Everyday Mechanics

TRADE MARK REGISTRATION APPLIED FOR

"It Tells You How to Make and How to Do Things"

VOL. 1 SEPTEMBER, 1916 NO. 6

ANNOUNCEMENT

In the July number I asked you if you would pay 10 *cents for your little magazine. Hundreds and hundreds of you have responded "yes." Out of the prodigious number of letters received I have not found one dissenting voice.*

Accordingly, the price of EVERYDAY MECHANICS *will be raised to* 10 *cents on the newsstands, commencing with the October number. This move is of grave importance, and it has not been made without the most thorough and intelligent consideration. Many of you have, no doubt, expected it, and we, ourselves, have feared for months that it might be necessary.*

In raising the price to 10 *cents, I shall not promise you double the reading matter, or even half of that increase. In fact, there will be no increase whatever in the number of text pages, until the little magazine has surmounted some of the many difficulties that have beset its path from the start. The quality, however, will steadily improve. After all, from the start I have promised you* QUALITY*—material that you could not get elsewhere—without saying one word about quantity. The two do not go together. We are but human, and if I am to give you the personal touch and care that you have had in past issues of* EVERYDAY, *I cannot well increase the number of pages without in a measure detracting from the quality produced by the concentrated thought and effort represented in every editorial page of your magazine.*

Therefore, in announcing this increase in price, I shall merely remind you that it is the voice of a majority of you who have so loyally stuck to EVERYDAY *through its trials and tribulations. The increased price will relieve the financial tension that at present (when every raw material entering* *the construction has doubled or trebled in price) is serious. This relief will enable the men who make your magazine to work with free minds and with increased energy.*

Our plans for the future are ambitious. One of them materializes in this issue with the article on our Experiment Station. My colleagues and I are determined to give you what you want by being one of you. We shall doubtless have imitators just as we have already had in our young life, but imitation does not worry us. We shall simply go right on plugging for you and our little magazine, cheerful in the knowledge that every mail brings us added confirmation of the fact that we are "making good" with our readers who, we feel, represent the inventors, scientists, and men of achievement of the future.

Sincerely,

THOMAS STANLEY CURTIS,

Your Editor.

P. S. You can subscribe for EVERYDAY *at the old price of 50 cents per year only until January 1. After that the price will be $1 per year. Better get in on the ground floor.*

T. S. C.

THE HOME CRAFTSMAN—HIS SHOP AND LABORATORY

By The Laboratory Staff

EDITOR'S NOTE: This is the first of a series describing the construction, equipment, and use of the *Everyday Mechanics Experiment Station*, Van Nest, N. Y. The suggestions offered may serve as an incentive to amateur mechanics, either singly or in groups or clubs, throughout the country to follow the example of our Staff.

WE had talked of it for months; in fact, the ambition to erect and equip a real experiment station or laboratory in which to develop and test our editorial ideas, was born with the first number of our little magazine. But it always seemed so remote and difficult of acquisition that we had almost abandoned the idea in favor of the original shop which occupied a corner of the editorial office. Then one Saturday afternoon, when it was time to go home, the "hunch" seized us again with redoubled fury, and two eagle-eyed members of our Staff were forthwith dispatched to *go out and find* a building that would answer the purpose. That settled the matter. How the boys found our "building" the writer cannot guess even to this day, but find it they did, for at sundown on the memorable Saturday afternoon a telephone call announced the gladsome news that a most pretentious *chicken coop* had been sighted on the tip of a little knoll and that the owners were quite susceptible to diplomatic reasoning.

Now, friend reader, do not sniff at that chicken coop idea. The building turned out to be a medium-sized barn of tolerable construction, with a large shed attached. There were no windows and the floor was wretched, and the walls had holes in 'em, and the roof leaked, and the whole place was abominably dirty! Outside of that it was passable.

A telephone call announced that a most pretentious chicken coop had been found.

Subsequent visits arranged a lease at an insignificant rental. Examination showed, it is true, enough repairs and alterations to make up for the low rental, but on the whole the place seemed an acquisition. We are now convinced that it actually was one.

Construction and Alterations

The floor space in the main part of the building is 13 x 16 ft. The shed contains just about as

The walls were covered with tar paper

much more. The hay loft is just high enough for a man to stand in, and we shall use it for a nice, dry, storage place.

The shed will eventually be used as a forge shop and for the storage of heavy, rough materials. We intend to leave the earthen floor just as it is until we can put down one of concrete. One end will be finished off to take our private lighting plant, which is now in process of construction.

The main portion of the barn shows the results of our labors. The old flooring was ripped up and the dirt of years swept, scraped, scoured and flushed out with volumes of water and a powerful disinfectant and deodorizer. The walls and studding came next, but the latter had been so plentifully washed with the rain that leaked in that this task was not difficult.

Next, we sent our scouts out to buy up old lumber, and, inside of an hour, they had located a pile that we bought blind at $8. It proved to be a bargain, although it was entirely in the rough. There was enough to face the walls completely with a few pieces to spare for odd jobs. We then cut a doorway between the main building and the shed, making the opening of a size to fit an old door that we had bought for a dollar from a second-hand dealer nearby. From the same man we secured three window sashes with most of the lights in, also for a dollar. In facing the walls, openings were left for the windows,

The seams in the tar paper were painted with asphaltum

two in the main building and one in the shed. The windows were later fitted in box-frames and arranged to swing outward on hinges so that rain would not enter even though they were open.

The ceiling of the main room was next covered with lath, which subsequently was faced with building paper. This handy and clean material was later placed upon the walls and the transformation was remarkable.

By this time we had experienced the discomfort and alarm of several rainstorms. Finally, in desperation, we bought some tar paper and mounted the roof, which is flat and has an incline of an insufficient degree. We ripped off the entire collection of roof-coverings that our predecessors had placed one over the other. There must have been five of them. However, a husky crowbar and cold chisels soon rolled up the combination of tin and tar paper and disclosed some ancient puddles beneath. These puddles had the maddening habit of dispersing their contents a drop at a time through the ceiling, and frequently down the necks of the workers. You will say that we should have fixed the roof first of all; well, we knew that, too, but we were just as anxious to disguise that main room and forget that it had housed chickens as you would have been.

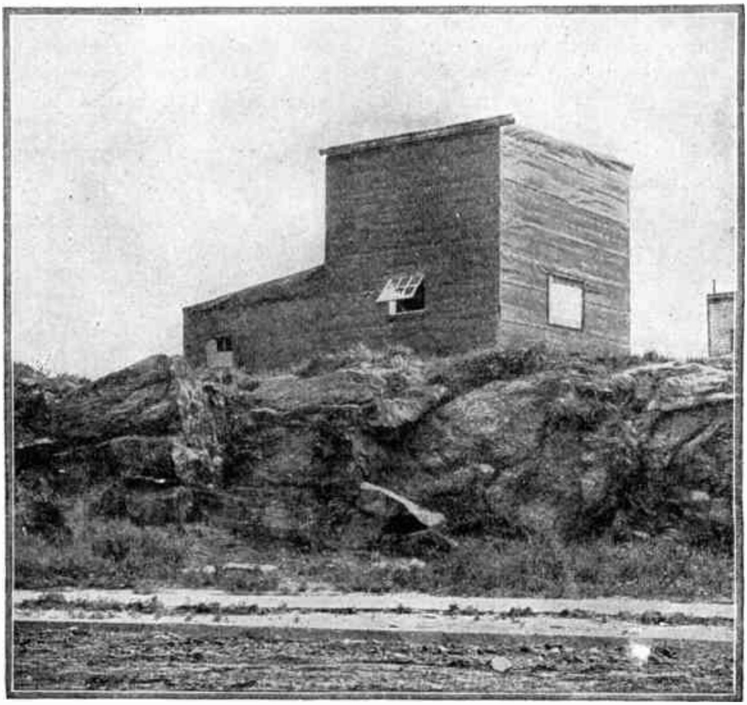
The roofing material cleaned away and the puddles quite dried, we proceeded to cover the roof with tar paper of the triple-ply variety. The first sheet was placed at the lower end of the roof and each succeeding layer laid on top of the last one, lapping well and painting freely the seams

His bark is a warning to prowlers after we desert the Station at night

with asphaltum. The tar paper tins were also painted with the varnish to prevent rusting.

This roof was a success from the start. We have had but two leaks since, and these were due to the shrinkage of the tar paper. If we had made our laps six inches instead of three, our roof would have been quite perfect. We have since had to go over many seams with narrow strips of paper, using the asphaltum plentifully at every seam.

The side walls were next cov-



Our "chicken coop" is no longer suggestive of the name

ered with single-ply tar paper, which covers about three times as much space per roll as the heavier variety. We started each piece at the bottom of the building wall and lapped as we approached the top. We had to make a crude scaffolding in order to reach the higher portions of the wall. How this was done is shown in one of the illustrations. The walls now are tight, and the appearance of the building improved several hundred per cent.

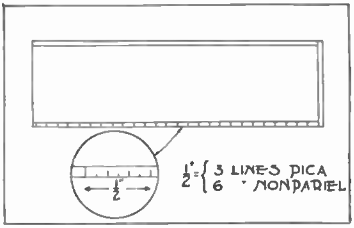
When the walls were tight we went back to the flooring of the main room. The rough foundation left when we removed the planks from the stalls appeared to be level enough, so we determined to lay our new flooring directly upon the old. The scouts once more brought in a bargain lot of lumber, this time securing a load of fine tongue and grooved stock over an inch thick and nine inches wide, while the length averaged twelve feet. This stuff cost us 10 cents a piece and we secured enough to do the entire floor and to build wonderfully firm benches all around the room. For the uprights of the benches, we used the old two by fours that came from the stall flooring.

The building now looked presentable. The next improvement was made when we scrubbed the new floor and benches and gave them a generous coat of lead-gray floor paint, which has dried as hard as one could desire. The place is now clean, and there is not the slightest trace of the once very prominent odor. It is dry and comfortable, and at this writing we have it working in full blast, with our machinery installed and our "juice" connected. But with this you will have to be satisfied for the present. We will tell you about the equipment in the next number, and for the benefit of those who live within a modest carfare of New York City we shall arrange visiting days so that you may see what we are doing. For our friends hundreds and thousands of miles away the best we can do is to publish lots of pictures each month, and to tell you what we are doing so that you may do it yourselves.

GAUGE-SCORED GALLEYS.

Job printers have been slow to adopt new accessories that promise to facilitate the production of work. They know well that "time is money," but the fear that time will be lost in introducing new processes, no doubt, prevents many from experimenting with appliances other than those they have been used to.

Every printer will, at a glance, see the utility of the composing room convenience illustrated; that



Pica marks on the galley aid the printer

is, a galley with a type gauge scored upon its near rim.

There being exactly six lines of pica, or twelve lines of nonpareil, to the inch, the most useful scoring would be for inches divided into twelfths, thus giving the printer three modes of measurement—inches, picas and nonpareils. In a printing office equipped with these gauged galleys no more time would be lost over illegible or mislaid separate gauges.

Contributed by J. W. HOSKING.

Fill the big crack in your stove with a cement made of coal ashes and white of egg; it will last for years.—MARY F. SCOTT.

CONSTRUCTION OF RADIO RECEIVING APPARATUS

By The Laboratory Staff

Editor's Note: The apparatus described in this article has been constructed and tested in the *Everyday Mechanics Experiment Station.* The models may be seen at the Publication Offices of the magazine.

In presenting the two designs embodied in this article, we do not wish to pose as originators of new types of apparatus, and neither do we wish to give the impression that the apparatus we have constructed is superior to anything on the market. The loading inductance presents no startling improvements in design or construction and the receiving transformer is just a good, substantial piece of apparatus that an advanced amateur need not be ashamed to construct and operate.

What we have endeavored to do, however, is this: We have tried to eliminate the defects, principally mechanical, that seem inherent in amateur apparatus; we have attempted to produce a design pleasing to the eye, convenient and smooth in operation, simple and inexpensive in construction, and of correct proportions and specifications from the radio standpoint.

The old "loose coupler" type of receiving transformer has long been a favorite for the very simple reason that it gives such universal satisfaction. The writer well remembers the experience of one of the best known manufacturers of amateur apparatus of the better grade. For years this concern had manufactured and sold great quantities of a certain number—a comparatively simple receiving transformer with sliding contacts and telescoping primary and secondary. True, the workmanship was excellent—as it was on every number turned out by the company—but there was nothing startling about that "loose coupler" to give it such a reign of popularity. However, when the manufacturer tried to substitute a perfect wonder of a tuner, with variometer coupling and a myriad of instrument-switch contacts, offering the new and improved device at the same figure as that asked for the plebeian coupler, the trade appeared to receive the newcomer with indifference and doubt. After several years of pushing and advertising, the little tuner had to be discontinued, relinquishing the field to a revival of the old-fashioned coupler. It is an actual fact that the demand for the old favorite was greater, probably just because of its simple goodness, than that for the improved instrument which was really a much better

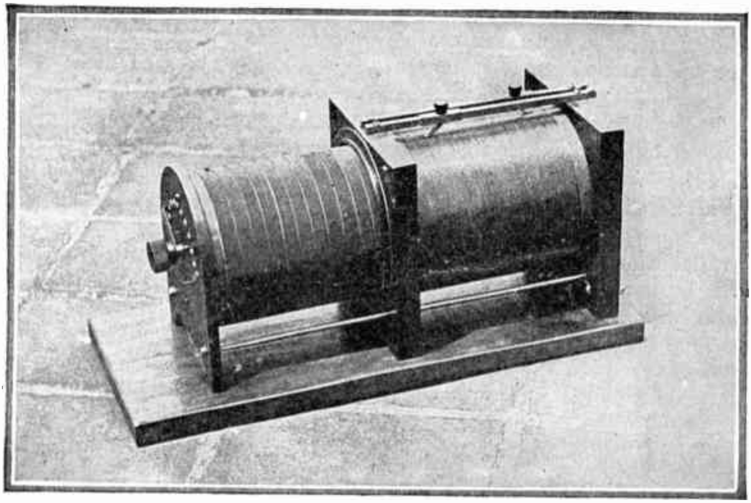


Fig. 1. Receiving transformer completed

buy, value considered, than its successful predecessor.

Perhaps the reader will wonder at this digression. It is given merely to justify the publication of the design of a type that has been described many, many times in contemporary magazines. If our readers could but see our models, turn their contact knobs, and listen in to the gratifying results obtained, this justification would be unnecessary. Whatever adverse criticism this article may bring forth, the fact remains that there are probably more of these simple receiving transformers in use, and in *successful* use, too, than there are of any or all other types.

THE RECEIVING TRANSFORMER

This transformer has instrument switch adjustment for secondary inductance and sliding contact adjustment for the primary. The construction is such that no metal (supporting rods) is used inside either primary or secondary windings. While the deleterious effect of metal in such cases is perhaps open to question, we have avoided its use as unnecessary in our design.

The transformer responds to wave-lengths as high as 2,500 meters without the loading inductance. This is believed to be the "happy medium" which reduces objectionable "dead ends" to a minimum and still affords a wave-length of great utility. The figure quoted is based upon the use of the instrument with the average antenna of the advanced amateur.

The construction involves some careful but not necessarily difficult wood-working. A lathe is not at all necessary, although it is, as always, desirable. If a jig saw is available, most of the turning can be avoided. The only real, good excuse for a lathe is in turning the wooden heads that fit into the cardboard cylinders, and also in winding the cylinders. substitute for the lathe in both turning and winding operations is an ordinary polishing head that can be purchased for a couple of dollars. The discs may be mounted on the taper thread and a very presentable job of turning done with the broken end of a flat file held on a simple rest.

The jig saw, however, is an essential. If one of the foot-power variety is not available, the hand fret saw frame will answer, although in our experience there is no comparison between the two.

