PRICE 10 CENTS POSTPAID

THE STAR TOY MAKER

PLANS AND INSTRUCTIONS FOR SCORES OF NOVEL DEVICES

JOHNSON SMITH & COMPANY
6615 E. Jefferson Ave. Detroit, Mich.

Printed in U.S.A.

PRICE 10 CENTS POSTPAID

THE STAR AMATEUR ELECTRICIAN

The HOW and WHY of ELECTRICITY: with PLANS for MAKING and OPERATING ELECTRICAL APPARATUS, TOYS and NOVELTIES

Published by JOHNSON SMITH & CO., DETROIT, MICH.

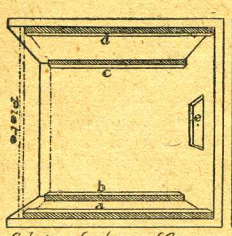
THE STAR TOY MAKER

PLANS AND DIRECTIONS FOR MAKING ALL SORTS OF CLEVER AND ORIGINAL TOYS, TELEPHONES, KITES, CAMERAS, WIND MILLS, RAILROADS, ETC. ILLUSTRATED FROM NEW SPECIAL DRAWINGS. ANY BRIGHT BOY CAN WORK FROM THESE PLANS. EVERY ONE HAS BEEN WORKED OUT BY A BOY.

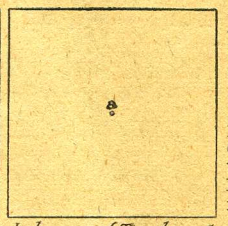
COMPILED AND EDITED BY

JACK READ

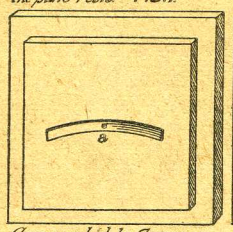
No. 4. *STAR RED BOOK LIBRARY*



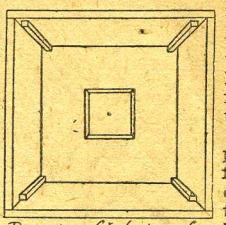
Side view of interior of Camera, showing the cleats on which the plate rests. FIG. 1.



Inch square of Tin, showing Lens or Pinhole. FIG. 2.



Cover or Lid to Camera, showing Plate holding Spring FIG. 3.



Rear view of Interior of the Camera. FIG. 4.

the open end, and bevel the edges with a jack-knife upon the outside of this hole. (See E, Fig. 1.) Take the inch-square piece of tin and drill a tiny hole in the center (see A, Fig. 2), and glue it **inside** the end of the box, in which the beveled hole is cut, so that it will expose the little hole in the tin. This hole in the tin acts as the lens, and should not be larger than the point of a pin.

To make the plate-holder, take four slender pieces of wood, each of them two inches long, and glue them in the four corners of the box so that the end of each will rest upon the end of the box to which the lens has been glued. These little uprights will form the plate-holder, the plate resting upon them a half inch from the open end of the box. (See A, B, C, D, Fig. 1.) It is necessary to get these pegs just a half inch from the end of the box, for this is the focus of the camera, and the plate must be that distance from the lens.

The end or lid (see Fig. 3) of the camera which holds the plate against the pegs, should be made of two thicknesses of the cigar box lumber, the lower piece being small enough to fit inside the box, and the upper piece large enough to cover the entire top. The lid must also be blackened upon the bottom side.

Nail to the under side of this lid the little strip of tin, bent into a half circle (see A, Fig. 3). This tin serves as a spring to hold the plate firmly to the pegs when the lid is put on. The lid may be secured to the camera with any sort of little clamps. I used small hooks and eyes (such as are used on some cigar boxes), four of each. The eyes fastened to the edges of the lid and the hooks to the four sides of the camera.

The plates to be used are 2½x2½ inches, and, of course, must be placed in the camera in a dark room. Fasten on the lid and place the finger over the hole in the end. To expose, take the finger from the hole half a minute and replace it.

Perhaps some of my amateur friends will be able to improve on my style of "shutter."—HORACE WOLCOTT.

A WATER WHEEL.

If you wish to build a water wheel, select a spot on some creek where there is a fall of 2 or 3 feet. Next get two boards, each should be 1½ times as wide as the creek is deep and as long as one-half the width of the creek. Place the boards, V-shaped, in the bed of the creek with a few sticks to support them. The two ends of the boards should be about 1½ feet apart. The other ends should be spread apart till they touch the banks (see Fig. 1). The point of the V should be just at the edge of the falls. The water rushing between the boards and the falls will cause a swift current.

FIG. 3. FIG. 2.

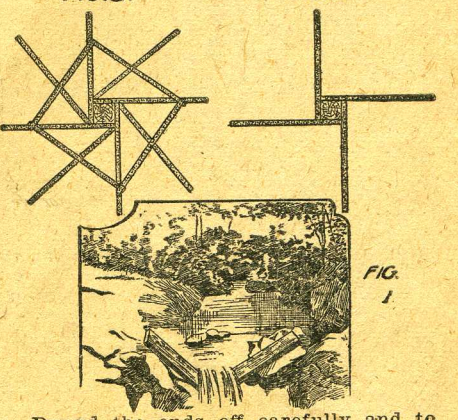


FIG. 1

Now find a long stick, a foot or two longer than the width of the creek and 2 inches square at the ends. Round the ends off carefully and to about the middle of it nail four paddles 1 foot square (Fig. 3).

On both banks place boards, the top of which should be as high above the water's edge as one-half the height of the falls. In each board bore a hole for the axle to rest in.

Now move your boards up till your wheel gets the full force of the water. At one end of the axle you can fix a wheel upon which a belt may be placed so as to run anything you wish it to.—NILES SMITH.

HOW TO BUILD A PADDLE RAFT.

First procure two pieces of pine board 5 inches thick, 8 inches wide and 14 feet long. If dressed boards are not procurable get the rough lumber and plane it smooth. In either case, round all the edges, especially the underside, so the raft will run through the water easier.


Figure 1

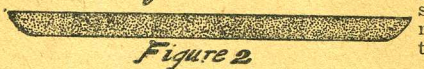


Figure 2

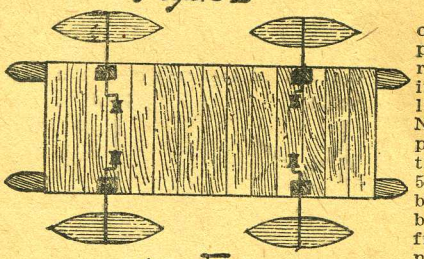


Figure 4.

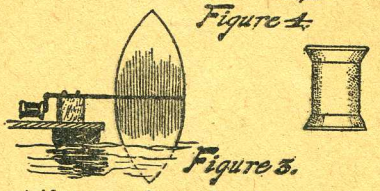


Figure 3.

Next cut the ends of these boards as per Figs. 1 and 2, rounding the corners into shape something like a model boat. Now get some ⅞-inch pine boards and cut them into lengths of 5 feet, which is to be the width of the boat. Start 1½ feet from the stern and nail the planks across as close together as possible until 18 inches from the bow. This is as far as they go.

Any carpenter will for a small sum make the paddle handles and paddles, but if you prefer make them yourself, using two large empty spools for hand grips. See Fig. 3.

Set each paddle on a block at the sides of the raft and fasten them with large staples, loose enough for the handles to turn easily. See Fig. 4.

The raft is now ready, except for the painting, after which you can launch her, and with a little practice learn to be an expert in running her.

The steering is done by the paddles. For instance, if you wish to turn to the left, hold the left hand paddles still and turn those on the right side. In backing turn the paddles in the opposite direction from which they go in going forward. —ORFILLE MESSICK.

A BONE HANDKERCHIEF OR TIE SLIDE.

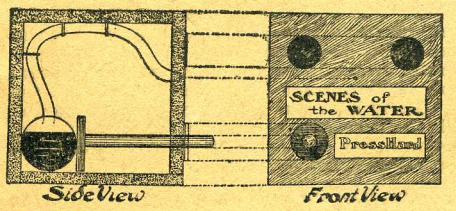
In the "wild and woolly west" the boys wear large silk handkerchiefs around the neck. Instead of tying them, they wear a hand-carved home-made slide made by themselves, as a rule, from the thigh-bone of a sheep. The slide is from 1 inch to 3 inches in length, according to the taste of the maker.

Saw both ends off even, remove the marrow, and cut out the inside of the bone (with a knife or rat-tail file) until the bone is the twentieth of an inch in thickness. Scrape the outside until smooth, take a pencil (an indelible one is best) and draw your pattern, a heart, diamond, initial, cross-swords, star, C. M. A., school or political badge. There are several kinds of carving. For open work cut the pattern **clean out,** so as to show the tie underneath. In raised work, cut the bone from around the pattern, leaving the pattern higher than the rest of the bone. In sunken work, cut into the bone.

A small three-cornered file, a small round file, and an oil stone to keep your jack-knife sharp, are all the tools you need, although with a small drill and a turning-lathe you could do better.—JAS. A. TWEEDIE, O. T. N.

A HARMLESS JOKE.

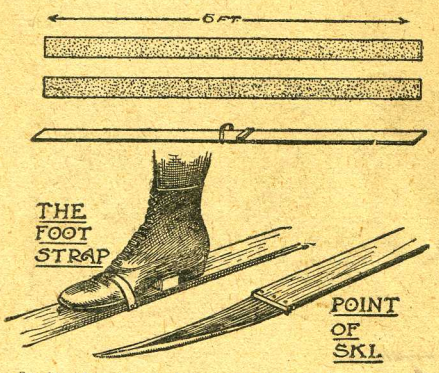
Procure or make a box about 7 inches by 7 inches with a removable back. Cut two holes to look in, about 2 inches from the side and top. These holes must be about one inch across. Next make a push button, as in diagram, this explains itself. Get a ball with a hose about 7 inches long and fasten it to a small hole directly under the eye-holes, and when the lever is pressed on the ball of water your unsuspecting friend will get "Views of the water" for fair.—ARTHUR E. GOODWIN.



HOW TO MAKE A PAIR OF SKIS.

By implicitly following the directions given below it is comparatively easy for a boy of ordinary intelligence to construct a pair of skis with which he can travel on the surface of the softest snowdrift without sinking.

First, procure a hardwood board about six feet long, four inches in width and half an inch thick.



Although soft wood will do, hardwood will answer the purpose better, as it polishes easier, and the smoother the ski is on the bottom the better it will run.

Next get a strap and tack it to the upper side of the ski, so as to form a loop. This should be placed exactly in the center of the ski and should be just large enough to admit the toe of your shoe. A small block should be fastened just back of the strap in such a position as to fit into the hollow of the foot just in front of the heel.

For the front part of the ski a piece of tin may be used. This should be about a foot long, four inches wide at one end and tapering to a blunt point at the other. It should be fastened to the under side of the front of the snowshoe and the pointed end turned up. The nail heads and all sharp points of tin should be filed off so as to make the under surface of the snowshoe as smooth as possible.

The other ski should be made in the same manner, great care being taken to get it the same size and weight as the other one. As it is rather hard for an inexperienced person to use them, it would be better to use a shorter pair at first.

With a little practice a boy can coast down a hill on these skies, standing erect.—MORTON WALKER.

NIGHT HELIOGRAPHY.

I will endeavor to describe to my "Young Craftsmen" friends, a night "Heliograph" instrument. This is not so complicated an affair as the military instrument, but, under the right conditions will answer the purpose just as well.

The machine sends messages by the aid of light flashes, which, with an unobstructed view can be seen for a half mile or more, at night.

To construct the machine, procure of your grocer a wooden box about one foot high by eight inches wide and eight inches deep. This is to hold the lamp, and a common kerosene lamp will answer the purpose.

Bore a few ½-inch holes in the top of the box for ventilators. In the front of your box bore a 1-inch hole. This is where the messages are sent from. On the hinged cover of your box fasten some kind of a reflector to strengthen the flashes. Then, you will have to fix some kind of a shutter. I made mine of a piece of tin, 5 inches long and 2 inches wide and hinged it with a nail, like Fig. B in diagram.

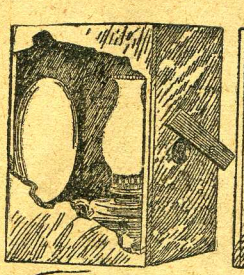


Figure A.

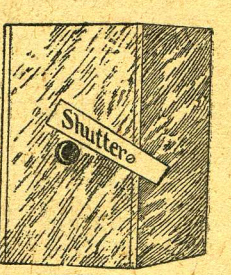


Figure B

Of course, your chum must have an instrument like yours. At night you set your machine up in a window, facing your chum's house, and turn out all the lights. You send a few short, rapid flashes; he seeing them, will get his machine in readiness and answer you, then you are ready to go ahead and carry on your conversation.

Use the Morse code for alphabet; a short flash for a dot and a long one for a dash. Fig. A and B will fully explain the machine.—HERBERT D. STRATTON.

A FOURTH OF JULY TOY.

Probably you never saw a battleship blown up by a torpedo, but read the following and you will learn how to make a small battleship which is blown up by a cannon-cracker.

First get a piece of wood 1 foot long, 3 inches wide, and between ¼ and ½ inch thick. Shape this like Fig 1. Now get two strips of cardboard long enough to reach along the sides of Fig. 1, and 3 inches wide. Paste these to the board. So far you have Fig. 2.

Next get a piece of thin wire long enough to pass through the boat like Fig. 3, 1 inch down from each of the lines marked A. Have the wire pass through the middle of a match before you put it through the sides of the boat. Now have a string tied to the bottom of the match in a way it will not slip, and put the string through the part of the boat marked B.

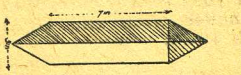


Figure 1.

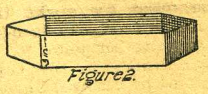


Figure 2.

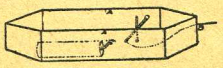


Figure 3.

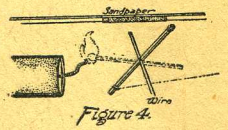


Figure 4.

Then put a cannon-cracker in the bottom of the boat, so when you pull the string the match will move like Fig. 4, so as to touch the fuse of the cannon-cracker.

Now you are ready to make the cover. Get for it the same size board that you had for the bottom, only you must have a small piece of sandpaper about 1 inch wide, and three inches long. Place this on the cover so when you pull the string the match will scrape against the sandpaper and light, and then light the fuse of the cannon cracker. Also paste the cardboard to the cover of the boat the way you did to the bottom. You may add one or two small sticks for masts, with paper sails. Do not make the boat strong, but strong enough to be able to sail until you wish it to explode, because if it is not strong it will make a better wreck.

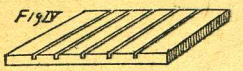
This little novelty makes a pretty amusement at night. Any bright boy can make one in a half hour.—GEORGE DAIDY.

HOW TO DRAW AN EXACT LIKENESS OF ANY PERSON.

It is very necessary that you should make a special box for this purpose, the dimensions of which are as follows: 1½ feet high, 1 foot long, 1 foot wide. Mark off both top and bottom as shown in Fig 4. Saw these lines to the depth as shown in Fig. 3. Now saw a hole in the front piece, perfectly in the center. (See Fig. 2.) Nail this front piece to top and bottom, also nail one side on. The other side must be fastened on with a hinge, so that it can be used as a door. The back is left entirely open. Now purchase a piece of ground glass, large enough to reach from bottom to top of the inside of the box. This you slide into the grooves, close your hinge door, and place the person

you wish to sketch in front of a window and also in front of the lens. You must fit a lens in the hole in the front. Any ordinary reading glass or magic lantern glass will answer. Now, by standing back of the ground glass you will notice an image on it. If you do not, move the ground glass in one of the grooves nearer to the lens or possibly further away, and when distinct sketch off with a copying pencil or indelible pencil. After you have sketched the image or face on the ground glass moisten a sheet of paper very slightly. Place the glass on a table face up. Lay your paper on the top of the glass and by gently pressing on the paper you will transfer your drawing to it; you will have a perfect likeness. Should you not care to purchase so large a piece of ground glass, then make a wooden frame, as in Fig. 1, and saw a little square hole in it, but bear in mind the hole must be in a perfect line with the hole in front of the box. By placing a large cloth over the top of the box, and by getting under it, you will be able to see the image much clearer. Keep as much light out as possible. If you cannot purchase a ground glass, take a file and rub it over an ordinary window pane and you can easily make one. The groves in Fig. 3 are to be the width the saw will make them. Paint the box black inside. To find the center of a board, draw the lines across, as in Fig. 5, and where they cross, that's the center.

