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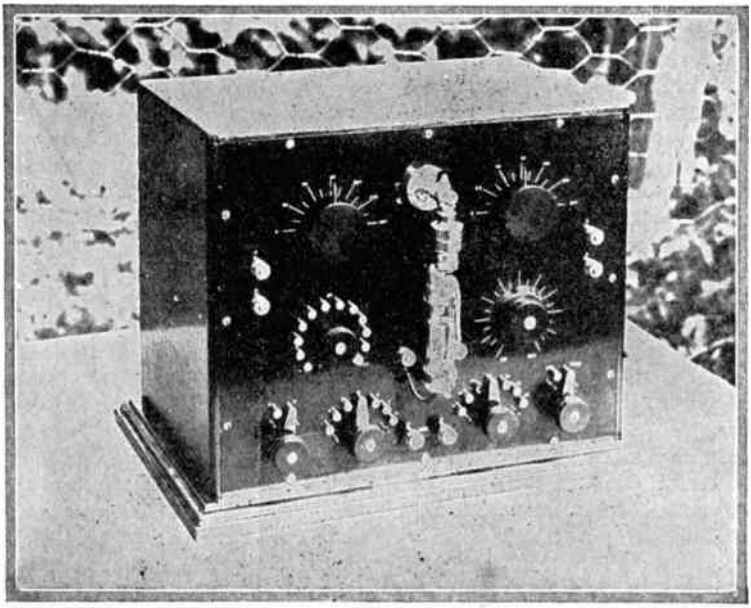
THE CONSTRUCTION OF A SUPER-SENSITIVE AUDION RECEPTOR

BY MAXWELL K. BURCKETT

THE audion detector, licensed for private use under the patents of Lee DeForest, is the most sensitive receptor of radio signals that has yet been brought before the world All forms of mineral and acid detectors require constant care to keep them



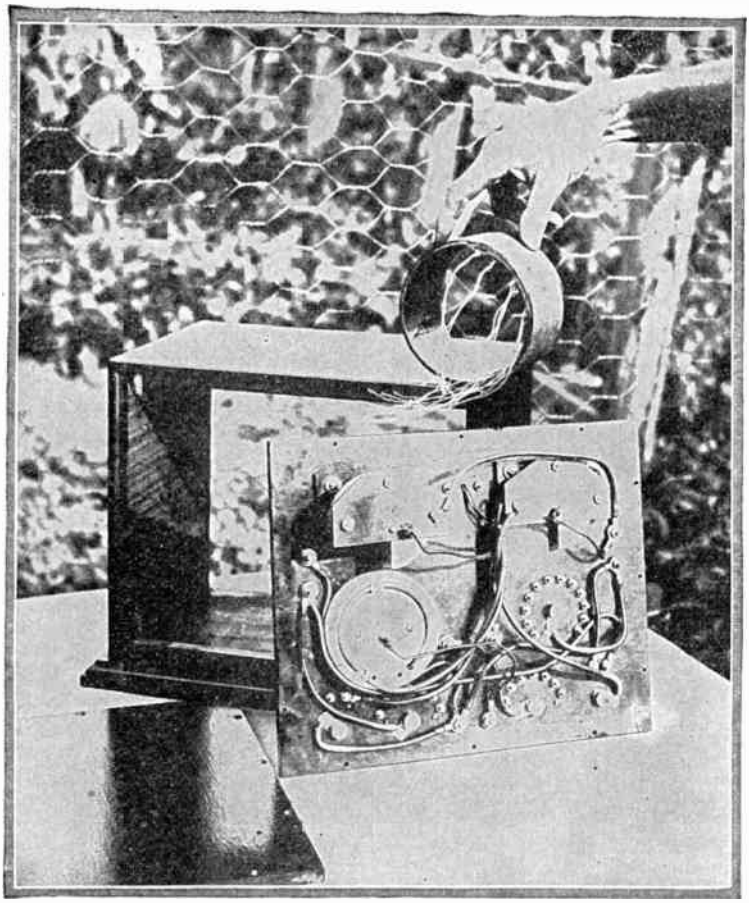
The Audion Receptor herein described presents many unique points of interest

in good working condition, and even under the best of care static disturbs their adjustment. Many articles in our American scientific papers deal with the theoretical side of the audion, but not with the practical or constructional side for the amateur. Some articles take up the apparatus used in the primary circuit, and then conclude by giving directions for connecting the standard DeForest audion to the set which they have described.

I have proved that with the set described herein as many as fifty different radio stations of from 200 to 3,000 meters wavelength can be received with one adjustment of the primary circuit, while the rest or the tuning is done in the secondary or immediate audion circuit. The important feature of this set is the fact that there are numerous methods of obtaining the resonance points.

The bulb to be used with this set should be of the X grade Hudson filament type, which is supplied with the standard De Forest sets. This type of bulb is not sold separately; nevertheless, the rest of the parts of the standard set may be utilized, such as the bracket, rheostat and batteries, although there will not be enough of the latter, as a total of fourteen 3-volt and seven 1-volt batteries is needed. However, recent tests prove that the DeForest tubular bulb, which is sold separately, closely rivals the original style bulb as to sensitiveness. Using this bulb reduces the cost of making the set a great deal, although the bracket, rheostat and batteries will now all have to be bought.

The set is mounted on a ¼-in. hard rubber panel, which is set into a mahogany cabinet of suitable dimensions with at least seven inches clearance in back of the panel. The method of mounting the panel is shown in detail in Fig. 2. The panel is laid out as shown in Fig. 1, with the holes for the switch arms, rheostat stem and variable condenser shafts drilled with a 3-16 in. drill, the holes for the contacts, binding posts, and wood screws drilled with a 9-64 in. drill, and the holes for the stop-pins and leads of the candelabra bracket drilled with a ⅛ in. drill. The names "Phones," "Secondary," "Grid," "Plate," "In and Out," "Battery P & N," "On and Off," and the numbers on the battery switches and dials should be stamped in the hard rubber with steel dies, while the condenser and rheostat dials are scratched in the hard rubber with a sharp pointed piece of steel rod. The dials are shown in Fig. 2, the rheostat dial is the whole diagram from "In" to "Out," while the condenser dials are only from "0" to "180." The rubber panel should then be rubbed with a piece of flannel well saturated with linseed oil



The entire apparatus is mounted upon a hard rubber panel. This view shows how the connections are made on the back

and rottenstone, to polish it The impressions on the panel are now filled in with white lead or Chinese white to make them stand out on the dark background

The small variable condenser consists of three stationary and two rotary semicircular aluminum plates, twelve stationary plate washers, two ⅛ in. and one 1-16 in rotary plate washers, three tie rods, ⅞ in. long and

threaded for ⅛ in. on both ends with 6-32 threads, one steel shaft 3-16 in. in diameter and one 13-16 in. long threaded for ⅝ in. on one end, with 10-32 threads, two pieces of hard rubber 3 in. x 2 in. x ¼ in., with the holes marked "A" drilled with a 9-64 in. drill and countersunk for ⅛ in. with a 5-16 in. drill, with the holes marked "B" drilled with a 3-16 in. drill, only one piece of hard rubber being drilled with a 9-64 in. drill at the places marked "C," while the other piece has the corners at "C" cut off diagonally one inch from the corner as shown in Fig. 3, two ⅜ in. long 6-32 thread brass machine screws, and six small diameter brass hexagonal nuts with 6-32 threads.