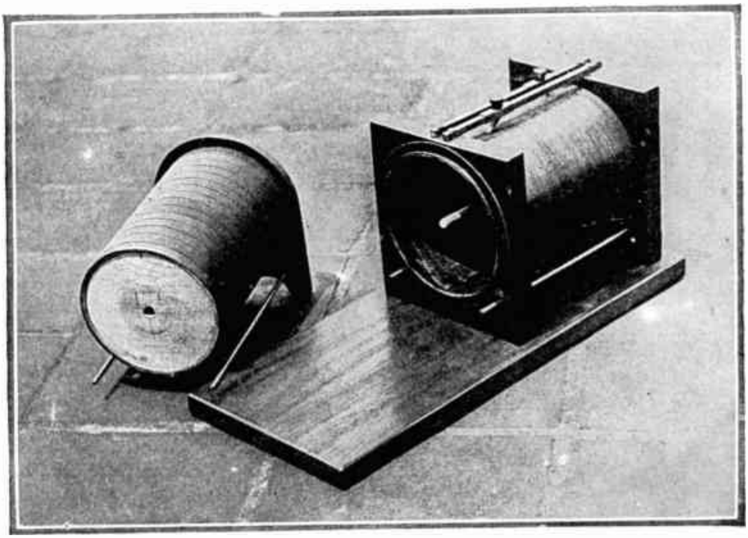


Fig. 2. Receiving transformer showing dowel arrangement for sliding

The latter operation may readily be done, however, by mounting the cylinders between centers on a base board. Another effective

The woodwork had best be done first of all. Figs. 1, 2 and 3 will give a good idea of the appearance and construction of the in-

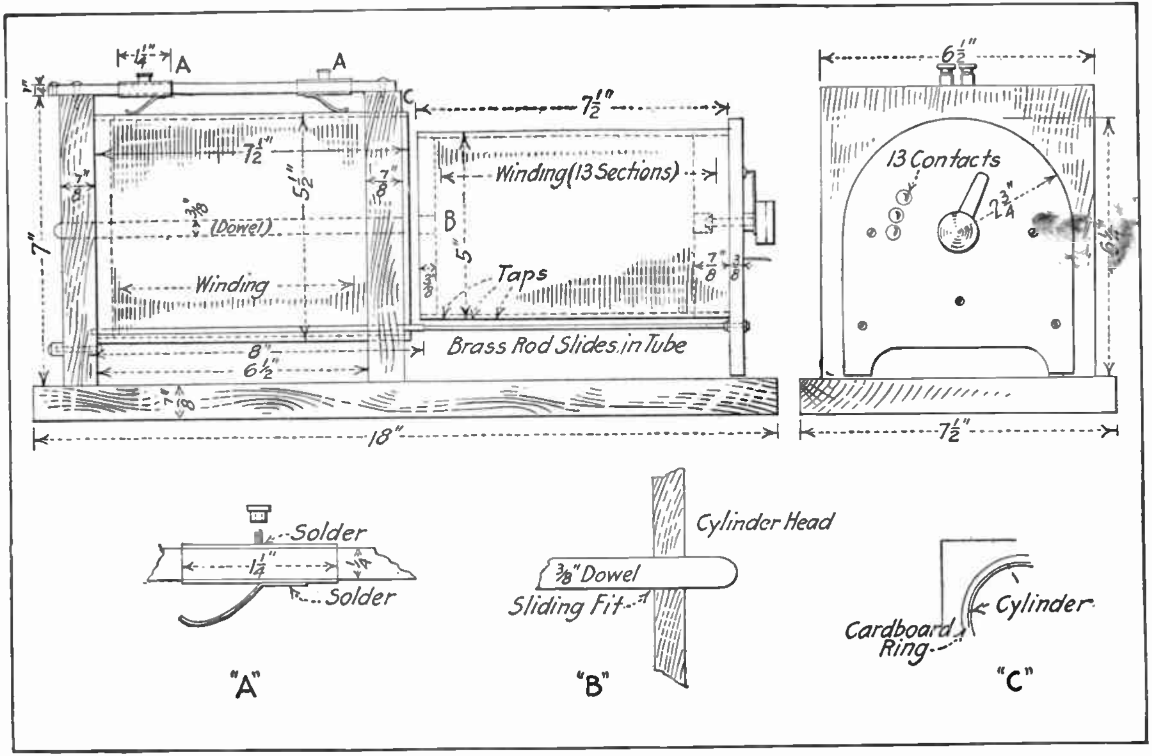


Fig. 3. Detail for construction of transformer

strument. The details and dimensions are given in Fig. 3. The choice of wood rests with the individual, but we favor whitewood. The base, 7½ in. wide and 18 in. long, is of ⅞ in. stock and quite simple. The upright pieces that support the primary are each 6½ in. wide and 7 in. high, while the thickness may be ⅞ in. The piece to the right in Fig. 3 is cut out to receive the cardboard cylinder which is 5½ in. outside diameter. The left-hand piece is left solid and it has mounted upon it a disc of ⅜ in. whitewood turned to fit the inside of the cylinder. The latter should not be permanently secured in its supports until after the holes for the brass tubes indicated in the drawing have been drilled. This operation will be detailed later.

The next step will be to get out the two discs for the secondary cylinder. One of these is of ⅜ in. stock, while the other is of ⅞ in. wood. They are, of course, to fit the inside of the cylinder tightly. The latter, as the drawing indicates, is 5 in. in outside diameter. The internal diameters of both cylinders will vary a trifle with different makes of cardboard tubing, but it is of little consequence. The thicker disc may be permanently affixed by means of glue and wooden pegs, but the thinner disc must be left removable until after the winding is finished and connections to the contact points are made.

The front support that holds the secondary may now be worked out with the jig saw, and with this the woodwork proper is finished. This is the time to do the staining and varnishing. If these decorative operations are left until later, the results will be rather unsatisfactory and the task difficult to perform. After the varnish is good and hard, so that handling will not injure the finish, the worker may lay out the centers for drilling the two holes through which pass the supporting brass rods. These holes are 4⅜ in. apart on centers and 1¼ in. up from the base. When the centers have been marked and pricked, the front support may be placed on two pieces which hold the primary, and holes drilled through all three while they are clamped together. This will insure alignment of the holes, which is quite essential to prevent binding when the rods are telescoped into the tubes. The holes in the secondary support may be ¼ in., the same as those in the other pieces, for a trifle of leeway is not objectionable to permit of easing up on any bind that may develop when the apparatus is assembled.

The brass tubing and the rods that enter it may then be placed. and the whole arrangement assembled temporarily to determine whether the work has been successful. As the drawing indi-

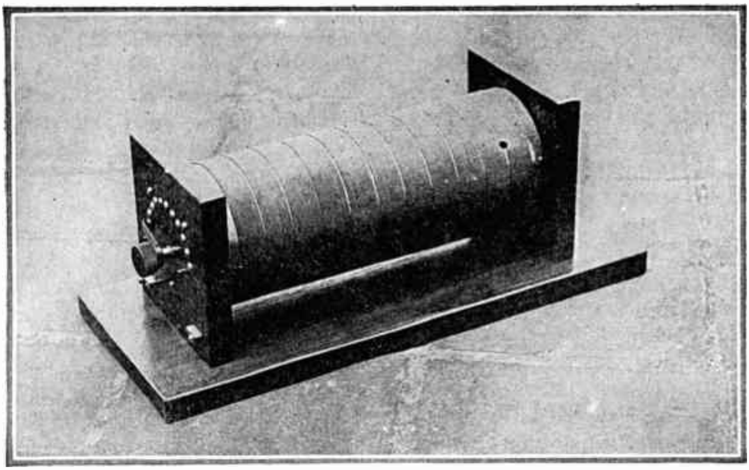


Fig. 4. Loading coil completed

cates, the secondary support is gripped between nuts and washers on the threaded ends of the rods.

We are now ready for the winding. The primary is wound directly upon a cardboard cylinder 5½ in. diameter and 7½ in. long. The winding is No. 24 bare copper wire. The winding is done with two wires wound in parallel and then, after the ends are carefully secured by pushing through holes in the cylinder, and plugging with wooden pegs, one wire may be unwound. This will leave a firm, neat winding of bare copper wire with each turn separated from its neighbor by the thickness of the wire. The winding should be made about 5½ in. long, leaving ½ in. of space at either end of the cylinder when the latter is mounted in the wooden supports. After the winding is finished, it should be given two generous coats of shellac, taking care to see that the fluid runs down between turns in order that they may be sealed to the surface of the cylinder. The contact path for each slider is to be scraped in the winding after the shellac is quite hard and dry. This operation, however, need not be attempted until the cylinder is mounted and the sliders are in place on their rods.

The secondary winding consists of a single layer of No. 28 S. S. C. magnet wire wound in 13 sections upon a cardboard cylinder 5 in. diameter and 7½ in. long. The winding amounts to a single layer which is wound in the following manner: The winding is started from one end and continued for ½ in., at which point the hand guiding the wire is jumped to a distance which leaves a space of about 1-16 in. between the finished turn of the section just wound and the beginning of the next section. At the point where the "jump" is made, a pin-hole is punched into the cardboard cylinder. Through this hole the tap which leads to the contact point will be made. This process is to be continued until 13 sections have been wound, at which point about 6½ in. of the surface of the cylinder will have been covered with the wire. Care must be taken to see that the holes through which the taps are taken are in a line, which will, of course, be at the bottom of the cylinder when it is mounted on the secondary support.

There are a number of ways of securing the silk-covered wire to the cardboard cylinder, but the best method in our experience is first to coat the cylinder with two or three applications of shellac, allowing the varnish to become "tacky" before placing the winding. This method will firmly secure each turn to the cylinder, and at the same time will obviate the necessity for shellacing the silk after the winding is complete.

The taps are made with lengths of slightly heavier bare copper wire pushed through the holes in the cylinder and soldered with a very fine copper, one to each of the "cross over" wires between sections. These taps should be long enough to extend through the ⅞ in. head to make contact with the points upon which the instrument switch bears. Each tap is to be covered with a sleeve of fine rubber tubing to prevent possible short circuits inside the cylinder.

The next operation, before going further with the taps, is to insert the secondary inside the primary after having wound heavy wrapping paper around the primary until it fits closely into the larger tubing. The secondary support with its brass rods firmly secured to it is then to be brought up to the wooden head of the secondary and holes drilled for the wood screws that secure the secondary to the support. The shrewd reader will at once see that this insures accuracy in assembling the component parts of the transformer and precludes the possibility of uneven space between primary and secondary cylinders. When the screws have been driven home, the secondary may be withdrawn and from this point on the secondary and its supporting piece should not be separated.

The next operation will be to lay out the arc of the circle for the contact points, of which there are 13. The radius of the arc on

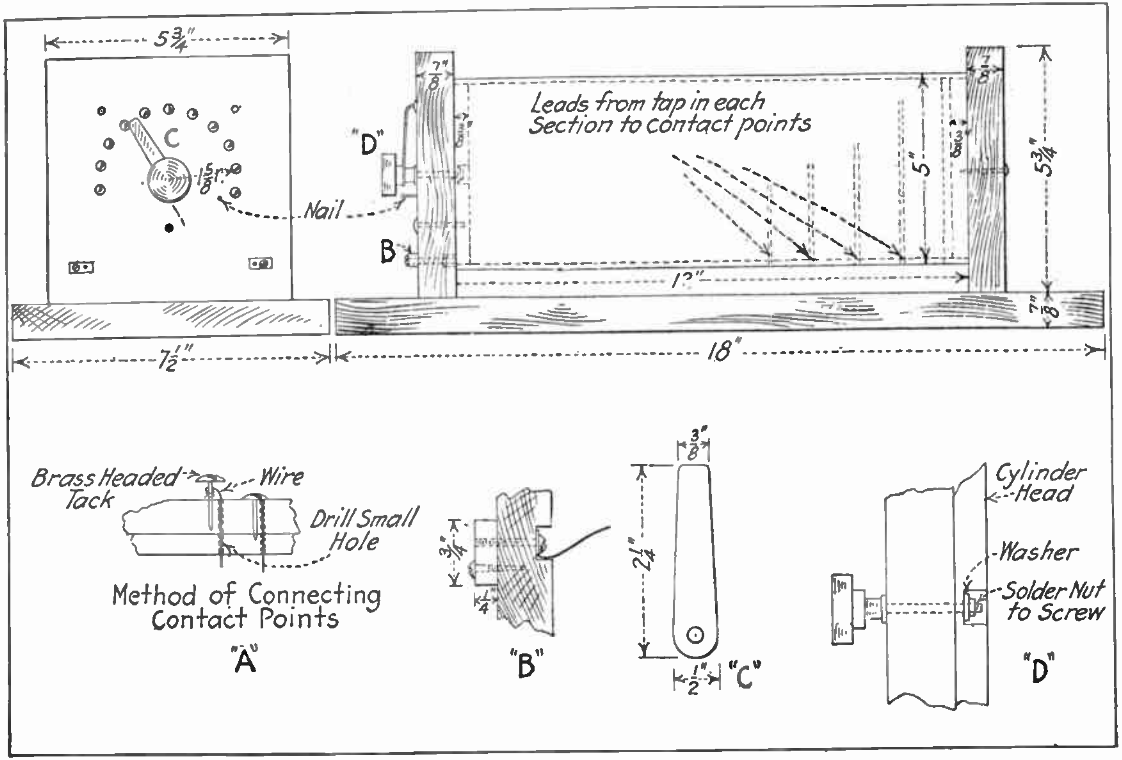


Fig. 5. Detail for construction of loading coil

our coil is 1⅝ in. This arc may be scribed on a piece of paper or cardboard, and the contact points laid off about ½ in. apart on the arc just drawn.

Now, placing the paper with its center mark over the mark which indicates the center of the secondary cylinder, prick punch a hole into the wooden secondary support at each point where a contact is to be placed. Go over these prick punch marks with a pencil so that you can distinguish them and then, alongside of each mark, but *not* in the same place, drill a hole with as small a drill as you have, carrying the point quite through both secondary support and wooden head of cylinder. The wires which form the taps of the secondary may then be brought through these holes ready for connection with the contact points.

The first turn of the secondary winding is connected with one of the brass rods, where it is secured to the secondary support, and from that point on each tap goes to a contact. The stud of the instrument switch, of course, is connected with the second brass rod attached to the secondary support. From this the reader will, of course, see that the instrument switch makes contact with first one section after another, making it possible to include a part or all of the sections in the circuit at will merely by turning the switch.

When the secondary has been connected, the wrapping paper may be replaced around it and the cylinder pushed home in the primary. First of all, however, the thin wooden disc should have been glued and pegged into the hand of the secondary cylinder. Now, when the secondary is accurately centered and held within the primary, and while an assistant holds down the entire instrument to the bench, run a sharp ⅜ in. bit through the rear primary support at the center, carrying the bit entirely through the thin wooden head at the inner end of the secondary. Remove secondary and take off the wrapping paper. Then ream the hole at *B* in the secondary head until it is a free sliding fit on a piece of ⅜ in. dowel rod. Cut the rod 8¼ in. long, and round both ends nicely. Glue the rod permanently in the rear primary support, wherein it should fit securely, in order to make a good, stiff support for the inner end of the secondary when the latter is pushed home.

The sliders and rods, by means of which the inductance in the primary is varied, are so familiar to the radio boys of to-day that we shall not take space to go into a description of them. Suffice it to say that the rods are of ¼ in. square brass stock. The sliders are of square brass tubing that is a nice sliding fit over the rods. The contact spring on each slider is a piece of phosphor bronze sheet, cut and bent to appropriate shape, and soldered to the bottom of the slider.

Binding posts are not specified, for connection may be made directly to machine screws in the ends of the slider rods in the case of the primary, and to small connection blocks electrically connected with the brass tubes that pass through the primary supports, for the secondary.

Loading Inductance

The loading inductance consists of a cardboard cylinder wound in a single layer with No. 24 S. S. C. copper magnet wire in 11 sections. Each section is tapped to a contact point in one of the heads as shown in the illustration. As the construction is identical with that of the receiving transformer just described, in so far as mounting the cardboard cylinder, etc., is concerned, we will not go into a lengthy explanation of the construction. All details are given very clearly in Fig. 5, and Fig. 4 shows well the appearance of the finished instrument.

A few hints relative to the standard products used in the construction of both of these coils may not be amiss. The instrument switch used on each coil is a standard product that may be bought in almost any large supply house. The builder is, however, advised to discard the usual brass contact piece and substitute for it a piece of phosphor bronze sheeting cut to the dimensions shown at *C*, Fig 5, and bent over at the tip so that the contact is made on the edge rather than on the flat surface.

The contact points may be ordinary brass-capped upholstery tacks or they may be oval-head copper rivets. The latter are much to be preferred, but they are more expensive and more difficult to install. If the rivets are used, however, the hole through which the tap wire passes may be made approximately the same size as the shank of the rivet in order that the latter may make contact as the stud is driven home.

If the upholstery tacks are used, the method of connecting shown at *A* should be employed. This insures contact between the wire and the brass head rather than with the steel shank of the tack.

The simple form of connection block that we favor is shown at *B*. This is merely a short length of ¼ in. square brass rod secured to the instrument at the desired point. Connection is made under the heads of brass machine screws in an obvious manner.

The cardboard cylinders for both receiving transformer and loading coil may be obtained from advertisers in this magazine, and the woodwork is best obtained from a local mill which will cut out the pieces to size at a very reasonable figure.

At *D* is shown the method we employ to secure the adjusting knob which carries the switch making contact with the studs. In the standard product a threaded shank is permanently fastened to the composition knob. The obvious way of securing this switch to the instrument would be merely to place a lock-nut over the first nut that goes on the shank. This method, however, is unreliable and unsatisfactory. Constant use will frequently loosen the nuts after the instrument is entirely assembled, and needless annoyance results therefrom. We used the simple expedient of locking the first nut with a drop of solder after we had secured just the tension we desired to make the knob turn with freedom but without unpleasant looseness.

The *Technical Adviser* is at the disposal of readers who require additional advice or instructions, and the *Service Department* will aid those who have difficulty in obtaining needed materials.

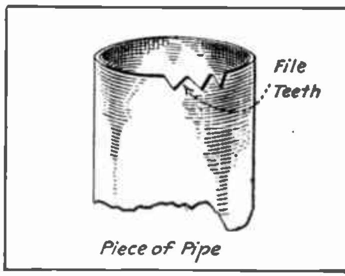
Paint For One Cent Per Pound

To one gallon of hot, soft water add four pounds of crude sulphate of zinc. Let it stand until it dissolves perfectly, and a sediment will settle at the bottom. Turn the clear solution into another vessel. To one gallon of paint (lead and oil) mix one gallon of the compound. Stir into the paint slowly for 10 or 15 minutes and the paint and compound will combine perfectly. If too thick, thin the mixture with turpentine.

Contributed by J. C. Gilliland.

Boring a Hole in Brick

Any man who wishes to bore a hole in brick and has not a cold chisel on hand will find this home-made chisel very handy. All that it consists of is a piece of galvanized iron pipe about 7 in. long and the diameter depends upon the hole you want to bore. In one end of this pipe, teeth must be filed about 1-16 in. apart. You will find that this will bore a clean-cut hole.



File teeth in one end of the pipe

Contributed by Fred W. Allen.

If the family is large and the kitchen sink small, try using an oval tin foot tub instead of the round dish pan.—Mary F. Scott.