Fig III



A DOG SLED.

Here is an article that will prove invaluable to the young hunter or trapper during the snowy days of winter. It is simple and easily constructed. It provides for you means by which to carry more luggage than is absolutely necessary, with less trouble and greater ease than it has before caused you to only carry what you absolutely needed. With this contrivance and a dog, no matter how small or large, all

that you have to do is to carry your rifle or shotgun and lead or guide the dog, for now the dog will carry the load. To make this handy little sleigh requires but a short time and little work.

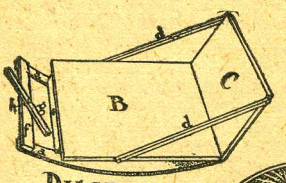
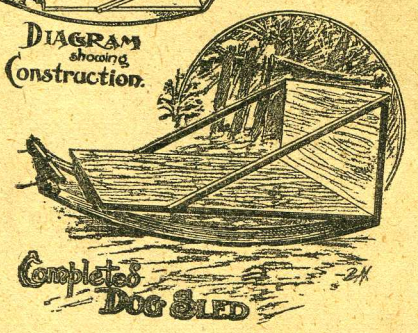


DIAGRAM showing Construction.



Completed DOG SLED

In the first place you require two barrel staves to serve as runners (A). These should be about three or four inches wide and perfectly smooth on the under or running side. Connect these about 6 inches from their front ends by the piece E (1 foot long by 1 inch wide by 2 inches high).

Now proceed to make the body of the sleigh in this manner: For bottom (B) take a board 1½ feet wide by 2 feet long and as light as will stand the weight you wish to carry. To the rear edge of this nail the back board (C), which is a solid board 1½ feet long by 1 foot high. Connect the top of this (C) on both sides with the bottom (B) 1½ feet from the base of C by the board D (20x1x1 inches). Now nail the rear ends of the runners (A) to the rear corners of the bottom (B), and nail the front of B to the board (E) which is holding the runners together. Now across the front tips of the runners extend the board (F) (18 inches long by 2 inches wide by 1 inch high) through the center of this bore a ½-inch hole (H). Then make the whippletree (G) (15x1x1 inches,), boring a ½-inch hole in the middle of this also, and join the two by a bolt through H.

The purpose of the whippletree is to keep the sleigh from swaying when being draw on the run.

A simple harness may be made for the dog by attaching traces to each side of his collar and at each end of the whippletree.

On this sleigh a comparatively light dog could carry a weight of nearly 75 pounds. Besides its mere carrying properties it insures a dry place to sit on while cooking or eating your lunch while on the hunt, and keep your goods perfectly clean and dry.—WILLIAM WHITEMORE.

HOW TO MAKE A CANOE FOR $1.00.

Get from a grocery store two strong boxes about 2x3 feet and nail them endwise, as in Fig. 1. Then nail two boards, about four feet long, across underneath the boxes, as shown in the sketch.

First see that your boxes are as near water tight as you can get them so, by caulking up the cracks with tar or putty. A good plan would be to cover the whole bottom and sides with canvas, and tar it over, and lacking tar, paint it. Now procure two wooden coal oil cases (C C Fig. 2) with two sound empty oil cans in each. Paint or tar these cans outside and see that they are airtight. Nail the wooden cases on to the boards F F, and also to the boxes A B, as shown in Fig. 2. Go over all the boxes with more nails so that they can't come apart with rough handling. You can also wrap the boxes securely together with galvanized wire. Tar or paint the whole outside of the four boxes.

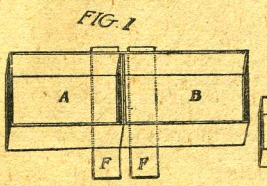


FIG. 1

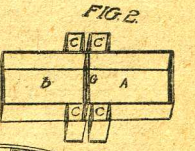


FIG. 2

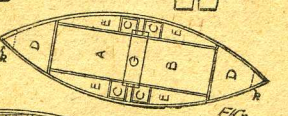


FIG. 4

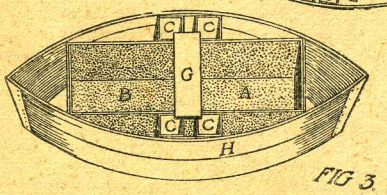


FIG 3.

Place a seat across the boxes at G. Then get four spring boards (H H in Fig. 3) and nail outside these boxes. Bring the ends to a point at each end, as shown in Fig. 4. The ends can be further secured by nailing sheet iron across the point, as shown by K in Fig. 4. They can also be nailed to two boards (A A) and further secured by wire threaded through the boards at K Fig. 4.

Now you have a boat or canoe as shown in Fig. 4, but the

only water-tight portions for the occupant are the two boxes A B. The air in the oil cans will make the whole so buoyant that it cannot sink. If more buoyancy is needed two or four more airtight cans can be secured in the spaces D D or E. E, or dry boxes can be put in there to contain articles needed. Of course, if you can cover the whole underneath part of the canoe with canvas and tar it over and thus keep out the water from the partitions P P and E E the boat will travel faster.

The boat cannot possibly sink if you see that your oil cans are kept airtight.—BARNHARD BENSON.

AMERICAN BOYS' MODEL R. R.

Where is the boy who, at sometime in his youthful career, has not longed for one of those expensive, and sometimes very fragile model railways for sale at most of our toy stores?

But our boys must not think that because these railways cost so much they will have to do without. Why so, when here right before their eyes are easy, simple instructions for making "the boys' own" model railway.

It will not be so hard to make as one might suppose. However, you will have to follow instructions very closely if you would be successful.

First of all come

The Ties.

Take an inch-board (as free from knots and imperfections as possible), cut it into pieces 5 inches long. Then with a chisel split them into pieces about one-half inch square by five inches long. You will cut as many of these as you need, which, of course, depends upon how long you want your railroad.

Next in turn come

The Rails,

which are merely strips of tin 14x1½ inches, bent to the shape of Fig. 1. A is the bottom, or part of rail that rests on the ties. B is the top of rails, or part that the wheels run on. Notice here that the tin is turned down at B to form a smooth surface for the wheels.

To bend a piece of tin evenly it is a good plan to scratch a line with a nail—or sharp tool—using a ruler as a guide, along the place you wish to bend. When you have done this you can bend evenly and in a straight line.

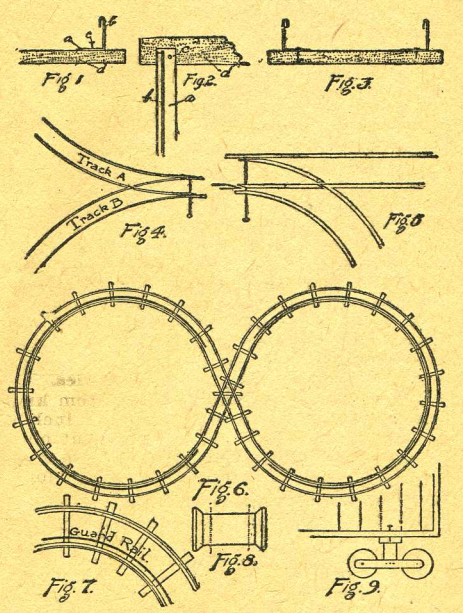
After you have finished the rails and ties you are ready to lay your

Track.

In doing this be very careful to keep the rails the same distance apart all along your line. If you don't your train

will run off the track. A nice gauge is about three inches, that is, three inches straight across from one rail to another. This gauge is just about right for the five-inch ties explained above.

It is best to have the bottom (A, Fig. 1) of rails on the inside, as that makes the track more real. The rails are tacked to the ties by means of small carpet tacks (C, Fig. 1). D, Fig. 1 represents the tie. When you come to the end of a rail you must be very careful not to let it extend more than half over its tie, so that the next rail may occupy the same amount of space **on the same tie.** (See Fig. 2: A is the bottom of rail—same as A, Fig. 1. B is the top of rail—same as B, Fig. 1. C is the tack—same as C, Fig. 1. D is the tie—same as D, Fig. 1.) Also notice that in Fig. 2, A—or the bottom of rail—is on the inside, as described above. (Fig. 3 shows this nicely.)



Now that we know how to lay straight track well, we will turn to more complicated work, the first of which will be a few

Switches.

Although they are hard to make, they are easy to understand, and the author has decided that a few illustrations would be of more value than much more explaining; and what would be best of all would be for the young railroad magnate to go to some nearby track and examine the real,

big switches. Fig. 4 is a nice switch and the easiest to make. A is the lever which regulates it. If you pull the lever toward track B the train will run on track A, and vice versa. Fig. 5 is a more common switch, and the one you would most probably see if you went to a railroad to examine. However, in principle, it is the same as Fig. 4.

If you don't succeed at first, try again, for sometimes even three or four attempts are made before success is attained.

After we have made three or four good switches we may turn our attention to

Bends and Curves.

Take one of your finished rails, and with an old pair of shears cut slits in bottom (A, Fig. 1) of rail about one-half inch apart. These slits enable you to bend the rails nicely, on one side by gaping apart, and on the other by slipping over. You now lay your ties in a curved line, and bend your rails as you tack them to the ties. Here, also, you must be very careful to keep your rails exactly three inches apart. If you wish, you can add a guard-rail to keep the train from running off the track while on the curve. It is represented by the middle rail in Fig. 7. You must be very careful to always place it on the side that the curve turns to. For instance, if the curve turns to the left, you must have the guard-rail on the left, otherwise it would do no good.

If you need practice in this line nothing could be better than to construct a "figure eight." There you will have to make eight pieces of curved track and one crossing. (See Fig. 6.)

We now have a complete line—switches, curves, straight track, etc., and are ready to build our

Engine.

For the foundation use a board 12 inches long, 3 inches wide, and one inch thick. To this nail a round cylinder of wood or tin, about three inches in diameter, letting the board project in front one inch farther than the boiler.

Now cut a piece of broom handle 1½ inches high and stick it in a hole previously made about one inch from front of boiler. This forms the smokestack. If you wish you may add a sand-box, whistle, bell and headlight, although they are not absolutely necessary unless you wish to have an exact model of a big throbbing American engine. For the cab use a small cigar or tin box, about 3x2x4 inches. Nail it behind the boiler and cut out or paint windows in the sides.

Next we make the driving wheels. They are four in number. To make them, cut from a piece of 1½-inch wood four circles, each five inches in diameter. Then cut from a piece of very stiff cardboard four circles, each [illegible] inches in diameter. Glue, or tack, the cardboard to the wooden wheels, letting the projection be the same all around, and make an ⅛-inch hole in the exact center of all four wheels. With shingle nails fasten one pair of wheels right by the side of the cab. The other pair should be fastened a little farther to the front. The rims of the two wheels on one side should be about 2½ inches apart.

Our engine is all ready for the track now, except a cow-catcher. This is made from a solid block of wood cut to shape and screwed to the front.

The Car Trucks.

There are two kinds of material of which car wheels may be made: Wood and type metal. The type metal ones are easy to make if one knows how, but I cannot take space to describe the process, so those that don't know will have to do with wooden wheels, unless they know someone who can tell them.

To make the wooden kind take an empty No. 35 linen thread spool and cut it as along the dotted lines in Fig. 8, throwing the middle portion away. Now you have one pair. Keep on in this way until you have enough wheels or your supply is out. For axles use ordinary two-for-a-cent pencils. If you cannot collect enough No. 35 spools, ask some dressmaker to save some for you. If you make the wheels of type metal it is best to have the axles made from thick wire.

Box Cars.

These can be made from cigar-box wood, while passenger coaches had better be made from tin. Fasten two pairs of wheels at each end of the cars, in the manner shown in Fig. 9, and your line is complete.

By establishing several stations, with a good long run of track, switches, etc., you will have a fine little model, and one that, as you grow older, you will always look down upon with pride, and think of those happy hours spent in that boyish pleasure.—RAY NOLAND.

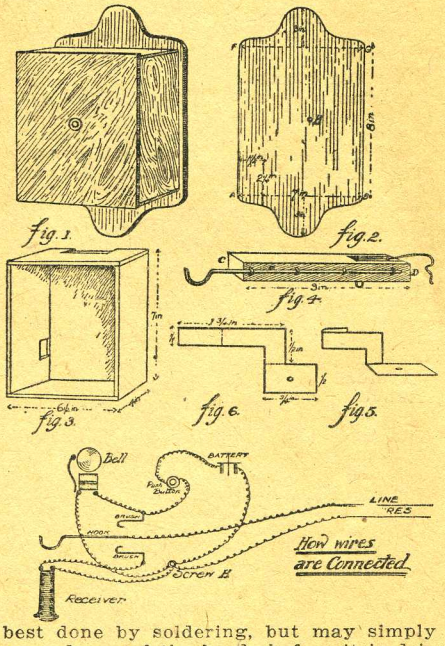
HOW TO MAKE A TELEPHONE.

The general rule in describing how to make a telephone is simply to describe the part known as the receiver, but I am sure some would like to know how to arrange for some means of calling by an electric bell. The telephone which I will describe had a bell and two dry cells contained in a wooden box, as shown in Fig. 1, in which also the "connections" were made.

The back of the box consists of a ½-inch board, the shape and size as shown in Fig. 2. The rest of the material for box was of ¼ or ⅜-inch stuff, the two sides being 4x7 inches and the end pieces 4x6x½ inches. The end-pieces were

thus long enough to be nailed clear over the sides, as shown in Fig. 3. The lid was 6¾x7¾x¼ inches, thus, when nailed on it will project over the front of the box about ⅛ inch all around.

Take a small block ½x½x3 inches and to it fasten a heavy iron wire bent into the form of a hook, as shown in Fig. 4. This may be fastened by staples or nails bent over the wire after first being driven in on one side. Next punch a hole through the block on one side of the wire about an inch from the end nearest the hook. The hook should be 1½ inches longer than the block. Next take a piece of tin a little less than ½-inch wide and about 4 inches long and tack it by means of small brads to the block so that it extends over the end D and an equal distance over the top and bottom. To this strip of tin must be attached a wire about 12 inches long. This may be best done by soldering, but may simply be twisted tightly around one of the brads before it is driven in. Also drive a staple in the under side of C D midway between D and the hole in the block.



Next cut two pieces of tin to the shape and size shown in Fig. 6 and afterward bend them like Fig. 5. Through the base of each, punch a hole by which the screw holds it in position and allows wire to be connected.

Take a 1-inch round-headed screw and after placing

washer on it pass it through the hole in C and drive it into the back board at a point about 2¼ inches from line A B and 1½ inches from left edge just far enough to allow C D to turn easily, but not so loose that C D will wabble.

Place C D in a level position and fasten the two tins like Fig. 5, which we will call brushes so that the part E of one is ⅛ inch above C D, and the part of the other ⅛ inch below C D, and so that by moving C D a little they will touch C D one at a time near the end of the strips. Keeping C D level drive in two small brads, one ¼ inch above and the other ½ inch below and near the end of D, so that they will act as stops for C D. Take a small length of spring, say about 1-inch long, and ¼-inch diameter, and fasten one end to the staple in C D. Draw the spring just tight enough so that C D touches the lower nail and fasten the other end of the spring by a staple driven in the back.