The large variable condenser consists of twenty-two stationary, and twenty-one rotary semicircular aluminum plates, sixty-nine stationary plate washers, twenty 1-16 in. and two ⅛ in. rotary plate washers, three tie rods 2 7-16 in. long and threaded for ⅛ in. on both ends with 6-32 threads, one steel shaft 3-16 in. in diameter and 3⅛ in. long threaded for ⅝ in. on one end with 10-32 threads, two pieces of hard rubber the same as used on the small variable condenser, two ⅜ in. long 6-32 brass machine screws, and six small diameter brass hexagonal nuts with 6-32 threads. The details of these parts are shown in Fig. 3.

The rotary plates are assembled with the thin washers between the plates and the thick washers on the outside. These outside washers are pounded to make them tight against the shaft and thus they form a rivet which holds the plates together. The stationary plates are assembled as shown in Fig. 3. The rotary plates are then put in between the stationary plates and the pieces of hard rubber hold the plates in position by means of the hexagonal nuts tightened on the tie rods. The holes where the tie rods come through the rubber are countersunk an ⅛ in. to allow the hexagonal nuts to be below the surface of the rubber and permit the complete condenser unit to be attached to the back of the panel, as shown in Fig. 3. The assembling of both the large and small condensers is the same, except for the quantity of materials used.

The loading inductance is of No. 30 single cotton covered copper magnet wire wound on a cardboard tube 4 9-16 in. in diameter and 2½ in. wide. The tube is drilled with very small holes, as shown in Fig. 1, and is then shellacked and baked in an oven to dry it thoroughly to prevent shrinkage.

When winding the wire on the tube, leads are taken out through the holes into the center of the tube. After this the wire is given a coat of insulating varnish to

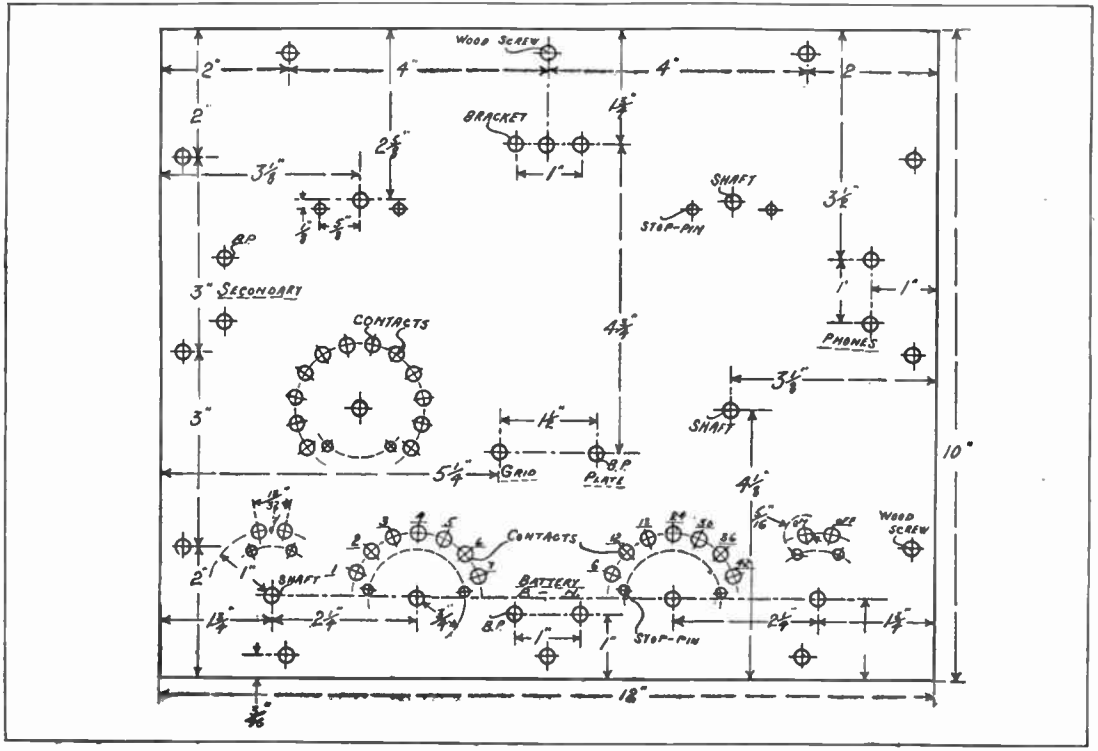


Fig. 1. Layout for drilling the panel

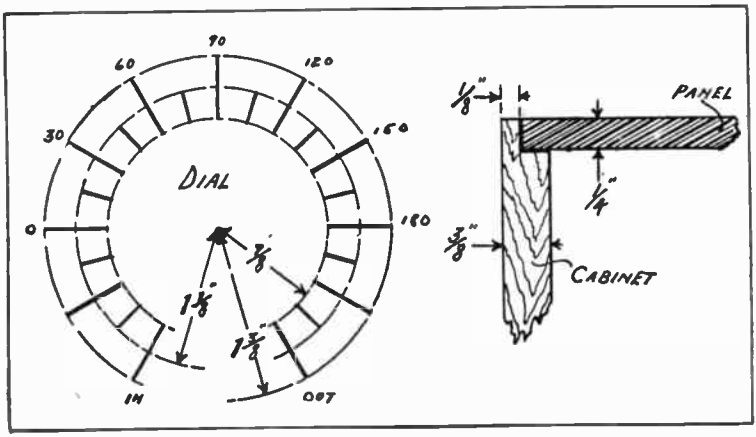


Fig. 2. Layout for one of the dials. Mounting the hard rubber panel in wooden case

prevent it from loosening. This inductance is held in place by means of strips of wood fastened to the sides and bottom of the cabinet.

The rheostat is of the standard porcelain type sold by all electrical supply houses and used on the DeForest audion. It is mounted on the back of the panel with two ⅝ in. long 6-32 brass machine screws, as shown in Fig. 5. The stem is the same as used with the switch arms, except that it is 2 in. long instead of 1¼ in. The contact arm is made of only one thickness of heavy spring brass 1⅞ in. long, with a 3-16 in. hole in one end for the stem to pass through. The arm is held in place by lock-nuts "A" and "C," as shown in Fig. 5. These are all soldered together to keep them tight after the pointer, which is a fine line scratched on knob "R," is set in position.

The knobs to control the switches, etc., are turned out of hard round rubber rod with the peripheries knurled. All the knobs except the two condenser knobs have countersunk holes in their centers to permit the stems to be level with the surface of the knobs. The switch arms are of medium spring brass, which are held tight against the knobs by lock-nuts "A," which are threaded on the stems. On the back of the panel lock-nuts "B" are threaded onto the stems, with copper lugs for connection under them, and soldered to keep them from loosening. The condenser knobs are held in place by tightening them against their point-

