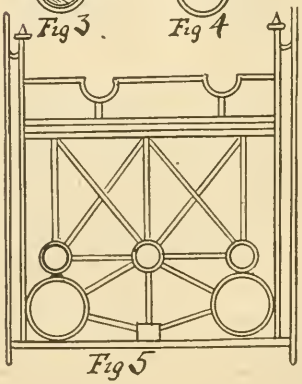


Fig 5

Fig. 1 is a design of grate front used for various purposes in connection with grate fires. The series of rings are united by a rivet between each at the joining point. With thin metal the holes can be punched

with an iron punch and hammer on an anvil where there is a hole to receive the point of the punch after the punch penetrates the metal. For the heavier forms of metal a drill is necessary. A metal drill and brace can be purchased very cheaply for this work. After drilling the holes, the parts are erected and the rivets inserted and

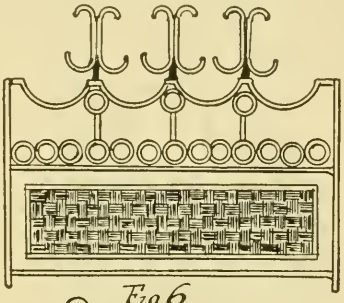


Fig 6

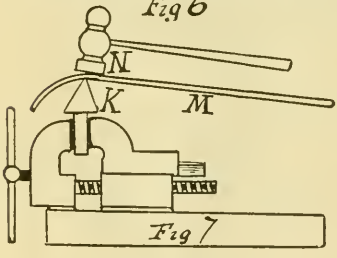


Fig 7

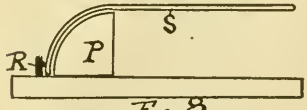


Fig 8

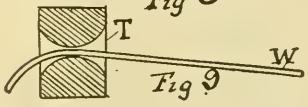


Fig 9

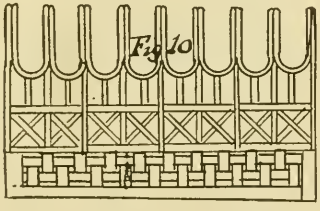


Fig 10

headed up as each addition is made. Thus the series of rings are united and then the side pieces are similarly riveted. The points at the top are then worked out and joined on. These points are filed down to the necessary taper after the union is effected. The finishing work involves smoothing rough places with a file and painting. Asphaltum makes a good black finish. Some of the best designs of grates are bronzed. Some are silvered. The different designs are finished as desired by customers.

Fig. 5 is another design of grate in which the process of shaping the rings is like that in the first design. There are some half circles in this pattern and these are framed by shaping the same about the mandrel with the hammer. In order to get the shoulders close and the circle complete it is necessary to heat the metal. A coke fire can be made in a hole in the ground. Then procure a tin blowpipe and blow the flame against the metal at the point to be bent. This metal will become red hot very soon, and can be bent readily against the anvil and the circular form. Let the metal cool off on the ground after heating. Fig. 6 is another design which can be wrought out. The middle adjustment is wire screen work which may be bought at a hardware store and set into the position shown. Fig. 7 shows a chipping off device useful in connection with this work. Metal chippers can be bought at any tool store. The chipper is placed in the jaws of the vise as at K, and secured there. The strip of metal in process of cutting is marked M. The hammer head is caused to strike the metal just over the cutting edge of the chipper. The quick, hard blow causes the cutting edge to penetrate far enough to sever the piece. Bending cold with a wooden form is done as in Fig. 8. The wooden form is marked P and is about 8 inches wide and 7 inches high, forming a one-sided oval shape. There is a pin R set into the base board of the oval form and the strip of metal for bending is grasped at S and the other end is inserted back of the pin R. By applying pressure, the strip of metal is bent to the form.

Fig. 9 shows the hour-glass wood bending form, made by selecting a piece of hard wood block, about 6 inches square and boring through with an inch bit. Then the hole is shaped hour-glass like. The view is a sectional one. The block is placed in a vise and the strip for bending is inserted as at T.

The strip of metal is grasped at W and can be bent to various forms by exerting pressure. Fig. 10 is another type of fireplace front, constructed by uniting the shaped metal pieces. In fact an almost endless variety of designs can be wrought out after the start is once made. A good way to figure the price on the grate is to add up the costs of the parts and charge about 12 cents per hour for the work.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A PROPELLING VEHICLE.

Any boy, with a little knack and a few odd tools, can rig up various contrivances which will be a source of pleasure to himself and oftentimes can be sold, to less ingenious boys, for a snug little sum. Any tool a boy can obtain is apt to be of use to him, chisel, bit, jack-knife or hammer.

Figure 1 shows what two boys did with old cycle wheels. They went to some junk shops where the concerns had purchased cast-away bicycles and noticed that there were numerous wheels in very good order that could be selected from among the sets of wheels with broken or bent rims, spokes, burst tires, etc. In fact, the lads had no trouble in getting several sets of bicycle wheels in fit condition for use at 20 cents for each wheel. These wheels were taken to the back-yard shop of the boys where the young fellows had rigged up a shed-like affair and put in a bench. The previous Christmas one of the boys had had a box of tools given him, and these tools included a little hand vise and the required tools for general boy's handiwork.

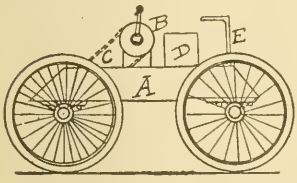


Fig 1

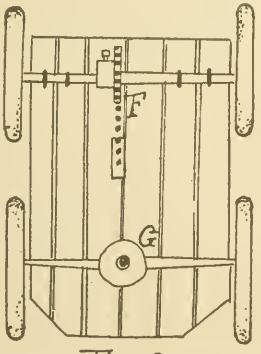


Fig 2

Four of the cycle wheels they used in making the hand-propelled vehicle shown at Fig. 1.

A wooden body, A, made of smooth boards rests upon shafts. Fixed on this body is an upright carrying the cog B. The upright is a piece of wood about 10 inches high and 4 wide, fitted with one of the bearings from the cycle. The regular cycle chain cog is used at B as well as upon the shaft. The regular chain of the cycle is likewise employed, so, when buying the wheels, it is well to select one or more chains with corresponding cogs from the junk heap. The detail of the adjustment of the parts is shown in next views. The letter D signifies the seat which is a box. The steering gear is a bent iron rod, also found in the waste pile of the junk shop, and is bent to right form by heating and bending over on a rock or any solid matter. The steering rod is marked E. It fits into a socket in the shaft of the forward wheels.

Fig. 2 shows the construction of the cart below. The cog is keyed or set-screwed to

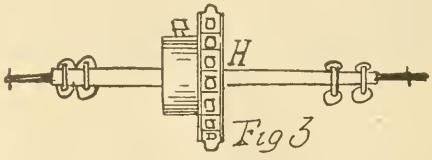


Fig 3

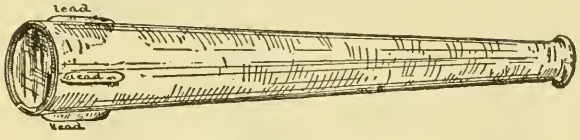

Fig 4

the driving shaft of the wheels with either key or set-screw used in original fastening, as the case may be. The chain is marked F, and there is a slot cut in the floor of the cart to let the chain pass up and through to the cog on the propelling shaft crank. The disk which receives the steering rod is at G. The forward shaft bears only at the center upon a disk of metal, consisting of any circular piece found among the pieces of iron or brass at the junk store. One can get nearly all the mechanical parts in junk establishments that purchase parts of out-of-date or cast-away bicycles. The detail of the driving shaft is shown at Fig. 3. The cog work is at H and this is just as it is taken from the original bicycle shaft. The bearings consist of wires looped around the shaft and inserted into holes bored in metal plates as shown. These plates are screwed to the bottom of the cart. The shaft itself is found in rods or even cast-away metal axles which are commonly found in most any carriage works, cycle shops or junk dealer's. Fig. 4 shows the disk that receives the steering gear. The disk is bored around edges for the securing screws, while the

center is open for the steering rod. When put together, three boys usually ride. One steers and the other two turn the crank. Freight can be carried and some boys do quite an express business in their town with one of the carts like this that they made.

HOW TO MAKE A WATER TELESCOPE.

Before you decide on a place to cast your hook it is best to look into the water to see whether any fish are there. Yes, certainly, you can look into the water and see the fish that are there swimming about, if you have the proper equipment. What you need is a water telescope. This is a device made of wood or metal with one end

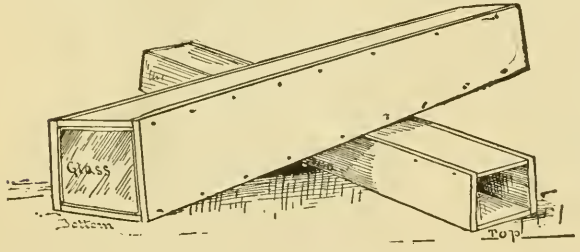


Tin Water Telescope

of glass. When the glass end is submerged, by looking in at the open end, objects in the water are made plainly visible to a considerable depth. In Norway, the fishermen use the water telescope regularly in searching for herring shoals or cod.

All that is necessary to make a wooden water telescope is a long wooden box, a piece of glass for one end and some paint and putty for making the seams watertight. Fix the glass in one end of the box, and leave the other open to look through.

A tin water telescope is more convenient than the wooden one, but more difficult to



Wooden Water Telescope

make. The principal essential for this is a circular piece of glass for the large end. A funnel shaped tin horn will do for the rest. Solder in the glass at the large end and the telescope is made. Sinkers consisting of strips of lead should be soldered on near the bottom to counteract the buoyancy of the air contained in the watertight funnel and helps to submerge the big end. The inside of the funnel should be painted black to prevent the light from being reflected on the bright surface of the tin. If difficulty is found in obtaining a circular piece of glass, the bottom may be made square and square glass used. To picnic parties the water telescope is of great amusement, revealing numerous odd sights in the water which many have never seen before.

HOW TO MAKE PAPER BALLOONS.

Any boy who can make kites can make enough paper balloons for a Fourth of July celebration and can make and sell enough of them to pay for all the necessary materials, which are very few.

Paper balloons may be of any size desired and have as many gores as one wishes in whatever colors one prefers. A very good size is 3 feet in height with 32 gores, each gore being 3 inches wide at the bottom, 8 inches wide at its widest point and 1 inch wide at the top. To make the balloon pear-shaped, the three widths mentioned when added together (3 + 8 + 1 = 12) should be one-third of the height of the balloon.

Procure close-textured tissue paper in any contrasting colors you like; red and white are good. Cut out a pasteboard pattern exactly the shape and size the gores are to be and cut the gores out by it.

Varnish each gore with boiled oil and hang it up on a line to dry, being careful not to let it come in contact with any other gore. When they are perfectly dry put them together by means of gum water, or clear thin paste. To do this gum about one-half inch of a gore and lay one edge of another gore midway across the gummed space and dab down very lightly by means of a clean cloth. In this manner unite all the gores in pairs until there are but 16 parts. Continue to unite them until you have two halves. Join these very carefully, closing the balloon at the top completely. Each time you paste a gore hang the part up until perfectly dry before using it further.

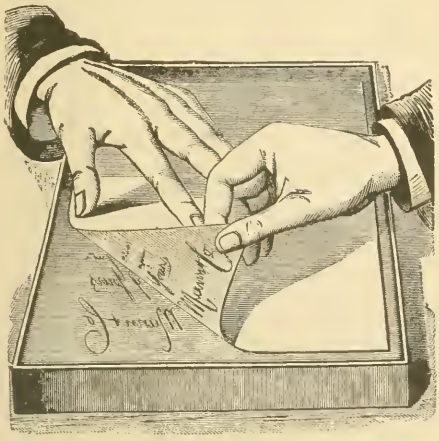
In the bottom of the balloon work a circle of wire 6 inches in diameter and fasten a wire with a piece of sponge strung on it across the circle of wire.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A HECTOGRAPH.

A hectograph is very simply and easily made and by means of it many copies of writing can be obtained from a single original.

Make a tray of either tin or pasteboard, a little larger than the sheet of paper you ordinarily use and about ½-inch deep. Soak 1 ounce of gelatine in cold water over night and in the morning pour off the water. Heat 6½ ounces of glycerine to about 200 degrees F. (93 C.) on a water bath, and add the gelatine. This should give a clear glycerine solution of gelatine.



Using the Hectograph.

Place the tray so that it is perfectly level and pour in the gelatinous composition until it is nearly level with the edge of the tray. Cover it so the cover does not touch the surface of the composition and let it stand six hours, when it will be ready for use.

Make the copy to be reproduced on ordinary paper with aniline ink; using a steel pen, and making the lines rather heavy so they have a greenish color in the light. A good ink may be made of 1 ounce of aniline (2 R B or 3 B) dissolved in 7 fluid ounces of hot water. Cool and add 1 fluid ounce of glycerine, a few drops of ether and a drop of carbolic acid. Keep in a corked bottle.

When the original copy of the writing is ready moisten the surface of the hectograph slightly with a sponge, lay the copy face down upon it and smooth down, being careful to exclude all air bubbles and not shifting the paper. Leave it nearly a minute and raise one corner and strip it from the pad, where will remain a reversed copy of the inscription.

Immediately lay a piece of writing paper of the right size on the pad, smooth it down and then remove as before. It will bear a perfect copy of the original. Repeat the operation until the number of copies desired is obtained or until the ink on the pad is exhausted. Fifty or more copies can be obtained from a single original.

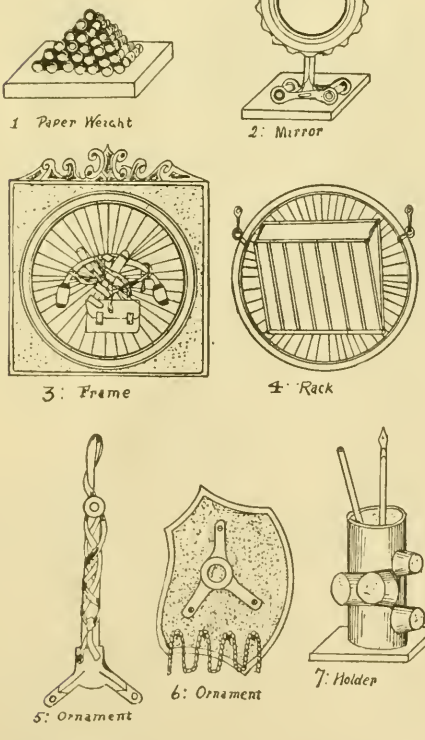
When through using the hectograph wash it off with a moist sponge, and it will be ready for future use. If the surface is impaired at any time it can be remelted in a water bath and poured into a tray as before, if it has not absorbed too much ink.

USEFUL ARTICLES AND ORNAMENTS MADE OF OLD BICYCLE PARTS.

A great deal of pleasure may be derived from turning parts of old bicycles into articles of use or ornamentation. Many original ideas can be used in this work and it is good practice for the boy of an inventive turn of mind. Sprocket gears, cone shafts, handle bars, wheel rims and other parts of old bicycles which were formerly disposed of as junk, are now carefully assorted, cleaned, polished or nickel plated, and used for wall and archway decorations. Plating outfits are expensive, but persons who possess them will do that part of the work for a small charge.

An idea of the character of the articles obtainable from cast-off bicycles is shown. Figure 1 is a collection of balls from several ball bearings, formed into a pyramid by means of cement, and nickle plated or gilded. The pyramid is then cemented to a wooden base and forms a useful desk paper weight. A table mirror (Fig. 2) is made by fastening a circular mirror to the center of a wheel sprocket gear; the stand is a pedal and pedal shaft. The pedal shaft is screwed tight to the pedal and consequently keeps the affair perpendicular. The sprocket, pedal and shaft are bronzed or plated and if desired, the sprocket may be wound with

fancy ribbon. Fig. 3 is an old wheel, the tire of which is filled with sawdust to keep it expanded, and in the center of which are several mementos of a by-gone cycle season, and all are hung to the wall. The tire of the wheel is artistically ornamented with oil or water colors or coated with silver bronze. The spokes are polished and the central articles are nickel plated, making an attractive showing. Another wall decoration of this order is shown at Fig. 4, in which the wheel tire is treated as before and prepared for a figure head or ordinary picture or wall mirror to be attached to the spokes. Fig. 5 is a pedal crank, plated and entwined with colored ribbons for hanging up. Memories of last season's wheeling are brought to mind by such designs as in Fig. 6. This is a spider, plated or gilded, and secured to a wooden base. There are pins beneath on which part of a chain is suspended. Perhaps this chain has a story



connected with it. It is finely polished or nickle plated and makes a memento of a bicycle which in its day had no equal in the estimation of its owner. The wooden base is either sanded or finished in natural state. Fig. 7 is a crank hanger separated from the tubes, japanned or bronzed, and used for a pencil and pen holder. Fig. 8 is a piece of hall furniture from which the hat

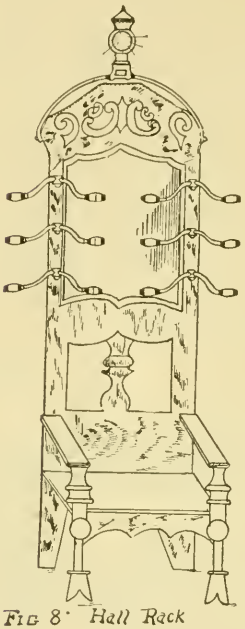


Fig 8: Hall Rack

Fig 9: Seat

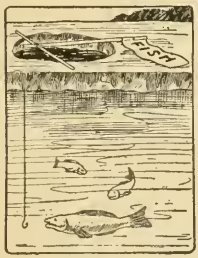
pins are removed and bicycle handle bars substituted. This is done by simply putting the bar posts through the original pin holes and securing the posts on the back by means of clamps. A cycle lantern is placed at the top, with fork and head piece, by expanding the fork and prongs to conform to the shape of the top. A set screw is put into the wood through the shaft holes in the forks and the whole affair is firmly held in place. The lantern can be kept in order and lighted. By cutting off the rear of the frame at the juncture of the seat pot lug and the crank hanger, a hall stool or seat can be made as in Fig. 9. The rear stays are spread out to form the necessary standing support for the affair. The tubing is re-enamelled or japanned and the bright work polished, while the saddle leather is treated to a surfacing of gold or silver composition, making an attractive and useful piece of hall furniture.

In 780 of the Southern Pacific Railway's 1,350 locomotives oil is used as fuel. In the shops at Sacramento, also, oil is used instead of coal.

MECHANICS FOR YOUNG AMERICA

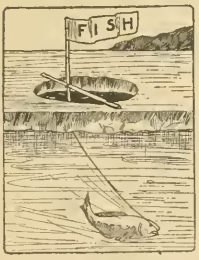
Devices of Winter Sports--How to Make and Use Them

Fishing in the south is confined to the warm season, but in the north the red-cheeked boy digs a hole in the ice and while he amuses and invigorates himself at skating, the fish underneath the icy sheet fasten themselves to the hook he has let down through a hole. The northern boy used to sit over the hole in the ice and wait for the fish to bite, but that became too slow and detracted too much from his pleasure at skating. So his inventive genius set itself to work and the "tip up" and "signal" shown in the illustration was the result. When the fish is not biting the flag lies flat on the ice, but as soon as a fish has swallowed the hook the flag pole stands straight up wafting its bright colored flag to the breezes and all the boys on the skating pond read the word "fish." The fish is drawn up, the hook re-baited and the youthful fisherman resumes his pleasures on the ice. Often a score or more of these "tip ups" are planted about the edges of the ice pond, each boy bringing his fishing tackle with his skates and thus finding a double source of amusement. Maybe one boy will thus have a half dozen different lines in the water at once, it being easy to watch them all together.



"Tip-Up" Pole

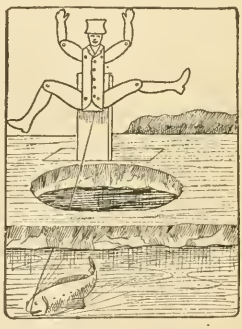
The device by which the fish is made to give its own signal when caught is exceedingly simple and any boy can make it. Procure a light rod about two feet in length and to one end fasten a small flag, made of any bright colored cloth. Bind the rod at right angles to another stick which is placed across the hole, so that a short piece of the flag-rod projects over the cross stick. To this short end fasten the fishing line. Be sure and use strong string in binding the two rods together, and also take care that the cross stick is long enough to permit several inches of each end to rest on the ice. After fastening the line to the short end of the rod, bait the hook with a live minnow or other suitable bait and let it down through the hole. When the fish is hooked the flag will instantly raise and wave about strenuously until the fish is taken from the water.



"Tip-Up" Fish Caught

"JUMPING JACK" FISHERMAN.

If the small boy has a "jumping-jack" left over from Christmas he may make this do his fishing for him and serve as well as the "tip-up," or he can easily make the jumping-jack himself independent of Santa Claus. The string which is pulled to make the joints move is tied securely to the fishing line; the hook is baited and lowered into the water through a hole in the ice. The "jumping-jack" waves his legs and arms frantically to notify the boys when the fish is biting. The "jumping-jack" is also used for fishing in summer time by placing it on a float which is cast into the water.


"Jumping Jack" Fisherman

WINTER VELOCIPEDE.

Bicycles may be converted into novel sleighs by simply overhauling. The usual bicycle frame and pedals are used, and gearing transmits to contact wheels, in which are sharp spikes for catching in the snow or ice. Instead of moving on wheels the machine is carried on runners.

THE RUNNING SLEIGH.

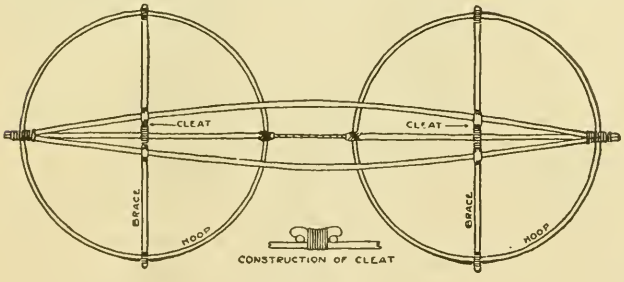
Another winter sport, very popular in Sweden last winter, and that has already reached America, is the "running sleigh," shown in the illustration. A light sleigh is equipped with long double runners and is propelled by foot power. The person using the sleigh stands with one foot upon a rest attached to one of the braces connecting the runners and propels the sleigh by pushing backward with the other foot. To

steady the body an upright support is attached to the runners. The contrivance can be used upon hard frozen ground, thin ice and snow-covered surfaces, and under favorable conditions moves with remarkable speed. The "running sleigh" has a decided advantage over skis, because the two foot supports are braced so that they cannot come apart. Any boy can make the sleigh with a little pains.

THE WINGED SKATER.

With the actual speed of the wind a skater may be hurled along the ice if he is aided by sails. He has been known to travel at the rate of 100 miles an hour, and the sport while affording the limit of excitement, is not attended with danger. The sails are easily made, as the illustrations and description will show.

Secure two large thin hoops about four feet in diameter. They may be obtained from an old hogshead or by bending thin strips. For each hoop select a piece of strong cane about three-fourths of an inch in diameter to constitute the fore and main masts or cross-yards. Extend these across the center of the hoop and fasten each end firmly to the hoop's sides. For the middle of each cross-spar make a



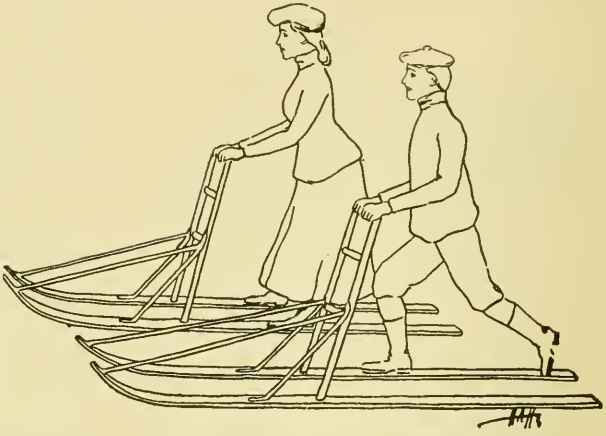
Skater's Sails

cleat and lash it on firmly.

The main spar should also be made of two pieces of strong cane, each about 9½ feet long. Bind them together at each end so that the large end of one is fastened to the small end of the other.

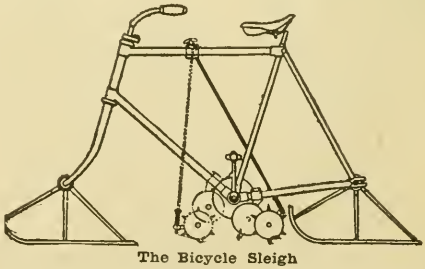
Next comes the attaching of the sails to the separate masts. The sails should be made of strong sheeting or thin canvas. Tack the cloth to the hoop on the inner side after the cloth has been wrapped around the hoop two or three times.

Now the main spar should be attached by springing it apart and slipping the cleats of the cross-spar between the two pieces. Bind the inner sides of the hoops tightly together by means of a very strong double cord, as shown in the figure. Then your sail is ready for the ice pond. See that your skates are securely fastened, raise your sail and you will skim along the ice as lightly as a bird on the wing. With a little practice you will learn to tack and guide yourself as desired.