Upon this hook the receiver is to hang when the work is completed, and if everything has been made right when the receiver is hung up the tin on C D should touch E of the upper brush, while if it is taken down the tin on the lower side should touch E of the lower brush.

Next get an electric bell having a 2½-inch gong, and fasten it to the center of the back so that the bell and hammer would be above the top of box (Fig. 3) when placed on. On account of this a place must be cut in top of box and at center of back edge about 2x1¼ inches. Also at the left side a hole about 1x¾ inch must be cut to allow the hook to protrude and also to move up and down. From one binding-post of the bell bring a wire and connect it with the upper brush, placing the end under the washer and screw head which hold the brush in position. Also connect a wire about 6 inches long to this brush.

At any convenient point on the back, as H, place a ½-inch round-headed brass screw, having two washers on under the head. This must be attached electrically, by placing between the copper washers the ends of four wires. One goes to the binding-post of the bell not already connected. Another goes to one binding-post on the telephone receiver. Another is left free 8 or 10 inches long to go to push button, as shown hereafter. The fourth passes through a hole in the back and makes connections with one line wire. Also the wire which is attached to the tin on C D makes connections with the other line wire. However, it should not be drawn so tight that C D will not move.

The other wire from the telephone receiver is connected to the lower brush. The batteries are then placd in and one binding-post of one is connected with 6-inch wire left attached to upper brush. The other pol of this battery and

one opposite kind on the other must be connected by a short wire. From the remaining binding-post a wire is left to connect with the push button.

The push button is fastened to the center of the lid. Holes are punched and the wire pushed through and properly connected. The lid is then nailed on, the receiver, if not already connected, is connected and hung up, when the telephone is complete.

If the receiver has no hook or screw-eye by which to hang it up drill a hole in the hard rubber on the end and insert a screw-eye. The wires for receiver must first be fastened on inside and then brought out through a hole in left side of box. A pony telephone receiver is not found satisfactory when spoken through, as is necessary in this case. Always have the receiver hanging up when not speaking.

It is evident that two such telephones as above described are necessary in order to carry on conversation. They may be placed in different rooms and No. 18 electric bell wire used for a line. The whole box should be screwed to the wall by screws passing through parts I and J of Fig. 2. The whole is then shellaced.

If only a very short line is used one cell may be all that is necessary. Try this before nailing on the lid. From the dimensions of the box it is evident that it is made to contain two standard-sized dry cells.

Where electrical connections are made it is best to use brass screws and copper washers.

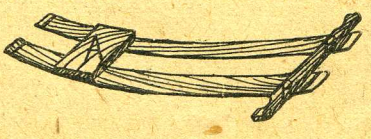
If your telephone does not work examine all connections and see that the covering on the wire is perfect, so that there is no short circuit.

With such a telephone, no matter how cold or stormy it is, your chum and you can talk as comfortably as if both were seated in the same room.—ARTHUR F. REQUA.

THE GRASS SLED.

Out here in California we have lots of fun coasting and we do not have to wait for snow. In fact, in many places snow is an unknown quantity, but boys in these places may enjoy all the pleasures of a coast down hill (provided there is a hill) by the use of a barrel-stave grass sled.

Take two sugar or flour-barrel staves (the widest you can get) because they are lighter than many other kinds. Nail them together 4 inches apart with a piece (A) 12 in. wide, ¼ in. thick and long enough to go to the outer edge of each stave. This will form a seat (A). Now



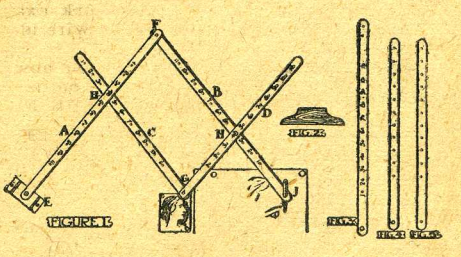
nail a piece 2 or 3 inches wide and 1 inch thick (B) at the other end and let it project 3 or 3½ inches on each side of the staves (C). These are to put your feet on. Now take your sled to the top of a steep hill covered with dry grass. Have your brother get on the sled and make a track by pulling him down two or three times. After this performance the sled will slide down alone (with you on, of course) and won't stop till you get to the bottom. It is excellent fun and the longer the sled is used the faster it will travel, as the runners will become polished by friction and the "track" in the grass likewise.—JAMES E. PREVORROW.

A USEFUL DRAWING INSTRUMENT.

Anyone who desires to copy a design from paper on to wood or to enlarge a drawing for any other purpose, will need a pantograph. It is especially useful to boys who do fret-work or inlaid work, and its construction is so simple as to require only a brief description.

The instrument is made of wood, and consists of four perforated strips, A, B, C, D and a block, E. These strips are arranged as in Fig. 1, joined together at the intersections, the two crossings being also joined together at F and G.

Perforations are made at certain distances along the strips, according to a set scale of measurement. The joint which connects the top pairs should be riveted, while the joints between the two crossing strips in each pair can be shifted as desired, by inserting joint pins H in different holes in each limb. By thus changing the pins a copy is reproduced on any scale, larger, smaller, or the same size.



Make the block (E) 1 inch thick, ¾ inch high and 3 inches long, shaped as in Fig. 2. Cut two wooden strips (A and B Fig. 1) 1 foot 3½ inches long, as in Fig. 3. At J drill a ⅜-inch hole for pencil to fit, and at other end of strip B drill a very small hole. These holes should be 1 ft. 2¼ in. apart from their centers, and the limb A should be similarly drilled, but with small holes at each end. Cut the strips

for C and D 12⅝ inches long, and ⅝ inch from end of each drill a hole and insert a tracing point (G) which can be a 1-inch wire nail. When joined together the strips will look like Fig. 1, each strip being ¾ inch wide ⅛ inch thick, as shown in Figures 3, 4 and 5, and the perforations along the strips being ⅞ inch apart. The intersections at H H are coupled together with small screw eyes.

When copying, numbers that correspond on the strips are put together, the end K pivots on the block E, which is immovably screwed to the table, the end hole J carries the pencil, and the bottom joint of strips C and D carry the tracing point G. Thus, lines traced by G are simultaneously drawn by J on a larger scale, according to the adjustment.

If a reduced copy is desired the tracer is placed at J and the pencil at G. To operate, fasten design under tracer G, follow its outlines carefully with the tracer, and pencil at J will repeat each line on a larger scale, according to the adjustment of the strips.

WAX FLOWERS.

Hold a lighted wax (not grease) candle over a glass of water and let some drops of wax fall into the water. As soon as it touches the water each drop will be transformed into a floating white cup. These little cups have exactly the same shape as the flowers of the lily of the valley and may be made large or small, according to the distance from the water the candle is held.

Now take a piece of very fine wire, with a small hook or knob at one end, and with it pierce the center of one of the wax cups, while it is still in water. Push the cup down till it rests on the hook of the wire and repeat the process until there are eight or ten cups wired; then intertwine the wires with the smaller cups on top and place in a vase, surrounded by pointed leaves made of green paper. These artificial cups wonderfully resemble the natural flower.

THE BOW AND ARROW.

A bow and arrow are the essential things in archery. I will first tell how I make the bow. There being several kinds of bows, I will not undertake to describe them all, as I am not acquainted with their numerous styles. I think that the long bow which was formerly used in England is a good model.

First obtain a straight piece of well-seasoned bois d'arc, free from knots and about 5 feet long. (Cedar, hickory and pecan are equally as good material.) Flatten the piece down to about 1 inch thick and 1½ inches wide. Find the middle of the piece and measure off about 2 inches from it towards the ends: A A.

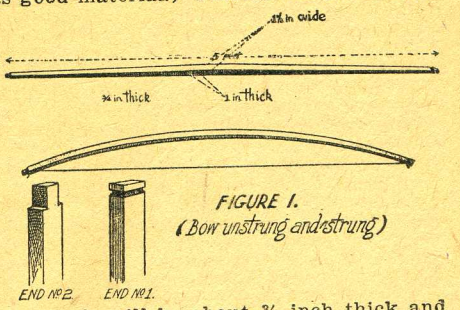


FIGURE 1.
(Bow unstrung and strung)

With a drawing knife gradually shave down the wood, on one side only, from the 2-inch lines, to the ends, so that halfway between the 2-inch lines and the ends it will be about ¾ inch thick and the ends about ½ inch thick. Also taper the 1-inch side, making the ends 1 inch wide by ½ inch thick. See drawing No. 1.

Test the bow by grasping the ends and bending it across the knee; if too stiff shave off a little more until each end bows evenly and in harmony with the other; otherwise it will not send the arrow true.

Put notches in both ends. One like end No. 1, and the other like end No. 2. Smooth off the sharp edges and dress down with sandpaper. Next, secure a strong cord or twine, about six inches longer than the bow, and in proportion to the bow's strength, and loop over end No. 1. When ready to use it, bend the bow, draw the string tight, and loop over end No. 2. Do not keep the bow strung up when not in use.

Hard light wood, about 3½ feet long is the best for arrows. Taper the arrow from the head, leaving it about ¾ inch in diameter, to the smaller end about ½ inch in diameter. There are several ways of heading the arrow, but I will give you one of my own manufacture. Bore a hole with a ¼-inch bit in the end of the head of the arrow (wrap with wire to prevent splitting) about as deep as half the length of a six-penny nail. Thrust the head of a nail of the same size to the bottom of the hole

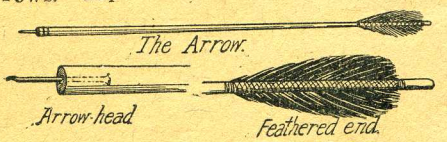


FIGURE 2.

and pour hot lead around it. The lead serves the double purpose of giving weight to the head of the arrow and welding the nail in place.

Cut a notch in the smaller end of the arrow to fit the string. Take a white goose or duck feather and instead of splitting the stem of the feather, strip the feather from the stem. On each side of the arrow (within an inch of the smaller end) glue the feather, and to make it more firm, wrap each end of the feather and along the middle with silk thread. Trim the feather so as to make it look like drawing No. 2.

Before using the bow for the first time rub it with linseed oil. If the oil is applied every month or so, whenever it seems to get dry, it will make the bow last longer. Paint the arrow in red oil paint, so that the rain will not injure it, and it can be found more easily.

To shoot the bow, grasp with the left hand the thick part, and place the notch of the arrow on the string, draw back with forefinger and thumb (some prefer to use the first and second fingers), bring to a level with the eye and in range with the object at which you are shooting, and after having drawn the arrow back sufficiently far, release the hold on the arrow. After some practice one may become accurate enough to bring down birds on the wing.—NORVIL BEEMAN.

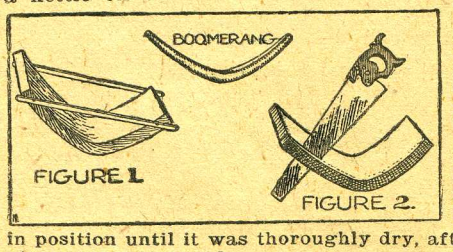
HOW TO MAKE A BOOMERANG.

"What are you making, Jim?" asked Jim's chum, as he came into their shop.

"It's going to be a boomerang when it's done," said Jim.

"Well, let's see how you make it."

"Now I'm just starting in, so you can watch me." Jim took a kettle off the fire and scalded a piece of well-seasoned knotted hickory plank and allowed the wood to remain in the water until it became pliable enough to bend in the shape of Fig. 1. When it had assumed the proper curve he nailed on the side-pieces (1) to hold in position until it was thoroughly dry, after which the side-pieces were removed.



He sawed the wood in as many places as would allow (Fig. 2). Each piece was now a boomerang in the rough that only needed to be trimmed up with a pocket knife and scraped smooth.

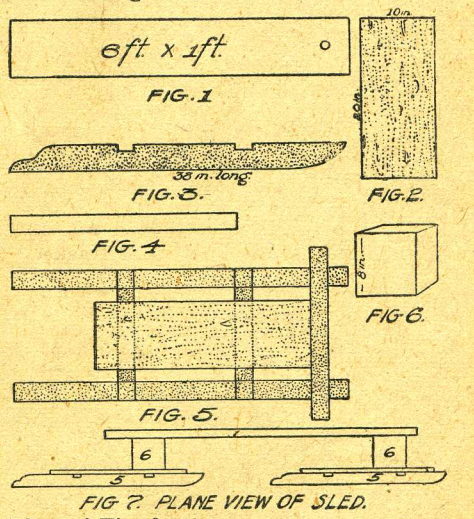
"There, it is finished!" exclaimed Jim. "Now let's try them." They went out in a field and before he threw his he showed his chum the way to hold his boomerang. To throw a boomerang, grasp the weapon and hold it as you would a club. Always hold the hollow side away from you and take aim at your target about 150 feet away. Never throw one in a crowd, as it is very dangerous.—NOMEN.

HOW TO MAKE A BOBSLED.

Procure a plank 6x1 feet and 1½ or 2 inches thick. This is the topboard as shown in Fig. 1. Somewhere near the end and in the center bore a hole about one inch in diameter.

Next get some wood and plane it up as shown in Fig. 3. Cut two notches in 1½x1½ inches. Make four of these boards.

Next cut four boards 1½ inches wide by 15 inches long (Fig. 4). Next cut a board 20 inches long, 10 inches wide, as Fig. 2. Now get two blocks of wood 8x8 inches. In one of them bore a hole one inch in diameter. Then get an iron bolt.



Take Fig. 4 and fit it in the notches of Fig. 3.

Next take Fig. 3, bore a hole one inch in diameter near one end and in the center. Take Fig. 2, nail it on these cross-pieces with hole near the front. Do the same with other sled, but do not bore a hole in Fig. 2.

Fig. 5 shows a single sled looking at it from above. On Fig. 5, the sled with a hole in, put the block with the hole of the block exactly over the hole of the board. On top of the

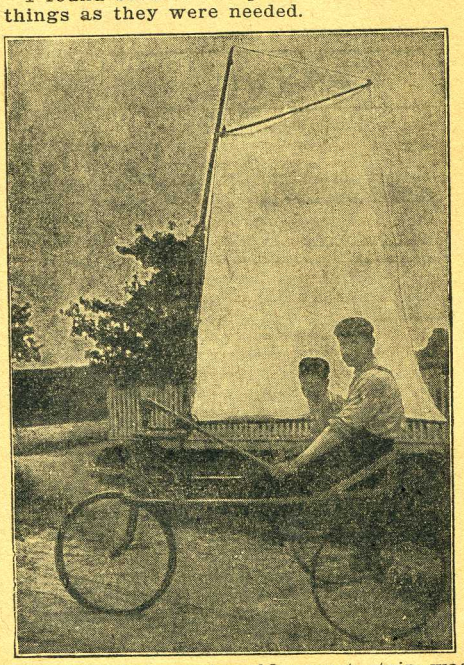
block put the topboard (Fig. 1) with the hole over the hole in the block. Through these holes slip an iron bolt.

Now take the other sled, nail the block on the board and on the block nail the topboard as in Fig. 7. Then sled is finished.—R. KOHN.

A WIND MOBILE.

I read of beach automobiles used on the Florida coast that were like a house-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 seven fence pickets for the framework and other things as they were needed.



Two rake handles were utilized for the mast and boom and a broom handle for splicing out the boom. 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 used. The wheels were cast-off bicycle wheels, the iron bar between the back wheels cost 15 cents and the pulley which raised and lowered the sail cost 5 cents, making in all a cost of 20 cents, the other things being found at home. An old carpet strip was the bed for the mast.