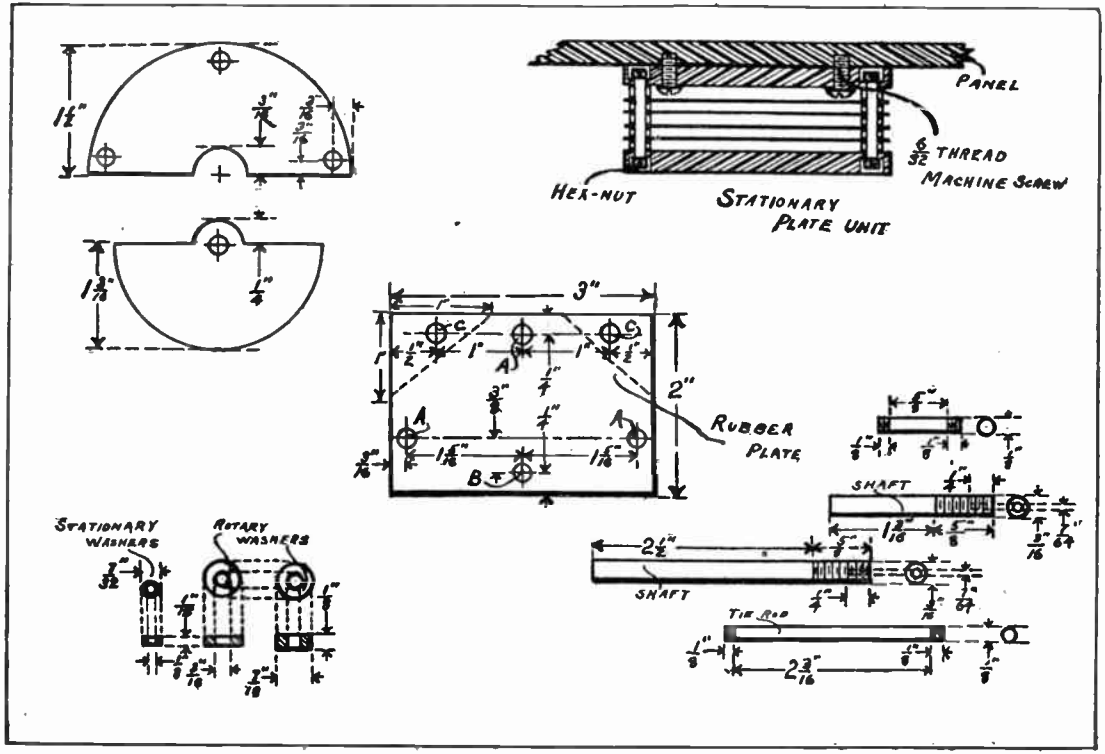


Fig. 3. Details of the condensers

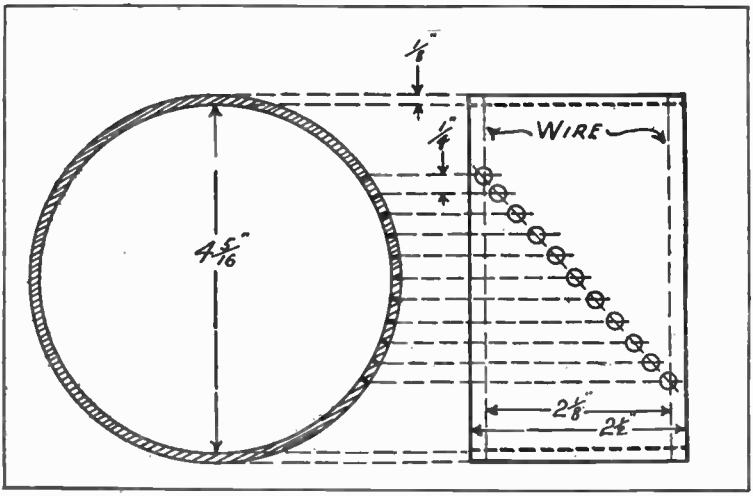


Fig. 4. The loading inductance and how it is tapped

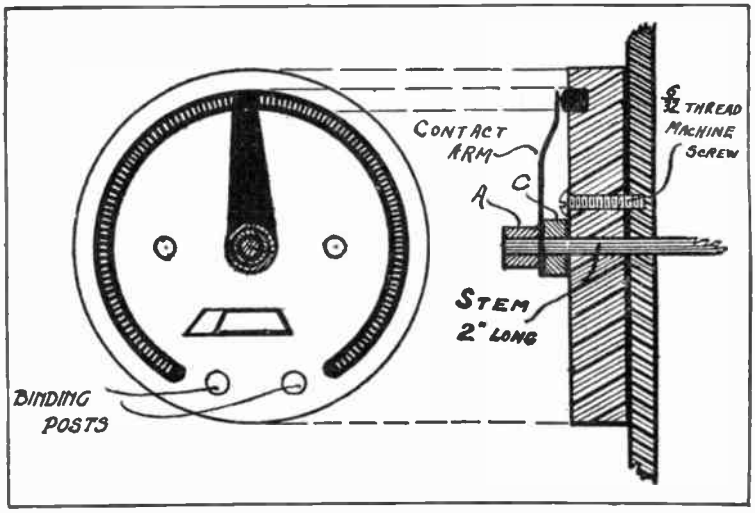


Fig. 5. The rheostat and how it is mounted

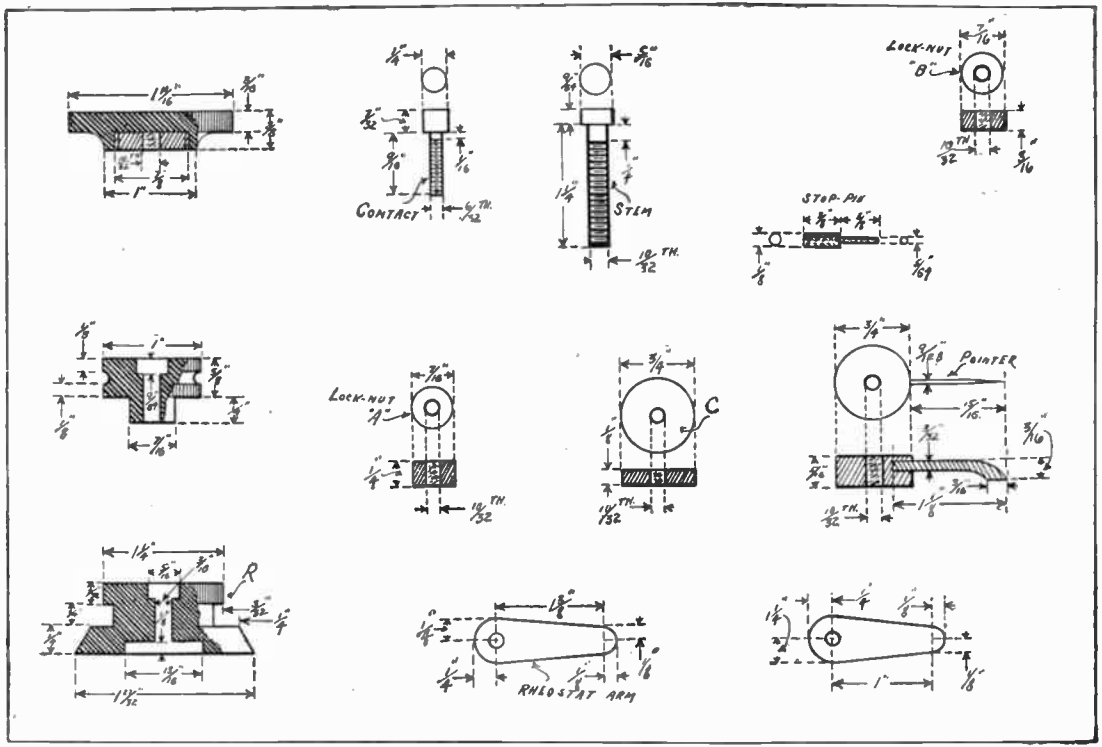


Fig. 6. The instrument switches in detail

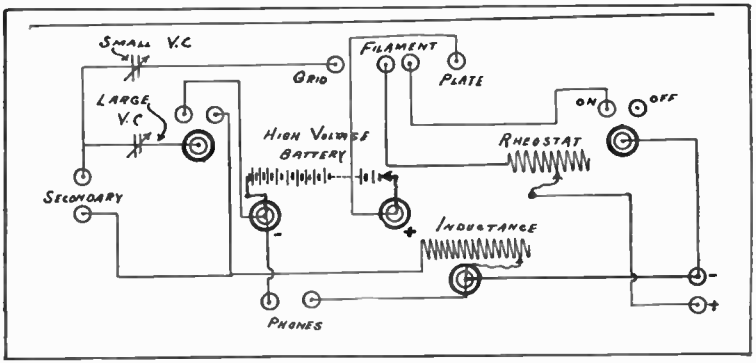


Fig. 7. Diagram of connections

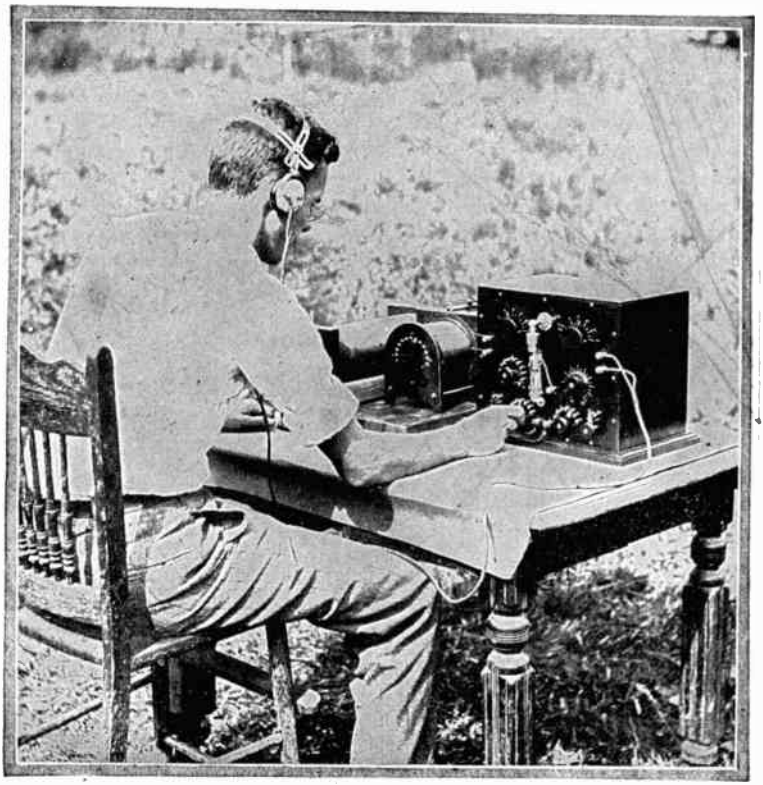
ers. The contacts are turned out of round brass rod ⅛ in. in diameter, and the stems are threaded with 6-32 threads. They are held tight to the panel by 6-32 brass hexagonal nuts threaded on the stems with small copper battery lugs underneath them with which to fasten the connecting wires. The stop-pins for the switches are turned out of round brass rod ⅛ in. in diameter, and are forced into the holes near the end contacts of the sets of switches. The binding posts are of the type which take telephone cord tips. The details of the above parts are found in Fig. 6.

After the panel has been laid out, the rheostat, switches, contacts, stop-pins and binding posts should be mounted, then the variable condensers should be attached to the panel and the leads from the loading inductance should be soldered to their respective contacts. Now the wires should be soldered to the stems of the contacts of the battery switches, with copper battery lugs soldered on the opposite ends to permit easy connection to the batteries, and the other connections should be made as shown in Fig. 7. The panel is next set in the cabinet and the two held together by means of ¾ in. brass oval-head wood screws.

The high voltage batteries are placed in the cabinet, while the low voltage battery, which is a 6-volt storage cell, is connected to the binding posts marked "Battery P & N." The terminals marked "Secondary" are connected to the secondary terminals of a large receiving transformer.* To obtain the best results the receiv-

*See article in the September issue, "The Construction of Radio Receiving Apparatus."

ing transformer should have a loading coil in the aerial lead and a variable condenser in the primary circuits are adjusted first, and last but not least, the immediate audion circuit is ad-



The apparatus completed and in use as a field set at the *Everyday Mechanics Experiment Station*

ground lead. Two thousand ohm phones may be used, although three thousand ohm will give better results. The filament and

justed It is at this point that the results stated in the beginning of the article are experienced.

HINTS FOR THE AMATEUR MOTORIST

Some Practical Working Instructions for the Man Who Drives His Own Car

By Mrs. A. Sherman Hitchcock

ONE of the greatest joys of motoring is to feel that one can rely upon one's car, and two very important items to the prospective purchaser are simplicity and reliability. The average buyer, who is unfamiliar with motoring, is quite prone to become somewhat confused if he has several cars demonstrated to him. He must remember that the car that will go faster than the one he has previously tried is not necessarily the better car. To be sure, it may be considerably faster while it is running, but the main thing to be sure of is that it will keep running.