Running Sleigh

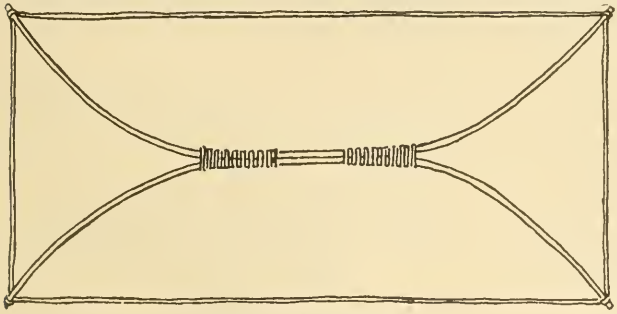
If the hoops cannot be easily obtained the sails may be made equally effective by using the main spar and fore and main masts as herein described, making the sails square shaped instead of round and leaving off the hoops. In this case the sails should be securely bound with strong tape. Attach a corner to each end of the cross-spar, and a corner to the outer end of the main spar. The remaining corner of each then appears opposite to each other, and should be fastened together by strong cord in the same manner as the hoops. In this case the sails may be left off until after the frame



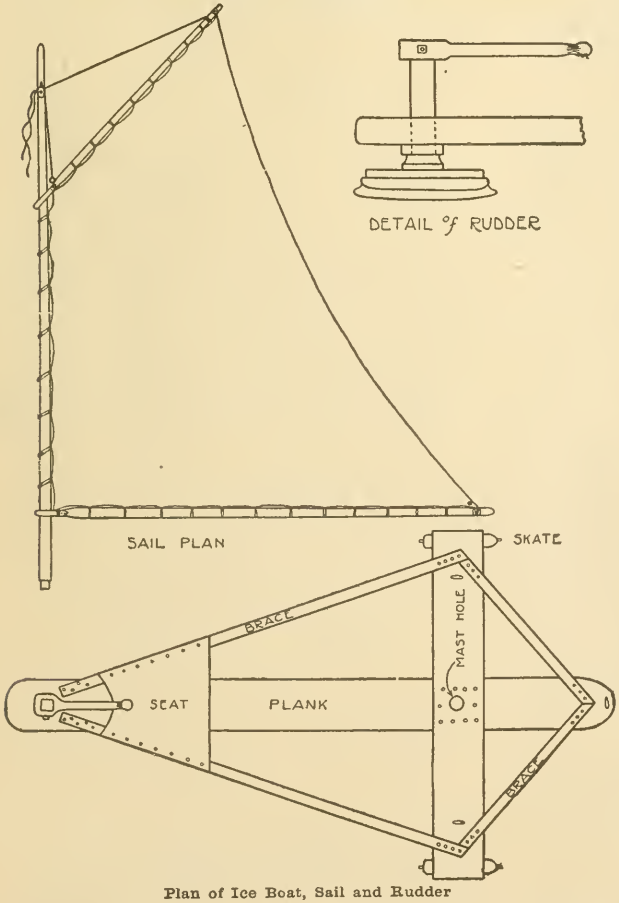
The Bicycle Sleigh

is entirely put together and then fastened on to the spars by buttons.

A more simple sail may be made according to the plans illustrated in the lower drawing. It is made by binding together in the center the halves of two strong hogshead hoops, or two bent poles are better.



Skater's Sails Finished



Plan of Ice Boat, Sail and Rudder

If possible the sail should be about eight feet long and four feet wide. Fasten on the sail at the four corners. The rig will convey two persons and is more easily constructed than any other.

ICE BOATING.

But the sport that is greatest of all, the one that used to be part of the life of every northern boy, and which is being revived in popularity after years of stagnation, is ice boating. With the aid of old skates, pieces of board and an old sheet or a small bit of canvas, any boy possessed of ordinary mechanical genius may make an ice boat. The frame of the boat should be made something in the form of a kite. The center-board should be four or five feet long, six inches wide and two inches thick. The cross board may be of a piece of 1 by 6 inch plank three feet long. Fasten these with braces of small stout strip, as shown in the drawing, and screw the cross piece securely to the center-board. Bore a hole in the center of the intersection for the mast pole. The seat may be made of a piece of strong cloth or leather. Three skates are fastened on to either

Boy's Ice Boat

side of the cross-board and one to the rear end of the center-board, the latter of which is to operate as a rudder. In attaching the skates first make a couple of runner blocks, each six inches long and three inches wide. Bore holes in them for the straps of the skates to pass through and fasten them securely. Nail the runner blocks firmly to the cross board about 1½ inches from each end.

In making the rudder hew down a piece of scantling one foot long until is assumes the shape of a club with a flat base. Nail a strip of wood firmly to this base, and to the strip fasten the skate. Run the top of the club through a hole bored in the stern of the center-

MECHANICS FOR YOUNG AMERICA

Coasting Sleds, Chair Sleighs, Toboggan Slides, Skis and How to Make Them

Make your own sleds, boys! There is no use in buying them, because your hand-made sled is probably better than any purchased one and then you can take so much more pride in it when you know it is of your own construction. There are so many different designs of sleds that can be made by hand that the matter can be left almost entirely

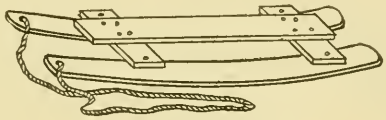


Fig. 1.—Barrel Stave Sled

to your own ingenuity. You can make one like the bought sleds and face the runners with pieces of an iron hoop which will answer every purpose. A good sled for coasting consists simply of two barrel staves and three pieces of board as shown in the picture, Fig. 1. No bought sled will equal it for coasting and it is also just the thing for carrying loads of snow for building snow houses. The method of its construction is so simple that no other description is needed than the picture. You can make a chair-sleigh out of this by fitting a chair on the cross board instead of the long top board or it will be still stronger if the top board is allowed to remain, and then you will have a device that can readily again be transformed into a coasting sled. In making the chair-sleigh it is necessary, in order to hold the chair in place, to nail four L-shaped blocks on the cross boards, one for each leg

Chair Sleigh

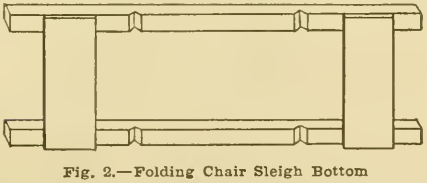


Fig. 2.—Folding Chair Sleigh Bottom

of the chair. Skating along over the ice and pushing the chair in front of him the proud possessor of a chair-sleigh may take his mother, grown sister or lady friend with him on his outings, and permit her to ride in the chair.

FOLDING CHAIR SLEIGH.

A folding chair sleigh is even more enjoyable and convenient than the device just described. If the ice pond is far from home this may be placed under your arm and carried where you like.

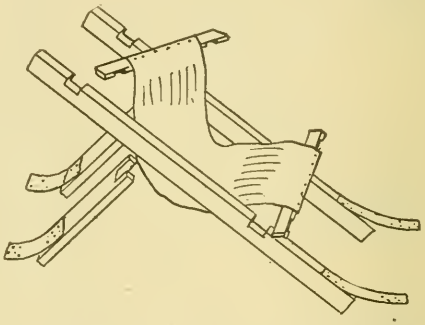


Fig. 3.—Folding Chair Sleigh.—Top Parts Disconnected

The illustrations, Figs. 2 and 3, show all the parts as they should look before being joined together. The seat may be made of

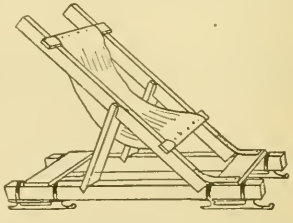


Fig. 4.—Folding Chair Sleigh Open

a piece of canvas or carpet. The hinges are of leather. Fig. 4 shows the folding chair sleigh after it has been put together. Skates are employed for the runners. The skates may be strapped on or taken off whenever

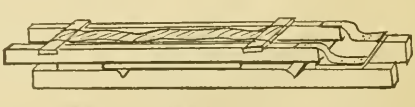


Fig. 5.—Folding Chair Sleigh Closed

desired. When the chair is lifted the supports slip from the notches on the side bars

and fall on the runner bars. The chair is then folded up so that it can be carried by a small boy. With regular metal hinges and light timbers a very handsome chair can be constructed that will also afford an ornamental lawn chair for summer.

THE TOBAGGAN SLED.

When the snow is very deep a toboggan sled is the thing for real sport. The run-

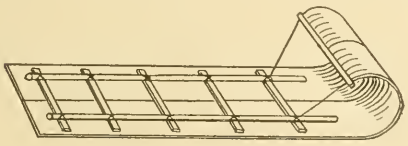


Fig. 6.—The Toboggan

ners of the ordinary sled break through the crust of the deep snow, blocking the progress, and spoiling the fun. The toboggan sled, with its broad, smooth bottom, glides along over the soft surface with perfect ease.

To make the toboggan sled, secure two boards each ten feet long and one foot wide and so thin that they can be easily bent. Place the boards beside each other and join them together with cross sticks. Screw the boards to the cross stick from the bottom and be sure that the heads of the screws are buried deep enough in the wood to not protrude, so that the bottom will present an absolutely smooth surface to the snow. Fasten two side bars to the top of the cross sticks and screw them firmly. In some instances the timbers are fastened together by strings, a groove being cut in the bottom of the boards so as to keep the strings from protruding and being ground to pieces. After the side bars are securely fastened, bend the ends of the boards over and tie them to the ends of the front cross bar to hold them in position. See Fig. 6. The strings for keeping the boards bent must be very strong. Pieces of stout wire, or a slender steel rod, are even better. The toboggan slide is the favored device of sport among the boys in Canada, where nearly every boy knows how to make them.

THE NORWEGIAN SKI.

You have often read of the ski, the snowshoe used by the Norwegians and other people living in the far north. With them the men and women glide down the snow-covered mountain sides, leap across ditches, run races and have all kinds of sport. They are just as amusing to the American boy who has ever learned to manipulate them, and it is wonderful how much skill can be attained in their use. Any boy with a little mechanical ingenuity can make a pair of skis (pronounced skees). They can be made from two barrel staves. Select staves of straight grained wood. Sharpen the ends of each and score each end by cutting grooves in the wood, as shown in the cut, Fig. 7. A pocket knife or small gouge will suffice for

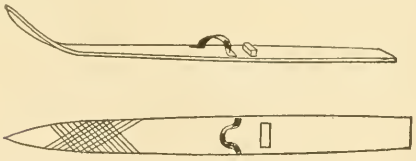


Fig. 7.—Skis

this work. Then smear the end of the staves with oil and hold them close to a hot fire until they can be bent so as to tip the toes upward, as shown in the picture, Fig. 7. Then with a cord bind the staves as they are bent and permit them to remain thus tied until they retain the curved form of their own accord. Now screw on top of each ski a little block, just broad and high enough to fit in front of the heels of your shoe. Fasten a strap in front of each block through which to slip your toes, and the skis are made. The inside of the shoe heel should press firmly against the block and the toe be held tightly under the strap. This will keep the skis on your feet. Now procure a stick with which to steer and hunt a snow bank. At first you will afford more amusement to onlookers than to yourself, for the skis have a way of trying to run in opposite directions, crosswise and various ways, but with practice you will soon become expert in their manipulation.

The building of a Canadian armed cruiser for the Great Lakes has caused comment on the treaty supposed to restrict such a movement.

John D. Rockefeller's gift of twelve millions to the University of Chicago should be appreciated. It takes John nearly twlve weeks' hard work to earn that much money.

The Swiss government is considering the advisability of substituting electricity for steam as a motive power on all the railroads of that country.

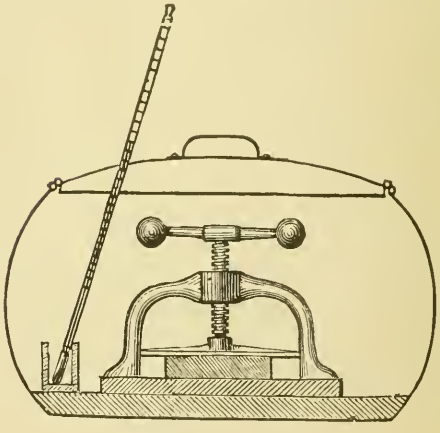
HOW TO MAKE RUBBER STAMPS

India rubber, especially prepared for stamp-making, should be procured from a dealer or manufacturer, if good results are to be obtained. As an experiment, it is possible for an amateur to prepare the rubber, but, in such cases, it is always attended with uncertain results. The mixed uncured rubber comes in white sheets, strong, firm and about one-eighth inch thick, and for its manipulation a press is indispensable, but can be home-made.

For the base of the press use a piece of iron, having two holes drilled in it at the middle of opposite sides, through which pass bolts, letting the thread ends extend upward and counter-sinking places for the bolt heads to keep the under side of the base level. Solder the bolts in place at the base. The upper part of the press, or the platen, is also of iron, cut so it can be swung off the bolts, rather than by removing the nuts and lifting it off. String a half dozen nuts, larger than those which screw on, on each bolt, so that when the upper nut on each is screwed to the extent of the thread the pressure will be communicated through the nuts wedged in between the platen and the upper nut. The bolt holes in the platen should be directly over those in the base. Distance pieces of an exact thickness should be provided for use on the base; these serve to keep the pressure even.

In preparing the mould, if type is to be copied, use rather large type with wide spaces and set up with high quads and spaces, or the type faces may be filled up by rubbing with either wax, or soap, lightly brushing off any that remains loose. The type so set should be locked into a frame. This may be made of two pieces of wood bolted together at both ends, or of printer's furniture. Place it on a flat surface (marble is good, but any perfectly smooth surface will do) and place distance pieces one-eighth inch higher than its upper surface on either side of it. Apply olive oil to the type faces and wipe off any excess. To form the matrix or reverse of the model, take a piece of iron larger than the inscription to be copied, and spread upon it to a depth of a quarter of an inch a putty made by mixing plaster of paris and water to the right consistency. By means of a table knife spread the plaster smoothly and then invert the plate upon the model and press down until the distance pieces are struck. Let it set 10 minutes and then remove. If care has been taken the matrix will be perfect. After it has thoroughly dried, preferably in an oven, saturate it with an alcoholic solution of shellac to strengthen it.

Cut a piece of smooth rubber, large enough to cover the matrix, from the sheet, throw this into a box of talc, or powdered soapstone, so that it receives a coating on both sides; dust a little of the powder over the matrix, also. Place the press on a support over a gas burner, or a kerosene lamp, and apply the heat. Place the matrix on the base of the press, dust off the piece of india rubber and place in the press upon the matrix and screw down the platen. Heat the press to 284 degrees F. (140 degrees C) and keep screwing down the platen so that the rubber, now soft and putty-like, is forced into every recess of the matrix. A

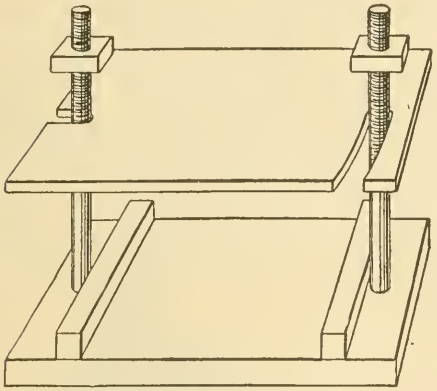


Fish Kettle Vulcanizer

thermometer is not necessary; some rubber always protrudes and the stage of the process can be told from that. At first it is quite elastic, then as the heat increases it becomes soft, then the curing begins and it again becomes elastic, so that, if a point of a knife blade is pressed against it, it resumes its shape when the point is removed. When this takes place it is then thoroughly vulcanized and the sheet can be removed from the matrix. Ten minutes, under favorable conditions, is sufficient time for moulding the rubber. By means of common glue, or a cement, composed of Stockholm pitch, 3 parts; American resin, 3 parts; unmixed india rubber 6 parts; oil of turpentine, 12 parts, heated and thoroughly mixed, fasten the rubber stamp to a wooden handle.

It is possible to dispense with the press in making stamps, where the work is not done in quantities, and use a hot flat-iron.

The matrix is placed on a stove at low heat, the rubber laid on and the hot iron applied. But a few moments are required to mould it.

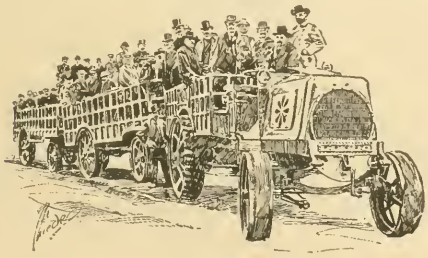


Vulcanizing Press for Rubber Stamps

An old letter press if it be inclosed in a tin oven makes a good press, or all the necessary materials and apparatus can be purchased from a dealer. Any type such as all printers use will answer.

MOTOR TRAIN TRANSPORTATION OF TROOPS.

Germany is utilizing the motor car for the movement of troops, and the practice operation of these trains is becoming a familiar sight. The excellent character of the German highways makes the plan practical and economical. One motor car will draw several of the troop wagons containing as high as 200 soldiers with their ordinary marching



Motor Car Train for the German Army

outfit. Other wagon trains follow, carrying tents, ammunition, supplies, etc. The distance covered is about double that which the men would make in a day's march.

A Boston lawyer has invented a machine by which many difficult cases of hip dislocation are successfully treated.

COAL MINING DEPTH HAS A LIMIT.

Heat and dust are greater menaces to our coal supply than is the rate of exhaustion or any lack of ingenuity among our engineers. The Royal Coal Supplies Commission of England have fixed the coal mining limit depth at 4,000 vertical feet below the surface, and even that depth is not possible unless the air supplied for ventilation be very dry.

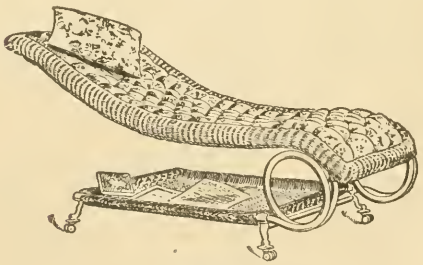
The rate of increase of heat varies in different districts. In some it increases one degree in 40 feet and in others one degree in 60, 80 or 100 feet. On the average, below a depth of 4,000 feet the human body cannot adapt itself to the conditions. Medical authorities state that the highest temperature in dry air at which a man can do hard work is 98 degrees. In air that contains very much moisture he cannot work where the temperature is above 84.

The fact that the air supplied to the miner must be perfectly dry removes one means devised for his comfort: that of spraying. Of course, the greater the heat the dustier the mine. For a while, spraying and other watering contrivances were used to lay the dust, but these means had to be abandoned because they increased the humidity of the air.

Means of conveying the coal from great depths, means of ventilation and in fact nearly all the engineering problems of the coal mine are comparatively easy beside the problem of cooling the air so the men can work below the limitation depth.

VIBRATING FURNITURE.

The illustration is self-explanatory of the latest thing in comfort furniture. Couches, rockers and cribs are now made in this



An Easy Couch

style which is light and airy. The tray at the base is large enough to contain books and other reading matter.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A BAGGAGE CARRIER FOR BICYCLES.

Here is an appliance for fastening books and packages on to the bicycle when starting for a ride in such a secure manner that they can neither be lost or injured.

A box 12 inches long, 8½ inches wide and 6½ inches deep is supported over the back wheel by two uprights clamped to the rear fork and by an iron clamp to the saddle-post. The box is made of well dried wood, the sides and lid being ¼ inch thick, the ends ⅜ inch and the bottom ¾ inch. The uprights A A, Fig. 1, are of ½x⅞-inch oak and are bolted to the bottom. They are strengthened by the iron brace B, Fig. 1, which is made of 1 x ⅛-inch iron. The uprights grip the rear forks by the simple clamp shown in Fig. 2. The iron strips c c Fig. 1, that run from the rear lower corner of the box to the upper forward corner and to the saddle-post are 1 x ⅛-inch iron and are firmly held to the box on each side by five screws. These strips are formed into the clamp shown in Fig. 3.

The lid opens backward and is held closed by the snap detailed in Fig. 4. The dotted outline shows the position the snap takes when the lip opens and closes; ½ to ⅛-inch iron is used in making this snap. The screw at the bottom of the iron piece acts as a hinge. A strap passing through the bottom so that it can be tightened around articles to be carried will prevent them from being shaken about and causing unnecessary noise. A coat of black enamel gives it a finished look. It has been tested with 135 pounds and found none the worse for wear.

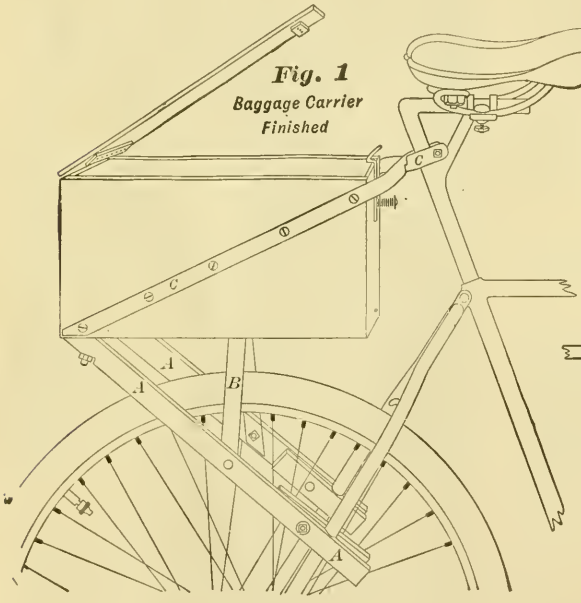


Fig. 1
Baggage Carrier Finished

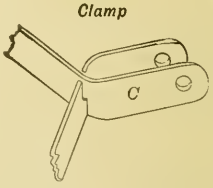
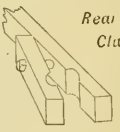
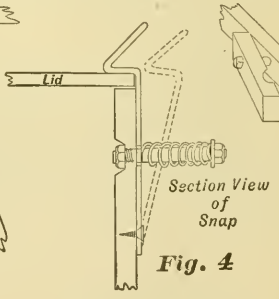


Fig. 3
Saddle Post Clamp



Rear Fork Clamp

Fig. 2



Section View of Snap

Fig. 4

A WATER CANDLESTICK.

A glass of water makes a fine emergency candlestick. Weight one end of the candle with a nail just large enough to hold the candle in the water so that the water touches its top edge, but does not touch the wick, and then light the candle.

It will burn until the last vestige of wick is gone and the flame will not flicker. The melted tallow that runs down but serves to hold the candle more stationary.

MECHANICS FOR YOUNG AMERICA

BOY'S HAND-POWER AUTO.

The picture shows what a nine-year-old boy at Oakland, Cal., constructed. His name is Earl Clifford. He took a coaster wagon and by means of a bamboo lever placed vertically and operating a short horizontally

working wooden "driving rod," connected to an iron crank fastened to one rear wheel, succeeded in producing a machine that makes quite good speed. The illustration shows the arrangement, which any bright boy can make with a few tools. Earl made this wagon motor without any suggestions or assistance from anyone.

HOW TO MAKE A PAIR OF DUMB-BELLS.

Any boy can make a pair of dumb-bells for himself and a lifting weight, also, which will do quite as well as any he could purchase, providing he does his work carefully.

First procure two large tin cans, such as fruit is often canned in, and cut the ends out of each. Shape four round pieces of wood just large enough to fit tightly in the ends of the cans and then cut a hole in the center of each piece of wood as shown in Fig. 1. Procure, also, a hardwood bar the length of the ordinary dumb-bell—a length of old broom handle will do very well.

For filling the cans mix one part of cement with two parts of sand and add water until it is soft, but still has a degree of firmness. Pack this closely into the cans and insert the wooden disks into the ends of the cans. Insert the hardwood bar through the holes in the inside disks so that it runs clear through the center of each can of cement, and joins the cans with a proper

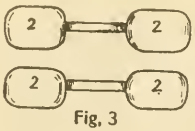


Fig. 3

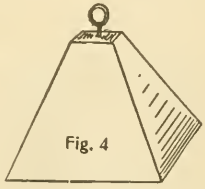


Fig. 4

length of rod between (Fig. 2.) It is well to first string the two inner disks on the bar and then drive a few nails through each end of it before pushing into the cement, to give it a grip. The disks are then pushed along the rod to fit into the open end of each can. Put a wedge in each end of the can to hold the bar in place. The other dumb-bell is made in the same manner.

At this stage let the bells stand for five days or until the cement is perfectly dry, then remove bits of wood and tin until only the cement is left. Cement dumb-bells may be filed into shape as in Fig. 3, and painted, also, if desired.

Fig. 4 shows a lifting weight made of cement. Its construction is very simple. The cement is packed into a wooden mould previously prepared and an iron rod with a ring is thrust in at the top. When the cement is dry the wooden mould is removed.

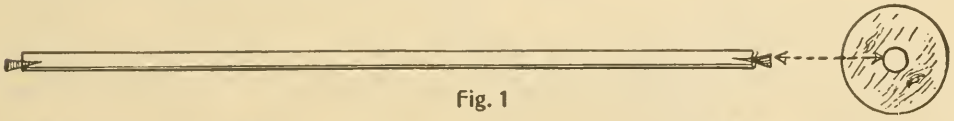


Fig. 1

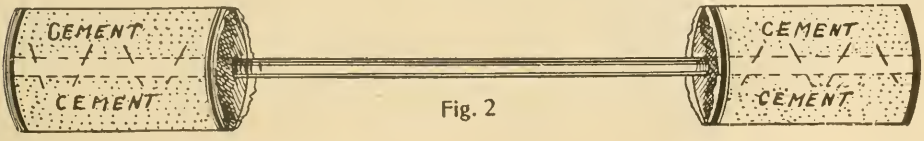


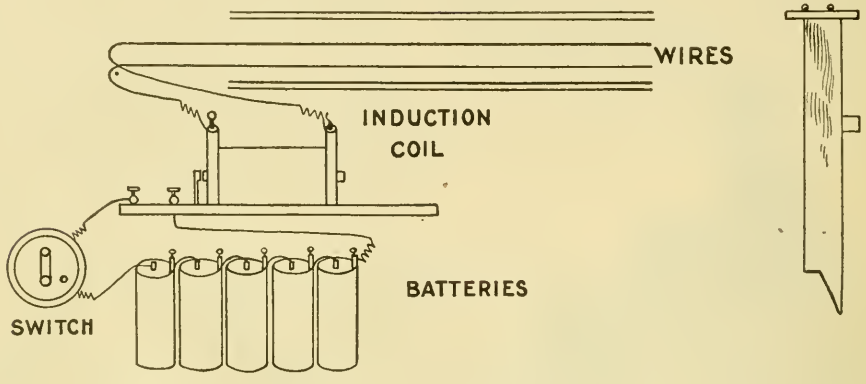
Fig. 2

HOW TO RID YOUR YARD OF CATS.