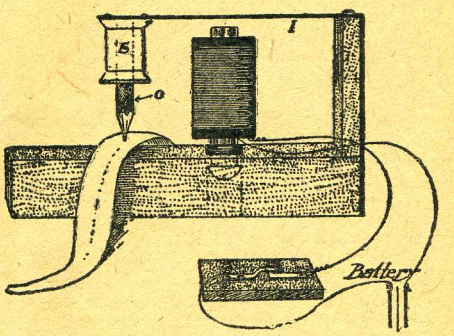
A saw, hammer and brace and bit were the tools used. Slats made the seat and a cushion from the house made it comfortable, and in a week everything was ready for sailing.

Once it was started with only my little cousin on, and it went so fast I had a hard time to catch up.

A SIMPLE TELEGRAPH RECORDER.

Select a block of wood 6 inches wide, 1½ inches thick and 8 inches long. This block is to serve as a base. Fasten to one end of the block a piece of wood in an upright position. This piece should be 3 inches high, 1½ inches wide, and ½ inch thick; to serve as support for the armature.

Cut from a tin box, or can, a piece of tin about 4 inches long and 1½ inches wide. Bend this double and make two thicknesses. This will serve as an armature (1). Fasten one end of this armature to the upright support, by means of a couple of screws.



To the free end of the armature fasten a small spool (S), into which slip a small pencil (O), which may be held firm by wrapping a little paper around it.

Fasten an ordinary electro-magnet to the base, and connect the two terminals to a key, as shown in the sketch.

Provide yourself with a long strip of paper which you place directly under the pencil on the base.

When you press the key down, it will close the circuit, and the current of electricity will magnetize the soft iron core, which will attract the armature (I). When the armature is touching the paper, and makes a dot, move the strip of paper along the base slowly, and every time a dot or dash is made upon the key, it will be recorded upon the strip of paper.—STANLEY H. PARVIN.

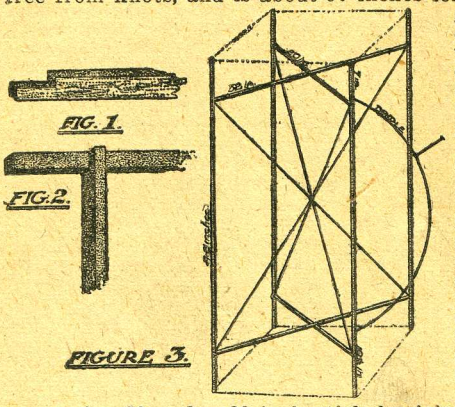
A BOX KITE.

In the spring, when the winds are fresh, kite flying is the ideal sport. One can learn a great deal in flying kites, too. In fact, the men who hope to make airships are now

studying kite flying and gathering many pointers from their experiments with box kites. The box kite is the most scientific kite made. It is, in fact, a tethered airship. It is often used to carry up a camera for bird's-eye views, etc. I will try to tell how to make a simple box kite.

It may be flown either single or tandem, and will carry up a considerable weight.

First secure some straight-grained pine or spruce, that is free from knots, and is about 50 inches long. If you cannot get this, some other light wood will do. From this cut four pieces 48 inches long by ½ by ¼ inch; two pieces 32 by ½ by ¼ and two pieces 20 by ½ by ¼ inches.



Now take your 20 and 32-inch pieces and ½ inch from the end cut as in Fig. 1, then turn it over and cut the other end in the same way, on the opposite side.

Now make a cross of a 20 and a 32-inch stick by joining at the center; nail, glue and wrap with twine so as to make a solid joint; but do not chip sticks at joint.

Now, 7 inches from the end of a 48-inch stick, fasten one arm of your cross, as in Fig. 2; be sure that the long cross sticks of each cross is fastened to the same stick. Nail, glue and wrap all joints. Now build up the framework as in Fig. 3. Now run a brace string from each corner to the opposite corner and knot at center, taking care not to draw tight enough to twist frame.

Now for cover get 2½ yards of red or black cambric, 28 inches wide, and cut it lengthwise into two strips 14 inches wide; hem the torn edges, and tack one end of strip to the framework at top and carry around frame, drawing tight and tacking at each corner.

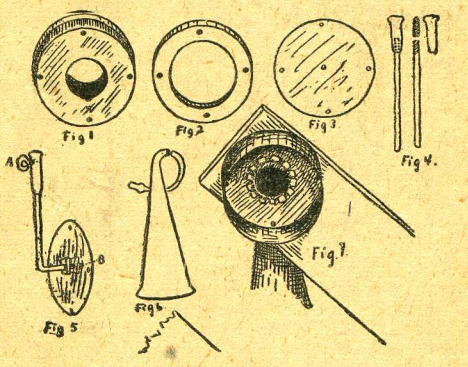
Place other strip at bottom of kite in the same manner. Now for a bridle secure a piece of strong linen twine, long enough to tie at each end and have 44 inches to spare; fasten one end 7 inches from top and the other 10½ inches from bottom. Fasten flying string 14 inches from the top end.

When finished your kite should look like Fig. 3.—CECIL CAMP.

A HOME-MADE TALKING MACHINE.

A talking machine is one of the possibilities that an ordinary boy may confidently undertake to build. His confidence will not have a fatal fall either, if the following tried and true directions are carefully followed. In order to not get confused in the work we will divide our machine into separate parts, commencing firstly upon the only tedious part of the whole machine. (The sound box.)

For this we will need a tin box 2½ inches in diameter by ¾ inch in depth. (A common salve box will answer admirably.) Also five small brass bolts 1½ inches long, a thin sheet of good clear isinglass, two bicycle spokes, a short length of ⅜x2½ inches dry pine, a few bits of 1-16 inch sheet brass, etc., as we come to it.



To begin with, cut out a ¾-inch hole through box, top and bottom corresponding, and also drill 4 small bolt holes equal distances apart through box close to the outer edge, as shown in Fig. 1. From the ⅜-inch pine strip cut out two washers to fit snugly inside the box, the central openings in same being 1½ inches in diameter. With a red hot wire burn out four holes through these washers corresponding with those already drilled through the box. (See Fig. 2.) Now from the sheet of isinglass cut a circular disc the same diameters as the washers, drill a 1-16 inch hole in the center, also the four corresponding holes around the outer edge (Fig. 3).

The needle holder next: From one of the bicycle spokes cut off a 3-inch length from the nipple end. Remove the nipple, clip off one-half of the threaded portion (see Fig. 4), then replace nipple, screwing it on firmly.

Drill a 1-16 inch hole through nipple close as convenient to the end, and with a bicycle spoke tap, thread it. Remove nipple from the other spoke and clip off 1½-inch length, bending it to the shape of a screw eye. This forms the needle-point set screw, as shown at Fig. 5. Now run threads up ½ inch on the other end of wire and from the soft brass metal cut, drill and tap two small burs to fit same; ¼ inch above these threads now bend the wire at right angles, put isinglass disc between these two burs and turn same tight. (B Fig. 5.) This part of the work is pretty tedious and one has to rely considerably upon his surrounding advantages. In many instances most of these bolts, burs, etc., can be found laying about the house, and it is seldom that a boy cannot enlist the interest and help of a machinist. In my case I used a friend's bicycle tools. Also, a hardware store usually carries these little articles in stock where a few cents will buy them.

Before putting the sound box together we must fasten on the horn box and arm. The arm is made from a good strip of pine ½ inch thick, 2½ inches wide by 12 inches long. Plane smooth, and in the center, 1½ inches from the end, bore a ⅜-inch hole to correspond with large central hole in tin box. For a horn I used a large toy tin horn of the pattern shown in Fig. 6, cutting it off where the diameter was ¾ inches. With a sharp knife, slit the end like saw teeth ⅛ inch in depth, all around. Shove horn snugly through the hole in sound box arm, also through bottom of the tin box, where it is fastened by bending the slit portions down, as in Fig. 7. The sound box arm is fastened firmly to sound box by letting the four bolts pass through it. Supposing that the sound box arm, horn, and bottom portion of the sound box are fitted together, as in Fig. 7, we now insert the four small bolts from beneath. Now set in one of the wooden washers, then the isinglass disc, then the second washer on top, which should fill the tin box, and project about ⅛ of an inch. Now put on the cover, screw taps on tight, and your sound box is almost complete. The needle shoulder should not touch any portion of the sound box cover, but a bridge is built up to support it with pieces of sheet brass (see A Fig. 8), when an extra bolt with a hook head must be inserted through sound box, as the other four bolts, save for the tap, are on the reverse side. This hole can be

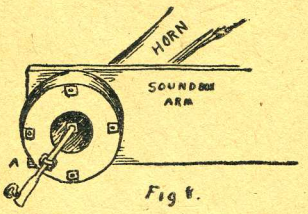


Fig 6.

drilled with an iron drill, and is left to the last in order to correctly set the needle-holder at an angle of about 45 degrees, comparing with the horizontal position with the sound box arm.

Laying this much of our machine aside, we now take up the base and table (or record-holder). The base is made from a 2-inch hard pine. Saw a block 8 inches wide by 16 inches long, and plane smooth. The record-holder is made by cutting out a wheel 6 inches in diameter by 2 inches thick (Fig. 9). Through the center drill ¼-inch hole. We need a spindle for this wheel to turn upon and a 6-inch length of ¼-inch iron rod will answer admirably. Cut threads down 3 inches on this rod and run on a bur. (See Fig. 10.)

Taking up the base again we now bore a hole in the center 3 inches from one end. Fit the unthreaded end of spindle into this hole and if it is too tight rim out some with a red hot iron rod, until spindle works smoothly, yet snugly. Put a few iron washers under the bur (if necessary) to raise spindle so that the end will not project through the bottom of the base. Now put record-holder wheel in place, and with a thumb nut temporarily clamp it firmly on the spindle. Of course this thumb nut is removed when a record is put on, and being turned on again clamps the record firmly to the table.

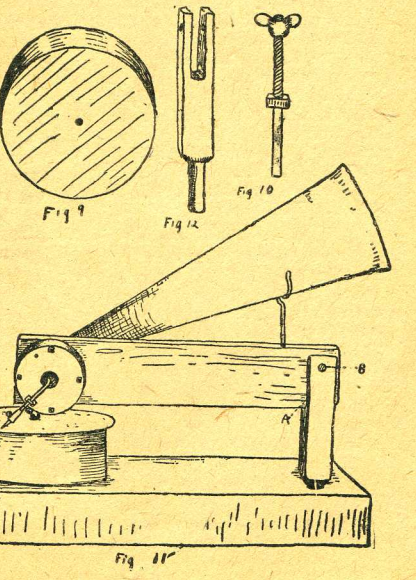


Fig 11

Now, setting the base before you, with the record-holder at the left-hand side, bore a ½-inch hole 2 inches from the right-hand end of the base and 3

inches from the near edge. In this hole an oscillating post stands, 5½ inches high, the upper end being slotted for the insertion of the sound box arm (see A Fig. 11), which must fit snugly and move in no direction but up and down, on pivot B Fig. 11.

This post is shown in Fig. 12, and from the illustration it is seen that the post turns on its pivot in the base, and the sound box arm raises and lowers in the slot at its top.

The horn needs a support of some kind and a wire post is set into the upper edge of the sound box arm, the top being bent to a curve, for a rest. Our machine is now complete save for motive power, and this I will leave to the reader. For my own machine I fitted another wheel similar to the record-holder wheel at the far edge of the base and connected the two wheels with a belt. The extra wheel was fitted with a handle, and by turning this by hand the belt, of course, set the record table turning also. The records used on this machine are the 7-inch flat disc records, and those and the needle points must be purchased from some dealer in phonographic supplies.

Having secured a record, place same on the record table and fasten there by turning on the thumb nut. Put a needle point in the needle-holder and proceed to turn on your band music, etc., etc.

As a further precaution I would say that the isinglass disc is the most important part of the whole affair, and this must be of the proper thickness and be of good clear quality. A sheet of thin paper is about the right thickness.

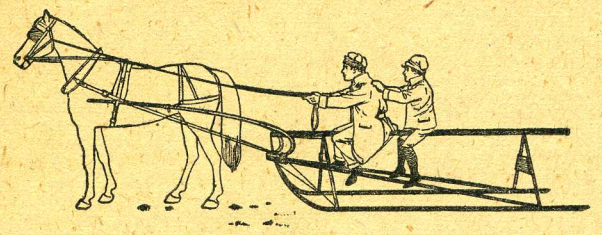
With due care in the construction you can turn out a machine that will produce remarkable results.—OSCAR P. ROBERTS.

THE HANDY STRADDLE BUG.

For coasting, the straddle bug, or as it is sometimes called the "Go Devil," is a great institution. Fasten a pair of shafts to it and you and your friend can have great sport exercising that horse that is eating its head off.

Get two straight poles for runners, each 9 feet long and about 3 inches in diameter. For the legs get four stakes, cut from small hickory poles each 3 feet long and 2 inches in diameter. Now get a 4x4 scantling 7 feet long, and with a one-inch bit bore four holes, as shown in diagram. Then bore two holes in each runner to correspond with holes in scantling, taper the ends of each leg and drive one end in the scantling and the other end in the runners, then wedge and nail them securely. Twenty-two inches of the scantling should project ahead of the front legs and 16 inches back of rear legs; also the runners should project 15 inches back of rear legs. Next nail a wide board to each set of legs as

shown in diagram. This stiffens the legs and keeps the runners from spreading apart. Next dress the top side of the front end of runners down so that the ends may be bent up



to the fore-end of scantling, and securely fasten by nailing into end of scantling, and also fasten a couple of wires from runners to front legs and twist up tight. Next nail a 2x3 piece 4 feet long to flat side of runner about 15 inches from the ground; stiffen by twisting a couple of wires from each front leg to each end of 2x3, or cross-piece. Also nail a 2x2 to each end of cross-piece and then securely nail to each runner just back of rear legs. Fasten a pair of shafts to the cross-piece in front, and you are ready to have a whole winter's sport riding on a 4x4.—HOMER E. BARNTHOUSE.

TO CONSTRUCT A KALEIDOSCOPE.

Procure a tube of tin or paper 10 inches long and 2½ or 3 inches in diameter. Seal one end of this with tin or paper, in which make a tiny hole for the eye to look through. Two pieces of well-silvered looking glass, B B, are now to be procured. They should not be quite as long as the tube, and should be placed in it lengthwise at an angle of 60 degrees, meeting at A, and separated at points C C, the polished surface inwards. A circular piece of glass is now to be laid on the top of the edges of the reflectors B B, which by their not being so long as the tube will allow for its falling in; and it will be supported by the edges of the tube which may be slightly bent so as to prevent the glass from falling out. To make a "cap" for the instrument a rim of tin or pasteboard must be cut to fit over the glass end of the

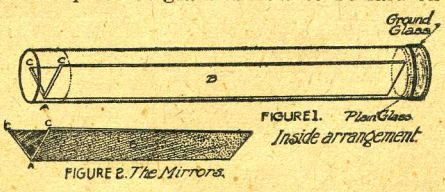


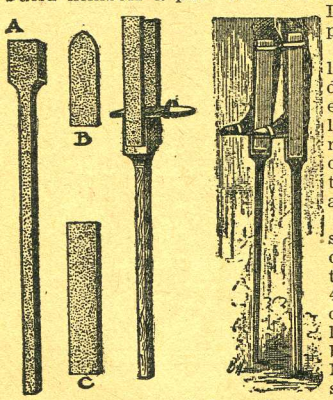
FIGURE 1. Plan Glass.
Inside arrangement.
FIGURE 2. The Mirrors.

tube, with a top of ground glass, so it may fit on the tube like the lid of a pillbox. Before putting it on, obtain some pieces of broken glass of various colors, little strips of wire, or other objects and place them on the cap, and by pressing it over the end so the broken glass, etc., has free motion, the instrument is complete. To use it, apply the eye to the small hole, and on turning it beautiful forms will appear in the most wonderful combinations.

The following curious calculation has been made of the number of changes this instrument is capable of: If it contains twenty small pieces of glass and ten changes were made every minute it would take 462,880,299,576 years to go through the changes of which it is capable.