The car to be selected should be one with a reputation for reliability, one that will not entail a large expenditure and remain for a considerable time at the repair shop. The joys of motoring are considerably lessened when a car is stranded on the country highway and has to be towed to the repairer.

Everyone who wishes to become a successful driver should prepare himself, as far as possible in guarding against troubles, which are liable to arise with even the best-constructed motor. Many people, both men and women, when beginning to drive the motor car, are continually anticipating troubles, instead of giving their attention to a systematic study of their car, with a determination to succeed and overcome the ordinary difficulties which may arise. The first time one operates his car alone, no matter whether he has been taught by an experienced driver or otherwise, he will have very little confidence in his own ability.

On each occasion when change of speed is necessary, when he has to avoid other vehicles and obstructions to his progress, it is exceedingly difficult for him to retain in mind even the simplest of his instructions; and it is especially necessary, at such times, to have the car under complete control, and to be possessed of presence of mind to do the right thing at the proper time.

The ability to judge speed and distance, and the knowledge of control are to be had only from actual experience, careful study and keen observation, combined with intelligence. Care and discretion will, in a short time, give one complete confidence to drive the motor car with perfect safety.

See that the tires are properly inflated before starting out

Before starting out with the car, the tires should be examined to see that they are in good condition and inflated properly; all the wearing parts of the car should be well oiled; one should be particular about having the axle-pivots, steering-gear, change-gear, levers, brake mechanism, and engine, liberally supplied with oil; the change-gear box, the crank case of the engine, and the rear or differential, should always be given an abundance of oil, the gasoline tank should always be filled before starting away for the drive

It is always important that the gasoline is strained before putting it into the tank—a very little grit or dirt is sufficient to clog up the carburetor Some troubles, of course, cannot be guarded against; but dirty gasoline is something that should never cause inconvenience, although it frequently does through carelessness

A mixture of gas is sometimes exploded in the muffler by the heat of the exhaust, and is miscalled back-firing. This is caused by too much gas being fed to the engine, which cannot be fired or exploded, and is, consequently, forced into the muffler with the exhaust gases. Blue smoke from the exhaust is a sign of too much lubrication, but black smoke shows that too much gasoline is being consumed; both cause sooted spark plugs and dirty valves.