The following is a description of a device I built at my home in Brooklyn, which not only gave us relief from the nightly feline concerts but also furnished much amusement to my friends.

I first ran two bare copper wires along the top of the fence about one inch apart, fastening them down with small staples, care being taken that they did not touch. To the ends of these wires I fastened ordinary insulated bell wire, running them to the house and connecting them to the upper binding posts of an induction coil; I then ran a wire from the lower binding post of my coil through the batteries back to the other lower binding post of coil, breaking the circuit by putting in an ordinary switch. The more batteries used, the stronger the current. The switch should always be left open as it uses up the current very rapidly.

When "tabby" is well on the wires I close the switch and she goes the length of the fence in bounds, often coming back to see what the trouble is, thus receiving another shock.—Contributed by Charles L. Pultz, 554 9th St., Brooklyn.



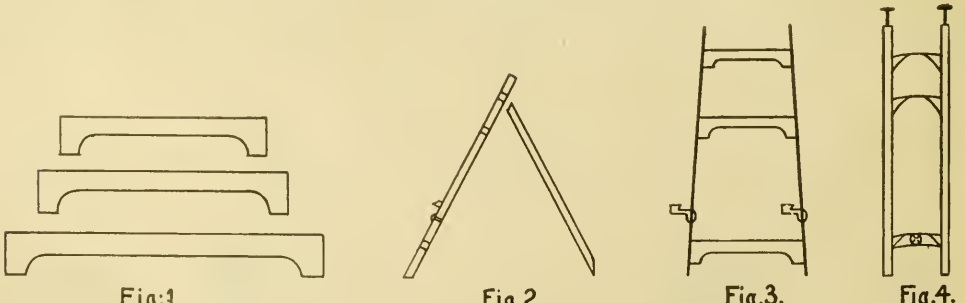
Electric Apparatus for Driving Away Cats

HOW TO MAKE AN EASEL.

A strong and substantial easel may be made at home with very little expense and no great difficulty.

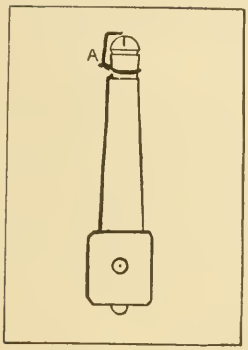
Smooth down with a plane, four pieces of pine, 4 ft. long, 4 in. wide and 1 in. thick, until suitable for legs. Make three crosspieces, Fig. 1, and join the legs with them as shown in Fig. 2. With an auger bore a hole in each leg about 3 in. from the bottom, and fit into each a little peg, Fig. 2, for the picture to rest on. The peg should be of hardwood so it will not break.

Cut the handle from an old broom, measure off the right length, and put a hinge on one end. Fasten this leg on the second crosspiece, thus forming a support for the two front legs, Fig. 3. The easel may be finished according to the individual taste. It may be sandpapered and stained and varnished, or painted in some pretty tint, or, if preferred, may be enameled.—Contributed by G. J. Tress, Emsworth, Pa.



Making an Easel

TO LIGHT A GASLIGHT WITHOUT MATCHES.



It is probably well known that if you rub your feet briskly over a carpet on a dry, cold day and then touch any metallic object with your finger it will emit a small spark. The following amusing experiment may be done on the same principle:

Take any small piece of wire about two inches long and twist it around a gas-burner as shown at A in the sketch. Have the tip of the burner about an eighth of an inch below the end of the wire. The wire must be just far enough away from the center of the burner to keep it out of the flame, or else it will melt.

Now get a friend to turn on the gas when you are ready for it. Go around the room once or twice rubbing your feet along the carpet. When you come around to the gaslight touch the point of the wire and if the gas is turned on, the light will flare right up as if it had been lit with a match.

This experiment cannot be done on a damp day or without shoes, and works best in cold weather.—Contributed by E. H. Klipstein.

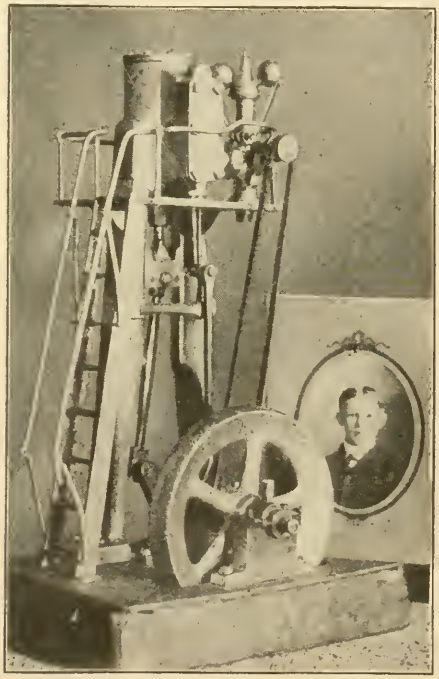
MECHANICAL RABBITS FOR TARGET PRACTICE.

The latest thing in target practice is a mechanical rabbit which jumps and runs like the real thing. These targets are being used in the shooting schools in England. The Sporting Goods Dealer says: Along the ground is laid a sort of miniature toboggan railway, and the rabbit is sent flying across it by the force of a spring. Of course the rabbit hops up and down, in the manner of a real galloping bunny. What makes the matter more confusing is that there are three such targets, and the sportsman never knows which rabbit the operator, who releases them by means of cords, will start first, but must be ready to take his shot when and where it offers. Another good contrivance is the snipe-throwing catapult, from which is discharged a tin plate, whitened and shaped like a snipe, which describes erratic curves in the air simulating very well the tricky flight of the real snipe.

ENGINE BUILT BY A BOY.

That a boy, and not a large one at that, can master the difficulties of engine building which would puzzle many a man, is proved in the following illustration. This engine was entirely constructed by Alfred E. Sharpe, of Elkhart, Iowa.

The youthful engine builder is only 14 years old and he was nearly a year working on it. Many of the parts had to be made over several times before he succeeded in getting them just right. The engine stands 16 in. high, and develops ½ hp., and runs



Engine Built by 14-Year-Old Boy

smoothly and without noise. He frequently belts it to his mother's sewing machine. The supporting part of the engine is made of babbitt, the cylinder of brass, and the rods and other parts of steel or iron.

A steel chimney 230 ft. high and 8 ft. in diameter has just been completed and will be erected in Mexico.

MECHANICS FOR YOUNG AMERICA

Things a Boy Can Make Out of Old Bicycle Parts

There are many things a boy can make out of parts of old bicycles, which he can either sell at a good profit, or can use for his own pleasure. Second-hand bicycles can be purchased for $3.00 or $4.00 and the ingenious boy can realize twice as much more on them.

A hat rack may be fitted up like Fig. 1. This involves, first the employment of three parts of tubes, about 10 inches long, soldered into a disk as at B, fitting the main part A. This main part is simply the cycle handle bar and steering shaft. The stand is coated with black varnish and the bars and shaft polished. The stand will sell for $1.50.

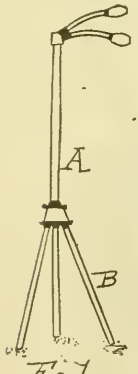


Fig 1

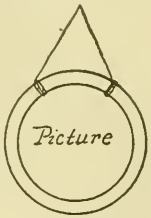


Fig 2

Fig 3

Rip the tires off the wheels and stuff them with curled hair and then clean and furnish them with wire supporting arrangements as represented in Fig. 2. Fit a disk of tin into the circle for a back. The two tires may be sold for 75 cents each for picture frames. The seat may be utilized as in Fig. 3 and a little hall or nursery stool results. The saddle with bar is simply set into the union of four pieces of tubing, each tubing being about 10 inches high. The connecting part is at C, which is adjustable, so that the height of the saddle can be regulated. These sell for $1.00 each. The frame brings another dollar when merely cleaned and repainted and fitted with a little wire to hold it upon the wall, with some sort of an inscription, on a walnut or sheetmetal background as shown.

Every part of the frame may be used in some way. Fig. 5 is a cluster of tool handles and parts made from tubes and joints. D shows a part provided with plug in the tee and into this plug is driven the

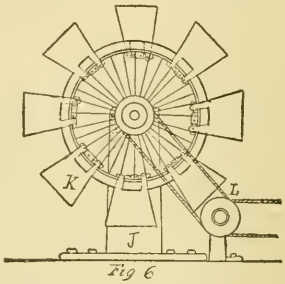


Fig 6

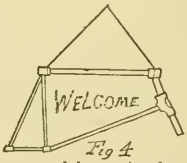


Fig 4

head of the punching tool required, this framing an awl or similar tool. E is a straight tube into which a hardwood mandrel is driven and there is a furrow on this mandrel and a shaft is inserted for screw driver or chisel. F is a little tube carrier, made with two sections of tube, one fitting within the other and either end closed with soldered disks. This is for holding tacks,

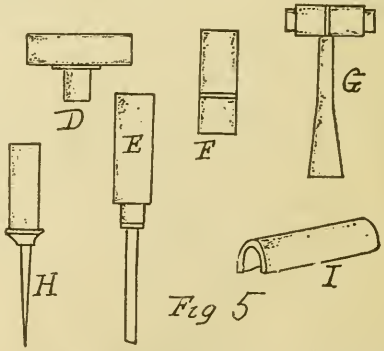


Fig 5

etc. G is a mallet-like tool, with the tube portion sustaining the wood or lead plugs for "soft" work. H is a prick tool made

of handle tubing, and the tubing is fitted with a flange and solidified with babbitt metal run in, or with hardwood plug. I is a half tube, used for miscellaneous purposes about a shop. By the use of these various parts of wheels boys can derive about $14 for each wheel, costing originally three or four dollars.

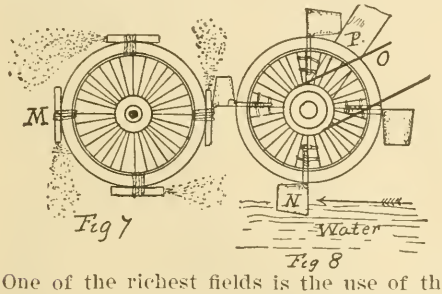


Fig 7 Fig 8

One of the richest fields is the use of the wheels of bicycles for mechanical devices. Fig. 6 is a windmill affair made with tin wings, the feet of which are split as shown, and one side of the tin is placed on one side of the tire and rim and the other on the other, and the two bolted on the inner side. The wheel is placed in a shaft bearing so as to revolve on a stand J. The wheel wing is marked K. At L is a wheel which is of wood and is grooved and arranged to guide the rope belt from the similarly grooved wheel on the driving wheel to the wheel L and onward to the mechanism to be driven. The wind plays against the wheel wings and the wheel is revolved.

A fireworks wheel is shown in Fig. 7, consisting of taking the wheel complete as in the windmill case and fitting the fireworks

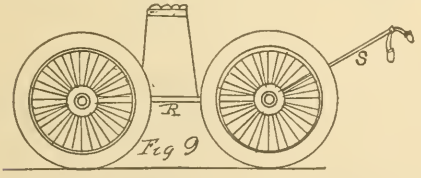
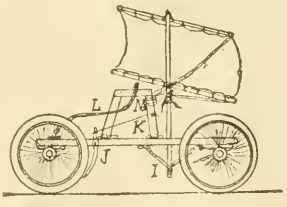


Fig 9

cylinders M by wires. These rockets or fuses, when lighted, cause the wheel to revolve as a pin-wheel is turned, and the display is quite effective. A model of a cycle wheel is fitted up as in Fig. 8, with the wheel arranged to turn on its bearings, the latter fitting into a wood projection P. This projection allows the wheel dippers to reach the flow of water. The dippers are ordinary kinds, and are wired to the spokes as shown. The flow of water forces itself against the dipper as at N turning the wheel. A pulley which is grooved is fitted to the shaft to drive the belt O, and this belt runs to the device to be operated. Vehicles for freightage purposes form a part of the cycle part construction shop trade. Fig. 9 illustrates one of the altered contrivances. Four wheels are selected and axles adjusted and a body placed thereupon, marked R. On this body, which is of wood, is the box seat. The handle bars and shaft are arranged to join on to the fore axle as at S, and this is the means by which the affair is hauled.

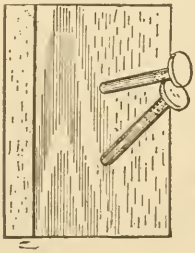
HOW TO MAKE A WIND PROPELLER.

A wind propeller may be constructed with four old bicycle wheels arranged with shafts pretty much like the shafts of a hand-propelled cart. The platform is flatter, however, and the body one tier so that it is lower. A framework of wood is built at M and this is a support for several purposes. The sail is secured to the mast which is fixed into the body of the cart as shown. The sail is linen fabric. There are two crosspieces to aid in keeping the sail properly opened. The steering arrangement is



through the rear shaft. The shaft is pivoted as in a hand-propelled cart, and the rod I extends from the middle connection of the shaft up to a point where the person seated on the wooden frame can handle it. There is a brake arranged by making a looped piece J and hinging it as shown. This piece is metal, fitted with a leather face. The cord K is pulled to press the brake. I marks the support for the mast underneath the body of the cart. In a steady breeze this cart spins nicely along the roads.

TO HANG HEAVY THINGS ON A NAIL.

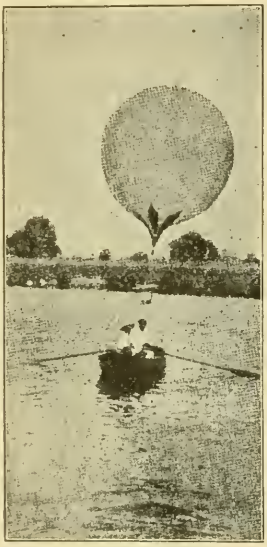


Boys will find many places around the house, where a hook to hang things on will be a great convenience. Instead of buying hooks use wire nails, and if driven as shown in the cut, they will support very heavy weights. Drive the lower nail first.

Photographing From a Captive Balloon

Within the Reach of Every Photographer, Amateur or Professional--Expense no Longer an Obstacle.

It is quite possible to take photographs from a captive balloon so small that the experiment is robbed of almost all of its expense and the apparatus is convenient to its owner on any fair day he may wish to use it.



The balloon need not be of more than 500 cubic feet capacity (simply large enough to carry the camera and light attachments) and may be inflated by running a tube from the ordinary household gas meter to the balloon.

The balloon should be spherical in shape and made of some very light material of close texture. Light silk is one of the best materials for the purpose. Stitch the gores well together with strong, fine silk and coat the balloon with linseed oil varnish—a very thick coat. The neck of the balloon where

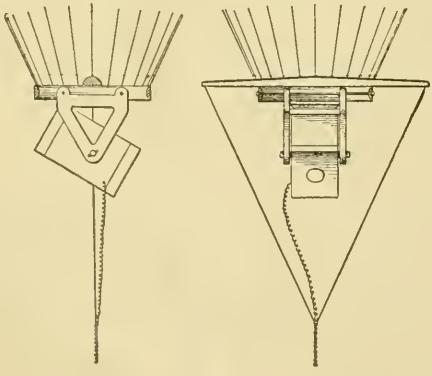


Fig. 1

the gas is entered is commonly left open. The purpose in this is that on ascending, as the pressure of the external air diminishes, the expansive force of the gas confined in the balloon greatly increases. For our purpose the balloon will not ascend to any great altitude, but were an ascent of several miles to be made, the expansive force of the gas would soon tear the silk envelope into shreds if there were not some means for a small amount of the gas to escape.

Over the silk envelope place a network of light, strong cords hanging down to the lower half of the envelope, and having cords or leading lines attached for fastening it to a hoop. A balloon of 500 cubic feet capacity can be inflated in about two hours.

For taking the photographs a camera of

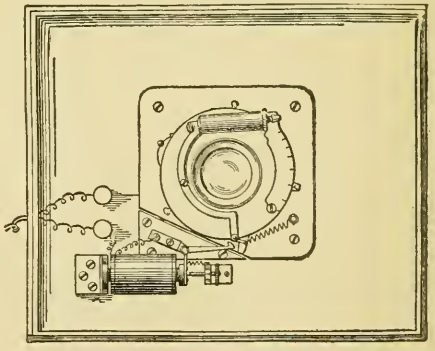


Fig. 2

box form with half-dark slides focused at infinity is most convenient. For attaching it to the balloon hoop use screw-clamped trunnions at its sides, mounted in triangular side frames, so that it can be set at any angle desired. This is clearly shown in Fig. 1. Fit to the lens of the camera a Bausch and Lomb shutter, as shown in Fig. 2, arranging a hook to hold it until it is time to remove the hook and release the shutter, this operation being performed by an electromagnet connected with a battery, which arrangement will be described further.

The length of the captive line may vary. Excellent photographs may be taken at an elevation of 150 feet and good ones at 500 feet. We would recommend the use of a long line, as there is a pleasure in experimenting with altitudes and comparing effects and results. The captive line should be

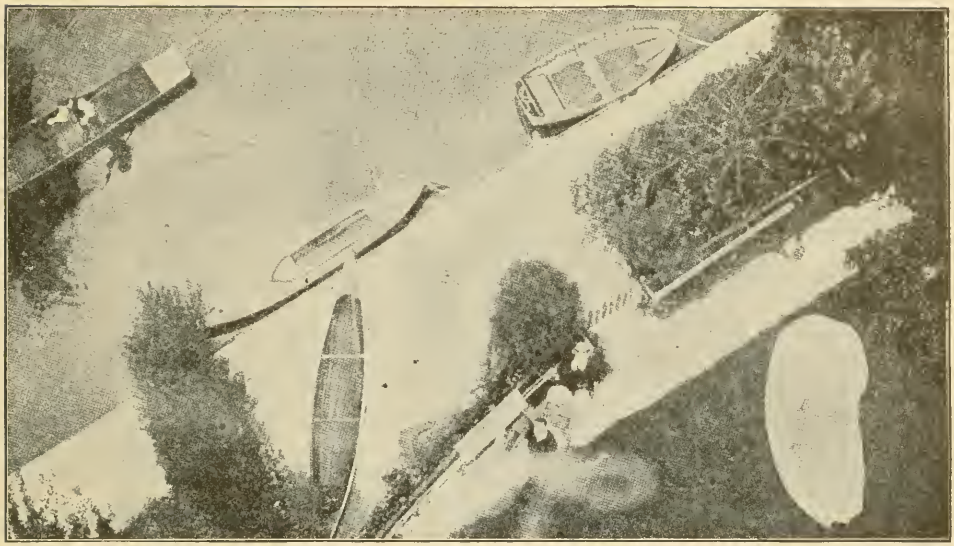


Fig. 3.—Broomwater Creek, England, Photographed at an Elevation of 160 Feet.

both light and strong and wound into a single cable with a double-strand flexible insulated conductor, such as is used in making telephone connections.

In Fig. 5 is shown a reel for winding and unwinding this three-strand cable. The reel runs on ball bearings and the inner ends of the two wires are connected with a plug terminal on the reel, so that a terminal battery may be connected at the moment the electric current is desired. The relation

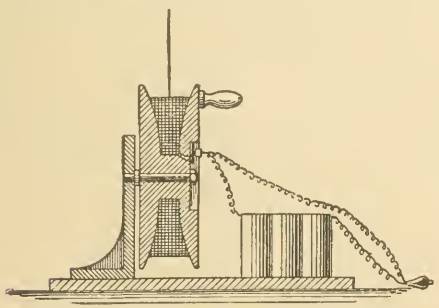


Fig. 5.

of the battery to the reel is also shown in Fig. 5. The battery has an electric switch for controlling the time of transmission of the current which releases the shutter covering the lens.

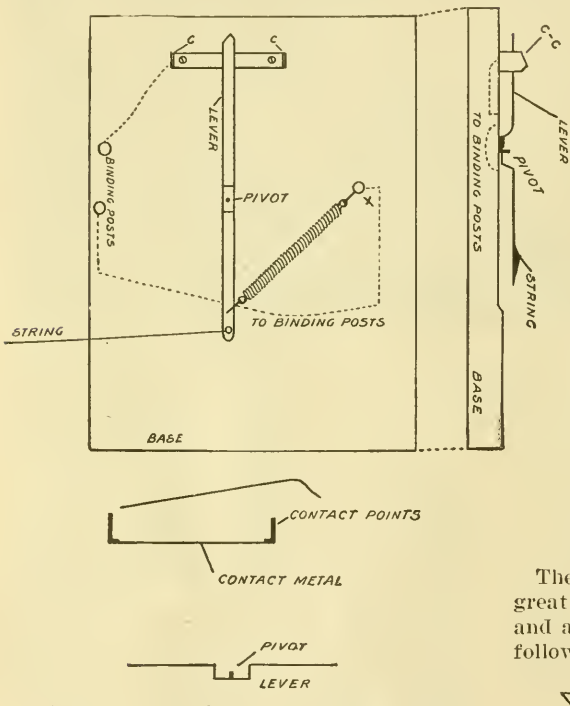
With this much of the apparatus prepared the rest is a matter of little time and trouble. Inflate your balloon, tie a string around its neck until you are ready to send it up, and tie bags of sand to the leading strings to hold it down, should there be any delay in proceedings. If the frame for the camera is ready, tie the leading strings to the hoop, being careful to tie them securely and at equal lengths. Insert the swing frame of the camera in the hoop, connecting it firmly by two long bolts. Pass the loose ends of the wires into the front partition of the camera and fasten them to the terminal screws of the electromagnet. Insert the dark slide and remove its front; set the shutter and adjust the hook for holding it in place.

If a true plan view is wanted, set the camera on its trunnions, with the lens pointing downwards. Release the reel and let the balloon carry the camera up—100 ft., 200 ft., or farther, according to your length of line and your wishes in regard to altitude. When it has ascended as far as desired apply a brake to the reel, insert the connection plug, press the button and send the current up the conductor, both that on the reel and that in the air, until it releases the shutter by means of the electromagnet lifting the hook and so effecting the exposure. The current may then be turned off and the balloon hauled down. To take another view, reset the shutter, change the plate and run the balloon up again. The captive balloon is held very steady by this method, whereas did the photographer himself ascend to take his views, the aerial craft would be susceptible to the least change in ballast. One aeronaut tells of sudden change in elevation of 20 or 30 feet

HOW TO MAKE A SIMPLE BURGLAR ALARM.

BY THOMAS M'CALL.

Take a piece of any wood about 6 by 8 inches for the base. This may be finished in any way desired. For the contact points



use brass or any sheet metal which will be satisfactory. Take a piece about 2½ or 3 inches in length and bend the ends up about one-half inch in a vertical position as shown. Fasten this to the top of the board using screws or nails. Under this strip of metal fasten a copper wire which can be connected to a binding post on the board if desired. Take another piece of metal about 4½ inches in length and make a lever of it in the shape shown in the diagram. Fasten this so that one end of it will swing freely, but not loosely between the ends of the other piece marked C-C. Near the end fasten a spiral spring (S) which can be obtained almost anywhere. Fasten the end of this to the screw marked X. Also fasten to this screw a copper wire leading to the binding post. In the lower end of the lever make a small hole to fasten a string to.

This string may be fastened across a door or window and any movement of it will pull it to the contact point on the right. If the string is cut or broken the spring will pull the lever to the contact point on the left and thus complete the circuit.

It may be best to use an automatic circuit closer with this as the contact is liable to be made for only a few seconds. Such a circuit closer was described in Popular Mechanics for May 23, 1903.

If the string is burned it will also act as a fire alarm.

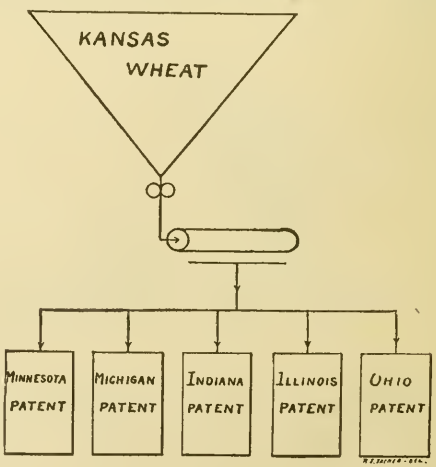
NOVEL CHESS GAME.

Some officers of the U. S. Navy played the most novel game of chess on record not long ago.

The United States cruiser "New York" was cruising down the western coast from San Francisco to Magdalena Bay. Several miles away was the cruiser "Boston." The officers on the two ships engaged in the game of chess by means of wireless telegraphy, making their moves almost precisely as though they had been on the same ship. The players of the "Boston" won the game.

KANSAS WHEAT IN DEMAND.

The grain dealers of Kansas are shipping great quantities of wheat into other states and a prominent milling paper publishes the following cartoon in explanation of where



the favorite state brands of flour get their supply.