CONSTRUCTION OF A MODEL SUBMARINE WITH WIRELESS CONTROL*

PART V. THE DIVING MECHANISM, WIRING AND CONNECTIONS

BY THE LABORATORY STAFF

THIS model is made to submerge by means of diving planes both fore and aft. The planes are tilted to a slight angle by means of plungers and solenoids in a manner similar to that employed in the case of the stern rudder. The general appearance of the diving mechanism is well shown in the photographic illustrations, Figs. 1 and 3, while Figs. 2, 4 and 5 give details of construction with the necessary dimensions.

The planes aft will receive our attention first. Reference to Fig. 1 shows that these planes are mounted upon the ends of the shaft of brass that passes quite through the hull, supported in bearings similar to that employed in the construction of the tube through which the propeller shaft passes. In the upper right hand corner of Fig. 5 is a section of one side of the hull with the brass shaft passing through the tube which fits closely in a hole bored through the wood. The end of the tube is capped with a collar that serves to hold packing in place to prevent water entering the hull between the shaft and its supporting tube. This packing may well be greased cord.

In preparing the hull for fitting and supporting tubes, it should be firmly clamped to the work table and a sharp ¼ in. bit should be run quite through both walls, boring from one side only. That is to say, after the bit has passed through one wall, it is carried through space to the other in order to insure perfect alignment of the two poles.

The bearing tubes, which are cut from a length of ¼ in. outside diameter brass tubing, may then be inserted after having been coated liberally with bathtub enamel to secure and seal them in place. The shaft, of 3-16 in. brass rod, may then be temporarily placed in position to determine whether perfect alignment has been secured in boring the holes.

The next operation will be to lay out and cut from 1-16 in. brass sheet the two rear diving planes, details of which are given below the previously mentioned sectional illustration in Fig. 5. This pattern is so simple that the work may be done entirely with hack saw and file, preferably fil-

*The next installment which will appear in the October issue will conclude this series. Back numbers can no longer be supplied and to meet the demands of readers who have missed earlier installments, the material has been put into book form. The book will be ready about the first of October.

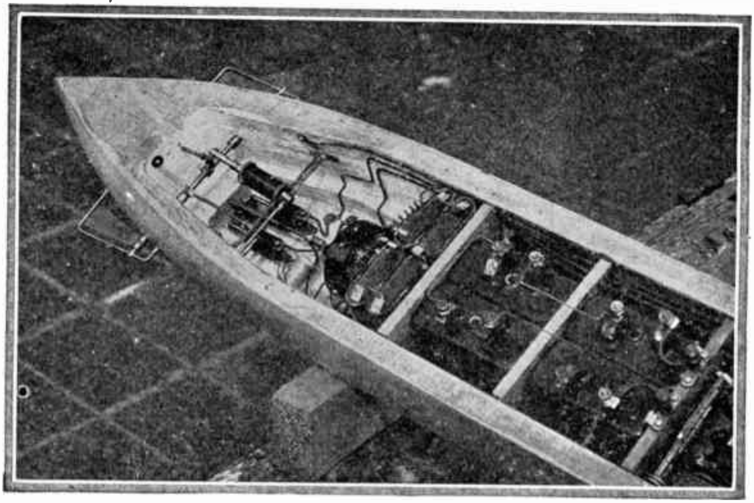


Fig. 1. Diving planes' and control aft

ing both pieces to size and shape at the same time.

The end of the vane which is to be bent around the shaft, should be annealed by heating it red hot and then plunging it into cold water. The bend may then be taken without fear of crystallizing or cracking the brass. When both vanes have been bent and fitted to the shaft, a tap drill for a No. 2-56 screw may be run through both vane and shaft and the hole tapped. Care should be taken to see that both vanes are in the same plane on the shaft when the holes are drilled.

Reference to Fig. 2 shows the solenoid and plunger mechanism which serves to tilt the planes when the craft is to submerge. The reader will note that the plunger is pivoted to an arm that is ⅞ in. long from center to center. A set screw secures the arm to the shaft. Beside the arm on the shaft, is a projecting rod that carries a small weight at its end to counterbalance the weight of the vanes carried at the extremities of the shaft. A spring of No. 26 brass wire causes the vanes normally to be held in a horizontal position. Thus, owing to the counterweight, the solenoid has merely to overcome the tension of the spring in order to tilt the planes.

Fig. 5 gives the details of the guards of ⅛ in. brass rod which are bent around the brass both fore and aft. These guards are first bent up according to specifications given in the drawings and then are placed against the hull and the point of entrance per washers shown in the drawing should be slipped in place. These washers are to be soldered in the correct position while the

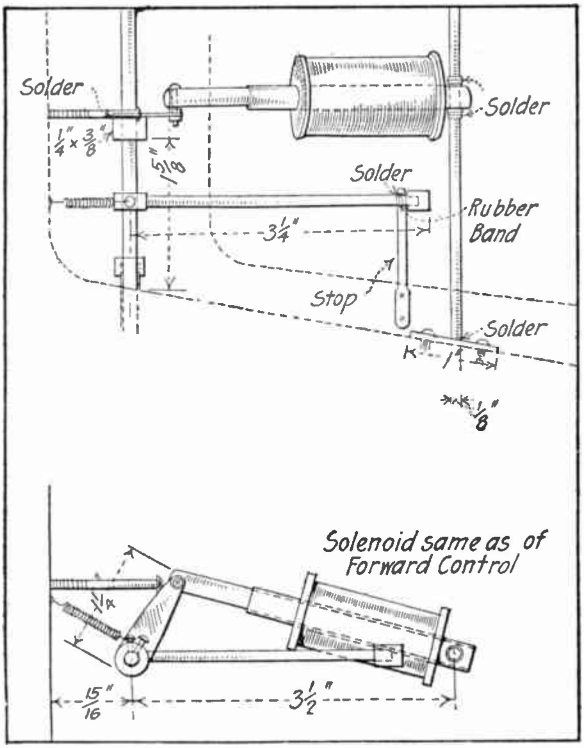


Fig. 2. Solenoid and plunger mechanism

marked for each leg. A ⅛ in. hole is then drilled at each of the indicated points and the legs of the guards are forced into the sockets thus formed. Before inserting the legs, however, the copguard is fastened in the hull. This will insure the correct angle being given.

Fig. 4 gives dimensions and details of the forward diving plane mechanism. The data for the

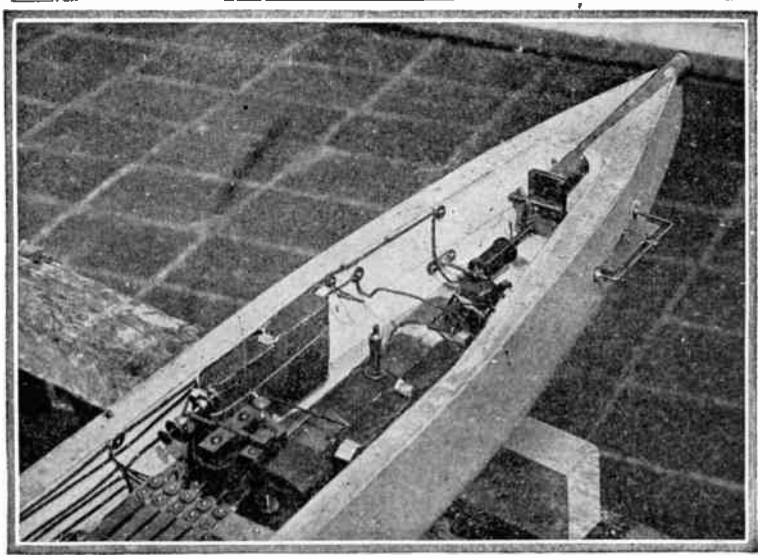


Fig. 3. Forward diving planes and guards

solenoids of both fore and aft controls is given in this one drawing as the two solenoids are identical. The dimensions need not be adhered to closely if the builder happens to have material that approximates the specifications given. The solenoids are wound with No. 24 enameled copper magnet wire and the exact number of turns is not of great importance providing the dimensions given in the drawing are followed with reasonable fidelity. The bobbins are merely to be wound until full of wire. The heads of the solenoid bobbins may be either of fibre or metal; if the latter, they must, of course, be carefully insulated with discs of paper secured with shellac.

The drawing, Fig. 4, does not show the packing heads on the bearings, but let it be understood that packing is just as essential in the case of this gear as it was in that of the diving planes aft.

The length of the travel of the plungers in the solenoids of both fore and aft gear is limited by stops placed as indicated in the drawings. The exact location in inches as regards the interior of the hull is not given, as no two hulls will be precisely the same in the hands of the different builders. Therefore, the placing of the stops is left to the intelligence of the individual.

WIRING AND CONNECTIONS.

As we have followed the construction of this model in the four installments that preceded this one, we have noted the placing of the various instruments and the relation they bear one to the other. As the construction has progressed in the EVERYDAY MECHANICS EXPERIMENT STATION various changes have been made in the original design which was worked out some years ago. One change that is of interest at this stage is the installation of flashlight dry cells in series-multiple connection to supply current for the central control device. This device was originally designed to operate from the main storage

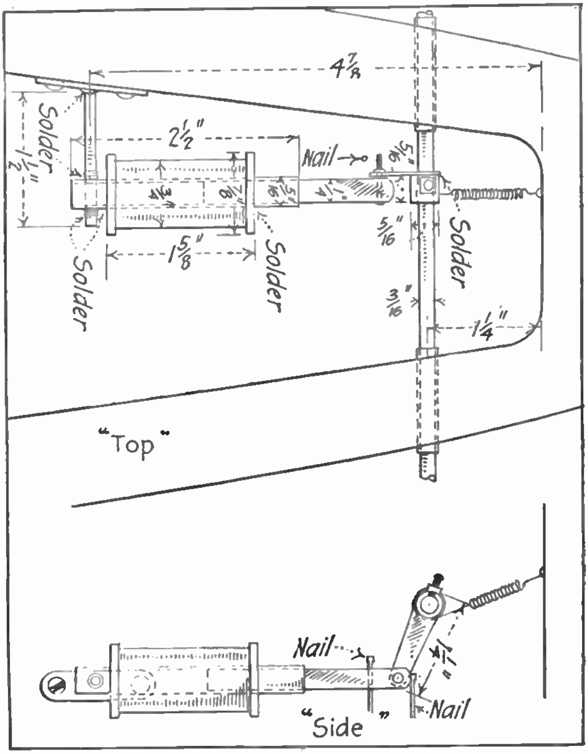


Fig. 4. Detail of forward diving plane control

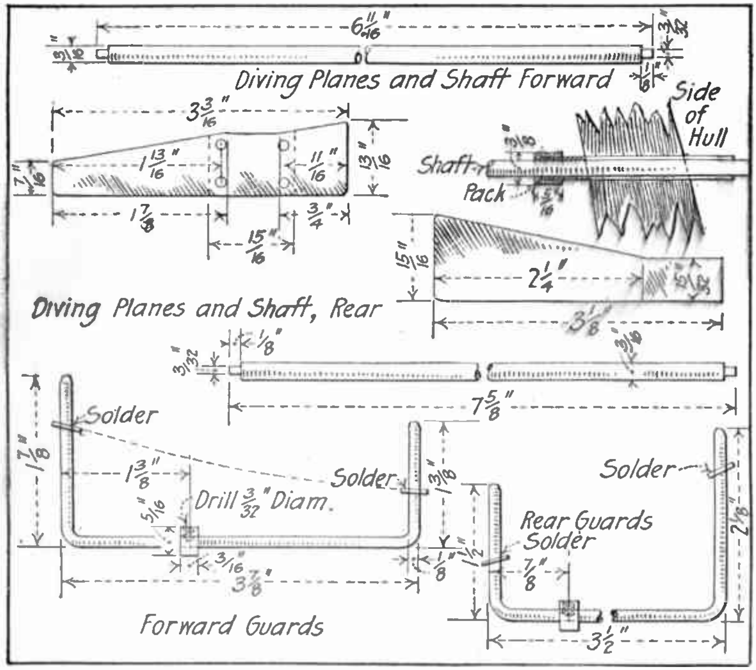


Fig. 5. Detail of planes, shafts, guards and bushing

battery in parallel with the other apparatus, but when an ammeter was placed in series with the main battery circuit and the controller sent through its evolutions, the needle of the meter jumped up on the scale at a rate that showed a very great overload for so small a battery. Furthermore, the potential drop was so great with this current demand that the operation not only of the controller but of the various units as well was sluggish and uncertain.

The installation of the flashlight cells solved the problem. There are two sets of four units each connected in series-multiple. This gives the potential of the four units and twice the ampere-hour capacity of one cell. Even though the instantaneous demand on the little cells is heavy, the current is on for a second only and the controller plunger jumps at a touch of the key. This is as it should be, for the contact cylinder should change from one position to another with certainty and dispatch.

Fig. 6 gives two views of the completed model (without deck) as the camera sees it. Just below Fig. 6 we have placed Fig. 7, a wiring diagram of the entire machine. The caption beneath the diagram labels each part and instrument, and if the reader will refer to the photographs above when reading the diagram, he will obtain a clear-cut idea of the wiring and assembly.

The wiring is done with standard annunciator wire which comes in various colors of insulation. The colors aid one in tracing circuits where a portion of the wiring may perchance be hidden from view. An examination of the diagram discloses a common ground wire which in our model is of No. 14 copper and perfectly bare. It is held to the inside of the hull with staples formed by cutting the heads from pins and bending the shank into hairpin shape. These little staples are smaller and neater than any we have been able to buy.

The object of the ground wire is to simplify the wiring scheme as a whole. The best way to gain a clear insight into the plan is first to familiarize yourself with the instruments in the model, then to locate them in the diagram so that you know what each symbol represents. Then, if you will trace the circuits, starting with the control device in the center, and gradually working out through each branch that leads from the controller, you will see how at each stroke of the key, the control cylinder turns one contact, sending a current through one instrument after another in the hull.

The photographs will aid in suggesting ways and means for placing the wire neatly and in a workmanlike manner. The method of procedure will perhaps vary with different builders, but the main point to observe is that the operation of the moving parts is not retarded by the connecting wires. All connections with the solenoids and other pivoted members had best be made with fine flexible conductor a few sizes smaller than lamp cord. This stranded conductor can be obtained in the No. 18 size, but with comparatively thin insulation, which renders it small and flexible, but still retains a goodly measure of conductivity.

In conclusion let us suggest that a pair of binding posts be added to the bulkhead that holds the storage battery (see Fig. 1) and connected with the terminals of the storage battery, the positive and negative poles being indicated clearly on the respective posts. This will facilitate connections for charging the battery and will obviate the necessity for making connection to the main terminals of the battery itself. The latter terminals are inconvenient to

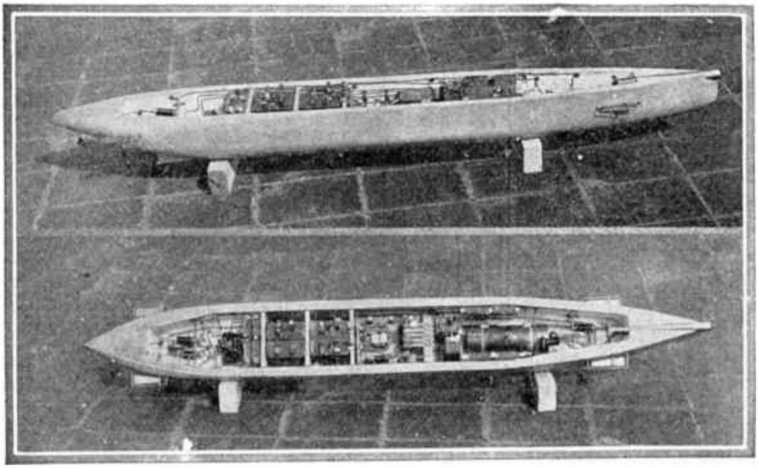


Fig. 6. View of model without deck and aerial

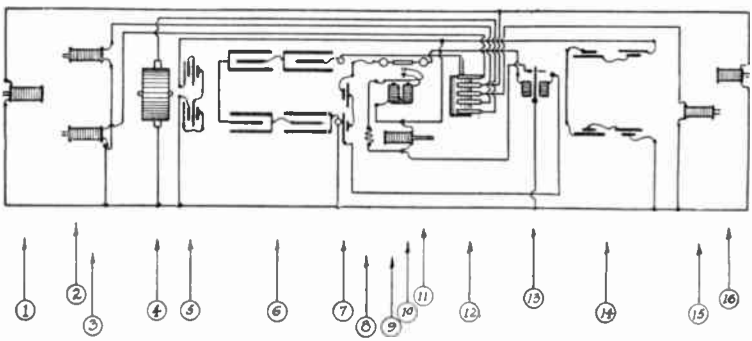


Fig. 7. Complete wiring diagram. (1) Rear diving plane solenoid; (2) Rudder solenoid, left; (3) Rudder solenoid, right; (4) Driving motor; (5) Central control battery; (6) Main storage battery; (7) Coherer-relay battery; (8) Decoherer resistance; (9) Central control; solenoid; (10) Decoherer; (11) Coherer; (12) Control cylinder; (13) Relay; (14) Central control battery; (15) Torpedo discharge valve solenoid; (16) Forward diving plane

reach and they should be tampered with as little as possible. The lugs of the battery, and indeed the binding posts themselves, should be coated with vaseline to prevent the battery fumes from corroding the metal. While we are on the subject, let us advise that every bit of metal in the model be rubbed with vaseline to prevent the fumes from acting in their peculiarly disagreeable manner upon the brass work after great care has been exercised to make it nice and clean.

The concluding article of this series will cover the deck and fittings and the explosive torpedo, which is a little piece of mechanism in itself.