SHEPHERD'S STILTS.

The best stilt walkers in the world are the shepherds of the Landes, who, during the wet season, have to walk on stilts, as the country is covered with water. If a reader will build himself a pair of these stilts he will always use them. Don't use these stilts on city pavements, as they might slip.



Take a 2x4 scantling, the length you want, and cut it down to about 6 inches of the end, like A. It should be of light, strong wood, ash or maple will do. Small pieces of board should be nailed on the wide part of A to make it as wide as the shoe.

Then a piece of thin board should be cut like B, the shape of and of the same length as the shoe, and be tacked on the 4-inch width of A, as in a complete stilt. A piece of leather can be fastened on the board to hold the toe solid. Next, four pieces of board should be cut long enough to reach from just below the knee to bottom of the feet as C, and about six inches longer to nail on the 4-inch side of A. After the pieces are nailed on to make it as wide as the foot, fasten with hame straps by buckling them on around the top of C, just below the knee. A long pole reaching from the ground to the top of the stilt-walker's head will be found to be a great aid in balancing. It is useful to aid in jumping.—WM. E. HIGH.

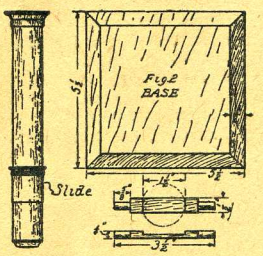
A MICROSCOPE.

A good microscope is generally a very fascinating instrument to most people, whether it is used as a toy or for the study of botany, insects, minerals, etc. And it is very valuable as an educator, training the eye and mind to habits of close observation.

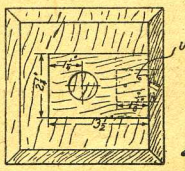
The first thing, and of course, the most necessary, is the tube containing the lenses. You must procure the first or "eye"-piece joint of a spy-glass or telescope of as high magnifying power as possible, though the one I used only magnified 11½ diameters, but even that is very much better than the small magnifying glasses with one or two lenses.

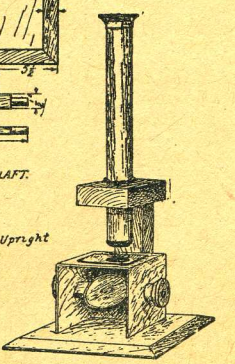
The tube in most good spy-glasses or telescopes contains four lenses placed two together in smaller tubes at each end. When the joint is unscrewed from the spy-glass you will find a short, threaded brass slide, through which the tube is drawn—this is to be used also in our microscope. See Fig. 1.

Next is the stand. It is composed of three pieces. First is the base, made from a piece of half inch hardwood, cut 5½ inches square with the upper edges beveled off to give it a neat appearance, as shown by Fig. 2.



The next piece is the upright—it is about 1⅛ inches square and 4½ inches long. The ends should be squared off true. This is to be fastened upright at one end of the base, ½ inch from the edge by nailing from the bottom of the base, or better still use a couple of long screws.





Next is the top part which holds the tube slide. It is a piece of ¾ inch pine 2¼ inch-

R.F. Durham, E.

es by 3½ inches. Make a hole of the exact size of the outside of the slide about 1¼ inches from one end (Fig. 3). This hole will vary according to the size of the spy-glass tube used. Now the block is nailed to the top of the upright, as is shown in Fig. 3. Put the slide in the hole and screw it in the wood enough to make it firm, then place the tube in position. The last but one of the most important parts is the object table and illuminating mirror. They are placed under the tube and the object to be examined is placed on a glass slip on the table and the mirror is adjusted to reflect the light up through it, thereby making it much plainer.

I made my table from very thick cardboard, but it would be better to make it of thin cigar-box wood. It is to be made in the form of a 2½-inch square box with the bottom and one side removed and a ⅝-inch hole cut in the center of the top, or where it will be exactly under the focus of the lenses when the box is placed against the upright with the open side opposite. Next make a ¼-inch hole in the middle of each side of the box for the shaft of the mirror to turn in. Procure a small pocket mirror, or if this is not handy and you have a glass-cutter and a piece of broken mirror, cut a round piece 1½ inches in diameter, then make a shaft holder for it from a piece of wood 3½ inches by ¼ inch by ½ inch, the ends to be cut round from about ⅝ of an inch and a piece cut out of the middle as long as the diameter of the mirror and half way through the wood, as shown in Fig. 4. This is made to fit the mirror exactly, so the latter may be taken out easily and cleaned. Put this shaft in the table and glue a half of a No. 50 thread spool on each end of it for handles. The table is now to be fastened to the upright with three or four tacks or small nails (Fig. 5).

Now, if you will get a clear piece of glass about 1½ by 2 inches to place the objects you wish to examine on, and give the stand a good coat of black paint or varnish you will have something that will more than repay you for your time and trouble.—RAY H. DURHAM.

HOW TO MAKE AN ELECTRICAL TOP OR SMALL MOTOR.

Tools and apparatus required:
A block of wood 4x2x½ inches.
Two pieces of wood each ½ inch square by 3 inches long.
A strip of tinfoil 1x2 inches.
Wire, 30 feet of No. 18, double cotton covered.
One soft iron nail, 3¼ inches long by ¼ inch in diameter.
One soft iron nail, 2 inches long by ⅛ inch in diameter.
Two screw cups taken from a dry battery.
One soft iron bolt (with nut) 2¾ inches long with ⅞-inch head and nut ⅞ inch square.

Now take the board and plane it smooth on both sides and round off the edges. Then with a bit bore two holes in the base, as we shall hereafter call it. Two in the corners at one end and one in each end, as in Fig. 1. The holes may all be made with the same bit, a little larger than the body of your screw-cups. Put the screw-cups in the holes marked A A Fig. 1, and screw them fast for the present.

Now take the two pieces of wood, ½x3 inches, and whittle them round, just taking off the corners and leaving them as large as possible. Take your knife and cut one end small enough to go into the holes B B Fig. 1, making a clean-cut projection as in Fig. 2 C. Now glue these pieces into their respective holes and set aside to dry while we attend to the field magnets.

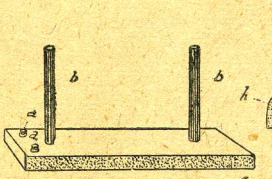


FIGURE 1

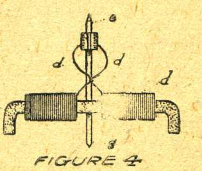


FIGURE 4

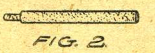


FIG. 2.


FIGURE 3.

Take the bolt of the right size and shape and wind it full of your insulated wire No. 18, as in Fig. 3, taking care that none of the coils of wire touch each other unless the insulation is sound and good. Make each layer as smooth as possible and always wind in the same direction around the bolt just as a spool of thread is wound. The next thing to do is to procure one of the small screws with a depression in the end which are used to hold the balance wheel in an alarm clock. Now fasten this screw in the middle of a small piece of hard wood, ½ inch long by ¾ inch wide and about ⅜ of an inch thick. This piece of wood has notches cut in the ends and is tied to the wire surrounding the bolt

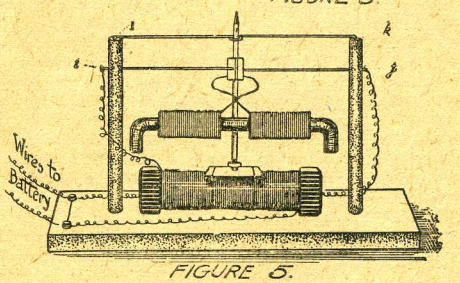


FIGURE 5.

and the bolt is then wired to the base with the block of wood on top with the screw in the center, depression up, as in F Fig. 5.

Now we turn our attention to the armature, which is made of the soft iron nail 3¼ inches long by ½ inch in diameter.

Bend the ends (after the head and ends have been cut off square) to the position shown in Fig. 4 H, and drill, or have drilled, a hole ⅛ inch through the center and having pointed both ends of your ⅛ inch nail (2 inches long) solder it into the hole with one end a little below the ends of the larger nail, as in G Fig. 4.

Now wind two layers of your insulated wire on the larger nail or armature, as in D Fig. 4, and let the ends project 1 inch from the winding, after twisting the two wires (insulated) together, to hold it in place. Now make a commutator by boring a hole in the center of a perfectly round piece of wood ⅜ inch in diameter, and gluing onto it two semicircles of tinfoil not quite touching each other. Put this on the axle E Fig. 4, and connect the ends of the wires D D with this commutator, one wire on one plate, the other on the other (Fig. 4).

Now rest the pointed end of the armature on the screw F Fig. 5, and stand it up straight. Get someone to hold it while you bend a piece of bare wire so that there will be a loop in the center when the ends are placed in slits in the end of the uprights I Fig. 5, as in K Fig. 5. Place the loop over the armature and you will find that it will revolve very freely and easily. Now take two copper wires for the brushes and run one from each one of the uprights to the commutator and let them press on each side of the commutator in such a manner that they will press on the tinfoil while the armature revolves, until it gets in line with the field magnets, when it will change to the opposite plates on the armature, thus changing the direction of the current through the armature at each half revolution.

Connect one of the ends of the coil on the bolt to one of the brushes, as in I Fig. 5, and run a wire from the other brush to one of the screw-cups, as in J Fig. 5, and connect the other end of the coil on the bolt to the other screw-cup.

Your motor is now complete, and should run at a high rate of speed on one cell of dry battery, if properly made.—TRUMAN NORTHUP.

HOW TO MAKE A POCKET BATTERY.

I wished for a pocket dry battery which would have power enough to ring a bell and yet be small enough to go in my pocket. Finally I made one, and as probably many of my

friends are interested in the same thing I here give directions for making one as I made it.

The first thing to obtain is a receptacle for our battery. I used a common straight cylindrical-shaped glass salt cellar, in which the inside is the same diameter through its entire length.

As electricity is generated by the chemical action of an acid on two substances in our dry battery, we must next procure the two substances, or "elements," as they are called when in a battery.

We will take carbon and zinc for the elements in this battery and the exciting liquid which we will use in this battery is a solution of sal ammoniac. Our zinc element we obtain by cutting from a piece of sheet zinc (preferably from an old dry battery) a piece just long enough to reach around the inside of the jar and as wide as the jar is high. It is best to leave an ear or projection as in A, Fig. 1, to form the electrode. For our carbon element we will use an old discarded electric light carbon (taken from an arc lamp and generally thrown away). In case this cannot be had we can use a piece sawed (from a carbon taken from an old dry battery) to the size of ½ inch square and a little longer than the height of your battery jar. Place the zinc, rolled up in cylindric form, in the jar, as in Fig. 2, and place the carbon in the center of it.

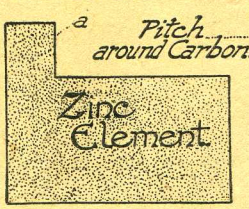


FIGURE 1.

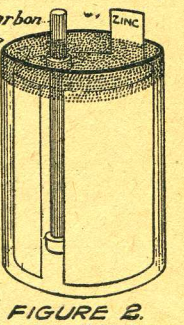


FIGURE 2.

Now place a rubber band around the top and bottom of the carbon to prevent it touching the zinc, which would cause the battery to "short-circuit," or, in other words, it would be about the same as joining the carbon and zinc with a wire, which would prematurely exhaust the battery and would render it unfit for use.

Now fill the jar with water and place in the water all the sal ammoniac that the water will dissolve, although it is not necessary to make the solution so strong. Now your battery should be able to ring a bell by placing the zinc pole in metallic connection with the one pole of the bell and the carbon pole with the other pole of the bell. We will now proceed to make it a "dry battery."

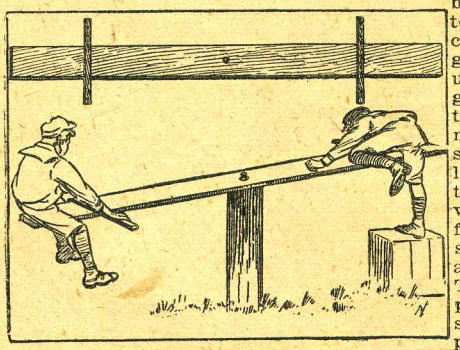
While the solution is still in the jar put some corn starch in it, a little at a time until the solution has taken up all that it will saturate and is made into a thick paste. Now set it aside while you melt some pitch to be used in sealing the jar.

When the pitch has been melted, take the jar and cut out about ½ inch of the paste (from the top) to provide a place for the pitch.

Having seen to it that the outside of the jar is clean at the top and also that the carbon and the zinc are smooth and clean, pour the melted pitch in the top of the jar in such a manner that the jar will be filled to the top, making an air-tight cover to the battery. This cover serves two purposes: It provides a means of keeping the contents of the jar from spilling out into your pocket and also keeps the liquid from evaporating from the battery, as it probably would unless the means that I have spoken of were used, or some other equally as good.—TRUMAN NORTHUP.

A WHIRLIGIG.

Any handy boy will be able to make this fun machine without any trouble. The simple sketch shown here will give you an idea of how the whirligig looks when it is ready for business, or I should say, pleasure. In a roomy backyard, or better still, on a vacant lot, set a good solid post upright in the ground. In order that everything may be secure, sink this post at least four feet in the ground. Tamp well. About four feet of the post should project above the surface. The top of the post should be sawed as level as possible; on this balance a 16 or 18 foot plank. Bore a hole through the center of the plank. Through this hole drive a heavy bolt deep into the post so it will not work loose. The shaft of the bolt should be the least bit smaller than the hole in the plank so the plank will revolve around it easily. The plank



should be greased well where it rests on the post so there will be the least possible friction.

Sticks nailed at right angles across the plank about 3 feet from the ends will serve as handles for the passengers when the whirligig is traveling at full speed. The method of using this apparatus suggests itself.—J. D. SIDDERS.

FUN FOR THE BOYS.

Take a piece of broomstick or soft wood about a foot long and cut out the shape of a snake, then cut a groove on the upper and lower side, extending from the neck to near the end of the tail. Next cut out of both sides notches or grooves as shown, viewed from the top, as in Fig. 2. Next string a piece of twine through a hole made in the neck and tail and let the twine be glued into the grooves in each side of the "snake" and ends tied under the head. Now gently break the snake (where it had been cut almost through) into the number of sections and the twine will still hold it together. Paint it black with whitish tint underneath and red eyes.

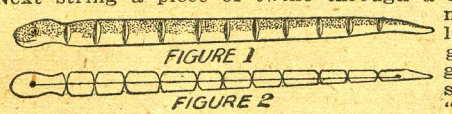


FIGURE 1

FIGURE 2

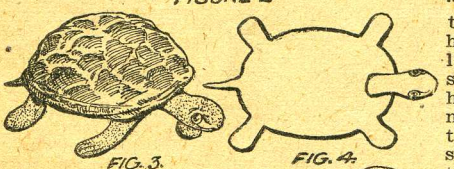


FIG. 3. FIG. 4.

FIGURE 6 FIG. 7.

Figure three represents a turtle made of a half shell of an English walnut, a piece of pasteboard in the shape of Fig. 4 with a piece of wood as a head is pasted or glued to the shell.

By exercising more ingenuity a turtle can be constructed with restless legs, tail and head, by cutting out of pasteboard the head, tail and legs and attaching the same by a small piece of thin rubber band to the inner side of the shell.

Fig. 6 shows the construction of the appendages, thin paper is used at the ends of the pieces of rubber, which is pasted to the inner side of the shell. The turtle can also be made to rest on a support, which is shown in Fig. 7, to rest on the hand.—R. E. HACKMAN.

A DIVING BOARD.

To make this diving board take a plank (Fig. 1) 10 feet long by 12 inches wide and 2 inches thick. Plank ought to be without knots and straight-grained. Next get two stakes 4 feet long, 3 inches in diameter. Drive the stakes in the ground 14 inches apart (B B Fig. 2); then get a crosspiece (C, Fig. 2) 14 inches long, 2½ inches wide, 1 inch thick, and nail 2 inches below top of the stakes.