Mills in practically every state east of the Missouri river are buying Kansas wheat.

MECHANICS FOR YOUNG AMERICA

TO MAKE A BINDER FOR POPULAR MECHANICS.

Get ½ yd. of cloth, one shoestring, a pasteboard box for covers, and some heavy paper. Cut the pasteboard into two covers, ¼ inch larger all around than the magazine, except at the back with which they should be even. Next cut a strip 1 in. wide off the back of each cover. Place the covers on the cloth, Fig. 1, with the back edges ¼ in. farther apart than the thickness of the volume to be bound. Cut the cloth around the covers, leaving 1½ in. margin. Paste the cloth on the covers as they lay, and turn over the 1½ in. margin, pasting down smoothly. Cut a piece of stiff paper to fit and paste on the back. Take a piece of cloth as wide as the cover, and long enough to extend over the back and 1½ in. beyond each "strip." Paste on to hold all together. Two pieces of paper the exact size of the magazine, pasted on the inside of each cover protects the edges of the cloth, and adds to the appearance. Let dry slowly.

With backs and edges of magazines even, place in a vise and set up tight allowing ¾ in. from back to show above the vise. Bore three 3/16-in. holes ½ in. from the back, one in the middle, the other two 1½ in. from each end. Make corresponding holes in the strips of the binder and use the shoestring to complete as in Fig. 2.—Contributed by L. L. Winans, Mexico, Mo.

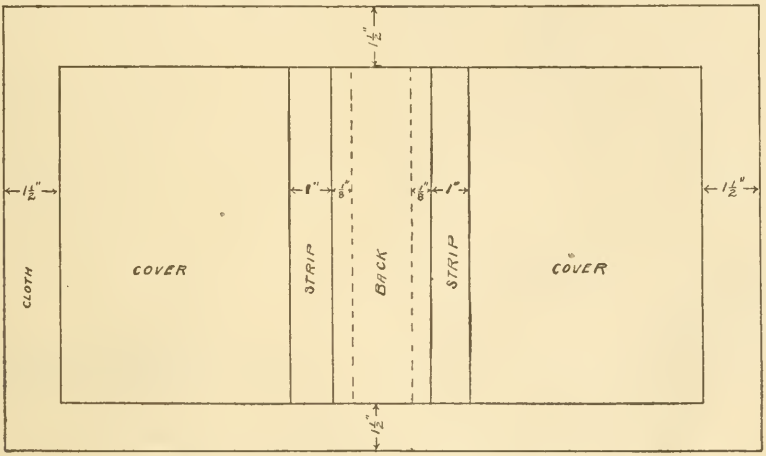


Fig. 1. To Make a Binder For Popular Mechanics

HOW TO MAKE A HAMMOCK.

Any one can make a hammock as good as can be bought and that at a cost so small that every member of the family can possess one providing there are places enough for hanging them.

The materials required are a needle about 7 in. long, and with a big eye, an iron ring for each end of the hammock, two long smooth sticks on which to knit the hammock and two pounds of strong hemp cord or twine. The twine may be colored in any color or combination of colors desired. A Roman stripe at each end of the hammock makes a pretty effect. The cost of the materials should not exceed 75 cents.

A hammock 45 in. wide will not be too

Fig. 2. Binder for Popular Mechanics Complete

large for solid comfort. To knit it first thread the big needle and holding it in the left hand, hold the cord in place with the thumb until you have looped the cord over the tongue, then pass the cord under the needle to the opposite side and catch it over the tongue. Repeat this operation until the needle is full. Cut a 2-yd. length of cord and make a loop and fasten to the door knob or to some other convenient place. Tie the cord on the needle to this loop three inches from the end of the loop. Place the small mesh stick under the cord with the beveled edge close to the loop, and, with a thumb on the cord to hold it in place, pass the needle around the stick and then, point downward, pass it through the loop from the top, and then bring it over the stick so forming the first half of the knot.

Pull this tight and hold in place with a thumb while throwing the cord over your hand, which forms the loop. Pass the needle from under through the loops and draw fast to fasten the knot. Hold this in place and repeat the operation.

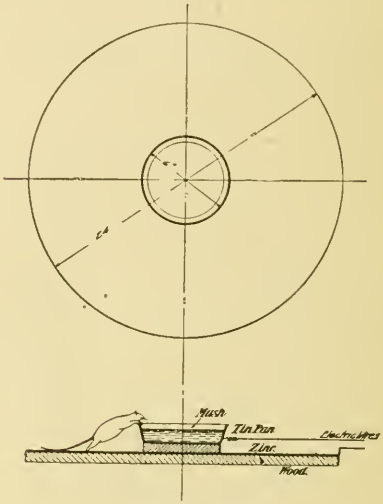
Make 30 of these knots and then push them off the stick and proceed in the same way with the next row, passing the needle first through each of the thirty knots made for the first row. Make thirty rows and then tie the last loops to the other iron ring. Stretchers may be made and put in place and the hammock, strong and durable, is finished. The work must be carefully and evenly done. One is apt to have a little trouble getting the first row right, but after that the work proceeds quite rapidly.

ELECTRIC RAT EXTERMINATOR.

Some time ago we were troubled by numerous large rats around the shop, particularly in a storehouse about one hundred feet 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 disc 6 in. in diameter in the center. On this disc 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 tires 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



Electric Rat Trap

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 two or three feet 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.—Contributed by John D. Adams, Phoenix, Arizona.

HOW TO BUILD A WIRELESS TELEGRAPH.

An illustrated descriptive article telling how to build a complete working set of wireless telegraph instruments, will appear in this department next month.

BOOK FOR BOYS.

We have reprinted in book form a large number of the articles which have appeared in the department "Mechanics for Young America." Tells "How to Build." Every boy should have a copy; 64 pages; price 25 cents postpaid.

MECHANICS FOR YOUNG AMERICA

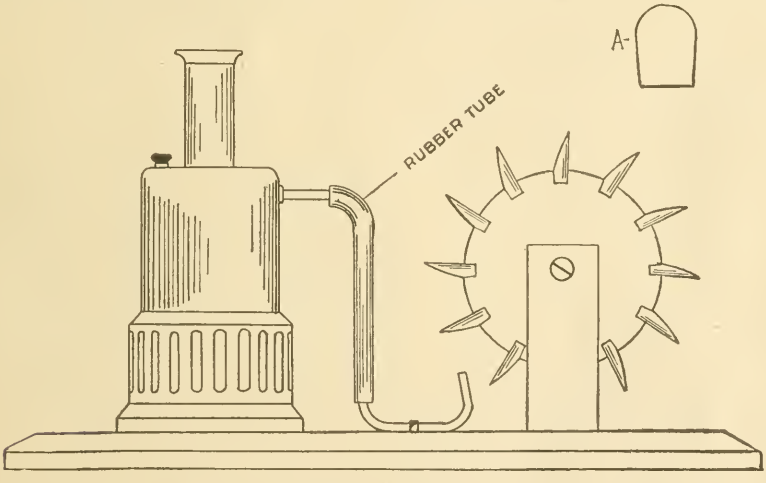
HOW TO MAKE A MINIATURE STEAM TURBINE

With an old toy steam engine boiler and a little work a steam turbine can easily be made but it will not generate ten thousand horsepower as some of the giant turbines do.

When you have the boiler the next thing to do its to make a disc of wood about ¼ in. thick and 3½ in. in diameter. Mark twelve points around the edge of the circle of wood, the points being at equal intervals all the way around. Cut with a fine saw 3-16 in. at each of these points. Twelve paddles should then be made of sheet copper or brass and cut in the shape of the figure shown at A in the sketch. Then wedge the paddles tightly into the saw cuts and bend them into the shape of a spoon. For the axle take a wire nail, cut off the head and sharpen each end to a fine point. Force the nail securely into a central hole in the disc.

Now we may go back to the boiler. As there is generally a small piece of brass tubing left on the side of a boiler, which was formerly connected to the steam engine, this piece may now be joined to a four or five-inch length of rubber tubing and bound with wire. The rubber pipe is then attached in the same manner to a piece of metal tube bent into the shape shown in the drawing and fastened to the base with a staple.

In mounting the wheel make two blocks of wood each 3 in. high, ½ in. thick and 1 in. wide. On the flat end of one of the blocks screw a small plate of sheet brass and punch a very tiny hole which should fit the point of the axle. For the opposite bearing file off the point of a one-inch screw and also make a small hole in the end of this to fit the other point of the axle. Then put the screw into the second block at the same height as the hole in the piece of brass on the first block. Fasten these bearings to a base made of a board one foot long and six inches wide. A fairly good idea of the way the wheel is to be mounted may be obtained from the sketch.



Plan of Steam Turbine

The turbine is now complete and ready to run. Power is obtained from an alcohol lamp or Bunsen burner and when under full steam the wheel will revolve with considerable rapidity.—Contributed by E. H. Klip stein, East Orange, N. Y.

HOW TO SEE THROUGH YOUR HAND.

Roll a tube out of a piece of pasteboard about 5 in. square, having one end just large enough to fit around the eye and the other slightly smaller. Take the tube between the thumb and finger of the right hand and put the large end close against the right eye. Hold your left hand against the other end of the tube and keep both eyes

open. There will appear to be a hole through your hand and objects beyond it will be plainly visible. The left eye is actually doing all the seeing of objects beyond, but it will seem like the right eye sees them, too, through the hand.

HOW TO MAKE A WOOD-TURNING LATHE OUT OF AN OLD SEWING MACHINE.

With a hack-saw, cut off the arm containing the needle on line AB Fig. 1, leaving the shaft only. On the end of the shaft will be found a round plate, in which drill four 3/16-in. holes. Now secure, or have turned, a piece of iron or steel 1½ in. in diameter, Fig. 2. Drill and countersink four 3/16-in. holes in it to fit the holes on the shaft plate. File a spur center 5/16 in. long, and two side points 3/16 in. long. Bolt this plate to the shaft plate with four flat-headed stove bolts, 3/16 in. in diameter by 5/8 or ¾ in. long, Fig. 3.

For the bed, use a board 32 in. long and as wide as the base of the machine arm.

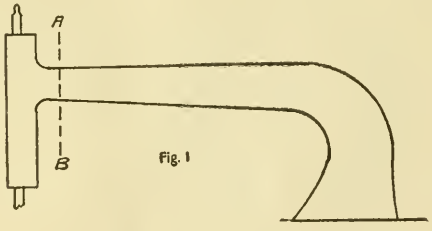


Fig. 1

This gives a limit of 2 ft. between spur and dead centers. Let this board be made level with the rest of machine table by making a pair of legs if needed. Next make a T-rail, Fig. 4, of two boards, one 5 x ¾ x 32 in., the other 3½ x ¾ x 32 in. Three-quarters inch of the wider board projects over each of the smaller boards. Nail firmly and clinch nails, or screw together. Screw this rail on the machine board so that its center coincides exactly with the machine centers. Bore a number of ⅜-in. holes with centers 2¾ in. apart along the center line of this rail, beginning 6 in. from the end nearest the machine. Make another T-rail for slide tool rest, of two pieces 32 x 3 x ¾ in., and 32 x 1½ x ¾ in. Fasten this in front of the larger T-rail and parallel to it, the center lines being 6½ in. apart.

To make the tail-piece, that is, the part

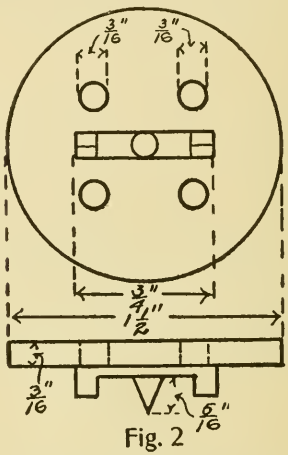


Fig. 2

to hold wood to be turned, get a board 6½ x 7 x ¾ in., and on the edges, Fig. 5, A, screw two pieces 7 x ¾ x 1½ in. so that the cap thus made will fit snugly over the large T-rail. Fasten to these last two pieces, with screws, two more pieces 7 x ¾ x ¾ in., Fig. 5, B. This tail-piece should move smoothly back and forth with no side motion. Now get a block of hardwood 4 x 2¼ in., and 1¾ in. higher than the spur center when mounted on the middle of the tail-piece just described. At exactly the height of the spur center bore through this block a ¾-in. hole, Fig. 5. Have a blacksmith make a crank 8 in. long, threaded for 5 in. as shown. At the dead center end taper the crank and make a cup center, out of which allow a 3/16 in. point to project. The cup prevents the point from boring into wood too rapidly. One inch from the outer end of the crank block, Fig. 5, bore a 3/16-in. hole, and force a ¼-in. bolt to cut its thread in the wood. This is a set screw to hold the crank in any position desired. Place a strap nut, threaded to fit the crank, on the head-end of the crank block, and a plain nut to act as a bearing, on the crank end. One and one-half inches from the back of the

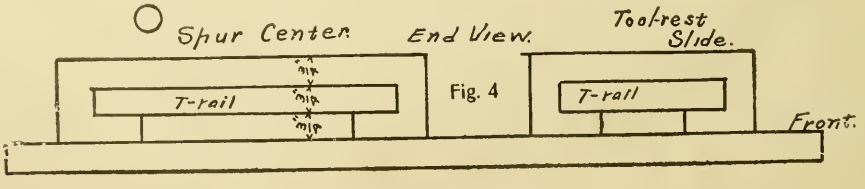
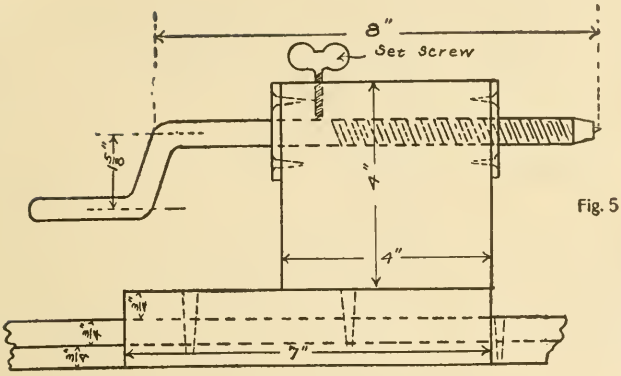


Fig. 4



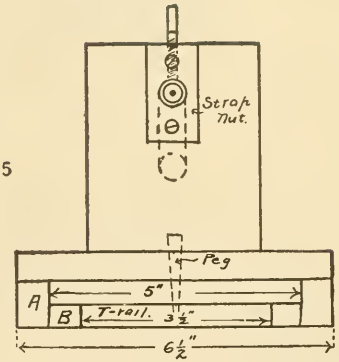


Fig. 5

tail-piece bore a ⅜-in. hole. Make a peg ⅜ x 2 in. To put in a piece of wood to turn, move the tail-piece back until the head end is over the center of the hole nearest the end of the block, then the peg will slip into second hole from the head end of the tail-piece, and into a corresponding T-rail hole, pinning the two together. Insert wood and screw up dead center to hold it.

For a tool rest make a second piece like the base of the tail-piece, 11 in. long and fitting the small T-rail. Cut out two blocks 1½x2¼x¾ in. and screw them, one on each end of the base of the tool rest, covering the half farthest from the centers, and having an 8-in. space between blocks. On the tops of these blocks screw a strip 11 x 2¼ x ⅝ in. Now for the rest proper, cut out a board 8 x 11/16 x9 in. to slide in the slot of the rest. Take a piece of oak 11 x 2 in., and high enough so that the top will be level with the centers of the lathe, and bevel as shown in Fig. 6. Screw on one end of the 8 x 9-in. piece exactly in the middle. This piece will slide in and out, closer or farther from the centers as desired, and also along the T-rail.

A center for turning rosettes, saucers, etc., may be made as follows: Remove the spur center and bolt in its place a 1-in. circular board of the same diameter, using longer 3/16-in. stove bolts with heads countersunk. Rotate the lathe, and with a gimlet bore a hole at the exact center and through the board. Now take off the board and countersink on the back a place for the head of a coarse threaded screw. Turn in a 1¾-in. screw, replace the board and any block held on the end of the rotating screw will turn on and be held while being turned. —Contributed by L. L. Winans, Mexico, Mo.

HOW TO REMOVE STAINS FROM MARBLE.

When other methods fail, try dissolving 1½ lb. potash and 1 lb. virgin wax in diluted muriatic acid or warm soap and vinegar. Boil the whole for 30 minutes and let cool. The wax will then float on the surface. Remove the wax, put it into a mortar and triturate thoroughly with a marble pestle; add soft water to it to form a soft paste. Apply this paste to the stained marble and let it dry. Rub off with a woolen rag.

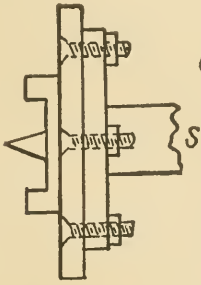


Fig. 3

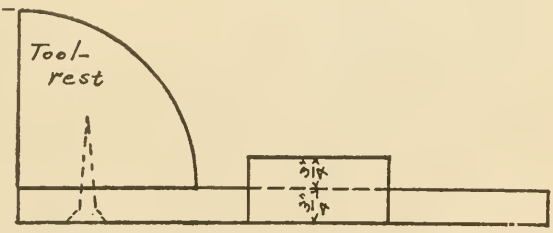


Fig. 6

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A TURBINE ENGINE

By A. L. Burkhart

In the following article is described a machine which anyone can make, and which will be very interesting, as well as useful. It can be made without the use of a lathe, or other tools usually out of reach of the

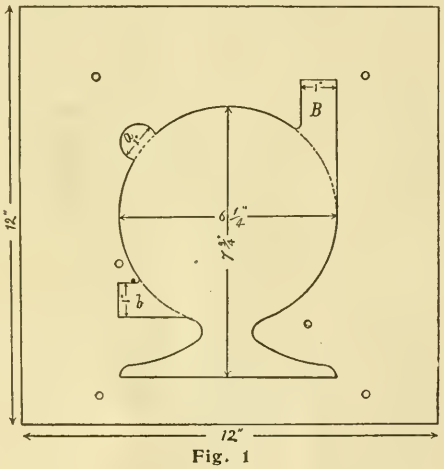


Fig. 1

amateur mechanic. It is neat and efficient, and a model for speed and power. Babbitt metal is the material used in its construction, being cast in wooden molds. The casing for the wheel is cast in halves—a fact which must be kept in mind.

First, procure a planed pine board 1x12 in. by 12 ft. long. Cut off six pieces 12 in. square, and, with a compass saw, cut out one piece as shown in Fig. 1, following the dotted lines, leaving the lug a, and the projections B and b to be cut out with a pocket-knife. Make the lug a ¼ in. deep, and the projections B, b, ½ in. deep. The entire cut should be slightly beveled.

Now take another piece of wood, and cut out a wheel, as shown in Fig. 2. This also should be slightly beveled. When it is finished, place it on one of the square pieces of wood, with the largest side down, then place the square piece out of which Fig. 1 was cut, around the wheel, with the open side down. (We shall call that side of a mold out of which a casting is drawn, the "open" side.) Place it so that it is even at the edge with the under square piece and place the wheel so that the space between the wheel and the other piece of wood is an even ⅛ in. all the way around. Then nail the wheel down firmly, and tack the other piece slightly.

Procure a thin board ¼ in. thick, and cut it out as shown in Fig. 3; then nail it, with pins or small nails, on the center of one of the square pieces of wood. Fit this to the two pieces just finished, with the thin wheel down—but first boring a ¾-in. hole ¼ in. deep, in the center of it; and boring a ⅜-in. hole entirely through at the same place. Now put mold No. 1 (for that is what we shall call this mold) in a vise, and bore six ¼-in. holes through it. Be careful to keep these holes well out in the solid part, as

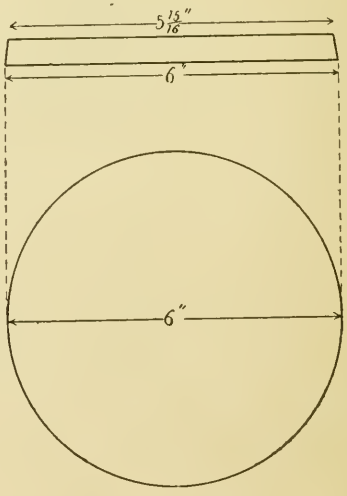


Fig. 2

shown by the black dots in Fig. 1. Take the mold apart, and clean all the shavings out of it; then bolt it together, and lay it away to dry.

Now take another of the 12-in. square pieces of wood, and cut it out as shown in Fig. 4, slightly beveled. After it is finished, place it between two of the 12-in.-square pieces of wood, one of which should have a ⅜-in. hole bored through its center. Then bolt together with six ¼-in. bolts, as shown

by the black dots in Fig. 4, and lay it away to dry. This is Mold No. 2.

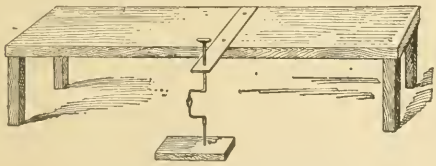
Now take Mold No. 1; see that the bolts are all tight; lay it on a level place, and pour babbitt metal into it, until it is full. Let it stand for half an hour, then loosen the bolts and remove the casting.

Now cut out one of the 12-in.-square pieces of wood as shown in Fig. 5. This is the same as Fig. 1, only the one is left-handed, the other right-handed. Put this together in Mold No. 1, instead of the right-handed piece; and run in babbitt metal again. The casting thus made will face together with the casting previously made.

Pour metal into Mold No. 2. This will cast a paddle-wheel, which is intended to turn inside of the casting already made.

If there should happen to be any holes or spots, where the casting did not fill out, fill them by placing a small piece of wood with a hole in it, over the defective part, and pouring metal in to fill it up.

If you cannot obtain the use of a drill press, take an ordinary brace, fasten a ⅜-in.



Using the Brace

drill in it, and bore a hole through the end of a strip about 16 in. long and 2 in. wide; put the top of the brace through this hole, and fasten the other end of the strip to a bench, as shown in illustration. Find the center of the paddle-wheel, place it under the drill, true it up with a square; and drill it entirely through. Find the centers of the insides of the other two castings, and drill them in the same manner.

A piece of mild steel 5 in. long, and ⅜ in. in diameter must now be obtained. This is for a shaft. Commencing 1½ in. from the one end, file the shaft off flat for a distance of 1 in. Then cut a slot in the paddle-wheel, and place the shaft inside of the paddle-wheel, with the flat part of the shaft turned to face the slot in the wheel. Pour metal into the slot to key the wheel on to the shaft.

The paddle-wheel is now ready to be fitted inside of the casing. It may be necessary to file some of the ends off the paddles, in order to let the paddle-wheel go into the

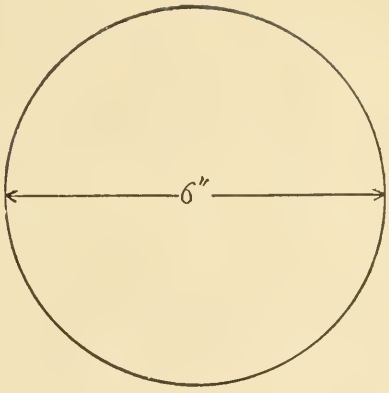


Fig. 3

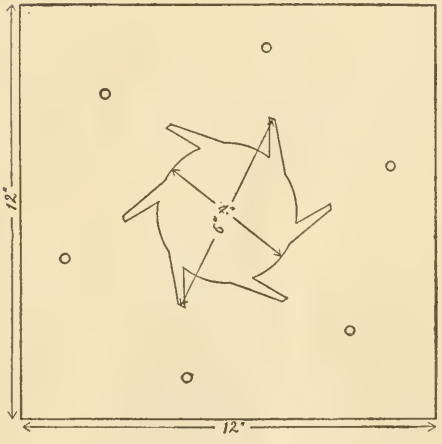


Fig. 4

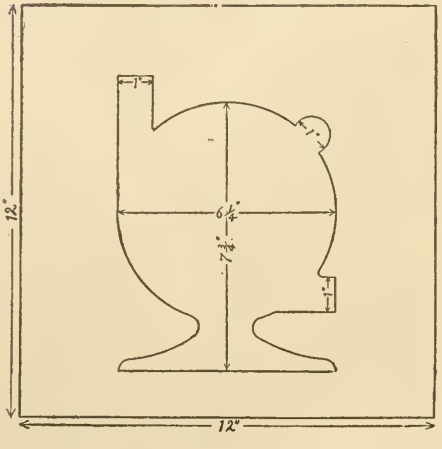


Fig. 5

casing. After it is fitted in, so that it will turn easily, place the entire machine in a vise, and bore three ¼-in. holes, one in the lug, one in the projections, B, b, and the other in the base, as shown by the black dots in Fig. 6. Also bore the port-hole in projection B, and the exhaust hole in projection b, and two ¼-in. holes at d, d, Fig. 6. Cut out a piece of gasket and fit it between the two castings. Then bolt the castings together, screw down, and connect to the boiler.

The reader must either cast a pulley out of babbitt metal, or else go to a machinist and get a collar turned, with a boss and a set screw, and with three small screw holes around the edge. Cut a small wooden wheel

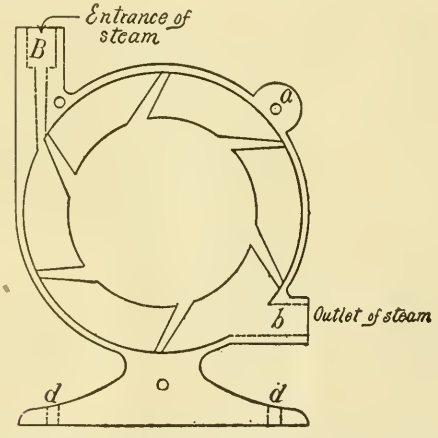


Diagram of complete machine

Fig. 6

out of wood; screw the collar fast to it; fasten it to the shaft of the turbine; and turn on the steam. Then take a knife or a chisel, and, while it is running at full speed, turn the wheel to the shape desired.