THE AMATEUR'S CIPHER CODE

By Fred Telford

BOYS often wish to send messages unintelligible to any person except the one addressed. The following is an easy way to send a message which cannot be read by anybody not acquainted with the code:

Divide a paper into 64 squares and cut out 16 of them as shown in the figure. Lay this paper upon another a little larger on which the message is to be written. Write the first sixteen words of the message in the blank spaces, 2 to a line.

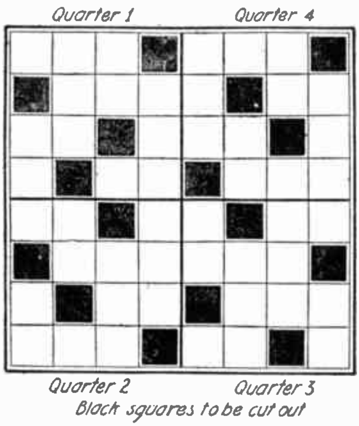
Now turn the upper paper a quarter of the way around, opposite to the direction the hands of a clock move, so that quarter I falls where quarter II was. Write in 16 more words as before. Then turn the upper paper another quarter, and add another 16 words; and finally the last quarter for the last 16 words.

The 64-word message is then complete, and without meaning to any person without a similar paper with the same squares removed, and a knowledge of how to use it. Here is the way an actual message looked to the receiver:

the	of	the	the	the	key	clump	boat
is	of	is	willow	bushes	chained	twenty	in
feet	a	to	forty	little	yards	the	north
due	big	of	slit	elm	the	a	east
foot	of	about	elm	the	a	the	above
hundred	oars	the	elm	ground	are	leave	yards
each	above	beside	on	the	thing	the	a
log	east	in	swimming	in	side	hole	place

The boy who received the message, using a paper with the same squares cut out, and turning it in the same way, arranged the words as follows:

"The boat is chained to the big elm about a hundred yards above the swimming hole. The key is in a little slit a foot above the ground on the east side of the willow twenty feet north of the elm. The oars are beside a log in the clump of bushes forty yards due east of the elm. Leave each thing in place."



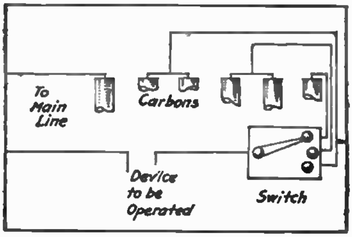
The key to the message

If desired, a letter may be used instead of each word. This makes the cipher still more difficult to read. If there are not enough words or letters to fill all the squares, meaningless ones may be placed at the end. Two or more sheets of paper may be used for longer messages.

Any boy with a little ingenuity can vary the cipher by removing different squares. Care is necessary to remove four from each quarter, and in such a way that the same space is not uncovered more than once as the whole is turned.

Home-made Rheostat

Many electrical "dabblers" want to know how to reduce their D.C. lighting current safely and inexpensively, without the use of a high priced transformer. A simple water rheostat which eliminates the necessity of a transformer, and cuts the current to quite a low standing can be made from three (3) jars of the "wet battery" type, fitted with wooden covers and carbons taken from "dead" cells. Fill the cells with water and drop a quantity of salt in each. Dip the covers in paraffin and slip the carbon rods in place, connected as shown in the diagram. The more cells used, the more the power can be varied. There is no limit to the number of cells.



Rheostat connections

This rheostat may be advantageously used on 110-volt circuits in connection with the operation of arc lights, miniature railways, etc.

Contributed by Wm. Wernecke, Jr.

THE WOODWORKER

Part II

By Ralph F. Windoes
Instructor of Manual Training, Davenport High School, Davenport, Ia.

BEFORE the craftsman attempts the construction of any project, it is necessary that he be very familiar with the reading of a working drawing, and the correct method of making out a mill bill, hence this article will be devoted to these preliminaries.

How to Read a Working Drawing

Figure 6 is from a photograph of a Mission table, and Figure 7 is its working drawing. A careful study of the photograph will make clear the construction of the table, and will permit of a ready understanding of the drawing.

The table is constructed around four *legs*, surmounted by a *top*. The horizontal members between the upper ends of the legs are called *end rails*, while the lower, narrower ones are known as *stretchers*. Between the sides at the top are the *side rails*, and between the stretchers is the *shelf*. One side rail is cut so as to receive the *drawer*. The rectangular "blocks" on the legs and stretchers show the table to be held together at these points with *through tenons*. At the top, where there are no "blocks," *blind tenons* are used. A tenon is a projection slightly smaller than the piece it is cut on, which is glued *through* or *into* a hole in the adjacent piece known as the *mortise*. These definitions will make the construction more readily understood.

The left hand view shows the front as it would appear if the eye of the observer was straight in front of each point of the object. That is, if imaginary lines were drawn from the eye to all points, they would be at right angles to the face of the table and parallel. Hence, only two dimensions can be given on one view—which suggests why it is necessary to always give two or more views of the object. The front view gives the length and height, the side view the width and height, and if a top view had been included, it would show the true length and width. In this particular problem, the top view is unnecessary.

The dotted lines represent *invisible edges, i.e.*, edges that we know to be there, but cannot see because of opaque material between them and our eye. For example, the dotted lines in the up-

Fig. 6. Mission table constructed by an amateur

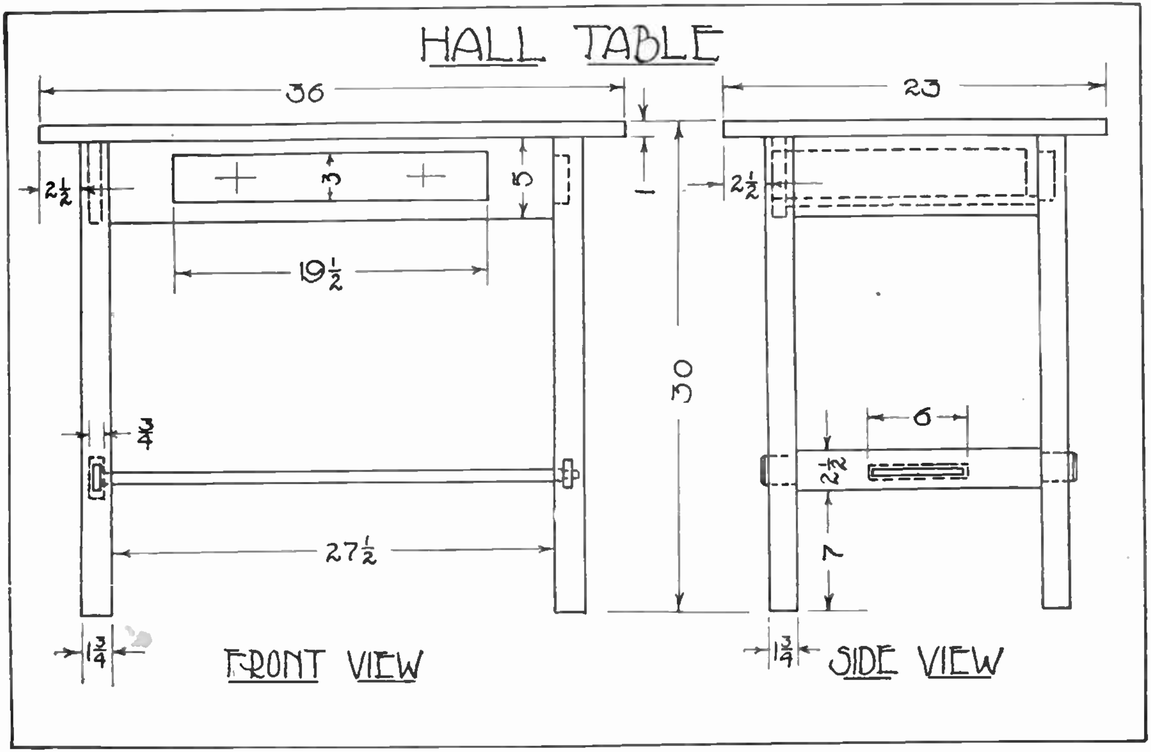


Fig. 7. Working drawing of the table

per end of the right hand leg—front view—illustrate the tenon that is cut on the rail to hold it to the leg. On the left hand leg we know a similar tenon is cut, but to make the drawing clearer we have omitted showing it and in its place have indicated the *end* (not tenon end) of the side rail. If both tenon and rail end were put in over the side tenon, as would be the case if we were strictly inclusive, it would result in such confusion of lines that the drawing would be very difficult to read. *Figure 8, a detail of this corner to a much large scale, makes this evident.

The lighter lines of the drawing are known as *extension* and *dimension* lines, and serve to give the full size dimensions necessary to properly construct the piece. The dimension lines are broken in the middle to insert the figure, and terminate where they strike the extension lines from the object with arrow-heads. The figure in the dimension line gives the distance on the object between the arrow-heads in *inches*. No *feet* dimensions will ever be given, hence the omission of the inch marks (") on the drawing.

Light lines are also used to indicate the location of the hardware, as the two drawer pulls on the table illustrate.

All drawings are made to scale,

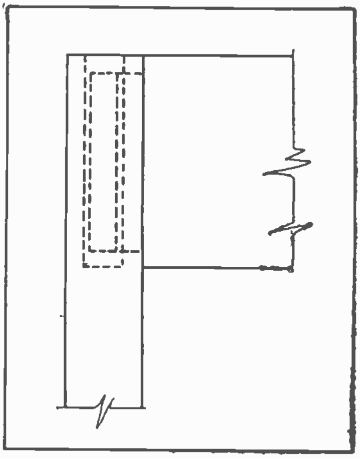


Fig. 8. Detail of the corner, showing joint

and the parts are in proportion, hence if a dimension is omitted, the worker can find it by comparing its measurement with the measurement of some given dimension.

In addition to the working drawing, we sometimes present *details* of various parts. These are drawn to a larger scale and give peculiarities of construction that it is necessary or helpful to know. Or *sections* through some part—also to a larger scale—showing the internal appearance of the piece at that particular point as if the material were cut in two and a part of it removed.

With these points in mind, and a good illustration of the finished piece to help, it is very probable that a working drawing can be

*Throughout the drawings in this series, this method of indicating invisible edges will be followed.

easily read and understood by the majority of craftsmen.

The Mill Bill

In the presentation of the various projects in this series, the autnor will give, along with the working drawing and the various details, a bill of material. This bill, when presented to the mill man, will furnish the correct amount of stock and enough to complete the project if no wood is spoiled or wasted. How this bill is made out will comprise the balance of this article.

Lumber is sold by dealers in five ways. It can be purchased as *rough stock*—just as it came from the saw and kiln; as *mill-planed stock*—the rough stock after being run through a surfacer and surfaced on two sides (S-2-S); as *mill-planed stock* surfaced on four sides to dimensions of width and thickness (S-4-S); *dimensioned stock*—surfaced, squared and cut off to exact dimension; and as *finished stock*—dimensioned, sandpapered, and the wider pieces glued up ready to cut and assemble.

In the construction of furniture, the last four mentioned are employed. The stock can be obtained in long boards or planks, and cut out by hand, or specified widths and thicknesses can be given and the lengths cut off, or the correct lengths can be obtained and the pieces hand-planed, scraped and sandpapered in the home shop, but the more economical method—time alone being considered—is to purchase stock glued up, squared and sandpapered by the mill machinery. It will cost more than any of the others, but the saving in time is worth the difference to the home craftsman. In school shops, where the students should do *all* of the work on the pieces, this method should not be employed, as their aim is to learn *all* the steps in the process, while the average craftsman's aim is the joy of the work and the finished piece.

Boards are rough sawed 1 in. thick, and will surface down to 13-16 in. or ⅞ in.; *planks* are 1¼ in. thick or over, and will surface to 1⅛ in. or under., 2 in. will surface 1⅞ in. or 1¾ in., and 3 in. will surface 2¾ in. or 2½ in. These four are the common sizes used in furniture construction. Under 1 in. must be planed down from 1 in. stock or re-sawed and planed to dimension. Hence, when purchasing stock under 1 in. the craftsman must pay for 1 in. stock; if 1 in. or over for 1¼ in. stock; if 1¼ in. or over, for 2 in. stock; if over 2 in. for 3 in. stock, and if over 3 in., it will probably be necessary to glue it up. (These sizes are S-2-S or S-4-S.)

In the mill bill, Figure 9, the

dimensions are finished sizes, all stock to be planed up, glued, squared, and sandpapered at the mill.

The number of pieces required is always given first; then their name and dimension. For example, one top is needed. It will be 1 in. thick, 23 in. wide and 36 in. long. The dimensions are always given in that order—thickness, width and length. The kind of stock in this particular case is quarter-sawed oak.

For the side rails, two are needed. Stock is ¾ in. thick, 5 in. wide, and 30½ in. long. The distance between the legs is 27½ in., but we have added 3 in. for the length of the two tenons.

All stock is figured in this fashion. The stock list is all the mill man needs, but we have added costs to this example in order to show how they may be estimated. We find that there are 16 board ft. of oak, and 3 board ft. of basswood. A board foot in 1 in. thick and 12 in. square, that is, there are 144 cubic inches in a board foot. The way to figure in an example such as this, is to find the total number of cubic inches and divide by 144, which will give you the board feet. Remember that you must watch out for *thickness*. The 1 in. table top must figure from 1¼ in. stock. There are 828 sq. in. in it, but we must add one-fourth of that to this number as it is cut from 1¼ in. stock, making a total of 1,035.

We have estimated the mill man's time as one hour, and the usual charge is 75 cents an hour for this work. The hardware—two drawer pulls, nails, screws, glue and sandpaper, will total about 40 cents, while a wax finish will cost about 75 cents, making the total cost of the table $4.

All projects can be estimated in exactly the same manner.

(To be continued.)

The Knobs of Pot Lids and tea kettles are always cracking off and are constantly in need of replacement. If a single strand of small wire, say No. 28, be twisted tightly around the knob in one of the grooves, and cut close and filed, the knob will last indefinitely. It may crack, but will seldom come off.—A. WAKELAND.

To do away with labels can be accomplished by making the plan of the garden on paper, which is ruled in squares. Allow one square for a square foot of ground. Write dates and names directly on the paper. By this method it is very easy to keep track of the plantings, especially if they are laid out in beds.—F. H. SWEET.

MILL BILL FOR HALL TABLE

NO.	NAME	T.	W.	L.	KIND	BD.FT.	@	TOTAL
1	TOP	1	23	36	QTD. OAK			
4	LEGS	1 3/4	1 3/4	29	" "			
2	RAILS	3/4	5	30 1/2	" "			
2	"	3/4	5	17 1/2	" "			
2	STRETCHERS	3/4	2 1/2	17 1/2	" "			
1	SHELF	3/4	6	21	" "			
1	DR'WR FRONT	3/4	3	19 1/2	" "	16	12¢	1.92
2	" SIDES	1/2	3	16	BASSWOOD			
1	" BACK	1/2	2	19				
1	" BOTTOM	1/2	16	19	"	3	6¢	.18
	MILLWORK							.75
	HARDWARE							.40
	FINISH							.75
								4.00

Fig. 9. The mill bill

HOW TO BUILD SIMPLE MERCURY INTERRUPTERS

By John Pike

EDITOR'S NOTE: Mr. Pike is an acknowledged authority among amateur induction coil builders in England. His article herewith is reprinted from the London *Model Engineer & Electrician.* The suggestions offered are quite practical in that they show several ways in which a common end may be achieved.

SPEAKING of mercury breaks in general, so far as I have noticed, the objections generally whittle down to the inevitable "muddiness" of the mercury due to the emulsion formed when the metallic liquid is churned with the alcohol or oil which fills the container. My containers require cleaning out only once in three months, and I do not lose 2½ per cent. of the metal.

There are other methods—everyone to his taste—but I use an equivalent bulk of methylated ether to clean the mercury after the "mud" has formed in seemingly hopeless quantity. The mud and ether are shaken together in a wide-mouth bottle, when it will be seen that the mud has resolved itself into its original form. The action is facilitated by stirring up the contents of the jar or bottle with a piece of blotting-paper rolled up into a stick. The ether is removed promptly in this way, and the mercury is then turned out on to a piece of chamois leather held in a basin and the metal squeezed through. The result is a very slight loss of mercury, but some very dirty fingers which call for instant application of a good hand soap of the kind favored by machinists.

Of mercury interrupters there are two basic forms—the one in which a contact piece dips into the mercury, and the other the turbine or jet type which pumps a stream of mercury against a series of vanes as its shaft is revolved by a small motor. The former is, of course, simpler and cheaper to build, but it cannot compare with the latter in point of efficiency and in the results produced. The dipping contact break is suggested in Fig. 1, wherein the contact is actuated by means of a motor. An equally satisfactory arrangement employs a pair of magnets which periodically attract an armature that carries the contact.

With these and other dipping breaks, the contact requires nice adjustment, bending and shaping so that it makes a clean dip and at the same time brings into contact with the mercury as much metal as possible. Then the cup or jar containing the mercury should be as large as possible, or, to put it another way, a container requiring a pound of mercury will be better for use than one requiring only a few ounces.