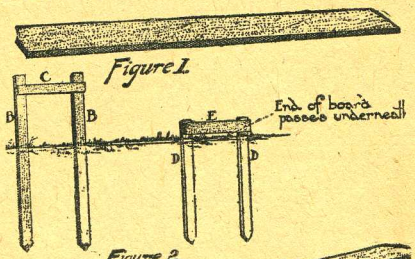


Figure 1.

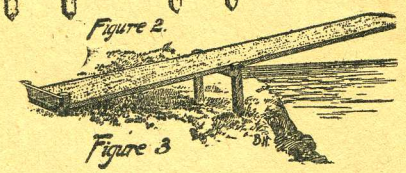


Figure 2.

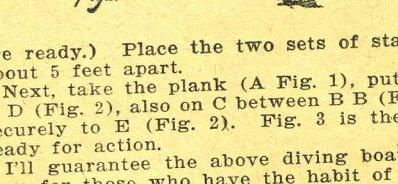


Figure 3

Next get two stakes (D D Fig. 2) 3 feet long, 3 inches in diameter, set them in the ground 2¾ feet, 14 inches apart, then nail a cross-piece (E Fig. 2) 14 inches long, 4 inches wide and 1½ inches thick to D D Fig. 2, so the edge of E will be on a level with the top of the stakes D D. (Nail securely or you might take a dive before you are ready.) Place the two sets of stakes (B B and D D) about 5 feet apart.

Next, take the plank (A Fig. 1), put it under E between D D (Fig. 2), also on C between B B (Fig. 1), nail the plank securely to E (Fig. 2). Fig. 3 is the way it looks when ready for action.

I'll guarantee the above diving board to be an effective cure for those who have the habit of taking what we fellows call "gutties."—ELMER S. STROH.

HOW TO MAKE AN ANEROID BAROMETER.

Procure a quart tin fruit can and solder on a thin flat tin top. Do not use the pressed top that belongs to it, but use a piece of perfectly flat tin—a piece that does not have a "snap" to it. Be sure to get it airtight. Near the bottom of the can punch a hole the size of a lead pencil and into it solder a bicycle valve. This is to enable you to test your can as to whether it is airtight or not. You can do this by

lightly inflating it with a bicycle pump and holding it under water. If bubbles arise air is leaking out. It must be airtight. Now let out the condensed air and warm the can, holding the valve open while you do so. When the can has got about as warm as you can bear to hold let the valve close and screw the cap on tightly. Never remove the cap again. Now cut off the point of a stiff pin and solder the pin upright (head down) in the center of the lid.

Make of heavy tin a piece shaped like Fig. 1, 6 inches long and about 1 inch wide through the middle. The projections (A A) should be just as wide apart as the diameter of your can. They may be about 1 inch long. The projection (B) should be 3¼ in. from one end and about ½x½ in. in size. Bend it down as shown by the dotted lines, leaving a space the thickness of a piece of tin between the projection and the main part of the piece.

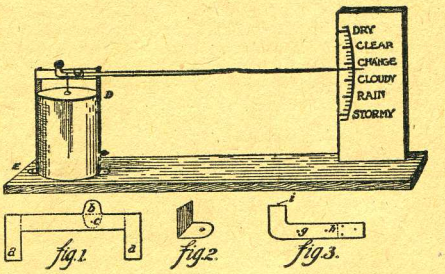


fig1.

fig2.

fig3.

Drill a hole the size of a pin through both parts at C. Bend A A along dotted lines at right angles—make the bends sharp—and solder this piece across the top of the can, upright, about ¼ inch above the lid. Solder at D D. Make two pieces of tin like Fig. 2, 1x1½ inches, and solder them to the can at E E. These are to fasten your can to a base. Make the base 5x20x1 inches and fasten the can securely 1 inch from end. At other end of base, 2 inches from back, fasten a board 3x7x1 inches. This is for the scale. To this paste a piece of heavy white paper.

Make a slender pointer, 18 inches long, ½ inch wide at one end and tapering to a point at the other, and 1⅛ inches thick. To the larger end fasten a piece of tin like Fig. 3, using short pieces of pins for rivets. Drill holes the size of a pin at G and H ½ inch apart and 1 inch from the smaller end. The other holes may be punched with a small awl.

Put the apparatus together, as shown in the illustration. Put a snug-fitting pin through at C and H. Now bend the

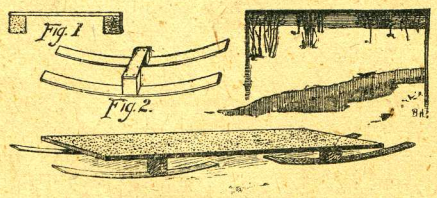
pin, at a right angle, that you soldered to the top of the can and insert it at G from the back side. Make the bend sharp and of the right length, that the long pointer will be in a horizontal position. Fasten a little weight of lead at I that will nearly balance the long pointer.

The apparatus is now complete, and will prove of good service if carefully made and thoroughly studied. You will soon observe that the pointer does not remain in one position, but changes from day to day, perhaps from hour to hour, and by comparing it with a standard barometer you will be able to arrange a scale in the course of time. Or, you can devise a scale that will answer your purpose by observing it in all kinds of weather and arranging your scale accordingly.—J. GREENE MACKENZIE.

(It may be explained to those who wonder why the pointer or indicator should rise or fall under varying conditions of weather, that in dry weather the air being free from vapors is heavy and presses on the flexible upper surface of tin, depressing it and drawing down the weighted end of the indicator which, of course, elevates its point—while in moist or rainy weather the air becomes lighter, and the elastic tin top recovering its shape forces up the weighted end of the indicator and depresses its point.)

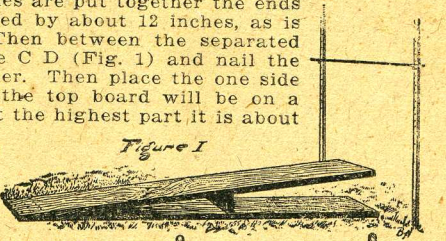
SNOW COASTER.

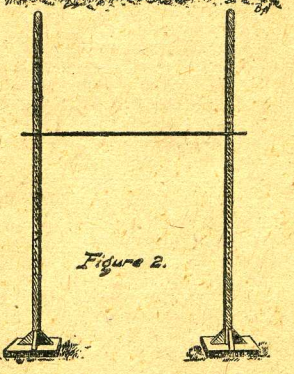
Winter is near at hand, so I will introduce a sleigh that will coast without having a crust on the snow. First procure four barrel staves for runners. Then saw four pieces six inches long from a 2x4, which are called knees. Now take an inch board six inches wide and cut two strips about sixteen inches long, which are beams. Nail the knees to the beam as in Fig. 1. Now nail the staves to these knees as in Fig. 2. Put the other bob together in the same manner. Now get a wide board cut as long as you desire for a platform. Nail the platform to the beam. In the front bob bore a hole in the center of the beam and in the platform about six inches back from the front end bore a hole half way from the side Take a bolt and bolt the front bob to the platform and the coaster is complete as in Fig. 3.—CLAUDE GLEASON.



A JUMPING APPARATUS.

To make this apparatus, first take two planks 12 feet long by 12 inches wide and 2 inches thick. Place the two ends so that when the sides are put together the ends opposite are separated by about 12 inches, as is shown in Fig. 1. Then between the separated ends place the brace C D (Fig. 1) and nail the opposite ends together. Then place the one side on the ground and the top board will be on a gradual slant, and at the highest part it is about a foot high. After having placed this in position take two pieces of wood 2½ inches wide and an inch thick and about 5½ feet high, at intervals of two inches bore holes along the length. Set these pieces about a half a foot in the ground or two feet on each side of the jumping board, and use this as a marker. Then, having made two pegs so that they fit in any of the holes in the uprights, lay a small stick, planed out of a lathe as a marker, across these pegs at right angles to the uprights, then the machine is ready for use, and as you increase your jumping powers, move the pegs and the marker higher. Then if you can't have the machine in the same place all the time you can make the uprights like Fig. 2 with a wide, flat base; otherwise the same.—BERT KEMPE, O. T. N.



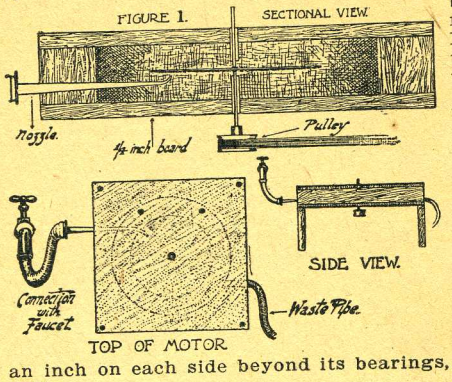


AN INEXPENSIVE WATER MOTOR.

A simple, but very effective, water motor can be made by anyone according to the plan shown here, with little trouble or expense. It may be necessary to have a few minutes' work done by a tinsmith. The maker may do this if he understands soldering.

In a pine board 7 inches square and 1 inch thick, make a round hole 5 inches in diameter, by the use of a scroll saw, or in any other convenient way. Then get two thin boards

¼ inch thick and fit them one on either side of the large board, but do not nail them on yet. In a small hole in the center of each thin board drive a small piece of brass tubing about ⅛ inch internal diameter; and through these brass tubes run a piece of steel wire so that it will revolve freely. This wire is the shaft of the motor wheel. It should be of sufficient length to project an inch on each side beyond its bearings, to receive a small pulley.



To the center of this shaft solder a brass disc 3 inches in diameter, so that it will revolve with the shaft, or if the brass disc cannot be had, a round piece of wood may be fastened on tight, so that it will revolve with the shaft, and to the brass disc solder a disc of brass wire gauze, 30 mesh. The edges of the gauze must, as the ladies would say, be "sewed over and over" with a fine copper wire to prevent it from raveling when the wheel revolves rapidly. If the workman is an adept he may solder a ring of brass or copper wire, say No. 18 or 20, to the edge of the wire cloth.

Now mount the wheel so that it will revolve freely in the 5-inch hole in the 7x7x1 pine board. The simplest way to procure a nozzle for the motor is to buy a cheap, small oil can having a nozzle with an opening in the smaller end about one-sixteenth inch. This nozzle is inserted into the edge of the wooden wheel case (Fig. 1), and its smaller end is bent so that it forms an angle with the wheel, with the point of the nozzle as near the gauze as possible without touching. To cause the wheel thus made to keep a central position in its case, pieces of small tube may be slipped through the hole in the small board so as to not quite touch the wheel (Fig. 1, A).

A small hole may be made at the bottom of the casing in which a small rubber tube may be inserted to carry away the waste water, and there should be a small hole on each side, near the top, to admit air. The casing may be secured to

wooden foot pieces with screws. It is desirable to make the casing impervious to water. To do this the various parts may be boiled in hot paraffine for ten minutes. If it is found difficult to get paraffine in bulk a few paraffine candles will do.

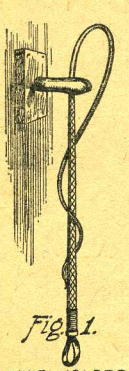
The inflammable nature of paraffine should be kept in mind and a cover should be provided for the vessel in which it is melted, so that it may be instantly extinguished should it become ignited. To prevent the checking of the wooden parts of the motor, the parts should be arranged with the grain lying in the same direction. With sufficient water pressure this motor will make from 1,500 to 2,000 revolutions per minute.

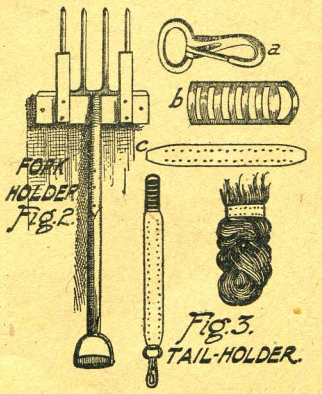
The full power is realized in a small motor like this one when a small pulley is attached to the shaft, with a very flexible belt with a large pulley on the things driven by it.—WEBB LUCKEY.

THREE HANDY HOLDERS.

I herewith submit to you three holders that will be of use on the farm and elsewhere, and any boy can make them easily.

The first (Fig. 1) is a whip holder. To make this get a wooden clothes pin and fasten it to the buggy shed in a post, or in a board and then nail the board up. If a whip is placed in this holder when not in use it will keep its shape much longer than when left in the socket in the buggy.





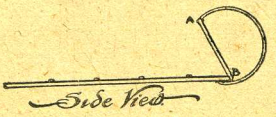
Next (Fig. 2) is a fork holder, which is made by nailing two pieces of board to a piece of 2x4. Behind these a fork will be safe, as no stock can be hurt by it.

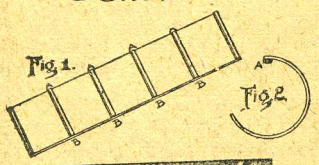
Next (Fig. 3) and last, but not least, is a tail holder, which is very handy when the roads are muddy to fasten a horse's tail up. A is an old overshoe buckle, B is a strip of brass

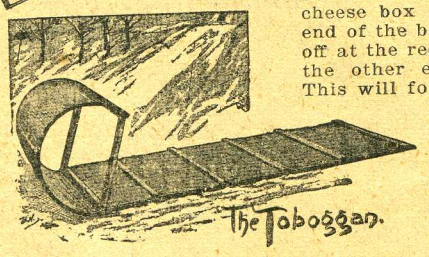
(or tin will do), at one end of this fasten the buckle and at the other the buckler, by bending the brass through the open end of each and firmly battering it down. When you put it on, buckle so that the buckle part is out of view, as C in Fig. 3.—JOHN KADING, O. T. N.

A CHEAP TOBOGGAN.

Every boy who is in some club or society in a country where snow falls wants a sled or toboggan on which to slide down some steep hill. Here is a very good plan:







Go to some grocery store and get a cheese box. This box should be without a knot or crack. Take the nails out of the box and pull the top and bottom out.

Get a good board the same width as the cheese box. The board should be smooth on one side, without a crack. Nail slats every 12 inches on the board (Fig. 1, A B). Nail a slat on the end (A) of the cheese box (Fig. 2) after the end of the box has been sawed off at the required length. Nail the other end of the board. This will form a curve on the toboggan. Place the side pieces (A B) on the sides of the toboggan. This will form handles to hold on with. The top ends of the curve can be strengthened by putting on strong leather straps.—GEORGE S. CHAIN.

ELECTRIC DOOR BELL.

To make a cheap yet satisfactory electric bell, cut out a small board 6 inches square with a projection 1 inch square on one end, as in illustration. To this board screw a block of wood 3x½x½ inches, and to this block fasten an electro-magnet (A). Fasten another block (B), size 1x½x½ in.

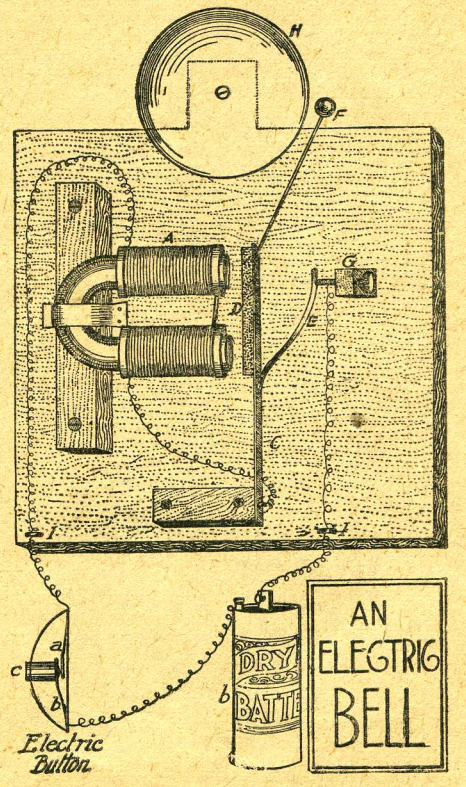
to the board, and to the block screw a piece of springy steel (C), long enough to reach over both ends of the electro-magnet. On one side of this strip fasten a small bar of steel (D). On the other side of the strip solder a small piece of steel (E), bent as in the illustration. Now screw a small wooden support (G) to the base-board and through this support screw a small thumb-screw so that the point of it will touch the end of E.