Your turbine engine is now ready for work, and if instructions have been carefully followed, will do good service.

HOW TO MAKE A LEAD CANNON

Any boy who has a little mechanical ability can make a very reliable cannon for his Fourth of July celebration by following the instructions given here:

Take a stick (a piece of curtain roller will do) 7 in. long. Make a shoulder as at A, Fig. 1, 4 in. from one end, making it as true and smooth as possible, as this is to be the muzzle of the cannon. Make the spindle as in Fig. 1, ¼ in. in diameter. Procure a good quality of stiff paper about 6 in. wide and wrap it around the shoulder of the stick, letting it extend ¾ in. beyond the end of the spindle, as at B, Fig. 2. Push an ordinary shingle nail through the paper

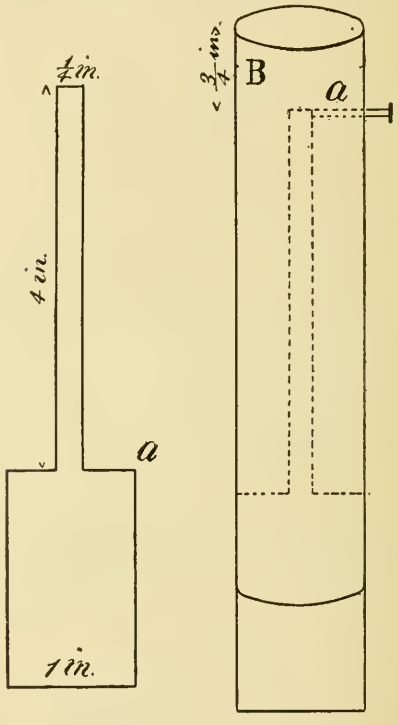


Fig. 1 **Fig. 2**

Fig. 3

and into the extreme end of the spindle as at A, Fig. 2. This is to form the fuse hole.

Having finished this, place stick and all in a pail of sand, being careful not to get the sand in it and letting the opening at the top extend a little above the surface of the sand. Then fill the paper cylinder with melted lead and let cool. Pull out the nail and stick, scrape off the paper and the cannon is ready for mounting as in Fig. 3.—Contributed by Chas. S. Chapman, Lanesboro, Minn.

The world's production of copper increased from 91,000 tons (1801-1810) to 2,269,199 tons during 1901-1904. This country produced 349,866 tons in 1904.

HOW TO MAKE A WIRELESS TELEGRAPH SYSTEM

By G. E. Collins

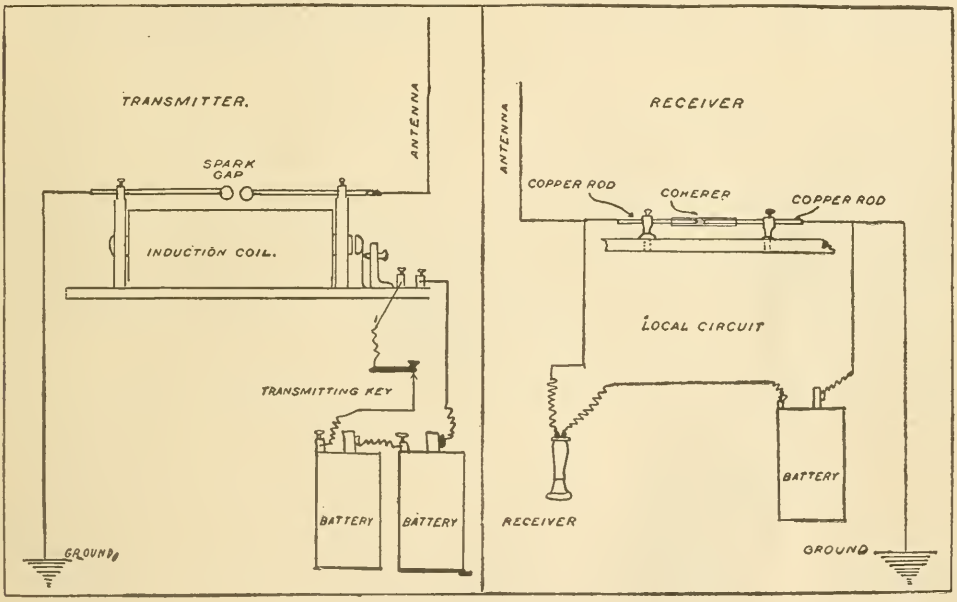
The wireless telegraphy plan shown in the accompanying sketch is one worked out by myself and is successful. Any other boy can easily make one for himself. I am eleven years old.

The transmitter consists of an induction coil giving a ⅛-in. spark between the spark gap or oscillators, two dry batteries and a transmitting key. The ground wire is connected to one oscillator and the other oscillator is connected to a wire 2 ft. in the air.

The receiver consists of a very sensitive instrument called the coherer. It may be made of a glass tube of 1-16 in. bore and 1½ in. long with some nickel filings loose in the tube and a copper rod fitted into each end so that they are 1-16 in. apart at the center of the tube. Between these ends are the nickel filings. It may then be mounted on a wooden base by binding posts.

When the coherer is completed get two dry batteries and a telephone receiver and connect as shown in the sketch. When connected pull the rods of the coherer out, just so the receiver thumps a little. When through telegraphing pull off the switch on the receiving apparatus.

When the switch is turned on and the transmitting key pressed the sound will be heard in the receiver. Use long buzzes for dashes and short ones for dots.



Home-Made Wireless Telegraph System

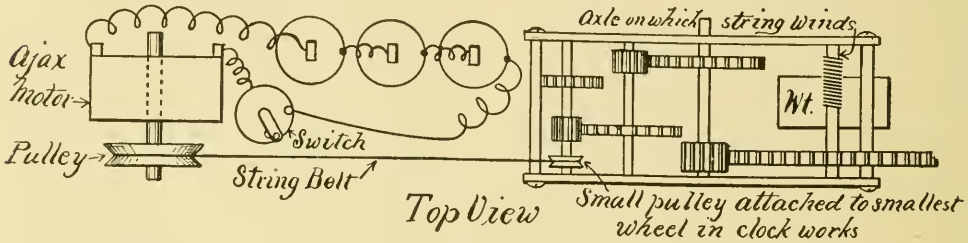
TEREDO-PROOF PILE COVERING

A pile covering that is said to withstand the ravages of the teredo and also to be proof against corrosion and the action of the sea water, is in use in British Columbia. Piles covered with the material and set three years ago are still in an excellent state of preservation, while those not treated are honeycombed by the teredo's work and must soon be renewed.

ANOTHER DESCRIPTIVE ARTICLE ON "HOW TO CONSTRUCT A WIRELESS TELEGRAPH" IS IN PREPARATION AND WILL APPEAR SOON. NEXT MONTH, "HOW TO MAKE AN ELECTRIC FURNACE REGULATOR"; VERY INTERESTING WORK FOR YOUNG ELECTRICIANS.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A TOY BATTERY MOTOR LIFT A 10-LB. WEIGHT



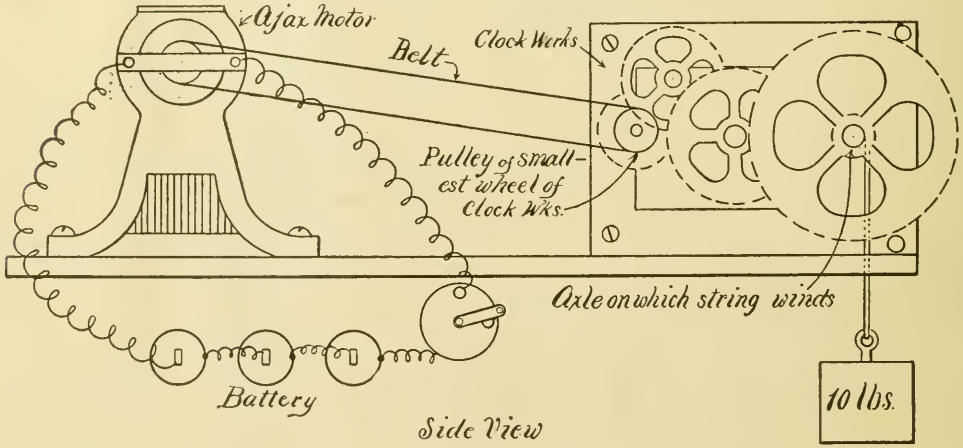
The materials necessary are a small battery motor, three or four cells of batteries, an old clockwork, and a board about 12 in. long and 6 in. wide. Remove the mainspring from the clockwork and make a small pulley and fasten it on the axle of the smallest wheel in the mechanism.

Fasten the clockwork on one end of the board in such position that the large wheel will project over the edge. Place the motor on the board about 6 in. from the clockwork and connect the pulley of the motor with the pulley in the clockwork by a string belt. Now fasten a piece of strong cord or chalkline to the axle of the large wheel of the clockwork and put a weight of about 10 or 12 lb. on the end of the string.

Using three or four batteries, the motor will lift the weight up to the level of the clockwork without difficulty. This experiment demonstrates the power of gearing.—Contributed by W. J. Slattery, Emsworth, Pa.

TO RENEW OLD DRY BATTERIES

Remove the paper that covers the cell and knock several good-sized holes in the zinc shell. Place the battery in a glass jar, fill it two-thirds full of strong sal ammoniac (or salt) solution and connect the terminals to whatever apparatus the current is to be used for. A few drops of sulphuric acid quickens and improves the action. The output of the cell will be nearly as great as when the battery was first bought.—Contributed by C. W. Arbitt, Austin, Texas.



WEATHERPROOFING FOR TENTS

Dissolve 4 oz. sulphate of zinc in 10 gal. water; add ½ lb. sal-soda; stir well until dissolved, and add ½ oz. tartaric acid. Put the tent cover in this solution and let lie 24 hrs. Take out (do not wring it) and hang up to dry.—Grinnell's Hand Book on Painting.

HOW TO MAKE AN ELECTRIC FURNACE REGULATOR

We have a furnace in our house and a part of my work each evening last winter was to go down in the basement at 9 o'clock, fill the furnace with coal for the night and stay there until it was burning in good shape, then to close the draft door. As this performance requires from twenty to thirty minutes I concluded to make a self-acting device which would close the draft and leave the furnace safe, without any further attention on my part, after putting in the coal and opening it up to burn. As some other boys may like to build the same regulator I will tell just how to make one and how it operates.

Referring to Fig. 1, you will see a straight cord is attached to the draft door of the furnace D, and is run over the pulley P and finally is attached to a small piece of iron H. This piece of iron is hinged to I. To the other side of H another cord G is fastened, which passes over the pulley N and terminates in any convenient place in the rooms above. This piece of iron H is held in place by the release A. Now C is a coil of wire from a door bell. R is an armature which works A on pivot J. M is a U-tube, filled with mercury, one end being connected to a half liter glass flask F by the tube T, and the other end terminates in an overflow tube O. B is a battery of three bichromate cells which are connected up with the C and the platinum points 1—2, which are fused into the U-tube.

On fixing the furnace the iron piece H takes position X, this being the normal position when draft door D is closed. On arriving upstairs I pull the cord G, which causes the piece H to become fixed in the vertical position by means of A. This opens the draft door at the same time. Now when the furnace heats up sufficiently it causes the air to expand in F, which causes the mercury in M to rise a little above the point 2. This immediately causes a current to flow through C which in turn draws R towards it, raises A and causes H to drop to position X. This shuts the furnace door.

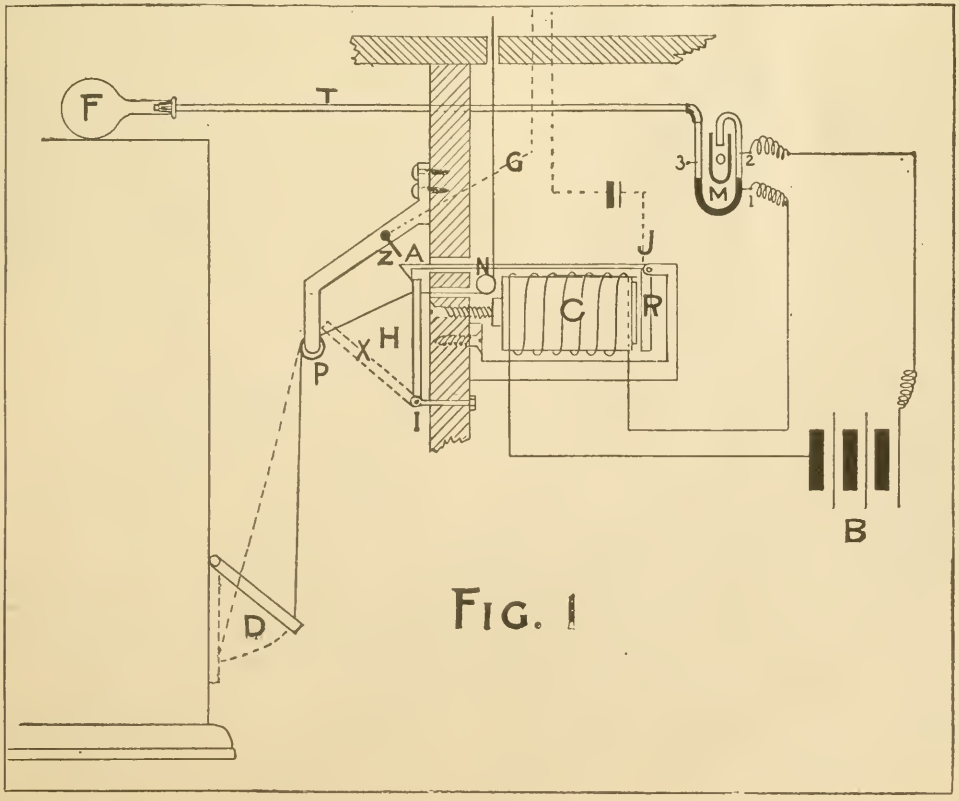


FIG. 1

Now the furnace, of course, cools down, thus causing the air in F to contract and consequently opening the circuit through C. If at any time the furnace should overheat, the raising of A, on which is grounded a wire from a signal bell upstairs, will make a circuit through the bell by means of the point Z and wire leading therefrom. This bell also serves to tell me whether H has dropped or not. This same device of regulating the draft D can be used to regulate the damper, found on the coal doors of most furnaces, by simply fusing a platinum point on the other side of M and changing the cord which is attached to D. A two-contact switch could also be inserted to throw connections from 2 to 3. It would work in this manner: The damper door, of course, which keeps a low fire, would be up in a position similar to D; on the furnace cooling too much, connection, due to contracting of air in F, would be made through 3 and C, causing H to drop, thus closing door. This simple device worked very well all last winter and gave me no trouble whatever.

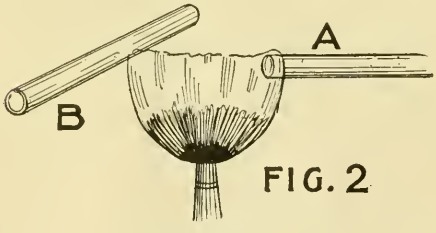


FIG. 2

If you cannot readily procure a U-tube, you can make one, as I did, and the work is interesting.

The U-tube is constructed in the following manner. A glass tube is closed at one end. This is done by holding the tube in one corner of a gas flame, somewhat near the dark area (A, Fig. 2), and constantly turning the tube, when it will be found that the glass has melted together. Now, after it is cool, about 3 or 4 inches from the sealed end, the tube is held steadily so that the flame will heat one small portion (B, Fig. 2). After this small portion is heated blow into the tube, not very hard, but just enough to cause tube to bulge out. Allow to cool. Then reheat the small bulged portion, blow quite hard, so that the glass will be blown out at this point, forming a small hole. Now insert about a half inch of platinum wire and reheat, holding platinum wire by means of a small pliers so that it will be partly in the tube and partly without. The platinum will stick to the glass, and if glass is sufficiently heated one will be able to pull it, by means of pliers, from one side of the hole to the other, thus sealing the wire into the tube. Another wire is sealed in the same way about an inch from the first. Now, to bend the tube, one must hold it, with both hands, in the flame and turn constantly until soft. Quickly withdraw from flame and bend, just as you would a piece of copper wire. Allow to cool slowly.

The several tubes are connected with a short piece of rubber tubing.

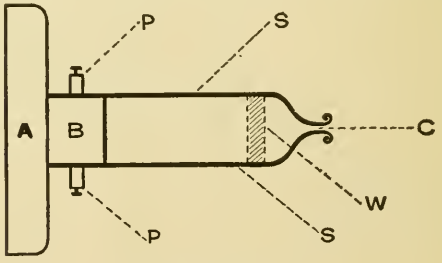
The total cost of materials for constructing the apparatus complete will not cost over one dollar—they cost me sixty cents.—Contributed by M. G. Kopf, Lewis Institute, Chicago.

HOW TO MAKE A SIMPLE FIRE ALARM

A fire alarm which is both inexpensive and simple in construction is shown in the illustration. Its parts are as follows:

A, small piece of wood; B, block of wood nailed to A; S, S, two pieces of sheet brass about ¼ in. wide, bent into a hook at each end; P, P, binding posts fastening the springs S, S, to block B, so that they come in contact at C. W is a piece of wax crayon just long enough to break the contact at C when inserted as shown in the illustration.

When these parts have been put together in the manner described, connect the device in circuit with an electric bell, and place it behind a stove. When the stove becomes too hot the wax will melt at the ends, allowing the springs to contact at C, and the alarm bell will ring.—Contributed by J. R. Comstock, Mechanicsburg, Pa.



Simple Fire Alarm

A speed of 83 miles an hour was made in a test of an electric locomotive pulling a heavy train on the New York Central recently.

HOW TO MAKE A BELL TENT

Cheaper Than Buying a Tent and Just as Good

A bell tent is easily made and is nice for lawns, as well as for a boy's camping outfit. The illustrations show a plan of a tent 14 ft. in diameter. To make such a tent, procure unbleached tent duck, which is the very best material for the purpose, says the Cleveland Plain Dealer. Make 22 sections, shaped like Fig. 3, each 10 ft. 6 in. long and 2 ft. 2 in. wide at the bottom, tapering in a straight line to a point at the top. These dimensions allow for the laid or lapped seams, which should be double-stitched on a machine. The last seam sew only for a distance of 4 ft. from the top, leaving the rest for an opening. At the end of this seam stitch on an extra gusset piece so that it will not rip. Fold back the edges of the opening and the bottom edge of the bell-shaped cover and bind it with wide webbing, 3 in. across and having eyelets at the seams for attaching the stay ropes. Near the apex of the cover cut three triangular holes 8 in. long and 4 in. wide at the bottom and hem the edges. These are ventilators. Make the tent wall of the same kind of cloth 2 ft. 2 in. high. Bind it at the upper edge with webbing and at the bottom with canvas. Also stitch on coarse canvas 6 in. wide at the bottom, and the space between the ground and the wall when the tent is raised, fill with canvas edging. Stitch the upper edge of the wall firmly to the bell cover at the point indicated by the dotted line, Fig. 2.

For the top of the tent have the blacksmith make a hoop of ¼-in. round galvanized iron, 6 in. diameter. Stitch the canvas at the apex around the hoop and along the sides. Make the apex into a hood and line it with stiff canvas. Have the tent pole 3 in. in diameter, made in two sections, with a socket joint and rounded at the top to fit into the apex of the tent.

In raising the tent, fasten down the wall by means of loops of stout line fastened to its lower edge and small pegs driven through them into the ground, Fig. 5. Run the stay ropes from the eyelets in the circular cover to stakes (Fig. 5) stuck in the ground. Use blocks, as in Fig. 6, on the stay ropes for holding the ends and adjusting the length of the ropes.

ENAMELING A BICYCLE FRAME

Make an enamel by mixing 2 oz. burnt umber with 1 qt. boiled oil, heating, and then adding 1 oz. asphaltum. Keep the mass hot until thoroughly mixed, says the Master Painter. Thin with turpentine while still hot.

Use a camel's hair brush for applying the enamel and allow it to set; then place the article in an oven, bake for six or eight hours at a temperature of 250 deg. F. When cool rub down with steel wool. Apply a finishing coat and allow it to bake eight hours at 250 deg. F. Rub down with a soft rag, varnish and bake again at 200 deg. F. Heat and cool the frame gradually each time. Black enamel is easiest to apply and bakes hardest, but requires a temperature of 300 deg. Colors can be baked at from 200 to 250 deg.

A little borax added to flour paste will double its adhesive power, and keep it from souring, also.

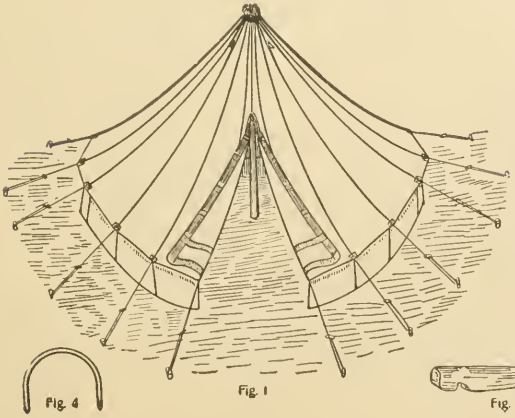


Fig. 1

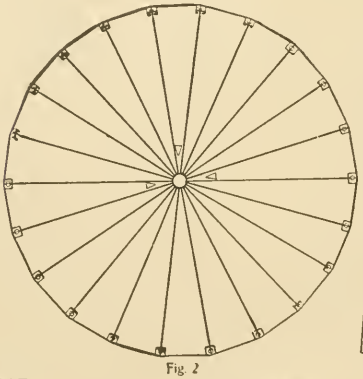


Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

MECHANICS FOR YOUNG AMERICA

A PRACTICAL CAMERA FOR FIFTY CENTS

By C. H. Claudy

I say for fifty cents, but really this is an outside estimate. If you possess a few tools and the rudiments of a shop, by which is meant a few odds and ends of screws, brass and nails, you can really make this camera for nothing.

The camera box is the first consideration, and for this a cigar box answers every purpose. It is better to use one of the long boxes which contain a hundred cigars and which have square ends. This box should be cut down, by means of a saw and a plate, until the ends are four inches square. Leave the lid hinged as it is when it comes.

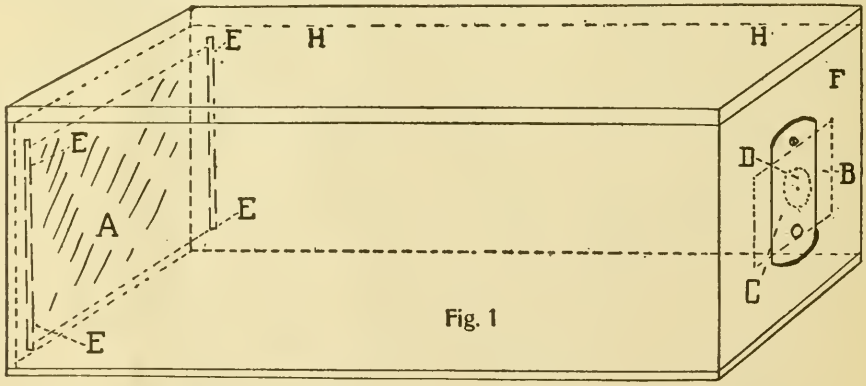


Fig. 1

Clean all the paper from the outside and inside of the box—which may be readily done with a piece of glass for a scraper and a damp cloth—and paint the interior of the box a dead black, either with carriage makers' black or black ink.

Now bore in the center of one end a small hole, a quarter of an inch or less in diameter. Finally insert on the inside of the box, on the sides, two small strips of wood, an eighth of an inch by a quarter and fasten them with glue, an eighth of an inch from the other end of the box. Examine Fig. 1, and see the location of these strips, which are lettered EE. Their purpose is to hold the plate, which may be any size desired up to four inches square. Commercially, plates come three and one-half by three and one-half, or, in the lantern slide plate, three and one-quarter by four inches. If it is desired to use the three and one-half by three and one-half, which is advised, the box should measure that size in its internal dimensions.

We now come to the construction of the most essential part of the camera—the pin hole and the shutter, which take the place of the lens and shutter used in more expensive outfits. This construction is illustrated in Fig. 4. Take a piece of brass, about a sixteenth of an inch thick and one and one-half inches square. Bore a hole in each corner, to take a small screw, which will fasten it to the front of the camera. With a quarter inch drill bore nearly through the plate in the center, but be careful that the point of the drill does not come through. This will produce the recess shown in the first section in Fig. 4. Now take a No. 10 needle, insert the eye end in a piece of wood and very carefully and gently twirl it in the center of the brass where it is the thinnest, until it goes through. This pin hole, as it is called, is what produces the image on the sensitive plate, in a manner which I shall presently describe. The shutter consists of a little swinging piece of brass completely covering the recess and pin hole, and provided with a little knob at its lower end. See Fig. 3, in which F is the front of the camera, B the brass plate and C the shutter. This is also illustrated in the second cross section in Fig. 4. In the

latter I have depicted it as swung from a pivot in the brass, and in Fig. 3 as hung from a screw in the wood of the front board; either construction will be effective.