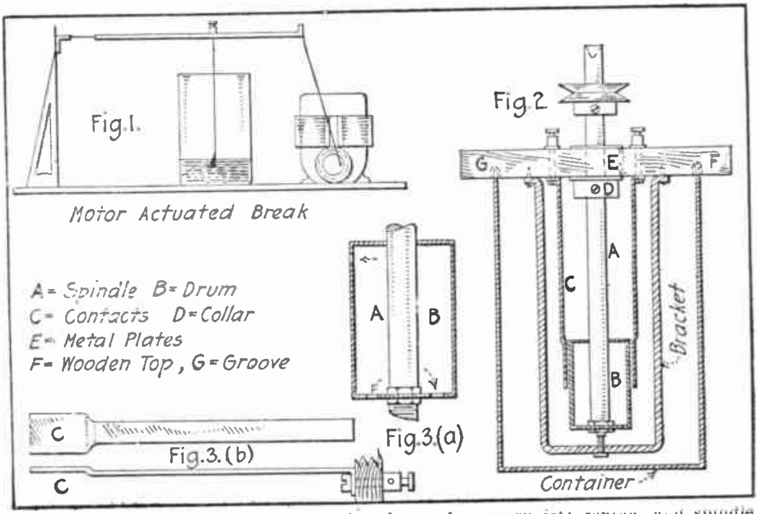
The simplest form of mercury jet is shown in Fig. 2. A spindle about 5-16 in. diameter and 6 in. long or so, has a cylinder or drum fixed at one end. The size of the drum may be 1⅞ in. by ⅞ in., and it should be of iron, neatly turned and fitted to run true. As a pattern, one may take one of those small pry-top tin cans in which samples of paint and enamel are sold (see also Fig. 3). A piece of silver-steel rod is cut and one end filed or turned down to the extent of ⅜ in. of the length, the end threaded and two suitable nuts fitted as in the figure. If the spindle is to revolve on a bearing, the end is to be drilled V-shape; this is shown in the figure.

In this simplest form the spindle is revolved by an independent motor. Now, although the drum may be made to revolve very freely by itself, it is a different matter when the apparatus is fixed up, and the container served with its supply of mercury. The latter, of course, offers some resistance, and an E. M. F. of at least 4 volts with 3 amperes or so of current is required to work the break. We can increase the number of interruptions by using three or four contacts; two serve very well, but there are occasions when four will be appreciated. These contacts may be as in the figure (Fig. 3, B. B.), spade-shape—fixed one on either side of the drum and 1-16 in. distant from it—note the curve given to the contact. If we want to put in four of these contacts or tongues, then it is convenient to attach them—cut shorter to suit—to a thin brass ring with a flange to screw on to the underside of cover (see Fig. 6). The one figured is an old lens jacket which has a convenient flange whereby two or more are connected to this one ring or jacket and by a wire to a terminal on the top of container.

The spindle might be coupled direct to a small motor, when it certainly runs more quietly; and as a fact, and presupposing a good fitting and bearing, this method should answer extremely well.

Another method of revolving the drum is to make the spindle part of the motor itself, and this is better than a coupling, which requires a lot of adjustment. In Figs. 4 and 5 we see an old type of electro-motor which can be made very easily to run with two or three dry cells, or if wound with suitable wire the afore-mentioned battery of 4 volts, 3 amperes will give considerable speed. This is an interesting type of motor and not so unsightly as one might suppose.

In these breaks, a glass jar or stout tumbler is used to hold



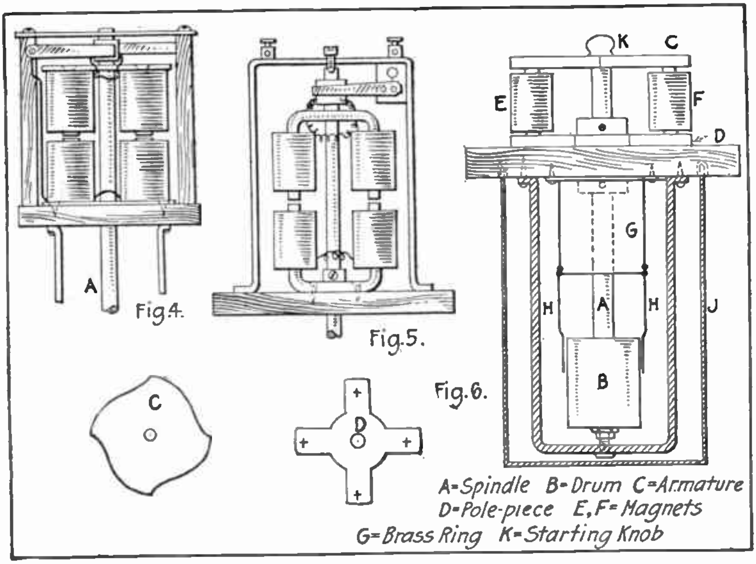
Motor actuated mercury break; simplest form of mercury jet; contact and spindle of mercury jet

the mercury and alcohol. The various fittings described being placed on and attached to a wood platform or cover grooved on the underside to fit the rim of container, and large enough to take four stout bolts, one at each corner, for secure attachment to the base; these bolts—two of them at least—serving also for connections to the wiring below.

I have been very pleased with this break, as it works evenly and with great speed and without excessive noise. This, of course, is largely a matter of fine fitting. V-shaped bearings at top and bottom answer very well, but I dare say some of my readers could put ball bearings at, say, the lower bearing in Fig. 5. In this break the idea was to dispense with any bracket and bearing under the platform; the drum revolving at the elongated end of the motor shaft. So far, however, Fig. 4 runs much better than Fig. 5. It is a mistake to make the parts too light. The spindle or shaft at 1/4 in. thickness is not too much; and the bobbins may be rather broad and "stumpy" than long and thin. The winding, as I have already remarked, is a matter of consideration. Almost any wire will do, but if the wire chosen is, say, anywhere close to the No. 20 gauge, the E. M. F. to be provided will be more than we can get from dry cells. If the wire is No. 28, then dry cells will answer better. The first break I made on these lines (Fig. 4), took from 4 to 8 volts, 2 amperes, to run it properly, but with 4 cells (storage battery) it ran superbly, and later on, with careful adjustment, runs equally well on 4 volts.

It must be remarked that one may not get the best spark results at the first attempt. This is mainly a matter for adjustment of the copper contacts; size (width and depth), distance and number. Then the hole through which the stream of mercury flows may be too large or too small. The metal of which the cup or drum is made should be thick enough to make a channel and this, if only 1-16 in. in length, will give a "direction to the flow" of mercury (Fig. 11).

From this one comes by a natural stage to an automatic break, one of the Gaiffe's patents, of which, however, the writer has seen drawings only (Fig. 6). The pole-piece *D* of Swedish iron ⅛ in. thick may be of any convenient size; the arms are drilled at the four points marked; iron cores cut, drilled, and tapped; bobbins of suitable size are then made and filled with wire—well insulated—and the four windings arranged in series. The armature is, roughly, of the shape figured, though the curves may be a little more pronounced. It is also of ⅛ in. Swedish iron plate, fixed by a screw to the top of spindle. The bobbins will require to be filled with wire of a size to carry at least 3 amperes; therefore, dimensions of, say, 1¼ in. x 1½ in. would appear to be most suitable. As the wiring of this break is in series with the primary winding of the coil (*i.e.*, wire carrying at least 9 amperes) it will be seen that what is required is to wind the bobbins with few turns (necessarily) of wire, but of as large capacity as possible. It is very difficult to wind thick wire on small bobbins, so that the amateur will no doubt compromise in doing the best he can; silk-covered stranded wire is easily put on and answers fairly well. Stranded magnet wire equal to No. 13 B. & S. gauge is to be had. In this break one at first looks for the commutator. This is, of course, down in the container, the same interruption cutting the current for motor and for coil; the revolving drum, sending out a stream of mercury, makes contact four times at each revolution, there being four copper contact plates. The break requires neat adjustment, and should be of a good substantial pattern. The testing may, of course, be done away from the coil, simply using a jar with a sufficiency of mercury. In winding the four bobbins, the commencing end of the wire is fixed to a binding post or terminal on the platform; the wire is then carried around the four, taking care to follow the usual S route from one to the other, the finish-



Two old types of motors for drum; Gaiffe's patent break

ing end being then attached to the base of the bracket, this taking the current down to the drum and mercury, thence it flows across the gap by means of the jet up to another binding post on the platform and back to the battery. If the coil is in use, then the primary is in series with break and battery, as in Fig. 7, with the condenser across the break as usual.

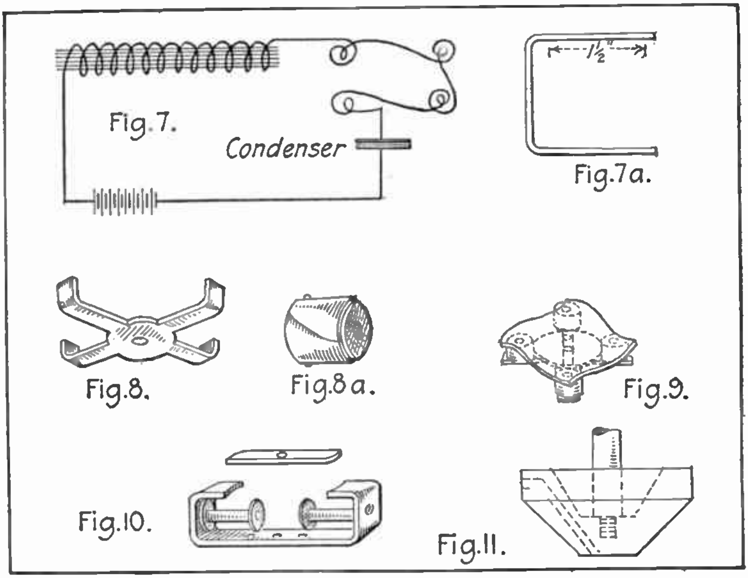
The armature is given a good swing round by means of the ebonite knob and promising a sufficiency of current takes up a high speed at one, and continues running while current is on.

Some people would prefer to do without the cores and bobbins by making the + piece longer in the arms and bending these up to exact and uniform height. This form would be rather easier to wind perhaps (see Figs. 8 and 9).

The preceding break, Fig. 4, is simpler, I think, and more easily made in a small experimental size also for use generally. Below the platform the break, drum and contacts are similar to others. Three or four contacts may be fitted. The wiring for this motor being independent of the spark coil primary we can wind the four bobbins with moderately coarse or fine wire at pleasure, regarding the battery power available. *i. e.*, using fine wire if dry cells are to be the source of current.

Possibly, the simplest way of building a motor of this type is to follow one of the oldest methods, *i. e.*, get a piece of soft iron, ⅛ in. section, ¾ in. wide, and about 12 ins. long. Bend up two pole-pieces out of this, U-shape, exactly alike, but the limbs not too long; allow 1½ ins. for winding (see Fig. 7a). Bore a hole 3-16 in. in the center of each at the bend. File and shape these to equal sizes, with special attention to the faces of each. The magnets may be easily tested for comparison, by placing them end to end or otherwise on a piece of silvered glass horizontal and levelled for the purpose; any disparity is noticed at once. Varnish each magnet and tape the limbs with one or two layers of silk. Measure off 8 to 10 yds. of this, tying there a piece of string to mark the half-way line. Leave a loose end of 3 in. or so, start from the bend of one limb and wind on the wire in even layers forward and backward, finishing also at the bend. Cross over and in the direction of the letter S—which is of the first importance—and wind the second limb as before, a similar proportion of turns and layers. Finish once more at the bed and tie up the loose ends. Treat the second magnet in the same way and then let the pair soak in shellac varnish for an hour; then dry thoroughly.

Now get a piece of silver-steel rod 3-16 in. diameter and about 9 in. long. Put this through one of the magnets, having first put a thread on to the extent of, say, 1½ in. from one end; a couple of suitable nuts, one inside and one outside, will serve to secure the magnet in its place. If the rod be now held up in improvised bearings, the magnet should carry it round very smoothly and balance evenly. In the way of bearings it is sufficient to drill a V-shape opening at each end. Also in place of the screw thread and nuts put on we may solder the iron U-piece to the rod; but if soldered this had better be done before winding that particular pole-piece. The first magnet is to be fixed upright on a suitable base similar to any of those figured, and will there require two extra holes drilling to take small screws, one on either side of the opening or centre. The commutator may be about ½ in. diameter by ⅝ in. long. This is of hardwood or ebonite with a brass covering, the brass being a little shorter than the wood. The tube should be fixed by means of screws short enough to be quite clear of the spindle, and the brass is then sawed through on each side, making a diagonal cut, as shown in Fig. 8a. Two thin springs of brass or German silver



Arrangement of connections, commutator, metal cup and parts of motors

practically complete the fittings. These are for the brushes or collectors. The motor is shown at Fig. 5.

The proper position of the commutator is a matter of importance and adjustment. Fig. 5 is sketched to show the four coils. The best way is to fix the commutator only after a test; a touch of varnish will hold it tightly against the iron pole-piece. A great difference is met with sometimes in easier running, etc., and, of course, the two springs, collectors or brushes must make light, but certain, contact.

There is one point which must not be forgotten in favor of this break, common, of course, to all breaks actuated by separate batteries. In the break, Fig. 6, when switching off the current to adjust the spark gap or discharges, one automatically switches off the break as well. The break will run on for a few seconds and give time for a momentary adjustment; but if it stops, then we have, as it were, to begin over again and start the break afresh. If the discharge rods are fitted with heavy ebonite handles, some operators can make the necessary adjustments without fear of a shock, but this is only when the discharging rod, *i.e.*, the metal part, is loose in its socket or holder. It is the safer plan to switch off before attempting any adjustment. The break should be quite suitable for wireless, I think, being practically silent and as fast as most; the speed can always be increased by adding another cell to the battery, but much will depend on the worker's ability to secure well-balanced coils, good and true fitting of the bearings and careful adjustments of the commutator and brushes.

The above, Fig. 6, has now been replaced by a simpler form of motor with two pole pieces—and one (or two) contacts. The new model, Fig. 10, is, as will be seen, rather easier to construct, it being noted that the sketch is not intended to be an exact copy; the armature—the rectangular figure above the motor—is fixed at the top of the shaft or spindle, similar to that in Fig. 6. It is shaped to fit nicely between the pole-pieces.

It must be said that the metal cup used is usually cone shaped, broad, and rather short, *i.e.*, the diameter is as 3 to 2, approximately, as in Fig. 11. Then the armatures in both these magnetic-attraction types require to be rather more solid than shown, *i.e.*, that at *C*, Fig. 6, is better with four solid iron knobs, one at each corner, and that in Fig. 10, one at each end. Both these models are well worth making. Fig. 10 requires no further description after what has been written. It may be said that there are several very efficient little motors of the magnetic-attraction type to be had from dealers, parts of which could, no doubt, be used.

The "Düsen" seems to be a very good break, of a type somewhat familiar; here is a condensed description: "A solid, truncated iron cone is provided with a central vertical shaft to which is attached at the upper end a cross-shaped iron armature. Into the extreme end of each limb of this armature is screwed a metal knob." A glass vessel is provided and all below the cover is practically as already described in other mercury jet breaks, *i.e.*, the metal cone revolving in mercury and throwing a jet of this metal against contacts or projecting copper teeth. Upon the cover is the cross-shaped armature and suitable binders, etc. The break is mounted on the base of the spark coil at either end so that the armature is on a level with the center of core—the distance is to be adjusted, and when working, this regulates the speed. "Connecting coil, break and battery in the usual way, a rotary motion is given by hand (from one of the four knobs); the mercury contained in the vessel is, by centrifugal force, thrown out against one of the copper sectors or teeth, of which there are four, four makes and breaks being obtained at each revolution. The resulting magnetization of the core of the induction coil acts on the four limbs of the interrupter armature, a continuous rotation of the mercury jet being thus obtained."

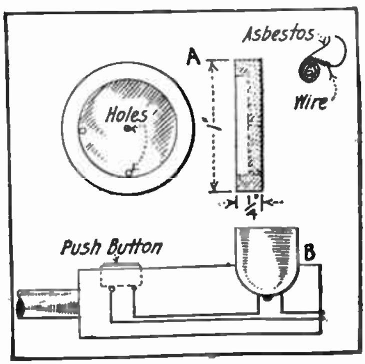
The writer has spent many pleasant hours in the construction of all these breaks and models, and can heartily recommend the work to others. Success is, of course, not always uniform, as so much depends on the neat adjustment of the fittings. It is to be remembered also, that as we increase the number of interruptions so—to get the same length of spark—we require to raise the voltage of the primary current. Supposing two coils of identical size and output being operated, one with a slow-acting break and the other with, say, double or treble the number of interruptions, then the E. M. F., through primary being the same in each case, the slow-working break gives the best spark result. Therefore, unless one has the run of a good supply of current, as from the mains, the best results will not be had from the most rapid breaks.

A good mechanic would make a real good break on the lines of Fig. 5 for the motor; this might be made to run as freely and silently as a ball-bearing pedal, and with a resistance in circuit could be run at any speed.

AN ELECTRIC CIGAR LIGHTER

By Wm. Wernecke, Jr.

THE most important part of this device is the heating coil which should be carefully tested out before fitting it to the handle. This coil is of the finest resistance wire obtainable (39 nichrome wire was used by the writer). Wind this wire on a mandrel made of No. 14 gauge steel wire, slip the coil off the wire and insert an asbestos cord which will fill the inside of the coil, but be sure the turns are well separated. The finished coil should be about 3 in. in length.



Detail of electric cigar lighter

Cut a piece of transmitter asbestos as shown in the illustration, *A*, and drill two holes in the recessed circle, one in the center and one near the side. Insert one end of the coiled wire through the center hole and wind spirally around itself with another cord between the turns. The other end of the coil is inserted through the small hole at the circumference. This proceeding brings the ends of the coil out on the back of the board. A piece of thin mica is fitted over the face of the coil to hold it in place when the coil and board are fitted into the socket on the handle. A piece of wire wrapped around the parts will serve to hold them together while making the tests. Connect the leads to a 110-volt circuit and if the wire is of the proper length, it will heat sufficiently to char wood through the mica covering. If in doubt about the length of the wire make it longer rather than short, for it can always be cut down. The handle is made as follows: Cut a small can (1 in. diameter) about ¾ in. long, cutting it so that it may be fastened to the cylinder, *B*. Cut a hole in the bottom of the can ¾ in. in diameter, and place the coil with its mica covering in the can end. Fill in all the unoccupied space with asbestos fiber, taking care to keep the leads well insulated from each other and from the box. Next, turn up a handle as illustrated. If there is no lathe at hand, this work can be done at a local shop, or by a person fortunate enough to own a lathe. A ¼ in. hole is bored along the length of the handle, and a 1 1-16 in. hole is bored to meet it from one side, over which the can part holding the coil is attached. Another hole is bored of a size to admit a flush push-button into the side of the handle, and on a line with the heating element. The connections are made from the push-button and the heater to the flexible lamp cord, as shown in the illustration. Direct or alternating current may be used if it is of 110 volts.