Now get an old bicycle bell, or a bell of an old alarm clock and fasten it to the projection on the baseboard. Then fasten the end of a stiff wire on the bar (D), and on the other end fasten a knob of iron or lead (F).

Now as to wiring. One end of the wire on the electro-magnet goes to the binding post (I). The other end goes to the spring (C). Then a wire goes to the binding post (I), from the screw at G.

Now fasten both poles of a battery to the binding posts and screw up at G until it is found that the bell rings loudly.

A diagram of the push button



is shown (A and B), being two strips of brass, and C, a push button, made of hard rubber or wood.

The method of putting up or connecting is shown in the illustration. The button is placed near the front door and the battery placed down cellar or somewhere out of sight.—BRUCE BEARDSLEY.

A BIRD HOUSE.

Every boy likes to build something. Why not build a bird house? I built two last spring and the martens seemed to be pleased with them, even if they weren't so fancy as one planned and built by an architect, for mine were built with limited tools, such as a hammer, saw and jack-knife. Now I will try and explain how to build one.

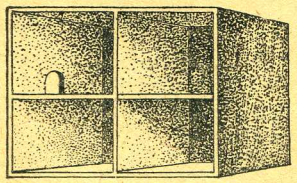


Fig. 1&2.

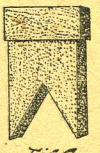
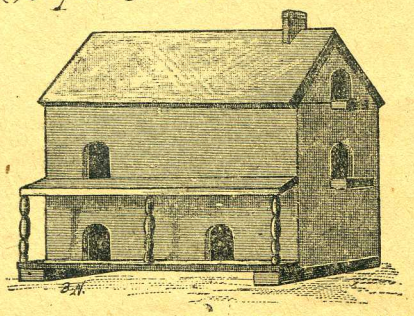


Fig 3

First get a dry goods box 15 inches long and 1 foot wide and 1 foot high, then partition it off into two rooms below, as in Fig. 1. Then put a floor over these partitions and divide the second floor into two rooms, as in Fig. 2. Then cover the partitions with a floor again and cut three pieces of board the shape of a "V," as Fig. 3, so they will just fit on the top of the box (that is, turn the "V" upside down), and then they will serve as rafter and partitions on which to nail the roof.



These two divisions also form the third floor, or garret, which makes two rooms there also. Altogether you will have six rooms, enough to allow six pair or twelve martens to make their home for the summer.

Now in putting the roof on let one side overlap about 5 inches, to serve as a stoop for the birds in the second story, and a fancy one may be made for the birds in the first story, or a plain one, just as you are able in craftsmanship. And you can also make a chimney, as shown in Fig. 4, also a weather-vane. I have for mine a flag cut out of tin and painted to represent the stars and stripes. I also painted my bird houses in different colors, like a house. Now, boys, better build one. The martens will sing many cheerful notes for you as a reward.—JOHN G. KADING.

TOM'S SNOW QUEEN.

"Say, Jack, I have an idea!"

"Will wonders never cease? What germ of wisdom has found lodgment in the barren desert of your brain, Tom? Tell it to me that I may cherish it, ere it dries up and withers."

"Quit your joshing, Jack, and listen seriously."

"All right, fire away. I am all ears."

"You remember that article we read about the ice boats on the Hudson? How they went faster than the wind, and beat a mile-a-minute New York Central train?"

"Yes."

"Well, my idea is to make——"

"An ice boat, and where are you going to sail it? A lot of good an ice boat would do you on these Dakota plains."

"Hold on a minute. I didn't say I was going to make an ice boat."

"Well, what are you going to make—an airship, O, second Santos Dumont?"

"No, but I am going to make a **snow** boat."

"Who ever heard of a snow boat?"

"You have, and from me, the original inventor, and inside of a week you will be sailing with me on it. Now, I'll explain how I intend to make it, but don't tell any of the fellows. We'll spring a surprise on 'em."

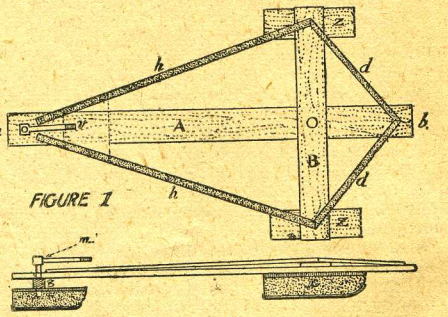
This conversation between Tom Henly and his chum Jack Barnes, took place in the latter's room one afternoon early in January, 1903. Both were sons of prosperous farmers, and were boys of sixteen for whom the long winters of Steele county, North Dakota, had no terrors.

About a week after Tom explained his great plan to Jack the farmers within a radius of 50 miles were astonished to see a great bird-like creature skimming over the surface of

the fenceless fields. It was the Snow Queen, manned by Captain Tom, and his faithful first mate, Jack.

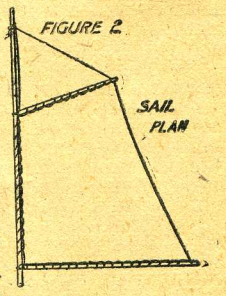
As Tom wishes all boys to get as much fun as possible out of his idea, he has given me permission to tell the boys of America how he and Jack made the Snow Queen. So here goes.

The first thing that is necessary is a board 8 feet long, 2 inches thick and from 6 to 8 inches wide; this is the backbone of your boat and should be of maple or oak. See A, Fig. 1.



Now three-quarters of the distance of a to b on A nail the cross-piece B, at right angle to A. See Fig. 1. B is a plank 5 feet long, 8 inches wide, and 1 inch thick. About 4 inches from the end A of the plank A, bore a hole 2 inches in diameter.

From a hard wood plank 6 inches wide and 1 inch thick cut out six runners, four of them 2 feet long and two of them 1½ feet long, shaped like X, Fig. 2.



Take a board 6 inches long, 2 inches thick and a foot wide, and fasten it securely across the tops of the two 1½ runners, thus making a small sled 6 inches wide (Y, Fig. 2).

Bore a hole 1⅞ inches in diameter through the top of this small sled, and into the hole fit a round piece of hardwood 8 inches long (G, Fig. 2). To make this piece, which is to be used as a rudder post, doubly secure, bore a hole 1⅞ inches through a block 3 inches cube, thrust it down over the piece G and nail it to the top of the sled and the post itself. It should look like M, Fig. 2, when completed.

Now take a thin piece of ash, 6 inches wide and about 1¾ feet long on the bottom of your runner, thus making a board running surface 6 inches in width for use in soft snow.

Get the blacksmith to make you some iron strips ½ inch wide and ¼ inch thick. These strips should be flat on the bottom, like a skate, not rounded like a sleigh shoe, so they will hold a hard surface well without sliding. Have the blacksmith make six of these strips, four 3 feet long and two 2 feet long. Each strip should have a screw hole one inch from each end, and another two inches from the end.

Fasten the two 2 feet long strips on the bottom of your small sled, parallel to each other, and five inches apart. You will find that they make a running surface on ice or glazed snow and do not interfere when the snow is soft.

Make two more small sleds in the same manner as you did the first one, with the exception of the rudder post. Fasten these firmly, one on both ends of the cross-pieces like z in Fig. 1. Run a stout brace from each sled to the end B, of A as D D in Fig. 1.

Also use two 2x6 timbers to run from end A to A to each sled H H, Fig. 2. These planks serve both as braces and seats.

Slip the rudder post through the hole in end of plank A, and fasten a tiller piece to it as V in Fig. 1, and your ice boat is all complete with the exception of the mast and sail.

For the mast use a spruce, or ash pole, 18 feet high, 3 inches in diameter at the base, and 1 inch at the top. Bore a hole at the intersection of the backbone A and cross-piece B and in it fasten the mast securely by means of braces. To this mast fasten a primitive leg-o'-mutton sail, or make a regular catboat sail with gaff boom, cleats, halyards, etc. The boom should not be longer than 12 feet.

When sailing, as you know, one man steers while the other tends the **sheet,** that is, holds the cords attached to the lower outer corner of the sail. This he slacks or draws in as the course of the boat is changed, always keeping the sail at an angle with the wind except when you are sailing straight before the wind. To stop the boat, head her into the wind.

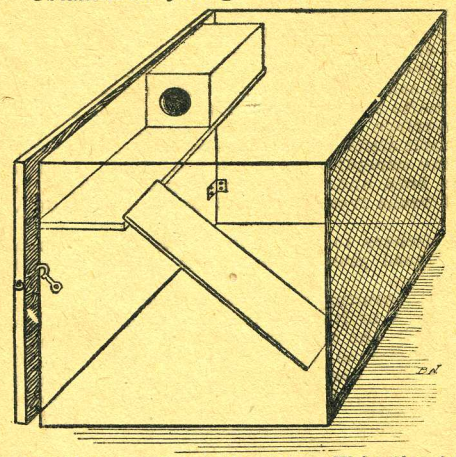
If you have never sailed before you may have all sorts of spills before you get proficient, but as there is no danger of drowning on land that is all in the day's fun. You will soon become good sailors, and I trust that you will have as much exciting sport with your snow boat as Tom and Jack did on the plains of Dakota.—JACK READ.

HOUSE FOR PET RATS.

The rats I have reference to are not the common house rats on which the cats wage a war of extermination, but those which animal dealers call "fancy rats." These are all

white, all black, or mixed black and white. They are much smaller than the common sewer and wharf rat, and make very docile and interesting pets; but it is about a house for them to live in, and not about the rats themselves, that I wish to write.

Obtain from your grocer an empty tea chest, or box, which should be about 2 feet square, but this size is not, of course, essential. The front end is removed and covered with strong wire netting. (See cut.) The entire opposite side or back, is usually converted into a door, which is of great advantage, as, when it is removed a thorough "house cleaning" can be easily accomplished. The house for the mice inside the box, is fastened to the inside of the door, about a quarter of the distance from the top. This the inhabitants speedily turn into a private living room, in which nests are constructed, etc. A strip of wood about an inch wide, leading from the floor to the platform in front of the nest room, at a gentle incline, serves as a stairway. A larger box permits the construction of side perches, aerial walks, run-ways, etc.



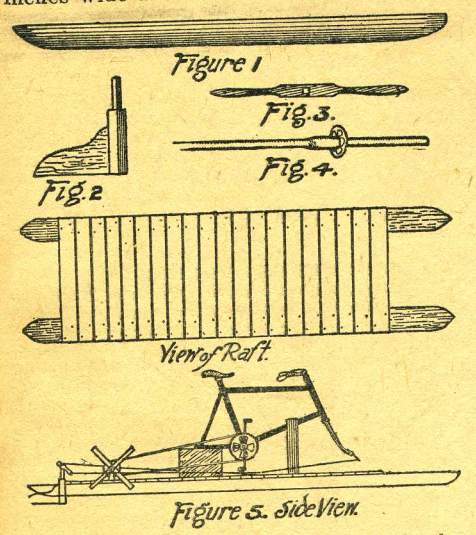
A tin can top for water in one corner, and absolute cleanliness throughout, means healthy pets and no odors from the house.—HARRY G. SELCHOW.

HOW TO BUILD A BICYCLE BOAT.

Having made and used one of these boats the greater part of last summer, and enjoyed it very much, I should like to tell you how to build this new craft. The idea is simple and the boat is easy to construct, and almost any man or bright boy can build one.

First, get two pieces of pine, four inches thick by eight

inches wide and fourteen and one-half feet long. Plane all four sides smoothly and round off the edges; then measure back 15 inches from the bow and shape the bow ends as in illustration.



Round the under edges—that is, the side in the water—in order to cause less resistance to the water when in motion. Now measure back from stern 8 or 10 inches and shape the stern as shown in illustration. Get some ⅞-in. pine boards, cut them four feet long, which is the width of the boat, then nail them across planks. Start twelve inches from the stern and lay the boards as closely as possible until you get within twenty inches from the bow. This is as far as they go.

An old bicycle frame is now set upon a block at such height as to allow free turning space for the pedals in the center of this craft, a little to the stern.

From the chain wheel the chain leads back to another sprocket-wheel (Fig. 4) on the pedal shaft. The latter is made of hardwood two inches in diameter. This shaft turns in and is supported by two blocks set near the edge of the boat, and at each end of the shaft four paddles are attached at such length as to dip from six to eight inches into water. Paddles can be made of half-inch pine boards. Have each paddle blade one foot long. The end of the paddle attached to the shaft should be about four inches and a half wide, while the end in the water should be nine inches. Of course, the smaller the paddles are the slower the boat will go and the easier it will be to run, but if speed is required make the

paddles larger. Although the boat will run somewhat harder if this is done, still the greater speed attained will make it worth while.

Paint the paddles and shaft red, and trim with green.

Through the holes in the front fork ends insert an iron rod and bend it in such a way to form a hook at each end. From these ends two wires run back to the rudder guide (Fig. 3), see illustration. Thus you guide your craft with the handlebars.

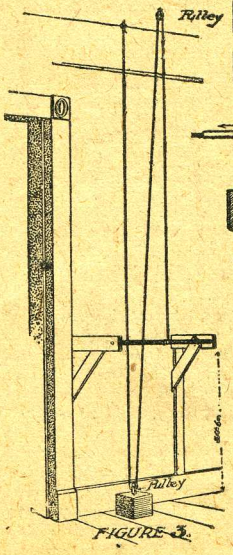
Launch your boat, mount the bicycle frame and work your feet, as you would on a real bicycle, then the paddles turn, and you're off.

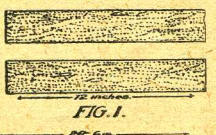
If two of these are made a great deal of fun can be had racing.—A. P. FARMER.

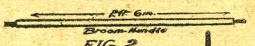
A GOOD WRIST STRENGTHENER.

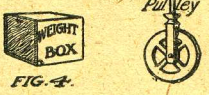
A good wrist strengthener, which I have tried and know to be a good one, may be made in the following manner:

First, procure two pieces of hard pine, 12 inches long, 2 inches wide and one-half inch thick. Nail these in position to the wall, as in Fig. 3, and brace them as in Fig. 3 with two pieces 9 inches long, 2 inches wide by one-half inch thick. Before placing the first two pieces in place, a hole one-half inch in diameter must be bored in them, about one inch from either end. Next get a broom handle 2 ft. 8 in. long; whittle this down to three-fourths of an inch in diameter, an inch backward from each end (Fig. 2). Place this in the holes of the pieces shown in Fig. 1 as shown in Fig. 3. Then measure the height of the ceiling, and secure as much heavy fishing cord as three times the height of the ceiling.







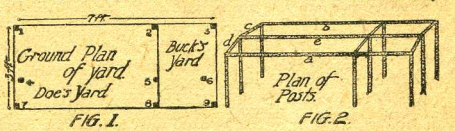


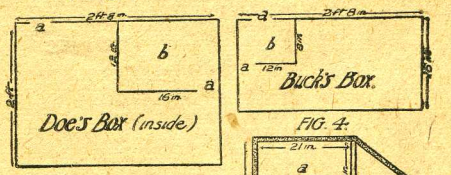
Adjust pulleys, box, etc., and attach cord to eye-screw, wind over pulleys and attach to broom handle at the right.