Lastly, it is necessary to provide a finder for this camera in order to know what picture you are taking. Make a little frame of wire, the size of the plate you are using, and mount it upright (see Fig. 5) on top of the camera as close to the end where the pin hole is as you can. At the other end, in the center, erect a little pole of wire half the height of the plate. If now you look along the top of this little pole, through the wire frame and see that the top of the little pole appears in the center of the frame, everything that you see beyond will be taken on the plate, as will be made plain by looking at the dotted lines in Fig. 5, which represents the outer limits of your vision when confined within the little frame.

When you want to use this camera, take it into an absolutely dark room and insert a plate (which you can buy at any supply store for photographers) in the end where the slides of wood are, and between them and the back of the box. Close the lid and secure it with a couple of rubber bands. See that the little shutter covers the hole. Now take the camera to where you wish to take a photograph, and rest it securely on some solid surface. The exposure will be, in bright sunlight and supposing that your camera is ten inches long, about six to eight seconds. This exposure is made by lifting the little brass shutter until the hole is uncovered, keeping it up the required time, and then letting it drop back into place. It is important that the camera be held rigid during the exposure, and that it does not move and is not jarred—otherwise the picture will be blurred. Remove the plate in the dark room and pack it carefully in a pasteboard box and several wrappings of paper to protect it absolutely from the light. It is now ready to be carried to some one who knows how for development and printing.

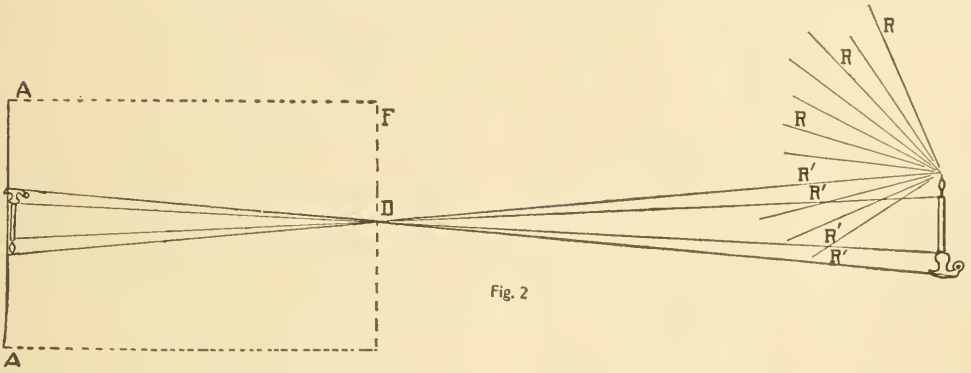


Fig. 2

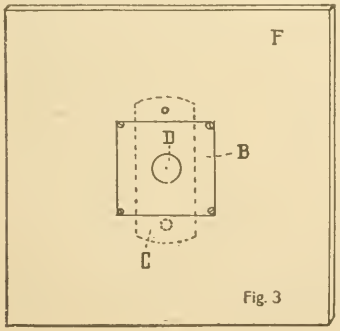


Fig. 3

Fig. 4

To explain the action of the pin hole I would direct attention to Fig. 2. Here F represents the front of the camera, D the pin hole, AA the plate and the letters RR, rays from a lighted candle. These rays of course, radiate in all directions, an infinite multitude of them. Similar rays radiate from every point of the object, from light reflected from these points. Certain of these rays strike the pin hole in the front of the camera, represented here by RRRR. These rays pass through the pin hole, and as light travels only in straight lines, reach the plate AA, forming an inverted image of the object, in this case a candle in a candlestick. Millions of rays are given off by every point in every object which is lighted by either direct or reflected light. To all practical purposes only one of these rays from each point in an object can pass through a minute opening, like a pin hole. This being so, any screen which interrupts these selected rays of light will show upon it a picture of the object, only inverted. If that screen happens to be a photographically sensitive plate, which is protected from all other

light by being in a dark box, upon it will be imprinted a photographic image which can be made visible by the application of certain chemicals, when it becomes a negative, from which may be printed positives. This camera is not a theoretical possibility, but an actual fact. I have made and used one successfully, as a demonstration of pin hole photography.

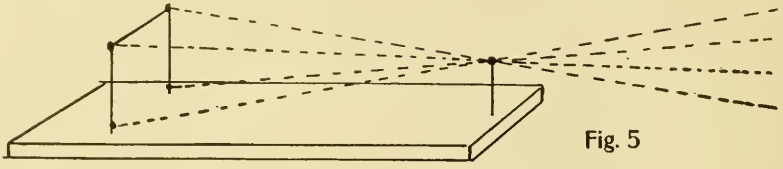


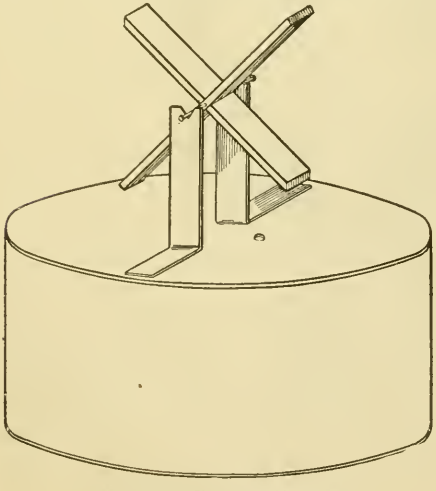
Fig. 5

HOW TO MAKE A VERY SIMPLE STEAM TURBINE

By A. L. Burkhart

A miniature steam turbine which is simpler in construction than the one described in the July issue of Popular Mechanics may be made as follows:

A tin can of quart size or larger may serve for the boiler. The can must have a good lid, so that it will not leak. In the top of the can, near one edge, punch a small hole. Through this hole the steam is to come out and strike the paddles of a small wheel. Make the wheel of two pieces of wood, fastened together by cutting halfway through the middle of each and then fitting each into the other, as every boy knows how to do to form a four-paddle water wheel. Drive a pin in each side to serve as a shaft. For the supports of the wheel use pieces of tin, bent into L-shape and soldered fast to the can. Place them in such position, with respect to the small hole punched, that the spurt of steam from the hole will strike the ends of the paddles of the wheel squarely. Fill the boiler three-fourths full of water, set it on a hot stove and as soon as steam is generated fast enough to come out the escape hole with slight force the wheel will start to revolve.



A Simple Turbine Engine

POWER OF SMALL COILS FOR SENDING WIRELESS MESSAGES

By O. F. Dame of the New England Coil Winding Company

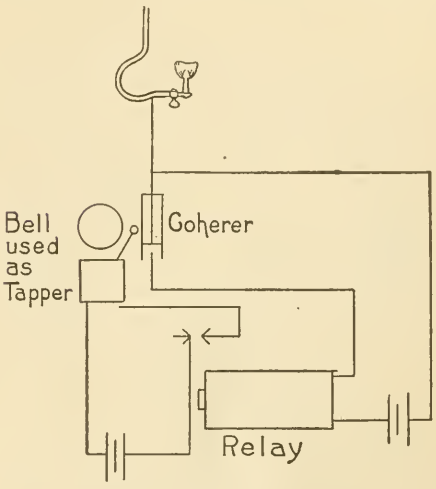
Hundreds of amateurs interested in wireless telegraph experiments are seeking definite information as to the sending power of small coils giving 1, 2, 3 and 4 in. sparks. As the successful operation of wireless apparatus depends considerably upon the efficiency of the receiving apparatus, there is absolutely no rule that can be laid down specifically, each man's experience differing from that of nearly everyone else.

Calculations based on recent experiments made by ourselves between two points three miles apart, over an uninterrupted stretch of water, and later from one hill to another, a mile distant, tend to show that one can send twice the distance over water that he can over land. In tests made at Atlantic, Mass., the minimum sending power required for one mile was ½-in. spark, and it was found that the maximum sending distance of an ordinary 2-in. spark coil operated by six cells of dry battery with no intensifying jars attached, was three miles. In these tests a glass tube coherer of the Marconi type was used. Each station was provided with a short pole, 15 ft. high, and a ground wire buried in moist earth. By the addition of Leyden jars and a more sensitive receiving device the same coil was used successfully a distance of eight miles over water.

It will therefore be seen that it is impossible for a coil manufacturer to state how much of a spark a customer will require for an estimated distance, without a thorough knowledge of the apparatus to be used at the receiving end, the location of the stations, and what is undoubtedly of more importance than anything else, the natural cleverness of the amateur in handling the subject. Wireless experiments furnish excellent opportunities for a man to exercise his ingenuity to the fullest extent. While it is true, that the induction coil is one-half of the outfit, a sensitive receiving device is equally necessary. The glass tube coherer was the first successful receiver and is used today by the United States government at some stations, and in locations where the stations are not thickly established will serve admirably for years to come. Wireless enthusiasts who have advanced in their experiments to a point where the coherer is discarded for the electrolytic or magnetic receivers, find small sparks rightly operated very successful over distances double that of the coherer period. It is safe, therefore, to assume that a 2-in. coil properly established is a suitable transmitter within the limits of a township, and a 3 or 4-in. coil sufficient for wireless communication of a more advanced character. The literature on wireless telegraphy, owing to the newness of the subject, overflows with questionable theories advanced by experimentalists whose researches lead them to think such and such things are so because certain experiments resulted that way. The future has in store so many undreamed-of discoveries that there seem to us to be very bright futures for the young students who master the principles while the thing is new.

RINGING A BELL BY TOUCHING A GAS JET

The experiment of scuffing the feet over a carpet and then producing a spark which will light the gas by touching the chandelier was given in the April Popular Mechanics. One of our correspondents, Frank C. Osborn, of New York City, says that if a wire is connected to the chandelier and led to one terminal of the coherer of a wireless telegraph outfit the bell will ring every time the spark is produced by touching the chandelier, and that, as the chandeliers are all connected by the gas-pipe, the bell will ring, no matter in which room the spark is produced.



Touch the Gas Jet and Ring the Bell

THE "BENNINGTON" DISASTER

The explosion of the boilers of the U. S. S. "Bennington" while in port at San Diego, Cal., has caused general adverse criticism by engineers and the public. Sixty-five sailors were killed or died from injuries. Had the explosion occurred a day later, when the vessel would have been at sea, her loss would doubtless have been one more of the "mysteries."

The generally accepted explanation is that the boilers were not only unsafe, but had been known to be in that condition for months past. It is far from creditable that the same critical boiler inspection which another branch of government so rigidly enforced against merchantmen could and should not prevail in its navy. Admiral Geo. W. Melville, chief of the bureau of steam engineering, says:

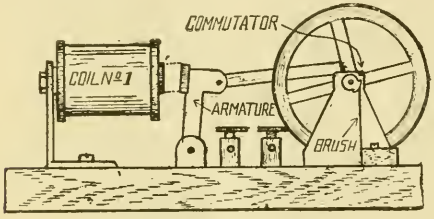
"It is passing strange that while we are wasting time and money on the boiler question, Great Britain is installing 23,000 horsepower of American boilers in their latest and greatest battleship that has been laid down by any navy in the world, the "Dreadnought." Great Britain has fought the "battle of the boiler" very much to her cost, and this greatest and most conservative navy in the world has selected an American boiler because in their service they have proved it to be the most economical, most reliable, smokeless and easiest kept in repair of any marine boiler in the world. Why should we not do likewise?"

MECHANICS FOR YOUNG AMERICA

HOW TO BUILD AN ELECTRIC ENGINE

This engine, if carefully made, presents a neat appearance and is capable of running toy machinery on very low current strength —the one I made ran satisfactorily on 1⅔ amperes.

The coils may be those of an old electric bell, mounted on a light piece of angle-iron, at a height of not more than one inch from the baseboard. The fly-wheel standard,



Simple Electric Engine

crank-rod and armature may be made out of galvanized iron, No. 16 being most suitable. A small valve-wheel makes a very good fly-wheel, but care must be taken in mounting it upon the shaft, for if the shaft is not in the center the engine will not run smoothly.

Make the shaft to extend on each side of the two bearings, so that the commutator may be atached to one side and so the other side may be bent into the form of a crank. On the commutator side place a brush in such position that during every revolution the circuit will be alternately opened and closed. Arrange the commutator so that the circuit will be closed either when the handle is at the top or when it is at the bottom, which makes no difference, except for the direction in which the engine will run.

Let us suppose that the crank is pointed downward. The circuit is now closed by the commutator and the armature is attracted by the electro-magnet, but, as it approaches the magnet, the circuit is broken and the fly-wheel pulls it back again, only to be attracted when the circuit is again closed.

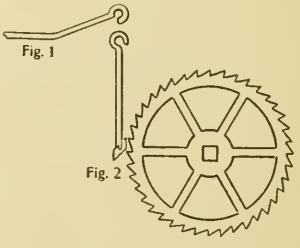
By adjusting the commutator, several different speeds may be obtained, as well as reversing the engine accomplished, which is done by placing the crank so that it points upward, then twisting the commutator around so that the circuit is closed.—Contributed by Warren B. Weyrick, 4 Russell Ave., Akron, O.

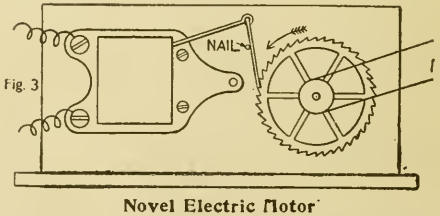
NOVEL ELECTRIC MOTOR

The materials necessary to make this motor are an old electric bell of the "buzzer" type and a cog-wheel from an old clock.

Remove the hammer-head and gong from the bell, then bend the end of the hammer into a loop, as in Fig. 1. Now make a little wire catch like Fig. 2, and fasten its loop into the loop of the hammer. Mount the bell on a small board as in Fig. 3 and fasten the cog-wheel almost on a line with it. Now press down the hammer and place a nail in the position shown in the diagram so that the catch touches one of the teeth.

Fasten the board in an upright position and attach two dry batteries to the binding





Novel Electric Motor

posts. If properly connected, the fly-wheel will turn quite rapidly and with amazing force for so small a machine. The machine, however, has a fixed direction as shown by the arrow, but the belting can be arranged so as to send the models in a reversed direction if required. The materials for the motor should not cost more than 25c for the bell and if you have an old bell it will cost next to nothing.—Contributed by Fred C. Curry, Brockville, Ontario.

HOW TO MAKE A SAILOMOBILE

By Frank Mulford, Shiloh, N. J.

I had read of the beach automobiles used on the Florida coast; they were like an ice boat with a sail, except they had wheels instead of runners. So I set to work to make something to take me over the country roads.

I found and used seven fence pickets for the frame work, and other things as they were needed. I spliced two rake handles together for the mast, winding

Photograph by Mrs. C. J. Lupton, Shiloh, N. J.

Sailomobile Built by Frank Mulford

the ends where they came together with wire. A single piece would be better if you can get one long enough. The gaff, which is the stick to which the upper end of the sail is fastened, is a broomstick. The boom, the stick at the bottom of the sail, was made of a rake handle with a broomstick spliced to make it long enough. Mother let me have a sheet, which I put down on the floor and cut in the shape of a mainsail. The wind was the cheapest power to be found, thus it was utilized; the three wheels were cast-off bicycle wheels.

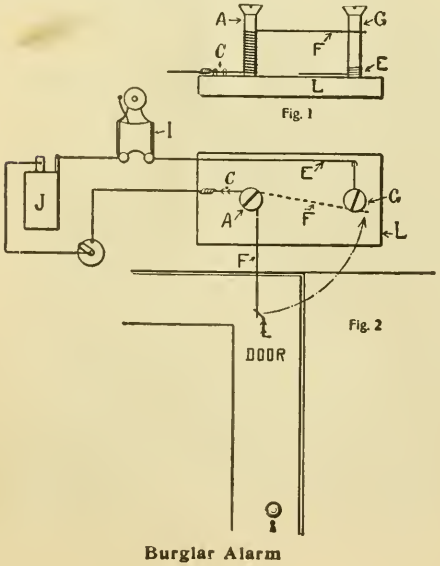
I steer with the front wheel, which was the front wheel of an old bicycle with the fork left on. The axle between the rear wheels is an iron bar which cost me 15 cents, and the pulley which raises and lowers the sail cost 5 cents. Twenty cents was all I spent, all the rest I found.

A saw, hammer, and brace and bit were the tools used. Slats made the seat and a cushion from the house made it comfortable, and in a week everything was ready for sailing.

Once it was started with only my litle cousin in it and I had to run fast to catch up.

HOW TO MAKE A NOVEL BURGLAR ALARM

The only materials required for this device are a small block of wood, two screws, some copper wire, an old spring, an electric bell, a dry battery and a one-point switch.



Burglar Alarm

The illustrations show how these parts are put together and the letters used indicate as follows:

A and G, screws; B, old mouse trap spring; C, anchor for spring; D, wire to hold F back at night, or when alarm is set; E, copper wire running from G to bell; F, straight part of spring which, when released from D, completes the circuit; H, same as E, but connected at G; I, electric bell; J, dry battery; K, a one-point switch to be set on only when burglar alarm is set, otherwise bell will ring all the time; L, base for the alarm.

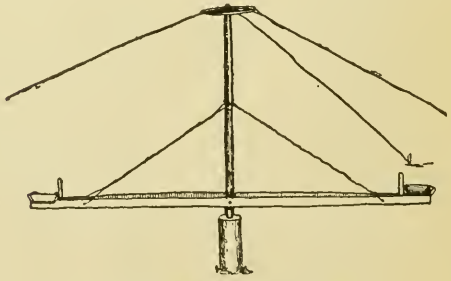
Fig. 1 shows the screws and spring arranged on the base; Fig. 2 shows the position of the wooden base above the door, and shows a complete plan of the wiring.—Contributed by Harry A. Peshon, 333 Cherry St., San Francisco, Cal.

SIMPLE X-RAY EXPERIMENT

The outlines of the bones of the hand may be seen by holding a piece of rice paper before the eyes and placing the spare hand about 12 in. back of the rice paper and before a bright light. The bony structure will be clearly distinguishable.—Contributed by G. J. Tress, 126 Centre Ave., Emsworth, Pa.

TO BUILD A MERRY-GO-ROUND

This is a very simple device, but one that will afford any amount of amusement. The center post rests in an auger hole bored in an old stump or in a post set in the ground. The stump makes the best support. The



Home-Made Merry-Go-Round

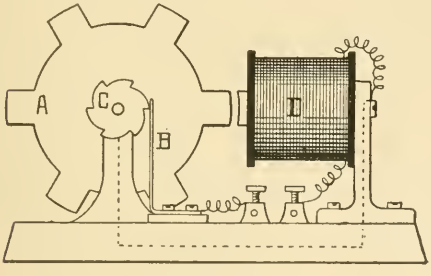
center pole should be 10 ft. high. An old wheel is mounted at the top of the pole, and the pole works in the wheel as an axle, says the American Boy. The wheel is anchored out by several guy wires. The seat arms may be any length desired. A passenger rides in each seat and the motorman takes his station at the middle.

MECHANICS FOR YOUNG AMERICA

ANOTHER ELECTRIC MOTOR

This form of electric motor is used largely in England in the form of an indicator. It is very easily made and if you have an old electro-magnet will cost about nothing.

A large soft-iron wheel is mounted on an axle with a pulley-wheel on one end



Electric Motor

and a circuit breaker on the other end. The teeth on the circuit-breaker must be the same number as on the soft-iron wheel.

The electro-magnet is mounted so that its core is level with the axle and in a line with the wheel. One wire from it is attached to one binding screw and the other end is grounded to the iron frame that supports it. This frame is connected to the frame supporting the wheel. A small brush presses on the circuit-breaker and is connected to the other binding screw.

In the diagram A represents the iron wheel; B, the brush; C, the circuit-breaker; D, the magnet. The wire conecting the two frames is shown by a dotted line.

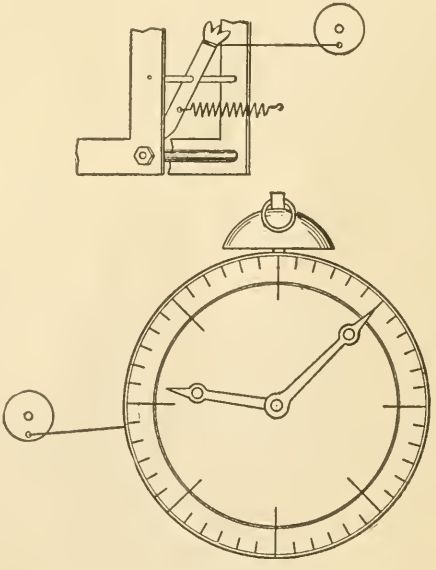
To start the motor, attach your battery to the screws and turn the wheel a little. The magnet attracts one of the teeth on the wheel, but as soon as it is parallel with the core of the magnet the circuit is broken and the momentum of the wheel brings another tooth to be attracted.

To reverse the motor reverse the connections and start the wheel the other way. Be sure that the frames are screwed down well or the motor will run jerkily and destroy the connections.—Contributed by F. Crawford Curry (14 years old), Brockville, Ontario, Canada.

USE FOR AN OLD CLOCK

Remove the hair spring of the clock, and fasten a spring to one end of the pawl and a small wire to the other end. Make a slit in the case of the clock opposite the pawl. Fasten the spring on the outside in any convenient way and pass the wire through the slit to an eccentric or other oscillating body.

To make the dial, paste a piece of paper over the old dial, pull the wire back and forth one hundred times, and make a mark where the minute hand stops. Using this for a unit divide up the whole dial. The hour hand has an inner circle of its own.



Revolution Recorder

Put the alarm hand at a little before twelve and wind the alarm. When the alarm is unwound the hour hand starts on a new trip. The clock I used was put on an amateur windmill and when the hour hand went around once 86,400 revolutions or jerks on the wire were made, while the minute hand recorded one-twelfth of this number, or 7,200. —Contributed by Richard H. Ranger, 19 W. 10th street, Indianapolis, Ind.

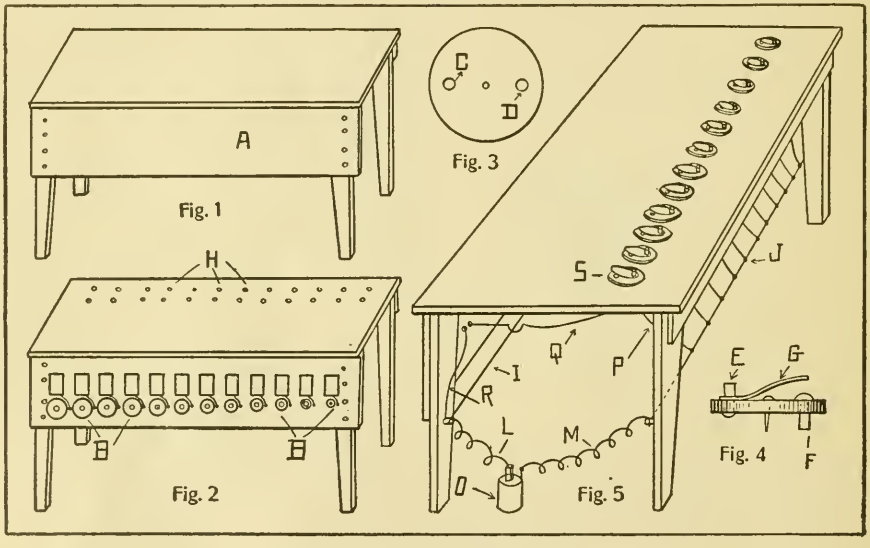
TO MAKE AN ELECTRIC PIANO

Make or buy a table about 3 ft. long and a foot or more wide, and about 2½ ft. high. Nail a board (A, Fig. 1) about 8 in. wide and of the same length as the table, to the table as shown in the illustration. Paint the table any color desired.

Purchase a dozen or so battery electric bells (they are cheaper if bought by the dozen) and screw them to the board. (See Fig. 2.) Arrange the bells in the scale as shown at B, Fig. 2. Bore two holes, near the posts of each bell for the wires to pass through.

Buttons for the bells may be purchased, but it is cheaper to make them in the following way: Take a piece of wood and cut it round, about 2½ in. in diameter and ¼ in. thick (Fig. 3) and bore two holes (C and D) through it. Then get two posts, about an inch long (battery posts will do) and put them through the holes as at Fig. 4. Cut out a piece of tin, ⅜ in. wide, punch a hole through it and put it under post E, Fig. 4, so that when it is pressed down, it will touch post F, Fig. 4. It may be either nailed or screwed down (G, Fig. 4).

Make two holes in the table for each button and its wires (H, Fig. 2). Nail or screw the buttons to the table as shown at Fig. 5 with the wires underneath. The connections are simple: I in Fig. 5 is a wire running from one end of the table to the other end, attached to a post at each end; J is another wire attached in the same way; L is the carbon wire running from the batteries to I; M is the zinc wire running from the batteries to wire J; O indicates the batteries; P is a wire running from J to one post of a button; Q is another wire running from the other post of the button to one of the posts of the bell; R is a wire running from I to one post of the bell. When the button S is pressed, the bell will ring. Each button should be connected with its bell in the same way. One battery can be used with each bell if preferred.—Contributed by Vincent de Ybarrondo, 1148 W. 25th St., Los Angeles, Cal.



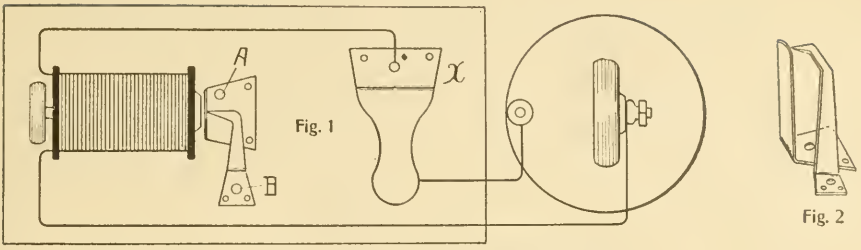
Details of Electric Piano

HOW TO MAKE A TELEGRAPH INSTRUMENT AND BUZZER

The only expenditure necessary in constructing this telegraph instrument is twenty-five cents for a dry cell battery, providing one has a few old materials on hand.