Fill in the holes in the lawn in April with good mellow loam if you want it to appear well in the summer. Then seed it over as you would for a new lawn. Scratch the entire surface of the grass with a sharp steel rake and scatter seed lightly if the grass is sparse. Top dress with a suitable fertilizer.

Immediately after sowing the seed roll the entire lawn with a heavy roller. Go over the ground just once. After this the lawn should be gone over about twice a week. If there are any plantains, dandelions or daisies in the plot, dig them out now.—F. H. Sweet.

TOOL CABINET AND CATCH-ALL

By T. J. Macgowan

TOOLS, screws, bolts and other odds and ends usually find their way into an open box which is kept in the kitchen. Then, when anything is wanted, the box is hauled out and almost emptied before it can be found. This can be done away with by constructing the tool cabinet described here. Note that there are no difficult joints to make and that the only tools required are a saw, plane, hammer, brace and one bit.

The following is a list of materials needed. In ordering stock, give the thickness, then the width, then the length wanted. This system is usually followed in the lumber and woodworking business.

Drawers

4 pieces ⅞" x 6" x 1-6". Fronts.
4 pieces ⅞" x 5½" x 1-4¼". Backs
8 pieces ⅞" x 6" x 11¾". Sides.
4 pieces ⅞" x 11" x 1-4¼". Bottoms

Front

3 pieces ⅞" x 1½" x 1-6".
1 piece ⅞" x 1⅝" x 1-6".
1 piece ⅞" x 2" x 1-6".
2 pieces ⅞" x 2" x 2-8"

Sides

2 pieces ⅞" x 1-6 ⅛" x 2-8".

Back.

1 piece ⅞" x 1-8 ¼" x 2-8".

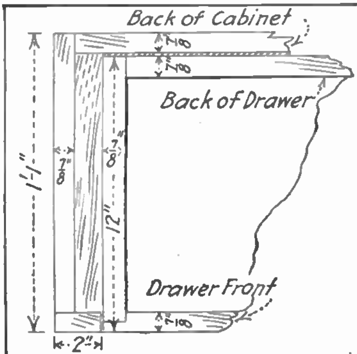
Top

1 piece ⅞" x 1-1½" x 1-11".

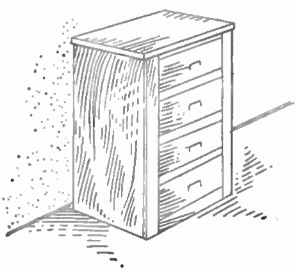
Drawer Runs

8 pieces ⅞" x ⅞" x 11¼".
8 pieces ⅞" x 2" x 11¼".

Where wide pieces are called for, as for the top, sides and back of cabinet and the bottom of drawers, they can be made



Sectional view looking down on drawer and run.



The cabinet complete

up of narrow pieces that have had the edges smoothed to make a nice tight joint. For the back and sides of the cabinet, nail a rough piece, not over 1½ in. wide at the top and bottom, so that these pieces will be inside the cabinet when they are put together.

The top can be built up of narrow pieces nailed in place after the front, sides and back are put together. Then saw to size, allowing ½ in. projection over the front and sides. Then round off the square edges with a plane.

When making the front, first mark on the stiles or upright pieces where each dowel will be, and bore for same. Next bore for and insert a dowel in the center of each end of the rails or cross pieces. Put the front together and nail same to the sides. Next fit the back in place and nail the sides firmly to it.

Now make the drawer runs, by nailing the two pieces together as shown in the drawing, and fasten them in place by nailing through the stiles and rails into the front end, also through the back into the back end of runs, and a couple of nails through the side. Nail the top in place as described before, and the cabinet will be ready for the drawers.

Make the drawers as shown, keeping the bottom ¼ in. above the bottom edge of the sides and front, and nail all firmly together.

After seeing that the drawers fit nicely, and run smoothly, give the outside a coat of paint or varnish stain. Do not paint any part except the outside, otherwise the drawers will stick until the paint is worn off.

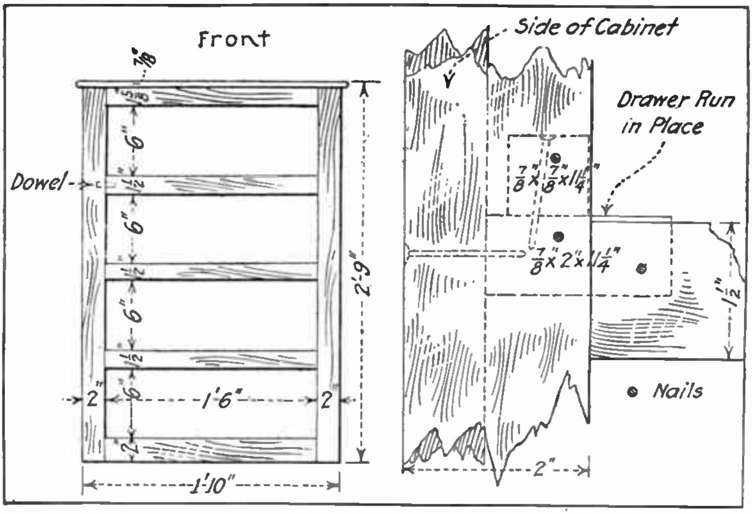
A can of paint or stain can be bought in any of the 5 and 10c. stores, and drawer pulls can be had in the same place at prices ranging from 2 for 5 cents to 10 cents each.

If the drawer pulls are fitted before painting, remove them and replace when the paint is dry.

Tools can be stored in the top drawer, or two drawers can be used, according to the number and size of tools.

Fit one drawer with a number of tobacco tins, a label pasted on the top of each marked "nails," "screws," "bolts," and so on down the line. Stand these tins in the drawer, with the label up, and when any article is wanted, it can be picked out at once without upsetting everything else. It will save time and confusion, and keep tab on your stock.

Another drawer can be used for odds and ends, or junk as the women call it, using tobacco tins with labels on top for the small articles.



Front elevation and front view showing drawer run

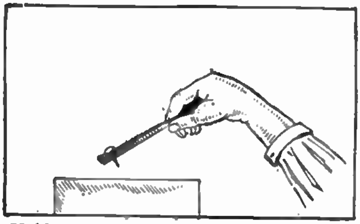
The cabinet can be made of any kind of wood, as even the hard woods are not difficult to work into the pieces called for.

If the stock that is used has knots in it, an oil paint of a solid color will have to be used, so that it will be of an even color, and the knots will not show through.

Excellent Cat Whiskers for galena detectors can be made from broken "A" strings of violins. Simply unravel the fine silver wire wound upon it and use in the detector stand.—William G. Mayer.

Holding Small Tacks

A good method of holding small tacks and nails to avoid hitting the fingers when hammering is to split a small pine stick half-way down its length and insert the tack in the split. Common matches may be used.


Hold the small nail or tack in a splint of wood

Contributed by N. G. Near.

HOW TO MEASURE INACCESSIBLE DISTANCES WITHOUT INSTRUMENTS

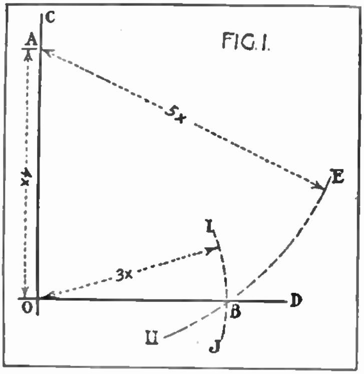
By Robert A. Foote

Author's Note; Almost every person at some time or other in his experiences desires to know the extent of some distance which cannot, conveniently, be measured directly. It may be that one wishes to learn the width of a river or the height of a tree, monument or other object, merely to satisfy his curiosity. Or he may desire to build a simple suspension bridge, cableway, fence or telephone or electric power line across a stream, lake or ravine and for that reason must find how great is the distance which is to be spanned. Obviously such distances can be reckoned with surveying instruments. But in this article methods are described whereby they may be ascertained by the application of some simple arithmetic and by the use of certain measuring equipment such as is always available.

VARIOUS modes, some of them more or less involved, have been proposed for the measuring of distances and heights which, for some reason or other, cannot be determined by direct comparison with a tape line. Herein will be described some methods by means of which such distances can be very readily computed. The only tools required for the application of any one of them are: (1) a tape line, (2) a 2-ft. rule, (3) a couple of wooden rods or staffs, possibly 12 ft. long and 1½ in. square, and (4), the most important of all, a fair equipment of common sense.

Several different processes are given for obtaining the distance across a body of water or ravine which cannot be measured directly. Which one of these should be used in any given case is a question which must be decided by the conditions affecting the specific problem under consideration. Hence, it is well for one to be familiar with all of them. It is suggested that the pictures illustrating the different methods be cut from these pages and pasted in the reader's field note book where they will be available for ready reference. The formula, if one is required, applying to each of the methods is shown on the picture, so that if the picture is retained all of the working information required will be with it.

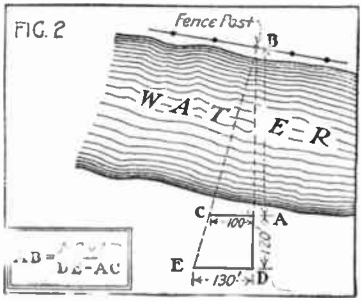
Some of the following methods involve the laying out of a right angle, therefore, the first step will be to show how this can be done very simply and, at the same time, accurately. Refer to Fig. 1, and assume that it is desired to lay out a line, *OD*, at right angles to the base line, *OA*. Lay out a distance, *OA*, four units long along *OC*. (The units may be any that are convenient, for instance, *OA* might be 4 ft.,



How to lay out a right angle

4 yds., or 40 ft. long, depending upon the ground space available for the lay-out.) Drive a stake at *A*. Then with a piece of rope tied to a stake, *O*, as a center, and with another pointed stake tied to the rope at *J*, scratch the arc *IJ* with a radius three units long. (This radius may be 3 ft., 3 yds., or 30 ft., depending on whether a unit of 1 ft., 1 yd., or 10 ft. was used in laying off *OA*.) Then with *A* as a center, and a radius of five units, scratch the arc *EH* on the ground. Then drive another stake at the point *B* where the two arcs intersect. A line, *OD*, passing through *B* will be at right angles to *OC*.

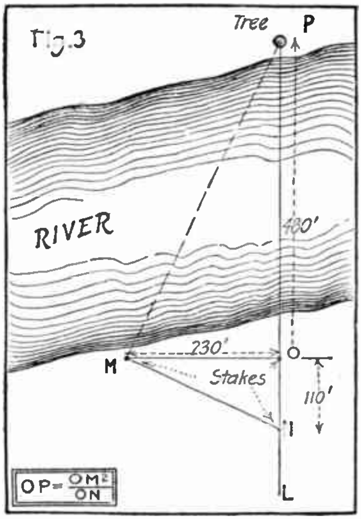
A good method of determining the distance across an inaccessible space is illustrated in Fig. 2. The procedure is as follows: Sight across the stream from any point, *D*, to some fixed point, *B*, on the opposite side of the inaccessible space. The point *B* may be a fence post, rock, a tree, the corner of a building, or any immovable object that can be easily seen. Then lay off some convenient distance, *AD*, along *OB* and measure it. Drive stakes at *A* and *D*. Now lay off *CA* of some convenient length, at right angles to *BD* and drive a stake at *C*. Lay off a line, *ED*, at right angles to *BD*, and walk along *ED* until the points *E*, *C* and *B* are in range, that is, in line with each other. Drive a stake at *E*. Then the problem can be solved with the formula shown on Fig. 2.



One method of measuring across a stream

Example: What is the distance, *AB*, across the body of water of Fig. 2? *AC* measures 100 ft.; *AD*, 120 ft.; and *DE*, 130 ft. Use the formula shown on Fig. 2, then

$$AB = \frac{AC \times AD}{DE - AC} = \frac{100 \times 120}{130 - 100} = \frac{12000}{30} =$$
400 ft.



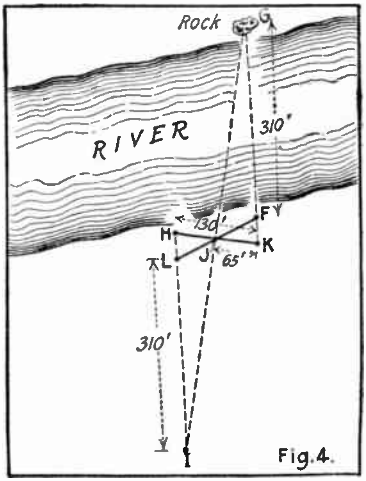
The right angle is also used in this method

Another way of computing an inaccessible distance is delineated in Fig. 3. Sight as previously suggested from any point L well back from the river bank to some fixed point P on the opposite bank. Drive a stake at L. Drive another stake at O, any convenient point on line LP. Lay off OM (any convenient measurable length) at right angles to LP and drive a stake at M. Now lay off line MN at right angles to MP and drive a stake at N where MN cuts LP. Then measure OM and ON and use the formula shown on Fig. 3.

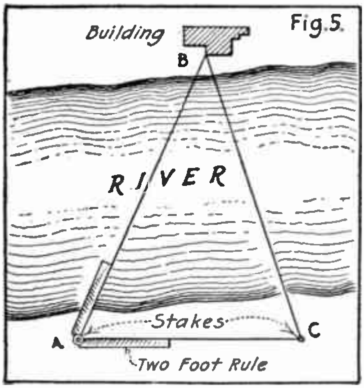
Example: How wide is the river shown in Fig 3? The distance OM measures 230 ft.; and ON 110 ft. Applying the formula given on Fig. 3:

$$OP = \frac{OM^2}{ON} = \frac{230 \times 230}{110} = \frac{52900}{110} = 480 \text{ ft.}$$

Still another and very accurate means which can be used where plenty of room is available is shown in Fig. 4. The black dots in the illustration indicate stakes that must be driven in order to make the measurements. After fixing an imaginary line, KG, across the stream, lay out another line, HK. Bisect (divide in half) HK and drive a stake at J. Then measure the distance, LJ, along any line, LF, equal to JF. Then the line HL prolonged will be parallel to KG. Now walk along HI from H until the



This method may be used where plenty of room is available



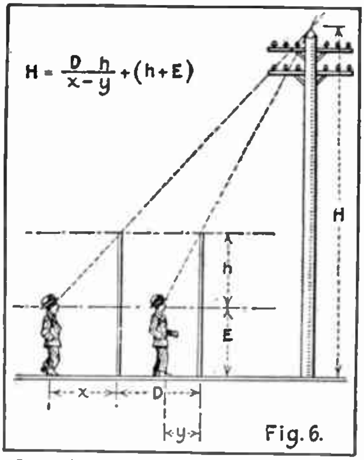
Measuring distance with a folding pocket rule

point *I* is reached, where *I*, *J* and *G* are all in range. Then the distance *LI* will be equal to *GF*.

An inaccessible distance can be readily approximated with no other tool than a 2-ft. rule as shown in Fig. 5. (The size of the rule shown in the illustration is very much exaggerated, merely to illustrate the method.) Any point, *C*, is selected, from which a fixed point, *B*, on the opposite side of the stream can be seen. A stake is driven at *C*. Then measure off another convenient distance, *AC*, with a 2-ft. rule, and drive a stake at *A*. The angle between *BC* and *AC* can be any convenient angle. Now, plot to scale in the note book or on a drawing board, the positions of points *A* and *C*. The angles *ACB* and *CAB* can be ascertained in this way: At stake *A* line up one leg of the rule with the inaccessible point *B* and line the other leg with *C*. Hold the legs of the rule firmly in the position that they now assume, and carry it to the sheet of paper upon which the plot is being made. Place the apex of the angle formed by the two legs of the rule on the point *A* on the paper with one leg extending along the line *AC*. Then draw the line along the other leg of the rule. Transfer the angle *BCA* to the paper in the same manner. The intersection of the lines *CB* and *AB* gives the position of point *B* and the distance *BC* can then be scaled.

There are several ways of finding the height of an object that cannot be measured directly. One of them which has been found to be easily handled and relatively accurate will be given here. It is shown in Fig. 6. The only tools required are a couple of rods like those referred to above and a tape line or 2-ft. rule. The observations are most conveniently made by two men, but one man can make them. Assume that it is desired to find the height *H* of the pole. A convenient distance, *D*, is measured off along level ground. Then a staff is set up on the ground at either extremity of *D*.

One staff can be made to do, by setting it first at one extremity and then at the other. Ascertain the distance, *y*, from the staff to



Measuring the height of poles, trees or buildings from the ground

a point where, if the observer stands, his line of sight (one eye open, the other closed) just cuts the top of the staff and the top of the object. Then a similar observation is made at a distance x from the other staff. Subtract the height of the eye above ground from the length of the staff to find h. This observation being made, the formula shown on the drawing can be used.