If the engine slows up, the fault will most likely be in the mixture of gas-supply, or due to the ignition batteries running down It it stops suddenly, the trouble can be attributed to an ignition fault. If it slows up and stops, and then, after a minute or so, starts up again and runs a mile or so, it is an almost sure sign that the battery is down

It will sometimes be found that a certain cylinder is missing fire If the plug has been examined and cleaned, and seems to spark well when the car is running on the level or down hill, but refuses to do duty when a hill is reached, it is an almost certain sign that the plug in that particular cylinder is short-circuiting, either from dirt or oil on the inside, or perhaps because it is cracked. The remedy is to change the plug for a new one.

The water-tank, unless it is an air-cooled engine, must always be kept well filled In the case of an empty water-tank, where the absence of water has not been discovered until the engine has overheated and the pistons jammed tightly, test the cylinders by sprinkling a few drops of water on them If the water hisses and dries off quickly, do not refill until it cools off. Kerosene taken from the lamps can

be poured into the cylinders to reach the pistons This can be done while they are hot.

If the pistons have seized, the cooling process is a slow and tedious one. The careful driver will try to avoid this happening, and will take prompt measures to overcome any symptoms of overheating. Steam issuing from the filling nozzle, or water coming out of the overflow pipe, while driving, are symptoms of overheating, as are continued firing after the ignition is switched off, or a slight cloud of smoke rising from the engine As soon as any of these symptoms are noticed, stop the engine and inject kerosene into the cylinder, meantime turning the engine by hand; as the temperature goes down the pistons will move more freely.

If a bearing should by any chance become very hot, the best and simplest way to cool it is to pour water on it until quite cool, then lubricate well before starting. In new cars, bearings are apt to run hot; the least looseness in the bearings of a connecting-rod or in the main shaft will set up a jarring knock or pound. This noise will speak plainly to an ear that has once recognized it, and, if it is not immediately overcome, it will prove most destructive.

A common cause of loss of power in gasoline motors is poor compression. This may be due either to the piston rings failing to bear smoothly and evenly against the cylinder wall, or to one of the valves, usually the exhaust, not closing tightly When three or four turns of the starting crank have been made and

Do not forget to fill the gasoline tank

the motor has not responded, the driver must look for the fault and eliminate it. This trouble may be caused by the switch being open, not enough gasoline in the carburetor, defective wiring, insufficiently charged batteries, dirty spark plugs, a closed throttle, or a poor mixture.

Good advice to those who aspire to drive the motor car is always to take bumps and crosswalks at an angle, as it tends to distribute the shock evenly; whereas, if one drives over them directly straight, it gives the front axle, steering gear and wheels the whole brunt of the shock, and in the long run will send the car to the repair shop —a place best to keep out of if possible.

Leave a foot of space between the wheels and the curb when drawing up. This will prevent disastrous abrasion to the tires and possibly prevent an awkward situation when you wish to start again

The motor should never be allowed to race, but should be run at its highest speed capable without racing; the moment it begins to knock or race, the spark should be retarded. A motor is running its best when at its highest speed without knocking. In changing gears, time should be taken; one should not throw in the high from neutral until satisfied that the engine is running good and strong. If not, the engine will become stalled, which means getting out and cranking —unless the car be equipped with the self-starter. In taking a hill one should give it plenty of throttle, but not enough to

choke the spark. Go as far as possible up the hill on the high speed, and, if the engine shows signs of dying down, be sure and shift into low before it becomes stalled.

Perseverance and patience in time will work wonders. Constant association with your car and a study of its characteristics will soon engender in you a feeling of security and confidence in your own ability to act in an emergency

A car should never be left standing alone without setting the emergency brake and removing the plug in the switchboard; this obviates possible accidents from people fooling with the car. A good rule for the woman motorist is to test the brakes every

day; it takes only a second, but it is important.

Never draw up with the brake, if possible; it wastes the tires every time it is done. Withdraw the clutch in anticipation of the place to stop, and just make the stand-still with the brake. It is decidedly bad driving to rush up to the stopping-place and then apply the brakes quickly, for several reasons. It scares the people who may be near the stopping-place; and the people inside the car may also be frightened, thinking, perhaps the brakes won't work. It also suggests the idea of a wish to attract attention, and give an impression of ability, which is decidedly unbecoming. It costs as much in tires to stop by brake power as it does to start with the same quickness. In the case of starting or quick acceleration, the motor is the motive power. In the case of slowing down suddenly by brake power, the momentum of, say, one and a half tons is the motive power, and the brakes are the retarding power. In both cases, the tires in contact with road surface have to communicate the power, and they depreciate accordingly; because the power of retarding is transmitted through the gears and reduces the life of the mechanical parts.

A car should never be started on high speed; throw into low until the motor is worked up, and then throw into high. Corners should always be taken at a slow rate of speed, and plenty of room be allowed in case of skidding. Chances should never be taken, as it is better to slow up and lose time than to injure some one or the car. A motorist should never pass on the wrong side; and, when driving, all his attention should be given to the work before him.

Perseverance and patience and time will work wonders, and constant association with things mechanical gives one a degree of skill in manipulating tools that will astonish the novice. Common sense is the first principle needed to run a car. Ingenuity is another needed requisite, and with intelligence and the desire to become proficient, the average person may confidently expect to develop into a successful and expert motor car driver.

Some Practical Points for the Automobilist

The easiest way to clean an automobile horn and remove any dust that may have accumulated in the reed is to pass a slip of thin paper under the reed.

When the celluloid windows in an automobile cape top get broken they can be mended by an application of acetone, which is a solvent for celluloid. Apply as you would any cement.

HOW TO HAVE A CLEAN GARAGE

By F. H. Sweet

CLEANLINESS in the garage is essential to the well-being of one's car. Next to that, cleanliness in keeping the car is most to be desired. The first of these two important points can only be secured when planning the building, and it is one that the owner will do well to look out for.

The draining of the floor should always incline toward the center, and should be of a cesspool pattern. Below the opening, there should be a receptacle to catch all grease and dirt, and with it a grit chamber. These should be carefully looked after, so as to guard against any obstruction.

A good thing to keep the garage floor clean is a hot, saturated solution of common washing soda, which, if wanted for use frequently, can be made up in large quantities and stored away. If this is done, however, the solution must be re-heated to about boiling point before making use of it. This will, of course, be too hot for the hands, so that an old broom or brush should be utilized to spread it around.

Another preparation as good, if not better, that can be used for this purpose, is tri-sulphate of sodium, which can be procured at from 4 to 5 cents a pound. This solution, although strong enough to remove paint, can be frequently used for the hands with impunity. It is more convenient than the first solution, in that it can be used cold.

For cleaning the body of the car, the use of needlessly strong alkali soap should be condemned. This, with neglect to wash off the soap and failure to dry the varnished surface perfectly, is responsible for a great deal of injury done to a car's paint. As a matter of fact, neither soap nor water should ever be used on a car above the under sides of the mudguards, except in cases where the mud is caked on the body in large quantities.

In most cars the first signs of wear of the painted portion invariably show on the varnished surface of the engine bonnet. This is due to the fact that it is frequently covered with mud on the return from a run, and is then washed away with soapy water while the metal is still hot. Soap should not be used on the bonnet until it has cooled, and even then should be carefully washed off. After a number of washings while the bonnet is still hot, the injurious effect is quite noticeable, and within a short period the car has to be repainted long before its legitimate time.