Procure a block of wood about 6 in. long and 3 in. wide and take the coils out of an old electric bell. If you have no bell, one may be had at the dealers for a small sum. Fasten these coils on the blocks at one end as shown in Fig. 1.

Cut a piece of tin 2 in. long and ½ in. wide and bend it so the end of the tin when fastened to the block will come just above the core of the coil. Cut another piece of tin 3 in. long and bend it as shown



Home-Made Telegraph Instrument

at A, Fig. 2. Tack these two pieces of tin in front of the coils as shown in the illustration. This completes the receiver or sounder.

To make the key, cut out another piece of tin (X, Fig. 1) 4 in. long and bend it as shown. Before tacking it to the board, cut off the head of a nail and drive it in the board at a point where the loose end of the tin will cover it. Then tack the key to the board and connect the wires of the battery as in Fig. 1. Now, move the coils back and forth until the click sounds just the way you wish and you are ready to begin on the Morse code.

When tired of this instrument, connect the wire from the coils to the key to point A and the one connected at the point under the key to B, leaving the other wire as it is. By adjusting the coils the receiver will begin to vibrate rapidly, causing a buzzing sound.—Contributed by John R. McConnell.

ONE-MAN ENGLISH MOTOR BUS

"The Bus Seats 32 Persons"

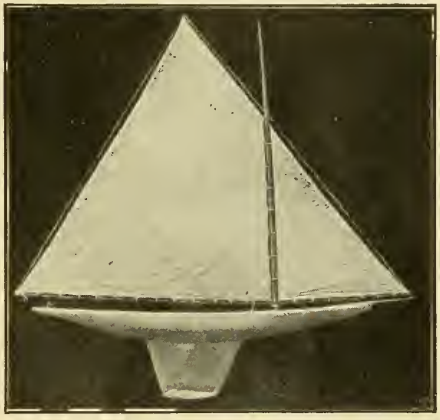
One English firm has brought out a novelty in a motor omnibus the vehicle being entirely in charge of the driver. The entrance is at the front, the upper deck being reached by the usual winding stairway, hence all who enter or leave are seen by the driver who sits opposite one side of the entrance. The bus seats 32 passengers who place their fare in a box on boarding the car.

The omnibus has been well patronized from its first appearance.

HOW TO BUILD A MODEL YACHT

By Alex. E. Quinn, of San Francisco

Within the past few years the interesting and instructive sport of model yachting has become very popular in the sporting circles of San Francisco. This popularity has been caused principally by the efforts of a lately formed model yacht club, in the affairs of which some of the foremost citizens of San Francisco have taken a great interest. Quite a few of these men are naval architects, marine engineers, etc. Another vital reason for the great hold this sport has taken upon the San Francisco public, is the donation to the city of a fine lake, especially for the model yachting, by one of



The Finished Model Yacht

our most public-spirited men, Mr. Spreckles, whose name the lake now bears. Lake Spreckles is situated in the beautiful Golden Gate Park, is about 250 ft. in diameter at its widest part, and around a portion of its edge a stone walk is laid, upon which the yachtsmen can easily go around from one side to the other.

On a Sunday or holiday morning you can see nearly half a hundred yachts of all sizes, shapes and rigs, sailing upon this lake, and the close contests between the different yachts furnish excitement and amusement for the large crowd of interested spectators.

Mr. Geo. W. Gickie, formerly manager of the Union Iron Works, presented a trophy cup to the San Francisco model yacht club, and this cup is held by the owner of the speediest boat in each special race; besides this cup many other prizes of all descriptions are won or held by the different competitors.

The yachts permitted to enter these races must not be over 50 in. on the load waterline, with a corresponding sail area of generally not more than 2,500 sq. in., being classified according to size, etc., in three classes.

The following will give an outline of how to construct one of these yachts. The first step is to build the hull, the best wood for this being cedar, and the best metal aluminum, the cedar boat (which will be described) is cheaper, but takes a longer time to build, as the wood has to be thoroughly seasoned, then shaped exactly on the outside to template taken from the lines of the plan; after which the inside must be hollowed out until the shell is about $\frac{3}{16}$-in. thick, except along the keel, where it is advisable to leave ½ in. of wood for fastening the aluminum fin which takes the lead, and along the deck line where it is best to leave ¼ in. thickness for fastening the deck to the hull. In order to make the hull perfectly watertight, it is best to first give it three coats of shellac on the inside, then to glue strips of light canvas or linen upon this and then give two or more coats overall. For a boat of 70-in. overall, 50-in. on the load waterline and a beam of 10 in., the hull must not weigh more than 7 lb. after the aluminum fin, Fig. 1, is fitted; the boat complete must not weigh more than 27 lb.

For ease in transportation the mast should be made portable, at the same time, however, the opening in the deck for the mast must be watertight, and this result is best

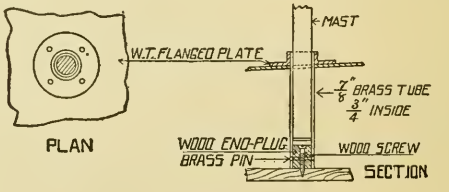


Fig. 2

obtained by placing a piece of ⅞-in. brass tubing over a plug secured to the keel by a wood screw (See Fig. 2). This tube is made long enough to project through the deck. To prevent turning, a pin is put through tube and plug. The mast may then be put in place or removed very easily. An aluminum flanged plate bedded in white lead is placed on the deck where the tube comes through in order to make it watertight.

The bow-sprit, (Fig. 1) is best made portable also, and the most suitable wood for this part is oak. The bow-sprit can be fitted to the deck of the boat by means of two brackets, the one at the end of the bow-sprit made with three legs, the other bracket need only be a common strap bracket. The material most suitable for these brackets is aluminum, as this metal is lightest and is not affected by water.

All the rigging fittings, such as rings, screw eyes, pins, etc., had best be made of aluminum also. Two aluminum travelers one for the gib and one for the mainsail, must be about 2 in. or more forward of the center of buoyancy of the hull, because these model yachts are fitted without rudders and this is necessary for them to sail straight.

The lead for the size of boat mentioned is best cast in cigar shape and must have its center of buoyancy directly under the center of buoyancy of the hull, because if these two are not in correct relation with each other, the waterline of the boat will change, making the hull dip either forward or aft.

The aluminum fin on which the lead is fastened is best attached to the hull of the boat (if boat is finished natural wood) by

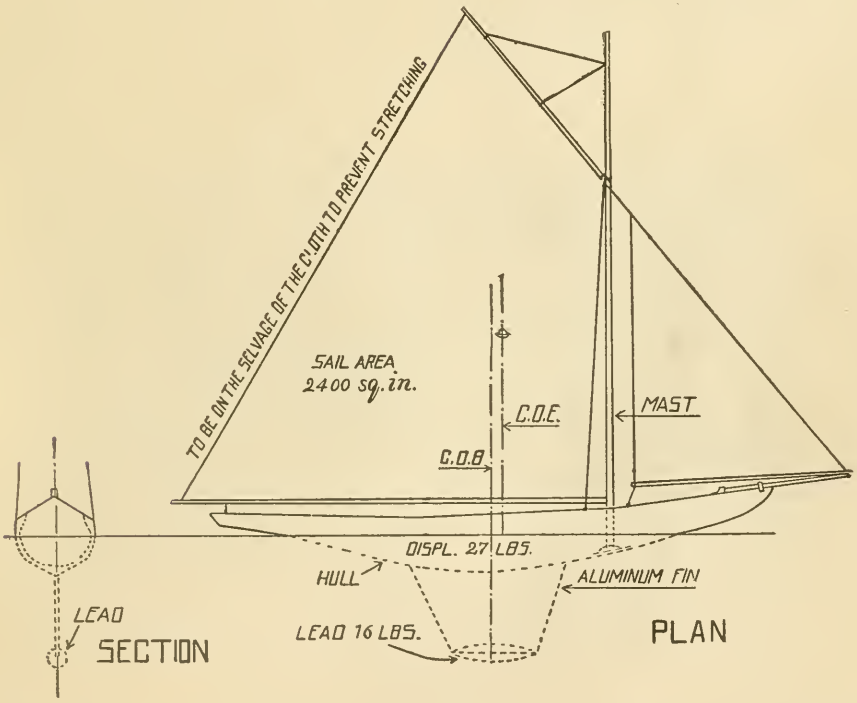


Fig. 1

must be fitted to the deck, so as to give the booms enough play. Both should be the same length, so the mainsail and gib will be on the same angle. This angle depends on the strength of the wind and can be found by experience in sailing boom stays to be fitted, so that they can be adjusted accordingly.

The best material for the sails is Lonsdale cambric. If care is taken to have the edge of the sail running from the gaff to the end of the boom, in the selvage, no trouble will be experienced on account of slack or baggy sails.

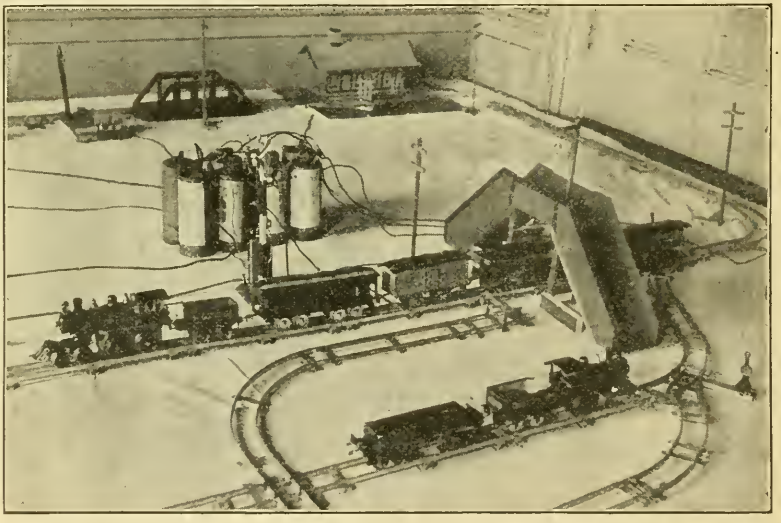
The center of effort of the entire sail area

means of two aluminum angles ¾ in. x ¾ in., or if the boat is to be painted or enameled, by cutting slots 1 in. deep and 1 in. apart, or as wide apart as will come out even, in the upper edge of the fin and then bending the squares alternately to right and left. The hull can then be recessed in way of these squares, in each of which three wood screws fastening it to the hull had best be put; in this way a very smooth job can be done. The lead may be fastened to the aluminum fin by slotting it lengthwise about half the diameter deep, then boring two or more holes through lead and fin, and fastening the lead to the fin

HOW A BOY BUILT A COMPLETE MINIATURE RAILROAD

Every Boy May Become a Railroad Magnate With an Entire System Under His Control

Railway systems with all their appurtenances, stations, switches, block signals, electric lights, etc., have always had a wonderful fascination for me, and for a long while, since I have been experimenting and studying along the mechanical line, it has been my intention to some day possess a model system of my own, complete in every detail. I have at last succeeded in carrying out my desire and will endeavor to describe to the young readers of Popular Mechanics the railroad I built.



An Entire Railway System

To begin with, the gauge of the track is only 1⅝ in., the track being set up in the form of an oblong, 10 ft. long and 4 ft. wide, with two side tracks, as shown in the illustration.

Starting from the crossing, the train passes through a tunnel to a certain point in the track where an electrical connection is made by the locomotive which operates the signal a few feet further down the track At the same instant a white light is flashed, which as you know, means clear track ahead. This signal is worked by two electric magnets, the electricity being obtained from eight dry batteries, which are all connected with the tracks. These eight batteries furnish the electricity for all the electrical apparatus connected with the road. The light on the signal is given from a very small electric light bulb, attached to the main pole of the signal.

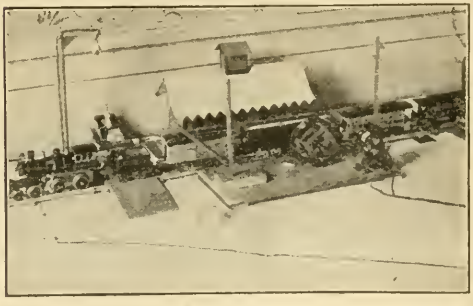
When the train has passed the signal a few feet, another connection is made in the track. This connection raises the signal arm and therefore a red light is flashed, which means danger for any train following. Leaving this point the train passes under an overhead bridge of the type that is used for passengers only. On this bridge is an electric light which is also connected to the track by wires and worked by the train; it then passes along to a station. From the station, a few feet further on brings the train to a bridge; over this bridge and a few feet further it comes to another station. At the station there is a little catch in the center of the track which, when set, puts the brake on the locomotive and stops the train, if so desired. There is also a platform at the station on which stands a small derrick. This derrick works by electricity. There is a small motor from which a belt runs to the works of an alarm clock, with all unnecessary wheels removed so as to get the

greatest mechanical advantage. The motor is started by making connection with a wire which runs from the batteries. The motor starts the clockwork, which in turn winds up the derrick cord, thus raising the different things to be loaded on the cars. When the weight is raised high enough, the derrick arm is swung over the car. Then the belt is shifted and the clockwork runs in the reverse order and lowers the weight into the car.

Right near the station is a crossing with the regular crossing gates to protect traffic. To make things more natural a small automobile stands at the crossing. Before the train reaches this point a bell rings in the station which announces its approach. The bell is rung by an electrical connection with the track. At the crossing stands a pole, from the arm of which hangs a small electric light bulb, which is lighted by the train as it passes. All along the entire track are telegraph wires supported by small telegraph poles. There is a telegraph instrument at the end of the line which is connected with the batteries and in working order, so that real messages can be sent.

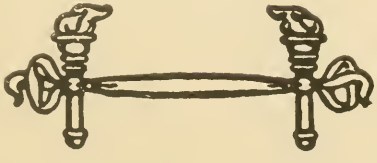
There are two side tracks, each long enough to hold a four-car train, reached by switches from the main line. On these side tracks one train can be standing while the other is running on the main line. The large locomotive has a reversing lever and an automatic brake, which is worked by a catch in the center of the track. By using the reversing lever the train can be run in either direction. The majority of the cars are of the double truck style, which take curves and switches very easily Both locomotives are heavy, being made of iron and steel, and are run by very heavy clockwork, which is much cleaner than steam, and when wound up runs quite a while, as there is a governor in each engine to regulate the speed.

Many interesting things are done on this



The Railway Station

road, such as a race between the two trains, or having two engines coupled together to pull a very heavy train. At night, when the room is darkened, the running of the two trains and the flashing of electric lights, signal lights, etc., give a very interesting effect. The stations, derrick, overhead bridge, railroad bridge, telegraph poles, etc., I made from white wood, which is very easily worked. The batteries that furnish the power for the lights, motors, etc., are placed in the center of the road with wires running in all directions.—Contributed by William B. Barry, Jr., Jersey City, N J.



POPULAR MECHANICS

An Illustrated Monthly Magazine, reviewing the Mechanical and Engineering Press of the World

and

"WRITTEN SO YOU CAN UNDERSTAND IT"

POPULAR MECHANICS is a current history of all the great events in mechanics and engineering as they occur throughout the world. It is written in plain, simple language. It is filled with interesting matter and instructive illustrations. To read Popular Mechanics each month is an education in itself. It does not go into small details, but it does tell all the average person cares to know about the great things. Wireless telegraphs, air ships, torpedo boats, battleships, submarine boats, steam turbines, all the latest things in electricity and steam on land and sea and in the air; these and a thousand other subjects are made plain.

Among the special departments are the following:

Shop Notes: From 8 to 10 pages every month of shop kinks gleaned from all parts of the world. This book is reprinted from pages which have appeared in the magazine.

Electrical Experiments: These describe how to make, at trifling expense, all kinds of electrical apparatus, such as telephones, storage batteries, electric motors, telegraphs, etc., etc., practical instruments which will do good work.

Wood and Iron Working: Instructive articles on wood and iron work for apprentices and beginners, written by experts.

Hints to Inventors: Many timely suggestions and ideas are offered to assist those who are working out patentable devices.

Mechanical Engineering Technical BOOKS

You can get any book published on Mechanics, Engineering, Electricity, Steam, Fuels, Metal or Woodworking, and all the Individual Trades and Professions, in fact any book on any subject, published in this country or Europe, that is obtainable, through the

Popular Mechanics Book Dept.

In every case we prepay in full all mailing or express charges.

Any book desired can be earned by securing one or more subscribers to Popular Mechanics. State book wanted and we will advise you how many subscribers will secure it. This is a very easy way to get the best books.

ENGINEERING

GAS ENGINES, With Instructions for Care and Working of the Same. By G. Lieckfield; translated by Geo. Richmond. 120 pages; illustrated; 12mo.; cloth. Price, $1. To which has been added full directions for the management of oil engines.

TRACTION ENGINE ITS USE AND ABUSE. By James H. Maggard. Small 12mo.; cloth; illustrated. Price, $1. Revised and enlarged by an expert engineer. Deals in detail with the principles and parts of a traction engine; directions for starting an engine; use of gauge, try cocks, pumps, governor, slide valve, etc.; water supply; the boiler, its care and management; methods of a good fireman; the engine; handling a traction engine. The book is teeming with practical points and suggestions put in very simple language and very effective manner. It should be in the hands of every man who runs a traction engine. The farmer and creamery operator, especially, should not be without it.

HANDBOOK OF MODERN STEAM FIRE-ENGINES. (Roper's Engineers' Handy Book series.) Price, $3.50. The only book of the kind ever published in this country. Contains descriptions and illustrations of all the best types of steam fire-engines, and fire pumps, injectors, pulsometers, inspirators, hydraulic rams, etc.; and treats more extensively of Hydraulics than any other book on the market.

SIMPLE PROCESS FOR ESTIMATING THE HORSE POWER OF STEAM ENGINES. By Edwin R. Keller, M. E. New edition. Price, 50c. Contains various methods of estimating and calculating the horse power of boilers and engines and ascertaining the power required to run line shafts, individual machines, etc., etc.

MODERN MACHINE SHOP TOOLS. By W. H. Vandervoort. Large 8vo. 555 pages; 673 illustrations; cloth. Price, $4. Just out, this "masterpiece of the machine shop," no machinist can afford to be without it. Treats the subject of Modern Machine Shop Tools in a concise and comprehensive manner. Each tool is considered from the following points: First—Its construction with hints as to its manufacture; second—its operation, proper manipulation and care; third—numerous examples of the work performed. A book in which the apprentice will find a thorough course of instruction, the mechanic a valuable manual of practice and the superintendent and foreman many valuable suggestions. In fact, it is in all respects the most complete, concise and useful work ever published on the subject. Of incalculable value as a work of reference. In 34 chapters.

PRACTICAL GAS ENGINEER. What It Is and How To Do It. Cloth. Price, $1.

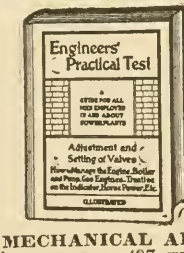
RECORD BOOK—VALVE SETTING. By A. B. Low. 120 pages; quarto; stiff covers. Price, 60c. For the use of marine engineers.

WATER WHEELS. By A. B. Cullen. 63 pages; 12 plates; quarto; cloth. Price, $2. Of all the books on Pumps and Hydraulic Motors this is one of the most practical. Treats of the construction of horizontal and vertical water wheels.

COMPRESSED AIR: ITS PRODUCTION, USES AND APPLICATIONS. By Gardner D. Hiscox, M. E. 4th edition, revised and enlarged; 820 pages; 545 illustrations; cloth. Price, $5. The most thorough and comprehensive treatise on the subject of compressed air that has ever been published. Well printed and substantial. No phase of the subject is omitted. Is a complete compendium in 36 chapters, valuable for reference and for study. Contents: The physical and operative properties of air from a vacuum to its liquid state; its thermo-dynamics; compression, transmission and uses as a motive power in operation of stationary and portable machinery in engineering, mining and manufacturing work; air tools; air lifts; pumping of water, acids and oils; the air blast for cleaning and painting; the sand blast and its work; and the numerous appliances in which compressed air is a most convenient and economical transmitter of power for mechanical work, railway propulsion, refrigeration and the various uses to which compressed air has been applied. Contains a list of patents on compressed air from 1875 to date, and 40 tables of the physical properties of air, its compression, expansion and the volumes required for various kinds of work.

ELECTRICAL ENGINEERING FOR ELECTRIC LIGHT ARTISANS AND STUDENTS. By Slingo and Brooker. 346 illustrations; 12mo. Price, $3.50. This new and revised edition contains all data and formulae relating to this branch of electrical application.

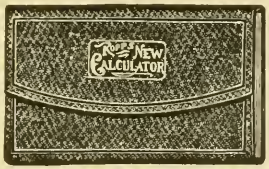
ENGINEERS' PRACTICAL TEST. Actual size, 6x4½ inches; stiff silk cloth. Price, $1. A guide for all men in or about power plants. Indispensable to engineers, mechanics, machinists, firemen, etc. Tells how boilers and engines should be managed. All about gas engines, engineers' license examination questions and answers.



MECHANICAL ARTS SIMPLIFIED. By D. B. Dixon, comp. 497 pages; actual size, 8¾x5½ inches; illustrations. Price, $1.50. With an appendix containing a thorough electrical department, an exhaustive treatise on ice making and a large collection of miscellaneous practical examples. A thorough and original reference book for architects, iron workers, boiler-makers, contractors, civil and mechanical engineers, firemen and ice machine men.

BOOKS OF TABLES. BOOKS OF RECEIPTS

ROPP'S NEW CALCULATOR. 200 pages. Actual size, 5⅝x9½ inches. Cloth. Price, $1.50. Pocket size, $1.00. Sustains the same relation to the commercial world that the new Century Dictionary does to the literary world. Fully abreast with



the age of air ships, submarine boats and wireless telegraphy. Designed for and adapted to the particular wants of bankers, accountants, mechanics, farmers, manufacturers, merchants, miners, etc., etc., and must prove of incalculable value to them—unless the book itself can calculate its own worth—for it calculates almost everything that is calculable.

QUESTIONS AND ANSWERS. Based upon the Standard Code of Train Rules. By G. E. Collingwood, Ed. Revised edition. 80 pages. Diagrams. Cloth. Price, $1. Intended for use in the examination of trainmen. The general rules, train rules, train orders, and the whole handling of trains is set forth in so simple and at the same time comprehensive manner that a careful reading of the book will fit any one with sufficient knowledge to meet any contingency that may arise in the conduct of a train. Endorsed by high railway officials from all sections of the country Every transportation man should have a copy.

FERRIC AND HELIOGRAPHIC PROCESS: A Handbook for Photographers, Draughtsmen and Sun Printers. By George E. Brown. 149 pages. Diagrams. Cloth. Price, $1. For architects, surveyors, draughtsmen, engineers and others who find the reproduction of tracings a matter of everyday necessity. It embraces: The ferro-prussiate process, toning blue prints, uses of blue prints; ferro-prussite in tri-color work; the kallitype process; the Obernettor process; the wranotype process; prints on fabrics, prints in dyes; heliographic processes compared; preparation of heliographic papers, making tracings for sun-copying; outfit for heliographic printing; ferro-prussiate or white line on blue ground; pellet or blue line on white ground; ferro-gallic, or black line on white ground; brown line on white ground; minor heliographic processes. A comprehensive little bibliography at the end of the volume and an index add greatly to its value and interest.

THE LOCOMOTIVE UP TO DATE. By Charles McShane. 736 pages. 380 illustrations. Cloth. Price, $2.50. Covers the whole range of locomotive construction and management down to the present day, including its latest development and all modern appliances, together with a classification and comparison of all kinds of locomotives, both simple and compound. It is a book culled from the mechanical books and papers of the world and so contains all the really valuable information to be found in a complete mechanical library. Every subject is fully illustrated and the descriptions given of all new devices were prepared by the inventors themselves. The contents include: Compound locomotives; combustion; air brake; breakdowns; locating blows and pounds; incrustation; injectors; inspirators and boiler checks; slide valves; valve gears; errors by the link motion; locomotive valve setting; steam indicator; modern locomotives; extraordinary fast runs; lubricators; metallic packings; general information; locomotive construction-erecting department; machine work; metric system; steam and air gauges; compressed air; modern counter-balancing and the history of the locomotive.

ONE THOUSAND POINTERS for Machinists and Engineers. By Charles McShane. 342 pages. 187 illustrations. Cloth. Price, $1.50. Includes articles from the best authorities on each subject. Embraces the most modern and approved practice in the construction, care and economical management of the locomotive. Written in plain language and condensed form, no mathematical demonstrations being given or required.

JOHNSON'S HANDY MANUAL. Price, $1. An authority on steam, hot-water heating and ventilating, plumbing and gas fitting. A valuable reference book for architects, those in pipe trades, engineers, janitors and those intending to install or alter heating or plumbing systems. All kinds of measurements arranged in tables. Fully illustrated with cuts and complete working plans.

FIFTY-CENT SERIES

HANDICRAFT SERIES—A Series of Practical Manuals. Edited by Paul N. Hasluck. Price, each, 50c.

BOOT-MAKING AND MENDING Including repairing, lasting and finishing. Illustrated. 179 engravings and diagrams. Price, 50c. Contents: Repairing heels and half-soling; patching boots and shoes; re-welting and re-soling; boot-making; lasting the upper; sewing and stitching; making the heel; knifing and finishing; making riveted boots and shoes.