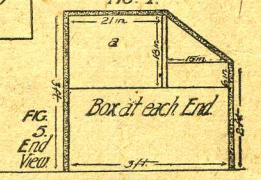
wind from you until the weight rises to the ceiling, then let weight return to the floor in the same manner.—CECIL E. CLIPPINGER, O. T. N.

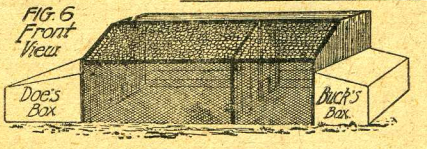
HOW TO MAKE A RABBIT YARD.

First procure nine pieces of hard wood 2x2 inches, of which six are to be about four feet long, and drive them into the ground so that the tops are three feet above the surface, as in Fig. 2 (1, 2, 3, 4, 5 and 6). The other three pieces are about three feet long, so that they are two feet above ground. Next procure some inch boards 10 or 12 inches wide, put them into the ground and fasten them to the posts on all four sides so that the rabbits cannot dig themselves out. Get some strips 1x2 inches, and nail them on the posts, as in Fig. 2, A on the three posts two feet high (front posts), B on the three posts three feet high (hind posts), C on the hind post and the post between the hind and front posts, or middle post, at each end, D on the middle posts and front posts, E on the two pieces and over the middle posts at ends and middle.









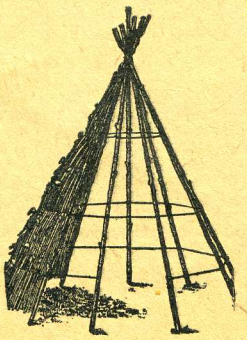
Now make a door that will fit on the pieces A, D and E from four pieces of 1-inch boards 2 inches wide and fasten it with three hinges at the top of E; then fasten a hook or latch at the center of the piece A to keep it shut. Now get some wire netting 2 feet high, 1-inch mesh, and nail it on the front side of the yard and the door. The top can be covered with

either boards or wire netting as you prefer and on the side nail some 1-inch boards. Now put a 1-inch board 10 or 12 inches wide in the ground and nail on the posts (2, 5 and 8, Fig. 1) and make a partition of inch boards up to the top so the buck and doe cannot get together. Now make a box for the doe (Fig. 3) from 1-inch boards about 2 feet 8 inches wide and 2 feet long, or so wide that it fits between posts 1 and 7, Fig. 1; make it 18 inches high in front and 12 inches high in the rear end, so the water can run off when it rains. Cut a hole about 5 inches wide and 6 inches high (A, Fig. 3), or large enough that the rabbits can get through it easily. Now make a place for their young from inch boards as B, Fig. 3, to the roof. The roof is made from inch boards, double layer, so that the rain cannot get through. Now make a box for the buck (Fig. 4) similar to that of the doe's, only it is 15 inches long and make it fit between posts 3 and 9, Fig. 1. Now nail inch boards B up to the roof to prevent the cold air coming in to his sleeping place. Now nail the spaces between the boxes and the top of the yard (Fig. 5, A) with boards at each end. In Fig. 5 it shows the end view and Fig. 6 the front view.—WM ENDLICH.

A TEPEE.

Last summer a cool, shady place in which I could rest or read was a hard thing to find on the farm where I was spending my vacation. I built a tepee and in that I found the much-desired shade and coolness. I will tell how I built it, hoping that some of my readers may find it of use.

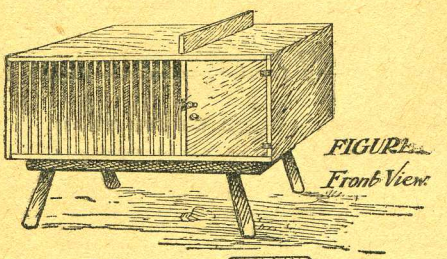
After I had selected the site for my tepee, I secured about ten poles, each ten feet long. These I tied firmly together about one foot from one end with a piece of wire. I then placed the other ends in a circle about eight feet in diameter, as in A. Next I took some more wire, and about every two feet, passed it around the frame, fastening it firmly to each pole, except in the lower ring, where I omitted one space for a door, as in B.



The next thing was a cover. As I was unable to get any canvas I had to find a substitute. Near my tepee flowed a little stream, on the banks of which grew tall reeds, about nine feet high, with large leaves. I gathered a great number of these and took them to my tepee. I tell you it was hard work carrying those reeds in a hot July sun. Then I fastened my reeds with a wire to the poles and cross-wires. Then I got a pair of grass shears and clipped about six inches off the lower ends. This made a draught through the tepee. I cut out the reeds covering my doorway and my tepee was complete.—C. F. PIETSCH.

RABBIT HUTCHES.

The most easily constructed can be made out of an old tea or egg chest, one third being divided by a partition for a sleeping place—a hole being cut in it, Fig. 2, sufficiently large for the rabbit to pass through. A sliding door, Fig. 3, must be made in the partition to confine the rabbits during the time of cleaning. Stout wires must be driven into the top and bottom of the hutch for the front, about an inch apart, and the door put on with two leather hinges and fastened with a latch or buckle.



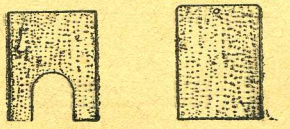


Fig. 2 (End View of Partition) Fig. 3 (Sliding Door)

More finished hutches may be constructed on the same plan with the addition of a drawer for the food; this should be tinned around the edges, also the circular hole in the partition, as well as every other part of the inside of the hutch which the rabbits can bite with their teeth. The bottom should be quite smooth, with a slip taken off the lower part, and the hutch set a little backward for the water to run off.

The buck's hutch (Fig. 4) is generally made of quite a different shape to that of the doe's or breeding hutch, but there does not appear any good reason for its being so. The form is something of the shape of a Dutch oven with very little room for exercise. One made on the same plan as already described for does, with the wires a little stronger, should be more generally used, as the separate apartment enables the rabbit to exercise himself when he

pleases. The buck must always be kept in an apartment of his own. The door to the buck's hutch is shown in Fig. 5, end view of Fig. 4.

Hutches may be set one upon another, or in rows, as most convenient; they should never be placed upon the ground, but elevated on wooden stools or benches and not put close to the wall, but sufficient room left for the dung to pass off from the apertures made in the back of the floor. They should be kept in a dry place, exposure to humidity being fatal to rabbits.—FRED T. KERR.

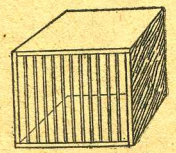


FIG. 4. Front View.

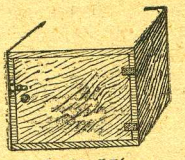
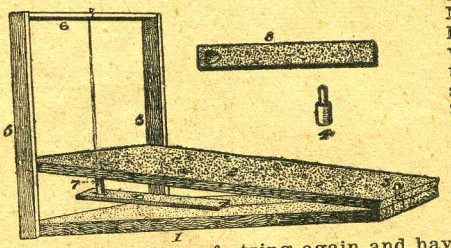


FIG. 5. End View.

A MOUSE TRAP.

First get a piece of board 2x12 and cut two pieces, each piece being two feet long, as Nos. 1 and 2. Then bore a hole through each piece, as in No. 3. Then cut a peg not quite as big as the hole. The hole should be one inch in diameter. Put the peg in the holes, as in 3, diagram of peg No. 4, the peg fits tight in lower board. Now get two pieces of board 2 inches wide and 1 foot long; nail them upright across the top, as No. 6. Now you have the frame-work done. Now take a piece of stout string about 9 inches long and tie it to piece No. 6. Then on the other end of this string tie a little piece of stick 1½ inches long, No. 7.



Now take a piece of string again and have it about 1½ feet long, tie one end to the peg, then on the other end tie another piece of board about ½ foot long, No. 8, and put a notch on one end of the stick, so that when the board is raised for setting stick, No. 7 can fit in the notch.

How to Set It.—Just lift board No. 2 up and let it rest on the top end of stick No. 7. Now the lower end of sitck No. 7 fits in the notch made in stick No. 8.

To Bait It is Simple.—Rub butter or lard on stick No. 8 and the mouse in order to get to lick it will step on it and board No. 2 comes down on him.—WILLIE BROWNLOW.

HOW TO MAKE A WINDMILL.

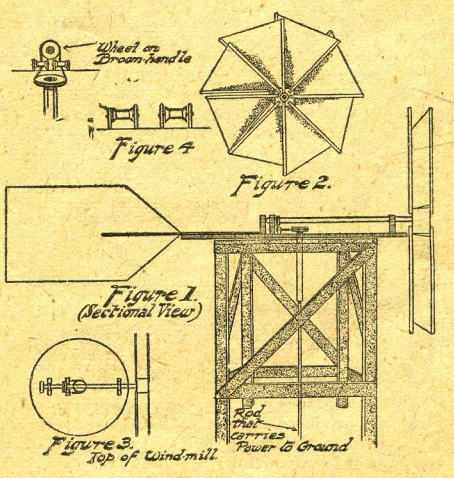
A good serviceable windmill that will run things can be made by following the directions below:

First, get four two by fours, two feet long and make a frame one and one-half feet square by nailing eight boards 1½ feet long on to the two by fours as in Fig. 1.

Then nail boards on this so you have a small table. When this is done bore a hole about 1½ inches in diameter in the center of it.

Next make a round frame, or if it is square it will not hurt, 2½ feet across the top and bore a hole in the center about 1¾ inches in diameter.

Now get a piece of pipe that will fit tightly into the hole in the table and loosely into the hole in the frame and fix it into the smaller hole, then lay the frame on top of this with the pipe reaching a little above the top of it as in Fig. 1. The pipe should be about one foot long.



The wheel part is made by boring a hole large enough for a pipe or broom handle to fit into, through a five-inch piece of six by six and nailing sixteen sticks 1½ feet long and 1x2 inches on it, eight on each end, as in Fig. 2.

Cut out eight pieces of canvas large enough to fit from a stick on one side of the block to the stick just ahead on the other side, and

sew them tightly on to the sticks. These are to catch the wind and turn the wheel around.

Now get the pipe or broom handle tightly into the hole in the block (the broom handle should be about 1½ feet long). Next get a small wheel or pulley for a band to run on and fasten it three inches from the opposite end of the broom handle, as in Fig. 3.

Then nail blocks of wood with half circles cut in the side of them, for the broom handle to set in, on top of the larger board on the frame. In Fig. 3 it shows how the blocks are set.

Nail a piece of leather, after the broom handle is in place, on the blocks so it cannot come off when the windmill is in motion.

Another block should be nailed behind the broom handle so it will not slip backward.

Now get two spools and fasten them on to four sticks with two nails, as in Fig. 4. Then nail them on to the top boards on the table directly under the wheel on the broom handle, as in Fig. 5.

Procure a small rod that will just fit in the pipe, put a wheel on the end of it and set it in the pipe.

When this is done get a piece of tape or other material that will make a good band and pass it around the wheel on the broom handle, under the spools, and around the pulley on the rod in the pipe.

Then get a board two by one foot and cut it down toward the end, as in Fig. 1. Next saw a piece one foot long and one inch wide out of the end that you cut down, as in Fig. 1, for another board two feet long and three inches wide to fit in tightly. It had better be glued or nailed.

After this is done nail the opposite end of the board that is glued into the larger one on to the top boards, on the table directly behind the windmill. You should grease the rod in the pipe, the broom handle where it fits in the blocks, the top of the table and the frame on it so they will run easily.

The windmill is now complete and only needs to be set up on some building where the wind is strong to be in working order.—GEO. D. STACY.

A BOOK RACK.

The following is how I made a nice inexpensive book rack.

In making one you need the following articles:

Nails (finishing nails or brads are best).

4 pieces of poplar 18x⅞x⅝ in.

4 pieces of the same 8 in. long.

2 pieces of poplar 18x5½x½ in. for shelves.

All of the wood should be nicely planed.

Take the four pieces (18x⅞x⅝) and saw the ends off (A Fig. 1) at an angle of 45 degrees.

Now take two of the 18x⅞x⅝ pieces and two of the 8 in. pieces; nail them together as in B, Fig. 1. The bottom of the piece marked A should be 4 inches below the bottom of the piece marked B, and the piece C C should be 2 in. from the ends of A and B respectively.

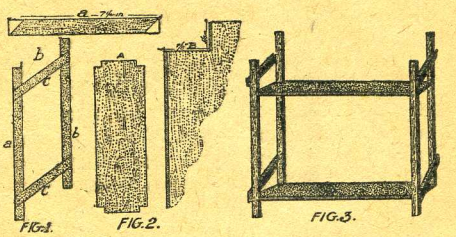


FIG.1. FIG.2. FIG.3.

Then make the other side like this, except have the cross pieces or C C on the opposite sides of the posts (A, and B, B, Fig. 1).

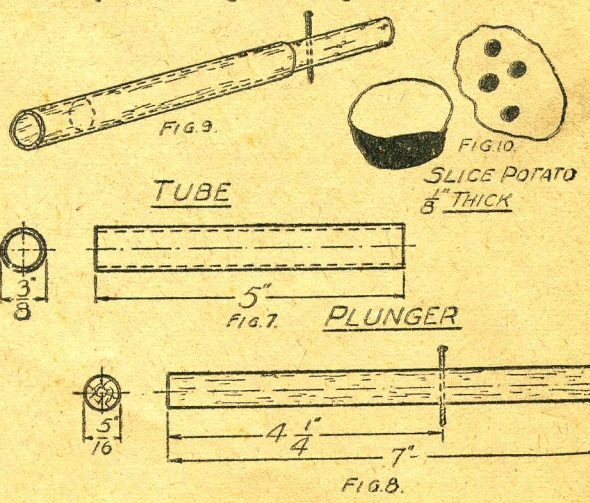
If you have this all right take the two pieces (18x5½x½) and saw out the corners (A Fig. 2) for the posts to fit in. For measurements see B Fig. 2. Having finished this, take the sides and shelves and slip the sides on the ends of the shelves, having the posts fit in the notches, cut out the ends of the planks; also be sure that the cross pieces (C, C, B, Fig. 1) of each side are on the outside. Nail the lower shelf even with the bottom of the back posts and 4 in. from the bottom of the front posts. Then nail the top shelf 4 in. below the top of the front posts and 8 in. below the top of the back posts.

Now lay the case down with back on a level surface and bore a hole in each post for nails to hang it on.

Fig. 3 shows how book rack should look when finished.—TRENT NEEL.

Potato Gun

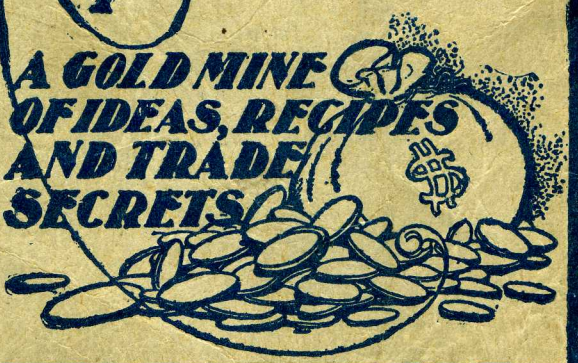
A potato gun is great fun. Get a piece of thin walled tubing as at Fig. 7. The kind used for a combination pen and pencil or a glass drinking tube will do. File one end sharp so it will cut the potato easily. Make a handle of a round piece of wood as at Fig. 8. Drive a nail through the handle so the end cannot be pushed all the way through the tube. It should stop about ¾" from the end, Fig. 9. Slice a potato as at Fig. 10 about ⅛" thick. Plug the end of the tube by forcing it through the slice of potato which should be placed flat on a piece of board. Plug the other end, and with the plunger push one plug through the tube. The other will fly out making a loud report.



PRICE 10 CENTS POSTPAID

The STAR MONEY MAKER

A GOLD MINE OF IDEAS, RECIPES AND TRADE SECRETS



JOHNSON SMITH & COMPANY
6615 E. Jefferson Ave. Detroit, Mich.