FITTING FLEXIBLE CONDUIT AND ARMORED CABLE

By Terrell Croft

ARMORED cables are made by serving spirally sheet-steel strips around rubber insulated copper conductors. The sheet-steel sheath affords a reasonably flexible, protective casing. Armored cable is then merely a flexible conduit with the two or three conductors, as the case

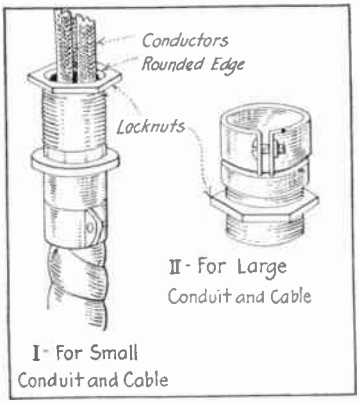


Fig 1. Connector used for securing flexible steel conduit and flexible steel armored cable in wooden panel boxes

may be, already installed within it. However, the casing is wrapped tightly around the conductors so they cannot be withdrawn. The sheath is constructed in practically the same manner as is flexible conduit. Numerous methods have been adopted by the different manufacturers for making armored cable, and for locking together the edges of the strip spirals. It is frequently used in finished building wiring, but is somewhat more expensive than conduit wiring, hence is applied only in cases where conduit cannot be conveniently used. It has the advantage that it can be fished with impunity through any place within a building. Fig. 5 shows a typical flexible or armored conduit installation. In general, the same installation requirements apply for armored cable as for rigid and flexible steel conduit.

There are two kinds of armored cable: moisture-proof and non-moisture-proof. The construction of cables of the non-moisture-proof type is such that moisture may enter the protective casing through the joints between the spiral strips. In the moisture-proof types, the entrance of moisture is prevented either by a spiral lead gasket or by the inherent construction of the cable sheath. Cable of the type using the lead gasket is sometimes called leaded armored cable. Moisture-proof cable should be used in places that are permanently damp.

The methods of securing armored cables in outlet boxes are illustrated in Figs. 1 and 2. A

special fitting or connector (Fig. 1) must be used at the end of each cable run to provide a means of attaching the cable in the outlet box and to provide a rounded edge at the end of the sheath on which the conductors may bear. The same terminal connectors are used with armored cable as with flexible steel conduit.

Couplings cannot be used with armored cable. While couplings or "straight" connectors may be used for joining together lengths of flexible steel conduit, they cannot be used with armored cables, inasmuch as it must be continuous from outlet to outlet without joints or splices. Fig. 3 shows the application of couplings for joining rigid and flexible conduit. Couplings should not be applied in this manner in armored cable runs.

Outlet plates, Fig. 4, may be used with armored cable or with flexible conduit. In the plate illustrated, which is for a combination gas-and-electric outlet, wedge-bushings are provided for clamping the sheath of the cable or the conduit in the fitting, and for providing a rounded edge upon which the conductor may bear. The hole in the center of the plate is for the admission of the gas pipe, and a set-screw is provided for securing the plate to the pipe and for grounding it thereon.

No gaps or open spaces should be left around outlet boxes or plates set in walls, because of the possibility of flames originating in the outlet boxes being drawn to within the wall or partition.

Armored cable sheaths must be grounded for the same reason that dictates the grounding of conduit systems. Ground clamps are used for the purpose, and they are installed in substantially the same manner as are those used for conduit.

Flexible steel armored cable installed in permanently damp places should have a lead protective covering interposed between the rubber insulation on the wire and the steel protective sheath. Cable of this construction is known as leaded cable. In some localities armored cable without the additional lead

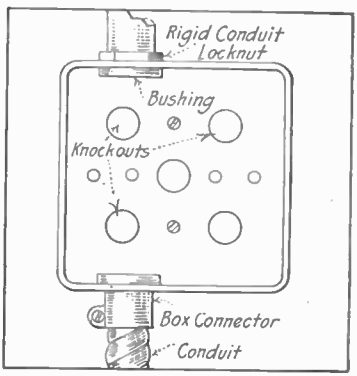


Fig. 2. Rigid and flexible conduit fastened in outlet box

sheath is not permitted for installation in fireproof buildings in course of construction, because these are considered damp places, due to the fact that the conductors will be exposed to the weather and moisture.

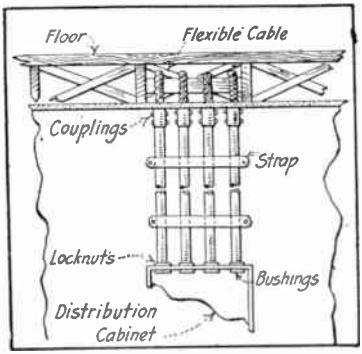


Fig. 3. Combination rigid and flexible conduit wiring

The leaded covering is not ordinarily required in brick or masonry inside walls that will, after the building is finished, be dry. The lead covering is frequently required for cables installed in outside walls or when the walls will be moist permanently.

Terminal fittings at outlet boxes, Figs. 1 and 2, take the place of the locknuts and bushings used with rigid conduits and perform two functions. They hold the ends of the armored cable or flexible steel conduit in the box, and also provide bushings protecting the conductors from abrasion where they emerge from the spiral-steel-strip sheath.

Armored cable and flexible conduit must not be bent to too short a radius, because if it is the sheath is liable to be opened at the joints and the conductors may contact with the deformed inner layer of the sheet metal sheath.

Armored cable in joists should always be so located that flooring nails will not enter it. This applies also to flexible steel conduit, because it is possible to drive a nail through the sheaths of either. Hence, where carried through joists, the holes through which they pass should be located far enough from the tops of the

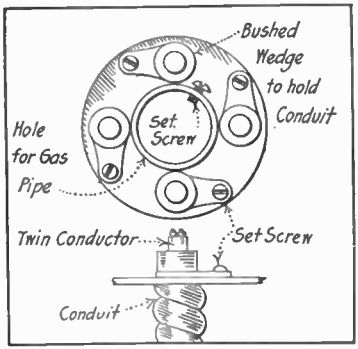


Fig. 4. Cast iron outlet plate for flexible-steel conduit or flexible-steel armored cable

joists so that the nails driven to secure the floor, or for other purposes, will not penetrate them. They should be carried through holes near the middles of the

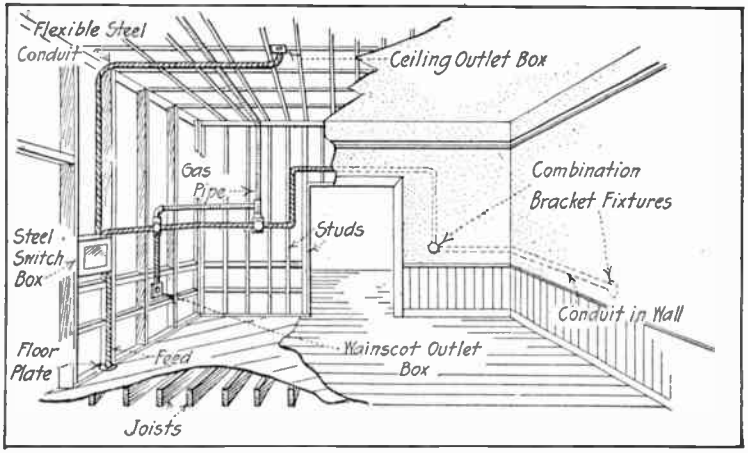


Fig. 5. Typical flexible-metallic-conduit installation

joists rather than through slots in the tops of the joists. In New York City slots for conduit in the tops of the joists are not permitted. There conduit or armored cable must be carried in holes bored through the joists about midway between the upper and lower edges.