Example: What is the height of the unstepped pole shown in Fig. 6? The observed measurements were as follows: $D = 9.7$ ft.; $E = 5$ ft.; $h = 5.2$ ft.; $x = 5.2$ ft.; and $y = 3.2$ ft. Using these values in the formula given on Fig. 6, we have

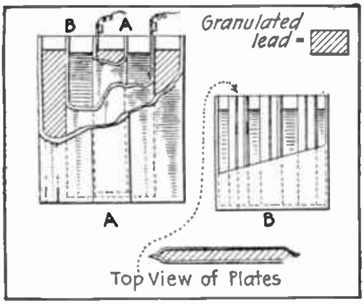
$$H = \frac{D \times h}{x - y} + (h + E) = \frac{9.7 \times 5.2}{5.2 - 3.2} + (5.2 + 5.2) = \frac{50.4}{2} + 10.4 = 25.2 + 10.4 = 35.6 \text{ ft.}$$

A NEW STORAGE BATTERY

By Chester Keene

TWO types of easily constructed storage batteries are described in this article, but the design can be varied almost indefinitely. Referring to *A* in the illustration, here is one of the simplest forms. It consists of two perforated cylinders of lead, one within the other. Lugs are connected to these cylinders to make connections, but the novel point of this battery is that instead of using red lead and litharge, granulated lead is packed around the outside cylinder and inside the smaller one. To granulate lead, melt some and pour it into water from a height of about 6 ft. The lead falls to the bottom and the water may be poured off. The cell is filled with the usual solution, consisting of about a 10% solution of sulphuric acid in distilled water. The electrolyte should cover the granulated lead packing.

Another form of cell with a greater capacity is shown at *B*. In this case small containers are made from perforated sheet lead and the edges crimped as shown. By increasing the number of plates, the capacity may be increased, but there should be one more negative plate than positive for best results.



Two forms of storage cells and top view of a plate

Though the efficiency of these batteries is somewhat lower than the regular lead cells, this is offset by their long life, as it is practically impossible to ruin them. Even reversing the charge will not affect them in the least. For automobile service they would be ideal, due to the uneven charging rates and the necessity of sometimes nearly drawing the last bit of current from the battery in emergencies.

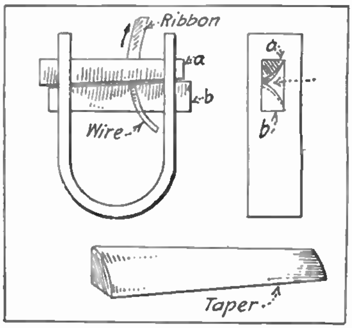
Glass Solder

A glass electric light shade which had cracked was prevented from breaking by running a small amount of solution of sodium silicate into the crack with a toothpick, wiping off any excess with a damp cloth, and drying. This might be termed a "glass solder," though requiring no heat. It is waterproof.

Contributed by E. P. Ferte.

Ribbon Drawing Device

Through a horseshoe-shaped strap of iron, cut two slots to hold the hardened steel jaws *A* and *B*. One or both of these jaws may be tapered, but their inner edges must be parallel. Moving *B* to the left narrows the slot, permitting a thinner ribbon to be drawn. Stock for the thinnest spring may be drawn with this device. To use it hold *C* in a vise. Slightly flatten the end



Draw the wire through as indicated by the arrow

of the wire to be drawn with a hammer and insert as indicated. One of the advantages of using this device is the straight ribbon it turns out.

Contributed by A. F. Stearns.

Everyday Chemistry

HOW TO DECIPHER FADED AND BURNT HANDWRITING

By W. C. Dumas

SOME inks, especially those formerly in use, were not fast to light, and have faded to such an extent that the text cannot be read. Many methods have been proposed for restoring and deciphering these faded manuscripts. In certain cases, for instance, when faded letters are to be used for legal evidence, it may be very important to know what is written on them.

Ultra-violet light photography has been tried in some cases, but its use is limited.

Most inks, both ancient and modern, are acid, and it is on this fact that one method of restoration is based.

The faded text is carefully and smoothly placed against silver chloride paper which has first been nitrated, and allowed to stand in contact with it for twelve hours or more. After this time has elapsed, the sensitive paper is exposed to the full light, and the counterpart on the faded paper slowly develops. The characters show in a metallic luster on a dark background.

This image cannot be fixed like a photograph, but is stable long enough for examination.

If it is desirable to get anything like permanent duplicates of the faded writing which has been transferred to this paper, it can be done by exposing the silver chloride paper containing the characters in metallic luster, to the fumes of burning phosphorus. This is done in a closed chamber. The writing now becomes plainly visible.

Another way to restore the characters of old writing is to place solio or some similar sensitive paper in contact with the text for a moderate length of time. After this, mercury is carefully dropped on this photographic paper from a height of about twelve inches, so the fine droplets will spread over it. When this has been done, the paper is immersed in dilute ammonia, and the duplicated text will develop.

Or the solio paper, after having been in contact with the faded writing, may be exposed to direct sunlight for about fifteen minutes. After this exposure, the paper is pressed on a dry plate which subsequently can be developed with dilute rodinal. In the latter method, it is possible to print as many copies of the original writing as is desired.

Sometimes important papers are charred or burnt, and it is necessary to decipher what is written on them. This may not be possible with any certainty by merely examining them, but if the substance of the paper itself is still intact, it can be done in other ways.

Most writing inks contain an iron or some other metallic base. In the burning, the characters are changed but not destroyed because of this base.

Sometimes the writing on charred sheets can be intensified by simply placing the sheet in a glass vessel and covering it with a 10 per cent. solution of glycerol.

A better way is to treat the injured manuscript with a potassium permanganate solution for several hours, and then immerse it for a minute or two in a solution of potassium ferrocyanide containing a little hydrochloric acid. The text appears as a greenish-blue writing, and can easily be read.

Occasionally a sheet, which has been burnt, will not yield good results by the above treatment, so an alternative method can be tried. The manuscript is kept for three hours in a glycerol solution containing 20 per cent. of glycerol. After taking it out of this solution, the excess liquid is absorbed with blotting paper. A glass plate is spread over with chloroform, and the sheet pressed smoothly on it with the writing up. A second plate is next put over it, and the whole subjected to a great pressure for twenty-four hours. The writing can then be deciphered.

An Alarm for a Lathe Boring Tool

The following description will serve for the construction of a device not only to prevent the boring tool from running into the face plate, but also to give an alarm when the tool is almost through the work. Fasten a small piece of metal about ¼ in. thick and 1 in. wide with a bolt having a wing nut to the bed of the lathe just ahead of the carriage, and a similar piece of metal on the carriage. To each of these fasten a piece of the hard rubber stem taken from a discarded tobacco pipe. These serve as insulators to which the ends of insulated wire are attached, and should be bored so that a contact will be made when the two meet. Put two dry cells and an electric bell in the circuit. If the metal clip is adjusted to the right location on the bed, the clip on the carriage will make contact at the right moment, causing the bell to ring.

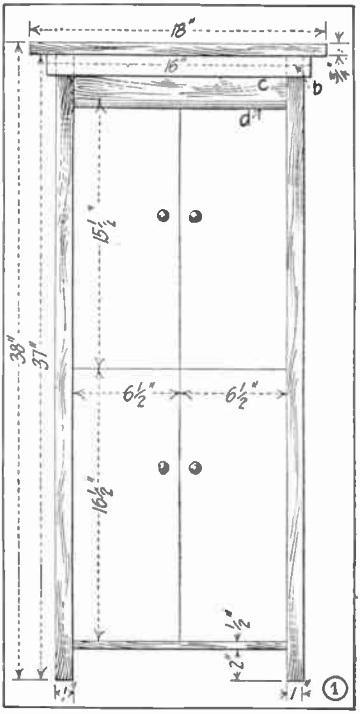
Contributed by Wm. Wernecke, Jr.

A CABINET FOR THE PHONOGRAPH

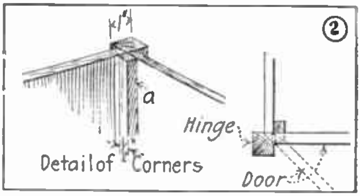
By Wm. P. Langreich

Editor's Note: This cabinet is somewhat unique in that it requires no extensive knowledge of the use of tools. No difficult joints are specified and the construction is so simple that even the indifferent amateur should be able to turn out a presentable job if he uses ordinary care.

THIS cabinet is large enough to hold a number of records, solid enough to support a talking machine, yet small enough to occupy very little floor space at the cry of "On with the dance." The top is an 18-in. square, ¾ in. thick. The legs are 1 in. square, and 37¼ in. long. The shelf and bottom are of ½ in. stock, one a 13-in. square, and the other 13 in. by 13½ in. The sides and back are of the same stock, 35½ in. by 13 in. Two of the strips marked *B* (Fig. 1) are 16 in. by 1¼ in. Two others are 15 in. by 1¼ in. The ones marked *C* (same Fig.) are 13 in. long by 2¾ in. wide. To support the sides, four sticks 18 in. by ½ in. by ½ in., and four others 16¼ in. long are used. The doors are ½ in. thick, the uppers 15½ in. by 6½ in., the lower ones, 16½ by 6½ in.



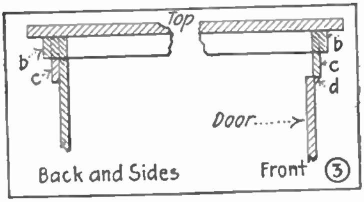
Front elevation of cabinet



Detail of corners and method of securing doors

The assembly is made clear by

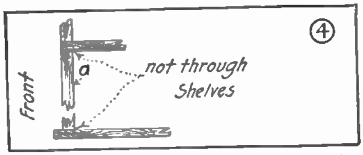
the illustrations, and attention is called to the construction of the top (Fig. 3) and corners (Fig. 2). The shelf is held 16½ in. from



How the top is built up and secured to the sides

the bottom by *A* (Fig. 4) and serves as a "stopper" for the doors, which are hinged to the legs. To the top of the two upper doors tack a strip of molding (*D*, Fig. 1).

When sandpapered and stained to match the phonograph casing,



The uprights do not go through the shelves, but support them as shown

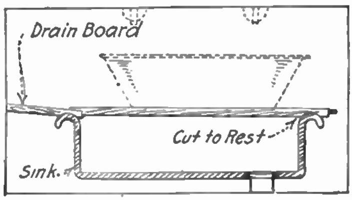
screw four knobs in the doors as shown in Fig. 1. The inside may be divided to suit the needs of the various-sized records.

FOR THE KITCHEN

Any housewife will tell you that men spend entirely too much time inventing ways and means of making their own work easier, and too little in helping the housewife in this respect.

When the man enters the kitchen he often wonders why the woman does a certain thing in a certain way, when a better way of doing it can easily be seen. Most likely it is because she is too close to her work, and the man in this case is like the onlooker at a game of checkers, who sees moves which are not apparent to the players.

For instance: The woman is washing dishes; the pan rests in the bottom of the sink, making it necessary to stoop slightly, which becomes tiresome; the man gets two pieces of board, ⅞ in. x 3 in. and which are of the same



Cut two strips to rest on the edges of the sink

length as the sink, and, after cutting these to fit the ends of the sink, he gives them a couple of coats of white enamel and puts a small screw-eye in the end of each.

When in use these boards make stooping unnecessary, and when not in use may be hung near the sink. The enamel, of course, makes them easy to keep clean. Contributed by J. B. Hunter.

How to Construct a Handy "Trouble Lamp"

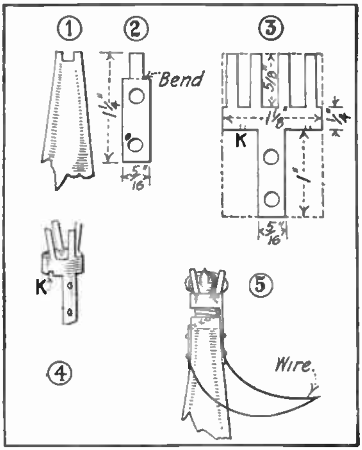
The principal materials necessary for the construction of this lamp are a small tool handle, a piece of thin and springy sheet brass, a 2.5 volt bulb, and about 6 ft. of flexible conductor cord. The measurements given below will vary slightly with different sized tool handles.

Remove the ferrule from the tool handle and file a notch ⅛ in. wide and ⅛ in. deep (Fig. 1). Cut and drill a strip of thin brass as shown at Fig 2 and bend where indicated.

Cut and drill another piece of brass, as illustrated in Fig. 3; bend the horizontal portion of the "T" in a circle the same size as the base of the lamp, and bend the slotted portions *K* into the circle so that they will catch the screw thread of the lamp base. Arrange the top projections in a cone, as shown in Fig. 4. (These projections serve to protect the bulb from injury.)

Mount the brass sections as shown in Fig. 5, making sure that their relative positions are such that a good connection is made when the bulb is screwed in tight. Connect the wires to the mounting screws as shown.

This lamp is run on two dry



Detail of the trouble lamp

cells connected in series. Cells that are too weak for ignition purposes give good service, for a 2.5 volt bulb burns only ¼ amp. Make one and see how handy it is around your launch, automobile or in dark cupboards and cellars.

Contributed by Roy B. Snow.

Bottles Can be Labelled by painting round or rectangular shapes on them, letting paint dry and scratch in words.—H. L. Baer.

PRACTICAL MECHANICS FOR EVERYDAY MEN

A NOVEL WINDOW ATTRACTION

By Wm. Wernecke, Jr.

HERE is a novel scheme for an electrical window attraction which will work for hours and have a sensational effect on its onlookers. The most important items for its construction are: A wooden cabinet (size arbitrary), an electric thermostat, a pair of electro-magnets, a large single magnet, some strong cord, four or five dry cells and one 8 and one 12 oz. weight.

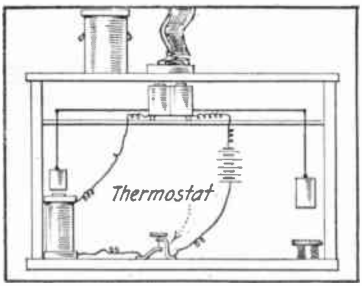


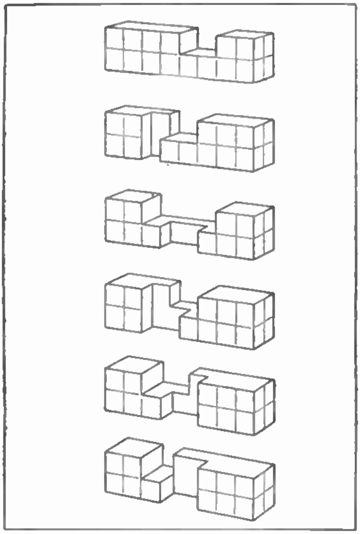
Diagram of connections and detail of the device

As illustrated, the large single magnet is fastened to the base on the lefthand side of the cabinet, preferably against the side. The thermostat is mounted on the base as shown. A small bumper to weaken the jars caused by the falling weights is suggested though not necessary. A second partition or shelf is fastenend near the top of the cabinet. This must be a little lower than the pair of electro-magnets which are fastened to a truck fitted with wheels. Small pulleys are screwed to the sides of the box to guide the cords. If the constructor possesses a little talent in drawing, he can sketch the image of a venerable old gentleman armed with an umbrella, cut it out and mount it upon a piece of stiff cardboard. A photograph of an ashcan may also be cut out and mounted. The latter is permanently secured to the top of the cabinet while the former is mounted on an iron base.

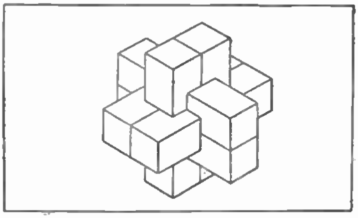
When this is done, the weights are adjusted. Strings, as shown, are passed from the truck over the pulleys. On the end of the string coming to the left hand side to the large single magnet is fastened the 8-oz. weight. To the string running to the small bumper on the righthand side of the box is fastened the 12-oz. weight. The wires running to the electro-magnets should be coiled so as not to impede the free movement of the truck. After the connections are completed, as illustrated, the device is ready for use. As soon as the switch is thrown, the thermostat heats and cools off alternately, thus opening and closing the circuit. When closed, the single coil at the left attracts the iron weight with enough "pull" to lift the weight at the right (12 oz.). When it opens, the coil at the left is devoid of magnetic influence and the weight at the right lifts the smaller one, thus drawing the small magnets on wheels back to the starting point. The effect is very realistic and comical, and it looks just as though the old man, apparently barring everything in front of him by the umbrella, always collides with the old ash-can, and in the moment, as though realizing his error, rushes back, only to bump and bump again.

Japanese Puzzle

Teachers in manual training will find an excellent and interesting problem in the six-piece puzzle illustrated. If the student can work out the various pieces so that when assembled they will form a double cross that will hold itself securely together, it may be safely assumed that he has learned the first essential of woodworking, to wit, to work accurately to line and to produce a true right angle.



How the six pieces are cut



The six pieces assembled forming a double cross

To make a plan and elevation of each separate piece thoroughly illustrates, in all its essentials, the principle of rectilinear projection as used in mechanical drafting.

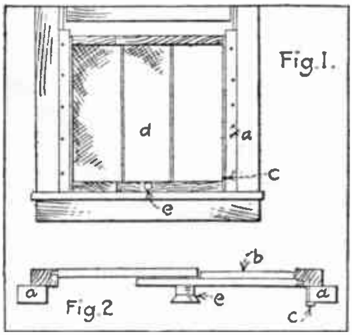
The six pieces are all of a size, and should be four times as long as they are wide. One-half or ¾ in. square strip results in a convenient size. The small squares in the drawing indicate the proportions without dimensions, as there are no fractions.

It usually takes anyone unfamiliar with the puzzle several hours to put it together.

Contributed by John D. Adams.