Others of the set are:

HOUSE DECORATION. Price, 50c.
HOW TO WRITE SIGNS, TICKETS AND POSTERS. Price, 50c.
WOOD FINISHING. Price 50c.
DYNAMOS AND ELECTRIC MOTORS. Price, 50c.
CYCLE BUILDING AND REPAIRING. Price, 50c.
DECORATIVE DESIGNS OF ALL AGES FOR ALL PURPOSES. Price, 50c.
MOUNTING AND FRAMING PICTURES. Price, 50c.
SMITH'S WORK. Price, 50c.
GLASS WORKING BY HEAT AND ABRASION. Price, 50c.
BUILDING MODEL BOATS. Price, 50c.
ELECTRIC BELLS: HOW TO MAKE AND FIT THEM. Price, 50c.
BAMBOO WORK. Price, 50c.
TAXIDERMY. Price, 50c.
TAILORING. Price, 50c.
PHOTOGRAPHIC CAMERAS AND ACCESSORIES. Price, 50c.
OPTICAL LANTERNS. Price, 50c.
ENGRAVING METALS. Price, 50c.
BASKET WORK. Price, 50c.
BOOKBINDING. Price, 50c.
BENT IRON WORK. Price, 50c.
PHOTOGRAPHY. Price, 50c.
UPHOLSTERY. Price, 50c.

READY SHORTLY.

LEATHER WORKING. Price, 50c.
HARNESS MAKING. Price, 50c.
SADDLERY. Price, 50c.

TECHNICAL INSTRUCTION, Important new series. Edited by Paul N. Hasluck. With numerous illustrations of the text. Each book contains about 160 pages. Crown 8vo. Cloth. Each, $1.

PRACTICAL DRAUGHTSMAN'S WORK. Price, $1.
PRACTICAL GASFITTING. Price, $1.
PRACTICAL STAIRCASE JOINERY. Price, $1.
PRACTICAL METAL PLATE WORK. Price, $1.
PRACTICAL GRAINING AND MARBLING. Price, $1.

OTHER VOLUMES IN PREPARATION.

SPON'S MECHANICS' OWN BOOK. 702 pages. 1420 illustrations. Half leather. Price, $2.50. General method of treatment of each subject is first, the raw materials worked upon, its characteristics, variations and suitability; secondly, the tools used, the sharpening and use; thirdly, devoted to typical examples of work to be done, materials and how to do similar work. Nearly all of the mechanical trades are here included and some of the professions.

...nd
Given

...eceipts and
... formulas and
... manipu... ... for the working of all the
...als and alloys; including the decoration and beau-
...fying of articles manufactured therefrom, as well
as their preservation. Edited from various sources
by William T. Brannt, editor of "The Techno-Chemi-
cal Receipt Book" and "The Metallic Alloys." A new
and splendid companion to all the metal industries.
Fully abreast of the latest inventions and discoveries,
as well in the largest and coarsest, as in the smallest
and finest of metal work. Illustrated by 63 engrav-
ings. One volume, of over 500 pages, 12mo, elegantly
bound in scarlet cloth, gilt, price $2.50. Given for 6
subscriptions.

The Techno-Chemical Receipt Book, containing several thousand receipts, covering the latest, most important and most useful discoveries in chemical technology, and their practical application in the arts and the industries. The materials have been princi-
pally derived from German technical literature, which is especially rich in receipts and processes which are to be relied on, most of them having been tested practically by competent men before being given to the public. In one volume, 495 pages, 12mo, closely printed, containing an immense amount and a great variety of matter, elegantly bound in scarlet cloth, gilt, price $2.00. Given for 4 subscriptions.

Abbott's American Watchmaker and Jeweler, by Henry G. Abbott. An encyclopedia for the horologist, jeweler, goldsmith and silversmith, containing hun-
dreds of private receipts and formulas, compiled from the best and most reliable sources. Complete direc-
tions for using all the latest tools, attachments and devices for watchmakers and jewelers. 354 pages, illustrated with 288 engravings, 12 mo, cloth, price $1.50. Given for 3 subscriptions.

A, B, C of Mining and Prospectors' Handbook, by Charles A. Bramble, D. L. S. "If it were only neces-
sary in 'a gold country' to dig a hole and take the chances of finding gold as one takes chances of find-
ing water in digging a well, it would be different. But it is not so. . . . This little handbook of less than 200 pages, that may easily be carried in the pocket, is intended to arm the new adventurer with just the knowledge of what to do and how to do it." 12mo, cloth, 183 pages, fully illustrated, price $1.00. Given for 2 subscriptions.

How to Make a Fiddle, by H. L. Hand, a Fiddler. This is the only work ever published for the amateur or those who would learn to construct a violin. The author has prepared the text matter from the ama-
teur's standpoint, making it a most simple and prac-
tical treatise. All technical words, difficult mechani-
cal operations and costly tools have been avoided. The book is handsomely illustrated with all working designs, including a large plate showing the actual size of the fiddle, which can be used for tracing in cutting all parts, etc. 12mo, cloth, price $1.00. Given for 2 subscriptions.

Stevens' Mechanical Catechism, by H. G. Stevens. Contains 355 pages of valuable information for sta-
tionary and marine engineers, electricians, firemen, motormen, ice machine men and mechanics in gen-
eral, 240 illustrations, silk cloth binding, price $1.00. Given for 2 subscriptions.

tics of all kinds,
...acts, etc. Dictionary of technical
term ... or setting gear teeth included with each
copy; price $1.00. Given for 2 subscriptions.

REFERENCE.

The Home Law School Series, by Chas. E. Chadman, LL. D., member of the Ohio Bar. Law Practice—In state examinations in every state for admission to the bar, students of these books have passed with dis-
tinction. This course is indorsed by the bench, bar and law schools. During eight successful years these books have proven their practicability. Every man or boy who aspires to the highest success in business will be helped immensely by this modern course in commercial law. The demands of the day are for business men with sufficient knowledge to guide great enterprises safely. No business man can afford to miss this opportunity to enlarge his capacity "In Pub-
lic Life." Legal training is almost essential in an efficient executive or law maker. Our government must, in all its branches, be dominated by minds with legal training. LEARN LAW AT HOME. We offer you a legal education within the reach of all. The seven books now ready are: 1. How to Study Law, $1.50. 2. Constitutional Law, Federal and State, $1.50. 3. Personal Rights and Domestic Relations, $1.50. 4. Contracts and Partnership, $1.50. 5. Agency and Bailments, including Common Carriers, $1.50. 6. Ne-
gotiable Instruments and Principal and Surety, $1.50. 7. Wills and Settlement of Estates, $1.50. To be com-
pleted in 12 large carefully prepared volumes covering the elements of the 20 branches of American law. Other volumes in preparation. Set of 7 volumes given for 18 subscriptions.

Felt's Parliamentary Procedure, for Clubs, Socie-
ties, Fraternal Orders, Political Gatherings, Etc., by Orson B. Felt. In preparing this work the author has eliminated those legislative rules which tend to confuse the student. The explanations of rules are intended particularly for students who have not given the subject much attention, and the arrangement of the book makes it possible to learn in the shortest time everything bearing upon any single topic. Each motion is clearly and briefly explained under its proper head, so that the desired information can be secured by consulting one part of the book. 208 pages, price, leather binding, 75 cents. Given for 2 subscriptions. Cloth, 50 cents. Given for 1 subscription.

Webster's System of Memorizing Easy and Difficult Words, by Wm. T. C. Hyde. It is a book for the desk —smaller than an unabridged, larger than a pocket dictionary and more convenient than either. It con-
tains all the troublesome words in the language. A book for busy people. 12mo, cloth, price $1.00. Given for 2 subscriptions.

Bookkeeping Self-Taught, by Phillip C. Goodwin. Mr. Goodwin's treatise on bookkeeping is an entirely new departure from all former methods of self-instruc-
tion and one which can be studied systematically and alone by the student with quick and permanent re-
sults, or taken up in leisure moments with an abso-
lute certainty of acquiring the science in a very short time and with little effort. Cloth, price $1.00. Given for 2 subscriptions.

Webster's Vest Pocket Dictionary and Gazetteer of the World. A new and accurate lexicon, pronuncia-
tion, diacritical marks and definitions, prepared by highest authorities. Contains other valued features, such as rules of etiquette, Latin words and phrases, business rules, etc. Genuine leather binding, price 25 cents. Given for 1 subscription.

...all
... James H. Ste...
trations, 223 pages, cloth, price $1.00 ...or subscriptions.

Modern Air Brake Practice, Its Use and Abuse, with questions and answers for trainmen, engineers, firemen, conductors, electric motormen and mechanics, by Frank H. Dukesmith, 250 pages, fully illustrated, cloth, price $1.50. Given for 3 subscriptions.

Practical Gas and Gasoline Engineer, by E. W. Longanecker, the best on the subject, cloth, price $1.00. Given for 2 subscriptions.

Locomotive Up-to-Date, the greatest accumulation of new and practical matter ever published, by Chas. McShane, 736 pages, 380 illustrations, price $2.50. Given for 6 subscriptions.

REFERENCE.

Bookkeeping Self-Taught, by Philip C. Goodwin, the most up-to-date system published, 12 mo., cloth, price $1.00. Given for 2 subscriptions.

Parliamentary Procedure, or Rules of Order for Clubs, Societies, Fraternal Orders, Political Gatherings, etc., by Orson B. Felt, 208 pages, cloth, price 50 cents. Given for 1 subscription. Full leather, price 75 cents. Given for 2 subscriptions.

Webster's System of Memorizing Easy and Difficult Words, a dictionary for the home and school, edited by W. T. C. Hyde, 16 mo., cloth, 336 pages, price $1.00. Given for 2 subscriptions.

Business Letter Writing and Book of Social Forms, by Chas. W. Brown, A. M., 16 mo., 208 pages, paper covers, price 25 cents; cloth, price 50 cents. Given for 1 subscription.

North's Book of Love Letters, with directions how to write and use them, 160 pages, price, paper cover, 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Standard Perfection Poultry Book, by C. C. Shoemaker, the recognized standard work on poultry, 200 pages, 80 illustrations, price, paper cover, 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Practical Etiquette or Society Guide, a modern book on politeness, by Josephine Stafford, 160 pages, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Complete Debater's Manual, with arguments, both affirmative and negative, by C. W. Brown, A. M., 160 pages, price, paper covers, 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Book of Toasts and After-Dinner Speeches, by William Young Stafford, invaluable to both old and young, male and female, 180 pages, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Zancig's New Complete Palmistry, by Prof. and Mme. Zancig. This book gives the most simple instructions in the art, 200 pages, 86 fine illustrations, paper cover, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Guide to Successful Auctioneering, or How to Become an Auctioneer, by Chas. Johnson, 140 pages, paper covers, 75 cents; cloth cover, price $1.00. Given for 2 subscriptions.

AMUSEMENTS.

New Century American Speaker, adapted from the Cumnock School of Oratory, 452 pages, over 100 illustrations, the most complete speaker published, cloth, price $1.25. Given for 3 subscriptions.

...co.
Given
Dutch
our leading
paper cover, 25 cents; ... ..., price
Given for 1 subscription.

Irish Wit and Humor, told by our foremost Irish comedians, 160 pages, price, paper covers, 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Conundrums and Riddles, by John Ray. This is the largest and best collection of conundrums and riddles ever published. 160 pages, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Negro Minstrels, Stump Speeches and Black-face Monologues, by Jack Haverly, a complete guide for amateurs for presenting a minstrel performance, 150 pages, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Modern Quadrille Call Book and complete dancing master, by Prof. A. C. Wirth, 160 pages, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Chas. K. Harris' Complete Songster, containing latest songs, 200 pages, paper covers, 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Standard Drill and Marching Book, by Edwin Ellis, containing an endless variety of new original drills and marches with music for young people, 160 pages, 30 illustrations, paper cover, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

The Gypsy Witch Dream Book, containing alphabetical list of dreams on every subject, 210 pages, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Because I Love You, the book of love, courtship and marriage for young and old, 200 pages, price, paper cover, 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Card Tricks and How to Do Them, by Prof. A. Rotenberg. This book gives with careful and easy instructions the newest card tricks and sleight-of-hand yet offered to the amateur. 170 pages, 80 illustrations, price with paper cover 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Tricks with Coins, by T. Nelson Downs. This book explains how to do every known trick with coins 170 pages, 95 illustrations, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

How to Tell Fortunes by Cards, by Mme. Zancig fully illustrated, 150 pages, paper cover, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Gypsy Witch Fortune Telling Cards, by Mme. Le Normand, containing 53 fine enamel cards for telling your past, present and future. Can also be used in playing any card game. Price, per pack, 50 cents. Given for 1 subscription.

Hermann's Book of Magic and Black Art exposed and explained, 180 pages, 41 illustrations, price paper covers, 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

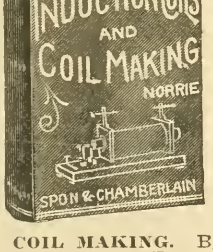
ELECTRICITY

A. B. C. OF THE X-RAYS. By William H. Meadowcroft. 12mo.; cloth. Price, 75c. The best primary work on the subject. A book for the people. The aim of this book is to explain the whole apparatus and the manner of its working in a popular and practical way. The text of the author is beautifully embellished with fine engravings, and nothing is omitted that will give the public a clear knowledge of the remarkable discovery of Prof. Roentgen.

ELECTRIC BELLS AND ALL ABOUT THEM. By S. R. Bottone. 196 pages; 100 illustrations; 12mo.; cloth. Price, 75c. In this volume the whole subject of electric bells is explained in simple language. Anyone can master it in a few hours. The illustrations are great helps to understanding the descriptions. The work begins by showing how the force applied to electric bells is produced, and goes on to tell how to arrange every kind of signal which can be given by electricity, as well as all needed information that belongs to the subject. It is just the book needed by mechanics.

HOW TO MAKE A DYNAMO. By Alfred Crofts. 12mo.; cloth. Price, 75c. A new and especially practical work for amateurs and electricians, containing numerous illustrations and detailed instructions for constructing dynamos of all sizes, to produce the electric light; containing 96 pages of genuine information, which will enable anyone to construct a dynamo either for pleasure or profit.

ELECTRIC GAS LIGHTING. By "Norrie." Fully illustrated; cloth. Price, 50c. You push a button to light the gas and this little book will show you how to do it.



INDUCTION COILS AND COIL MAKING. By "Norrie." Illustrated; cloth. Price, $1. How to make spark coils, bath coils, ray coils, medical coils, induction coils, automobile coils, and gas engine coils, etc. Value of this book greatly enhanced by the American tables of wires.

METAL AND WOOD WORKING

DIES, THEIR CONSTRUCTION AND USE FOR THE MODERN WORKING OF SHEET METALS. By Joseph V. Woodworth. 384 pages; 505 illustrations; cloth. Price, $3. Most elaborate treatise that has appeared on sheet metal work. Will be of special interest to two classes of persons: First, the practical tool maker or die maker; second, the manufacturer who wishes to reduce the price of his product, for the author shows how dies can be used to produce many forms which are ordinarily manufactured by much more expensive methods. Hardening and tempering of press tools and the classes of work which may be produced to the best advantage by use of dies in the power press, fully treated. Engravings illustrate dies, press fixtures and sheet metal working devices, from simplest to most intricate, and the descriptions so clear and practical that all metal workers mechanics will be able to understand how to construct and use them. Many of the dies fixtures treated in this work were either by the author or under his supervision. built by skillful mechanics and are in use in large sheet metal works and machine shops. In 12 chapters.

PRACTICAL GRAINING AND MARBLING By Paul N. Hasluck, ed. Cloth; illustrated. Price, $1. Contents: Introduction, tools and mechanical aids; graining grounds and graining colors; oak graining in oil; oak graining in spirit and water colors; Pollard oak and knotted oak graining; mahogany and pitch-pine graining; walnut graining; furniture graining; imitating woods by staining; imitating inlaid woods; marbling. Value of the book greatly increased by numerous engravings and diagrams.

MODERN WOOD FINISHER. By F. Maire, former editor of Painting and Decoration. 160 pages. Price, 50c. Wood finishing in all its branches is herein treated in an interesting and thoroughly practical manner. Includes: Tools and materials employed; preparation of surfaces; stains and staining; fillers and filling; shellacking, varnishes and varnishing; rubbing, polishing. French polishing, wax polishing, oil polishing, etc. Also a very full description of the woods employed in this work, their treatment and the finishing of floors.

MINING AND METALLURGY

FURNITURE AND CABINET FINISHER. 16mo, price 50 cents. A guide to polishing, staining, dyeing, and other preparations of hard and soft woods, including the various imitations of costly woods, and a multitude of trade recipes and secrets of the trade.

ELECTRICITY AS APPLIED TO MINING. By A. P. Lupton, G. D. A., and H. Perkins. Fully illustrated, price $3.50. Contents: Dynamic electricity; driving of the dynamo; the steam turbine; distribution of electrical energy; starting and stopping of electrical generators and motors; electric cables; central electrical plants; electricity as applied to pumping and hauling; electricity applied to coal cutting; typical electric plants recently erected; electric lighting by arc and glow lamps; miscellaneous applications of electricity as compared with other modes of transmitting power; dangers of electricity.

HARDENING, TEMPERING, ANNEALING AND FORGING OF STEEL. By Joseph V. Woodworth. Large 8vo, 280 pages, 200 illustrations, cloth, price $2.50. Uses to which the leading brands of steel may be adapted, discussed and their treatment for working under different conditions explained, also particular methods for the hardening and tempering of special brands. Chapters: I. Steel, its selection—identification; steel for various purposes; treatment of well known brands of steel. II. Annealing processes; the terms; annealing, hardening and tempering defined; annealing of malleable castings. III. Heating and cooling of steel; location of heating arrangements; use of gas blast furnaces and heating machines; tough steel and hard steel. IV. Hardening of steel in water, brine, oil and solutions; special processes for special steel. V. Tempering; by colors; in oil; on hot plates; by thermometer; in hot water; in the sand bath; by special methods. VI. Case hardening processes; use of machinery steel for cutting tools and the treatment of it. VII. Hardening and tempering milling cutters and similar. VIII. Hardening, tempering and straightening all kinds of small tools. IX. Hardening and tempering of dies and all kinds of press tools or the working of sheet metal. X. Forging and welding. XI. Miscellaneous kinks; tables for use in metal working. XII. Grinding. The text of this work is remarkably well arranged and illustrated and the style clear and free from the use of technical terms.

BRASS FOUNDERS' ALLOYS. By John F. Buchanan. 129 pages, 12 mo. Price, $2. Contains many valuable tables, notes and data for the guidance of manufacturers, and descriptions of approved modern methods and appliances for melting and mixing the alloys.

MANUAL OF MINERALOGY AND PETROGRAPHY. By James D. Dana. 12mo, Illustrated. price, $2.

HARD SOLDERING. By Harvey Powell. 56 pages, 12mo, cloth, price 75 cents. Contains detailed discussion of utensils and chemicals.

MECHANICAL TRADES

HOW TO FRAME A HOUSE; or, House and Roof Framing. By Owen B. Maginnis. Illustrated. Cloth. Price, $1. Part I—Balloon Framing. Part II—Roof Framing. Part III—How to Frame the Timbers for a Brick House. Over 80 large engravings.

HOW TO JOIN MOULDING; or, The Art of Mitring and Coping. By Owen B. Maginnis. 16mo. 55 engravings. Cloth. Price, $1. Methods and appliances necessary to be used in joining mouldings in construction and decoration, showing how to proceed practically and accurately in this important part of carpentry, joinery, cabinet making, plastering, and picture-frame making.

LIGHT, HEAT AND POWER IN BUILDINGS. By Alton D. Adams, M. E. 12mo. Cloth. Price, $1. Presenting in compact form the main facts on which selection of the sources of light, heat and power in buildings should be based, the problem being to determine the kind of equipment that will yield the service required at the least cost.

AMERICAN SANITARY PLUMBING. By J. J. Lawler. 320 pages. Illustrations. 12mo. Cloth. Price, $2. For plumbers, steam fitters, architects, builders, apprentices and householders. Containing practical information of all the principles involved in the mechanics and science of modern plumbing, illustrating, with original sketches, the fundamental principles of everything the plumber should know. Everything explained in the most simple language, so that it will be impossible to misunderstand anything. The best illustrated work of the kind ever published, showing many new appliances and devices not illustrated in any other work.

BUCHANAN'S TABLE OF SQUARES. 9th edition. Price, $1. This well known work has been in use for many years with the leading bridge building firms. Saves time and is thoroughly reliable.

SOAP MAKERS' MANUAL. 12mo. Price, 25c. A plain and practical guide for the manufacture of plain and fancy soaps, washing fluids, medicinal soaps, toilet preparations; shaving soaps and creams, soap powders, etc., for families and manufacturers. Has best American, English, French and German formulas. Any family in the country can make good soap at trifling cost.

HOT-WATER HEATING, STEAM AND GAS FITTING, ACETYLENE GAS—HOW GENERATED AND HOW USED. By J. J. Lawler and Geo. T. Hanchett. Large 12mo. Cloth. Price, $2. For plumbers, steam fitters, architects, builders, apprentices; a book especially valuable for householders. It contains all modern methods and practical information of the principles involved in the construction of steam, hot water, acetylene gas plants, and how to properly do gasfitting. The chapter entitled "Acetylene, How Generated and How Used," is written for the express purpose of putting the user in close touch with the present state of the art. Its methods of manipulation are taken up in detail and from every class of generator on the market. The chapter includes a set of insurance rules compiled from the best codes, and tables of cost of materials and apparatus relative to acetylene generation and consumption. The best illustrated work of the kind ever published, showing many new appliances and devices not illustrated in any other work.

NAVAL CONSTRUCTOR. By G. Simpson, M. I. N. A. Illustrtted. Price, $5. Specially prepared with the object of supplying a ready reference book for those engaged in the design, construction or maintenance of ships, and that the author has been eminently fortunate in carrying out his design is readily seen by any one who will take time to glance through this handy little volume. Treats especially of ship designs for students, naval architects, ship builders and owners, marine superintendents, engineers and draftsmen. It has been the author's aim to eliminate all obsolete and antiquated data and to bring the book in line with present day requirements. It is the most complete thing in its line to b[illegible] presented it in a most attractive form and size.

FISHING, TRAPPING, HUNTING AND POULTRY KEEPING

HUNTER'S AND TRAPPER'S GUIDE. 16mo. Illustrated. Price, 25c. Practical little guide to gunning and rifle shooting, gives satisfaction every time. Has concise information about different kinds of game; making and using traps; snares and nets; baits and baiting, tanning and dying skins and furs; season for trapping; hints to trappers; fire hunting; pigeon catching; camping out; sporting vocabulary; recipes for sportsmen and other points for the hunter and trapper to know.

PROFITABLE POULTRY KEEPING. By Stephen Beale. Edited with additions by Mason C. Weld. 12mo. 278 pages. Illustrations. Cloth. Price, $1. An excellent book for all desirous of making poultry keeping a successful business. The author, a practical man, fertile in expedients, gifted with rare common sense and with a knowledge of his subject on matters of useful and essential detail, gives a book which will result in profitable poultry keeping for its readers.

MISCELLANY AMUSEMENTS

DEPRECIATION OF FACTORIES, MINES AND INDUSTRIAL UNDERTAKINGS AND THEIR VALUATIONS. By Ewing Matheson, C. E. 143 pages. 8vo. Cloth. Price, $3. Second edition with marginal notes. Part I—Depreciation. The general practice of depreciation; the depreciation of land and buildings; division into classes for depreciation; depreciation of plant and machinery; writing off the diminishing value of terminable undertakings; examples and tables. Part II—Valuation. Different kinds of value defined; the value of a factory as a going concern; the rental value of factories; value of a factory that has stopped working; valuation of losses by fire; rateable value of factories; locality of factories; trade fixtures; bills of sale; debentures; index.

METHODS IN THE ART OF TAXIDERMY. By Oliver Davie. 40 illustrations. Price, $2.50. Text by Oliver Davie, who has made Taxidermy his life study, illustrates in a peculiarly lucid manner the most practical methods of the art. The full-page engravings, 90 in number, are drawn by Theodore Jasper. 500 figures in all.

TAXIDERMIST'S MANUAL. 12mo. Illustrated. Price, 50c. Full and plain instructions for collecting, preparing, preserving, stuffing and mounting all birds, animals and insects. Written in popular and intelligent English, so that any intelligent boy can understand and apply its instructions. Not, however, an amateur's guide, but a standard with professional taxidermists, and gives all the processes and secrets of the profession.

THE ART OF BOXING. By Ned Donnelly, Professor of Boxing in the London Athletic Club. 12mo. Price, 25c. With 40 instructive engravings and Marquis of Queensbury rules and London prize ring rules. This work explains every movement of attack and defense in the clearest language; how to hit and hit hard; how to stop quickly and easily, and how "to get away" without even stopping a blow, are all explained plainly, so that one can learn to be a perfect boxer without taking lessons. Also, a "Complete Manual on Training," by John Goulding.

DOG TRAINING. 16mo. Price, 25c. Contains simple tricks and training, to teach him his nam[illegible] to leap, walk erect, dance, jump rope, sit and [illegible]s, down at command, beg, give his paw, sneeze, [illegible]ased, for it, fetch and carry, bring his tail in his [illegible], to stand on a ball and roll it up and down, typica[illegible] to walk on stilts, to go up and down a [illegible] how [illegible] "sing," to stand on his head, and to [illegible] mechanic[illegible] in general. [illegible] the prof[illegible]