To Fasten Lag Screw in Brick Wall

A very good way to fasten a screw in a concrete or brick wall and which is not as much trouble as melting the lead and pouring it in the hole, is to roll up tightly a piece of sheet lead (about 1-16 in. thick) a little bit larger than the hole and force it in with a hammer. Drive a nail a short way into the lead, which serves as a starter for the screw. I have known this way to hold when an expansion bolt would not.

Contributed by P. M. Eames.

Hints from a Carpenter

During my work for several years past I have learned the following facts: 1,000 shingles laid five inches to the weather will cover 125 square feet; 5 lbs. of four-penny nails will put them on, or 4 lbs. of three-penny. One cord of stone, three bushels of lime and a cubic yard of sand will lay 100 cubic feet of wall. Leave out one-half the lime and put in one barrel of cement and your work will be improved.

Contributed by John Upton.

HOW TO WIND HIGH FREQUENCY COILS WITHOUT A LATHE

By the Laboratory Staff

THE editorial correspondence of the past few months has disclosed a surprising dearth of knowledge among the readers on what we had assumed to be "old stuff." We have found that many readers, for instance, have refrained from attempting to build large high frequency coils merely because they had no lathe in which to do the winding.

In many of our articles and books we have specified a simple winding rig which, to us, seemed so simple that no lengthy explanation was necessary. Such is apparently not the case, however, for the questions continue to come in. Instead of attempting to answer all of the many queries through *The Technical Adviser* we have made a short article of the subject and have incorporated illustrations made from our own apparatus in the Experiment Station.

Fig. 1 is a photograph of a finished coil wound upon a cardboard cylinder, 7 in. diameter (outside) and 18 in. long. The photograph shows all there is to the winding rig. Fig. 2 shows the parts dissected, and the reader will observe that the winder embodies two upright pieces of wood mounted upon a base; two discs cut out on a scroll saw to fit tightly into the cardboard cylinder, one at either end; and two stove bolts, ¼-20 in size, one of which is fitted with a crude crank and handle to facilitate turning the cylinder.

Below the winder and attached to the face of the bench with wood screws is a rig for holding the magnet wire. This consists of two supports through which a length of wooden dowel is passed. This rod will hold two large spools of wire at one time to take care of the double winding to be described. No tension is used on the wire, as the spools unwind slowly as the cylinder is turned by hand. And right here let us say that the hand winding is not at all slow; if a lathe were used, it would have to be run at the lowest speed and *backward*.

In Fig. 3 the boys are doing the trick. This photograph shows a double winding being placed. On this cylinder the effective winding is to be a single layer of No. 24 D. S. C. magnet wire, and each turn is to be spaced from its neighbor by the thickness of a piece of No. 30 D. C. C. wire. Obviously, the simplest way to accomplish this is to wind both the silk and the cotton covered wires

on in parallel and afterward to remove the cotton, leaving the silk wire in position with turns evenly spaced throughout the length of the cylinder.

one of these brads (see starting of winding in Fig. 3). This permits of removal without disturbing the silk covered wire at the starting point.

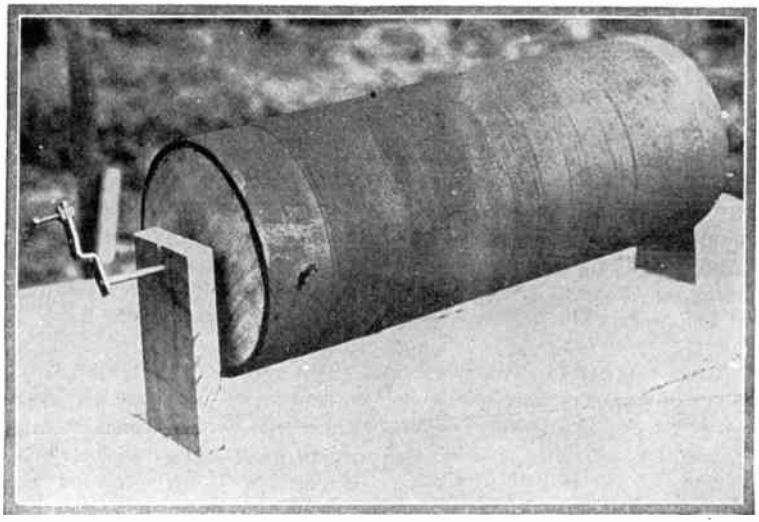


Fig. 1. A coil already wound in the winding rig

To perform the double winding, the permanent wire, *i. e.*, the No. 24 silk covered, is passed through a small hole punched in the cylinder at a distance of an inch from the left-hand end. This hole is then plugged with a piece of match stick dipped in thick shellac. The wooden discs should have been secured in the cylinder by means of small brads with heads left projecting for easy removal. The cotton covered wire may then be wrapped around

Both spools of wire are placed on the dowel of the wire holder and the base of the winder screwed or clamped to the bench before starting the work. When the end of each wire has been secured, one operator grasps the crank handle and commands the double wire. The two wires are held between thumb and forefinger and *close together*. The middle and third fingers then separate the wire as it comes from the spools. The assistant

stands ready to exert pressure on the cylinder when necessary, for this double winding is essentially a two-man job.

Starting a turn or two and making sure the wires are parallel and *not crossed*, the operator may proceed to wind until a "true turn" is taken. By true turn we mean a turn that goes on accurately and is concentric with the edge of the cylinder; the first few turns will not be true—they will vary as the hand wavers in guiding the wire. After the first true turn is placed, the starting turns may be gently shoved up to it in order to start a true winding.

From this point on, the work is plain sailing. The operator winds slowly at first, while the assistant maintains pressure with his finger tips, as shown in Fig 3. The one disagreeable feature is the irritation to the eyes. When winding the green silk and white cotton covered wires in parallel, the vision is so confused that everything is a blur after a few minutes. The imperative move right here is to rest the eyes by looking off at a distance and preferably out of the window if there are green fields and trees in the distance. A few moments will do wonders, when the winding may proceed.

After some little practice, the operators will be able to literally spin the cylinder, and the time consumed in winding the coil is really but fifteen or twenty minutes. This proficiency is attained, however, only after practice.

In Fig. 4 we see the duplicate wire being unwound. This operation is performed only after the end of the silk covered wire has been secured in precisely the same manner as the starting end—with the wooden plug through the wall of the cylinder In removing the wire from the cylinder, we of course use the lathe to spin the wire spool The worker who has no lathe may turn the spool by hand or else mount it on the end of a hand drill, winding the wire by turning the drill crank.

Choice of Windings

The number of turns placed on the cylinder determines the length, quality and characteristics of the spark delivered by the coil The cylinder just described requires about six turns of primary of any convenient form, a condenser of between .01 and .02 mfd. (see condenser article in this issue), and a transformer of the standard wireless type of from ½ to 1 kilowatt capacity. With a ½-kilowatt magnetic leakage transformer, the cylinder gives a beautiful spark, thick and white, and of a frequency so high that no perceptible shock can be felt The length of the spark varies with different points of tuning from 6 in to 18 in.

Now for comparison, the same size of cylinder wound with No.