Adjustable Screens Changed Into Sliding Ones

When moving into another house, a number of adjustable screens brought along were



How the screens are made to slide

found to be about an inch too high to fit in place under the window sashes. To avoid the cost and delay of getting new screens the old ones were easily and quickly converted into the sliding kind.

Narrow, thin strips of wood were procured at a near-by planing mill and sawed into lengths about an inch longer than the height of screens. One of these strips was then screwed to the edge of each window stick on the room side, as *a*, Fig. 1.

The screens were then adjusted to the right width and strips were fitted into the spaces on the side next to sash where one section of frame slides on the other, as *b*, Fig. 2. These keep the screens rigid and prevent insects from crawling in between the sash and screen. To prevent insects from getting in where one section of the wire netting overlaps the other, as *d*, Fig. 1, the laps were sewed together with strands of wire raveled from the edge of the screens.

To guide the screens and keep them from slipping outside, a square turn-screw hook was set in each side near the bottom of the frame, as *c*, Fig. 1. Halves of small spools, *e*, Fig. 2, were used as lifts. Finally, when stained to match the other woodwork of the windows, these screens gave a very pleasing appearance and have proved very satisfactory. The cost of remodeling was less than three cents a window.

Contributed by T. H. Linthicum.

HOW TO MAKE A SIMPLE INDICATOR

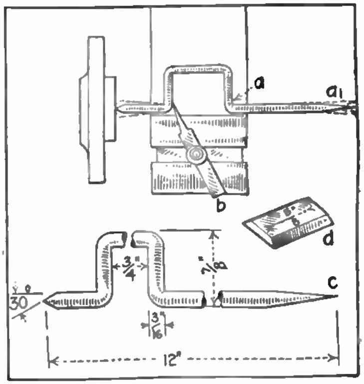
By James W. McIntyre

When necessary to drill two holes a certain distance apart within a few thousandths limit, a device called an "Indicator" is used to true the prick punch marks so that they are perfectly central.

For example, a die block *D* is to have two ⅜ in. holes exactly ⅝ in. (.625) apart; first, the distance is laid off and two prick punch marks made .625 apart. The die block is now clamped onto the faceplate of a lathe and the indicator point is placed into the prick punch mark and held there by the pressure of tool *B*.

Turn the lathe spindle and if the prick punch mark is not true the Indicator *A* will run out; that is the end of the Indicator that is in the air describes a circle of say 1 in., indicating that the prick punch mark runs out 1-12 of an in. As the indicator is 12 in. long, any eccentricity of the prick punch mark will be multiplied twelve times. Now, the die block is moved by tapping with a hammer until the end of Indicator *A1* runs perfectly true. If the prick punch mark runs out 1-12 of a thousand or .00083, the end at *A1* will run out a thousandth of an inch, or .001. Of course, the longer the indicator the greater the accuracy.

After making the prick punch true, the indicator is removed and the hole drilled and bored to size in the usual manner.



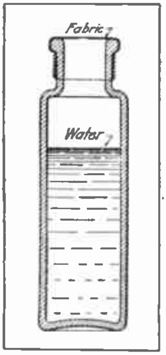
The indicator need not be of the dimensions here given, but both ends must be concentric

The indicator is preferably made from Stubbs steel, bent as shown and hardened on both ends. The dimensions given are arbitrary; the most important point is to have both ends concentric with one another. This indicator is sometimes called a "Wiggler."

Put a lump of washing soda over the sink drain, and pour hot water over it after each dish-washing. This will keep the pipes from clogging and save many a plumber's bill.—Mary F. Scott.

Envelope Moistener

Although the problem would appear to be a simple one, it seems impossible to secure a simple envelope moistener that will not in a short time become foul and impervious, due to the accumulation of the adhesive. And yet our modern notions of sanitation practically prohibit the use of the tongue. A small sponge with a suitable cup answers very well, but this requires frequent attention and the drying of the hands after using it, which is quite impractical where envelopes are intermittently sealed.



The envelope moistener

Confronted by these conditions the writer has tried with considerable success the simple moistener here illustrated. This consists of a narrow bottle with a comparatively wide mouth (such as fountain pen ink comes in), over which is placed a rather heavy piece of cotton rag. The bottle having first been nearly filled with water, the fabric is stretched over the mouth and bound on with a few turns of stout thread or light cord wrapped around the neck. Upon inverting the bottle and passing the mouth over the glued surface, an even streak of moisture is delivered, without any danger of spilling or dropping. In fact, the fabric might be subject to quite wide variations without seriously affecting the result, which appears to depend largely on the adhesion of the water to the paper. Evaporation is almost negligible, even in a dry climate and one filling will probably be found sufficient for over a thousand envelopes.

Contributed by John D. Adams.

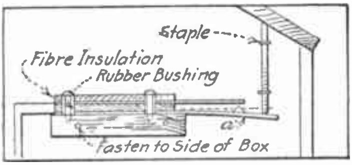
Iron Pyrites

In a widely varied experiment with detector minerals, one amateur found that the substance known as "Coal diamond," when used as a detector mineral will stand a very large amount of rough usage, much more than any other mineral he knows of, and is very uniform in sensitiveness. He finds that its sensitiveness is about on a par with silicon, which is so largely used in this capacity.

Contributed by C. H. Biron.

Rural Mail Box Alarm

The wiring of this device is similar to the bell system, the contact spring acting as a push button. When the cover is raised,



No matter how little the cover is raised, the alarm rings

contact is made at A, closing the circuit. The upright rod is secured to the side with staples in a manner to have free movement.

Contributed by OTTO A. KOERNER.

Fingernails may be protected from sharp acids by coating them with a preparation of melted wax and olive oil. Melt the wax by putting it in a vessel which is set in another, partly filled with boiling water. To each ounce of wax add one dr. of olive oil and stir thoroughly. Dip the fingers in this preparation and then allow it to dry on them. This is especially recommended for photographers, chemists and experimenters.

Contributed by WM. J. WERNECKE.

Lubricant for Commutators and Slip Rings.—A tallow candle is a good compound for lubricating slip rings and commutators, if not applied to excess. It gives the chocolate color that makes engineers jump with glee, if they know its value.—H. L. BAER.

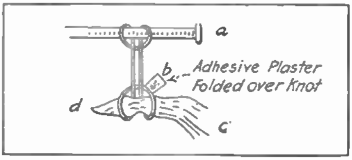
EVERLASTING LAMP WICKS

Everlasting lampwicks, often advertised as asbestos, are prepared in the following manner.

Take ordinary cotton wicks and steep in an aqueous solution of tungstate of soda; then dry thoroughly in an oven. Sodium tungstate can be procured at any chemical house. An ounce is enough for a hundred wicks. Contributed by J. C. GILLILAND.

A TOWEL HOLDER

There are many places where it is impossible to hang a towel-rack. To hang towels on nails is a nuisance, as the towel falls very often and sometimes is torn. To tie them on strings means that



How the towel is held

task of gnawing on a knot before removing. The method illustrated here is a combination of the two last methods. To remove the towel, hold it at D and pull up on B.

Contributed by E. P. FERTE.

Small wooden embroidery hoops make most excellent rings for variometers.—C. H. BIRON.

THE TECHNICAL ADVISER

The object of this department is to answer the questions of readers who may experience difficulty in the construction or use of apparatus described in the magazine. The columns are free to all readers whether they are subscribers or not, and questions pertaining to matters electrical or mechanical will be answered in the order in which they are received. If the reader cannot wait for an answer to be published he may secure an immediate answer by mail at a cost of 25 cents for each question.

In order to insure prompt attention, readers should adhere closely to the following rules which have been formulated with a view to expediting the handling of the mass of correspondence. Questions should be written on one side of the paper, enclosed in an envelope addressed to The Technical Adviser, care of Everyday Mechanics, Æolian Hall, New York City. The letter should state plainly whether answer is to be published or sent by mail; in the latter case the fee of 25 cents per question should be enclosed in coin, one-cent stamps, check or money-order. The envelope enclosing questions should not contain matter intended for any other department of the magazine.

27. **O. S., New York City,** writes: The writer some time ago was in need of a contrivance that would feed a rapid stream of round steel balls to a tube, single file, and in his simplicity thought that the question would be solved by a hopper with a funnel-shaped opening ending in a tube slightly larger than the balls. They jammed, and kept on jamming, whatever the size or shape of the opening. On inquiry he found that hoppers for that purpose were arranged with moving parts to keep the balls stirred in the hopper, but, while this arrangement may be satisfactory for a slow, jerky supply, it is not where a rapid, continuous stream is desired. The writer set out to solve the problem, and did produce a hopper that will supply an unlimited number of balls to a tube, quite simple of construction, and without any moving parts, something that apparently has not been done before.

The question is: Is there a sufficiently wide use for such a contrivance to make it worth following up with applications for patents and further exploitation, or, who uses them and to what extent? Ans.—Your letter is interesting and we have no doubt that the device you have developed would be of very great importance to a manufacturer who chanced to use steel balls under the circumstances you have outlined. We, however, do not know just what to advise. The inquiries we have made have not brought forth any great amount of useful information. Perhaps some reader will care to express his opinion or to offer a suggestion. We can quite appreciate the ingenuity represented in your device and believe there must be an important market for it, if only you can make known its merits to the right men.

28. **E. S. B., Elkins, W. Va.,** writes that he is using a Hunt and McCree 1-in. spark coil on 110-volt alternating current with a lamp bank of six 80-watt lamps. The coil gives a good, fat spark using the vibrator. Is this advisable? He has never heard of

anyone using a coil that way before. The coil will not work well with an electrolytic interrupter, but works well on the line with the lamp bank described. Ans.—We presume that just by luck your interrupter is of the correct period to at least partially synchronize with the alternations of the current. This will account for the successful operation in series with the lamp bank. There is no harm in using the outfit as it stands, providing you do not try to get more work out of it. The six 80-watt lamps would not pass too much current for intermittent operation, for we assume the primary of your coil to be wound with about No. 16 wire. If the spark at break is not destructive, you may work without hesitation. Do not force the coil beyond this point, however.

The electrolytic interrupter is not adapted for use with alternating currents. It is fundamentally opposed to such use, and the only possible excuse a manufacturer can have for recommending it under the circumstances is to broaden his field.

29. **N. J. K., Dubuque, Ia.,** writes: I am about to ask you some questions which, no doubt, a large number of experimenters would like to know, and, no doubt, have stunned more than a few. For the past few years I have been building an electric light plant, and, while I modified it somewhat, I followed the articles written by T. S. Curtis on the charging plant, and W. C. Houghton, on storage battery. These appeared in the 1911, January, February, March, May, July and August issues of *Electrician and Mechanic.* I might add that I have in my possession Dr. A. E. Watson's small and large book on storage batteries, and various other mighty good books on storage batteries. So I hope you will give your answers clear and concise and don't refer to any books. Dr. Watson certainly has a good book on care and operation, but he passes too easily over the making of a pasted positive plate (the Faure type), and this is my entire trouble. I have negative plates as good as any made, and, if the positive plate would do its duty, I would have an outfit with some class.

Of course, I have a 16-cell, 32-volt outfit, and have 3 counter cells, which reduce the voltage for lights while charging goes on, and furnish my engine with an excellent spark.

My design for plates is an exact replica of that of W. C. Houghton, both for positive and negative. Sizes of plates are 5 in. x 8 x ¼ in. thick. With 4 negative and 3 positive plates per cell, this gives me a positive plate surface of 240 sq. in., and I have given it the liberal rating of 80 ampere hours, although I think it could get up to 100 ampere hours.

The charging rate is 10 amperes and fused with 12 amperes. The lighting circuit is fused 10 amperes, besides having an automatic circuit breaker. I never popped a fuse, and my grief is not from abuse, as far as I can see. I might add that I have jeweled volt and ammeter of a reliable make, and a Sangamo Mercury Amphom meter, and any figure which I may give you is accurate.

The negative plates were pasted with pure litharge mixed to a paste with electrolyte of 1,200 specific gravity strength. I formed these by giving a daily dip in the same strength solution until the plates were used to it.

The positive plate I made by using red lead and 1,200-degree electrolyte and tried to form in a chloride of lime bath, but they shot like popcorn when they touched this bath. Then I tried the dip stunt in 1,200-degree electrolyte, but ruined practically every plate. Finally, I used 25 per cent. litharge with the red lead, and formed them by giving them a daily dip in electrolyte of 1,200-degree strength. They looked pretty good. After assembling I began charging at 4 amperes, and finished with 3. The initial charge took 3 days of 15 hours each. I immediately discharged some at 4 amperes for 11 hours, and the voltage was still at 2 per cell, but I stopped. Then I filled it at a 6 ampere rate and the battery began doing business. It was some battery. About the fourth charge I took out 80 amperes, and the battery still had lots of pep. But I would not run it down. This kept on for about 3 months, and I had electric light galore, and, permit me to say, it was equal to any. After that my capacity dropped off at every charge. The battery began to look dirty, and when I investigated, all that paste of the positive plates was loose and looked like mud. It did not look like blocks or chunks, but was almost as fine as powder. I used rubber perforated separators and the negative plates have a nice gray color, and I think are good for another trip. I am now ready to shoot some questions.

The positive frames or grids are still perfect. Can they be pasted again and used over? I would hardly think so, but maybe I am wrong. Then, can these grids be melted over, made into new grids and used? What strength of sulphuric acid and water should I use to mix the paste? In books I have read, anything from 1 of acid and 10 of water to 1 of acid to 2 of water. Now, if one is right the others must be wrong. It appears to me as though a whole lot of writers just write to fill a book, but never stop to try some of that stuff and get bumped like I did.

What strength should the chloride of lime solution be? I don't know what is meant by a "strong solution." Give the quantity of chloride of lime by weight and water by measure and I can understand. How long should they remain in this solution? Can the solution be used repeatedly? How much washing is required after taking plates from this solution?

I wrote the makers of the red lead in regard to my trouble. They suggested to use a small amount of ammonia in mixing the paste. In what way could this remedy my trouble? I am no chemist. Could it do any harm? I do not want this battery only for a day. I want it for years, and charging once every 8 to 10 days I don't see why it would not last. Surely, manufacturers of batteries cannot experience all this trouble. There certainly must be a way of doing it.

I am not the kind to give up, but I am disgusted. I would like to have these questions appear in EVERYDAY MECHANICS. I would also like to see an article "How to make" a magneto magnet charger, to operate on a 6-volt storage battery.

I have made a good many contrivances in my days, and, no doubt, will be a boy all my life, but I never had so many ups and downs as I did in the storage battery end. To me it seems as though it were impossible to build a positive plate, but I am ready to try "again."

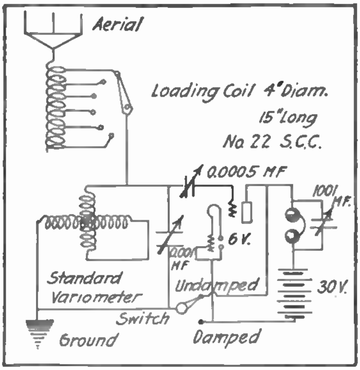
I am anxiously waiting for the next number of EVERYDAY ME-

CHANICS. Ans.—You certainly are the kind of reader we wish we could have half a million of. Your work, dating from away back in 1911, does you credit, and we are going to see you through to a successful finish by placing ourselves in your boots. We have been in touch with all of the authors you mention, and the combined data we have gathered will be worked out in the *Experiment Station* under conditions as nearly like yours as we can picture them. With this you will have to abide your soul in patience until we can report progress. It would be useless for us to reiterate all of the old advice, and when we undertake to answer your questions we want to tell you what *we* have found. We are working on the design for a magneto magnet recharger, and hope to have the article ready for an early issue.

30. **B. C., New York City,** asks questions as follows: Referring to your articles on the 100 Watt Radio Spark Coil in the March issue, how much wire is required for the primary and for the secondary, in pounds? (2) Can flashlight batteries be used to operate the coil? (3) Where can micanite sheeting be bought? (4) What would be the range of the coil, etc.? (5) Do you consider the coil practical for use in a portable set? Ans.—(1) Two pounds of No. 14 D. C. C. wire for the primary and 6 pounds of No. 32 enameled for the secondary. (2) No, they cannot be made to deliver 100 watts of electrical energy unless you have an inordinate number of them. (3) Try the Clapp-Eastham Co., Cambridge, Mass. (4) We cannot estimate sending and receiving ranges. The coil is quite the equal of any professional product of the same power, and the radius is as much up to the operator in this case as it is in any other similar one. (5) Yes, the coil is admirable for a portable set.

31. **D. E., Marshalltown, Ia.,** asks the name of the firm that makes the motor used in the submarine, and (2) if it is necessary to use a polarized relay in the model. Ans.—The motor is manufactured by the Kendrick & Davis Co., Lebanon, N. H. (2) A polarized relay is not absolutely necessary, as we at first used one of the ordinary type. However, results are so much more certain with the higher priced relay that its use is justified.

32. **W. P., Néw Bedford, Mass.,** sends us a diagram of a hook-up that he wishes to use in operating a long-wave station, and asks for data on the apparatus. His aerial is 45 feet high and 50 feet long; he could increase the length to 100 feet if necessary.



Ans.—We advise you to employ the diagram shown herewith rather than the one you send us. If you will refer to the articles on the Trans-Atlantic Receiving Set in past issues, you will get the necessary data.

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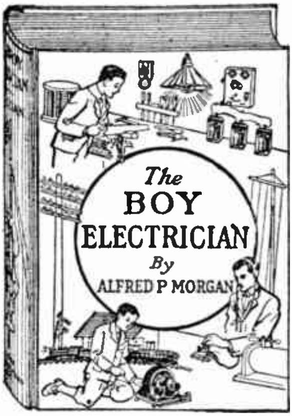

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