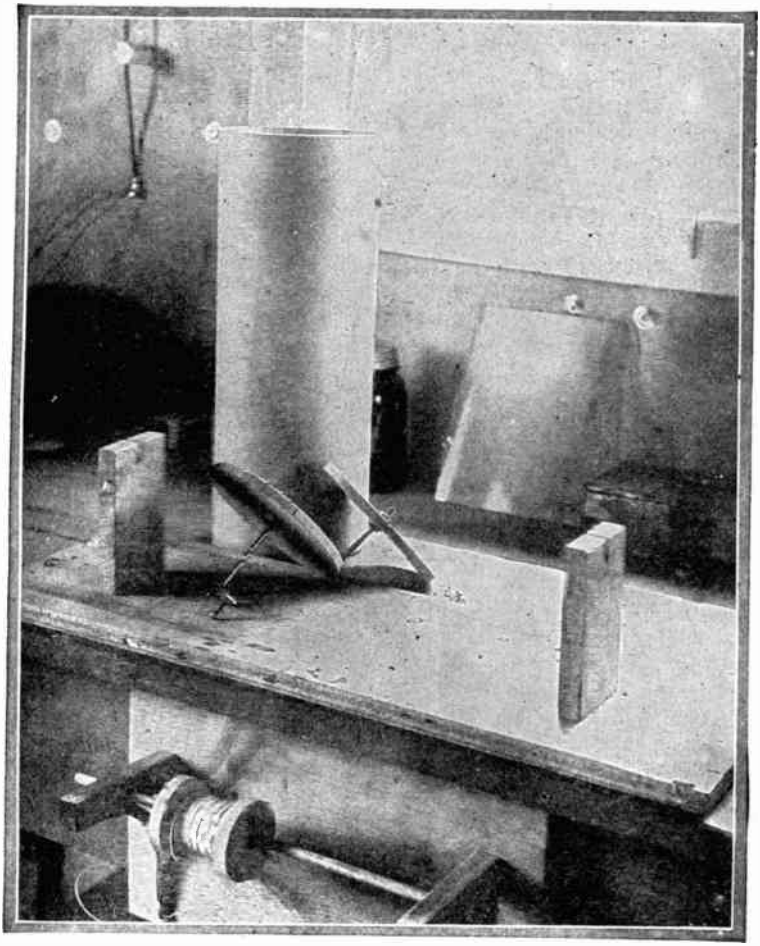


Fig. 2. The various parts of the winder and the cardboard cylinder

30 double cotton covered wire wound close or without any separation whatever, gives a spark quite distinctively different. The streamers are thin and blue and of a hairlike texture. They

do not appear nearly so angry as those from the other winding, but on taking the discharge through the body, we find the frequency has been lowered so that we get an appreciable shock—not a bad one, but we can feel it. The length of the spark is rather greater, but the spark is thin. The coudenser is larger—about .02 to .03 mfd., and the primary has sixteen turns.

If we insert a variable resistance or a choke coil in series with the primary of the transformer, and open out the spark gap, we get a periodic discharge that almost exactly simulates the discharge of an induction coil with a slow vibrating interrupter. Carrying the resistance higher, we get a very slow, crackling spark of the true static type This spark is cold to the touch, but it causes much greater muscular contraction than before One can feel the impulses of the current and see the muscles respond in the bare arm

The choice of winding will rest with the individual For us—we can never make enough of them. Every time we try something new we learn more and disprove our former theories The cost is so low that the true high frequency fan will go after all of the variations he can think of. We have given the results of our experiments in a very brief way in this article just for the sake of completeness.

INSULATION OF THE WINDINGS

We use shellac and also a queer compound that we have hit upon by accident. The formula will not be published just yet for the simple reason that we are not sure just yet what we have in the mixture. Suffice it to say that our best coils and the most durable ones have been those coated very liberally with shellac and most thoroughly dried. Then after three or four coats of shellac have dried in, we give them a final coat of armalac or this new mixture of ours. The secret of success is to have patience to *thoroughly* dry out the shellac after every coat We allow it to dry for days before putting current through the winder.

Wax can be used aud, in this connection, beeswax is the only thing It is costly but worth its price For a cheaper compound and one mechanically much harder, beeswax and rosin may be used in equal parts. The wax insulation should be put on by melting the compound in a shallow pan and slowly revolving the coil (on its winding supports) through the molten mixture. The revolutions should continue after the wax has been taken away, to insure an even coating as the mixture dries and hardens on the surface of the cylinder

We do not favor this wax insulation particularly, as we have had such good success with the other compounds. However, in-

Fig. 3. Starting the winding. Note how the wire is guided

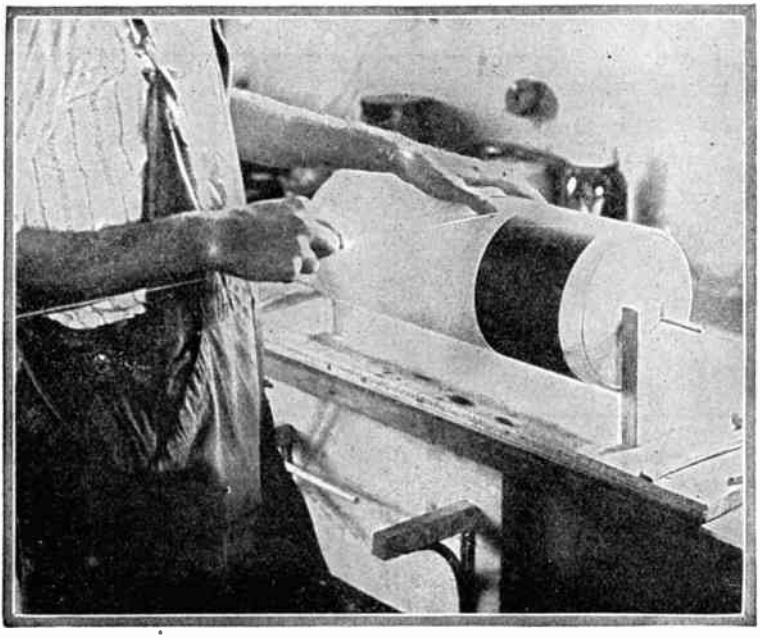


Fig. 4. Removing the extra wire used for spacing. This is done by winding the coil backward and starting where the winding was finished

quiries constantly come in regarding it, and we have suggested the one method we have found practicable for the case in hand. Of course, in the case of a very closely coupled coil such as one of the pancake type described in the March issue, wax is the only thing to use unless oil can be tolerated.

AMATEUR LANDSCAPE GARDENING

By E. Blair Wall

THE principal of one California school has obtained some very unusual results from her manual training class. Among other things covered is landscape gardening. The two cement and boulder seats shown in the photograph border a cinder track and are a segment of its curve.

Each student brought a supply of the boulders, and the under-

ground base—about 2 feet deep—was prepared. This is slightly longer and wider than the seats proper, which are 19 feet long. Forms were made for molding the outside back, the ends and the base. The inside of the arms, seat and back

were worked out with crowbars. The seat has a depth of 15 in., and the back is, in a very literal sense, the angle of repose. The greatest height is 33½ in., the thickness at the top about 10 in.

The lower picture is of a drinking fountain built by the same class. The plumbing, of course, was in place before the work was begun. The upper picture, the "Lantern Fountain," was cemented only where security for the stones was needed.

THE WOODWORKER

By Ralph F. Windoes

Instructor of Manual Training, Davenport High School, Davenport, Ia.

IN the May number of Everyday Mechanics, a small wood-working bench was illustrated in Fig. 4 of this series. This bench is of such simple construction that any amateur with no previous tool experience can build one similar to it. This article will be devoted to the construction of this bench.

Although the absolute beginner with a good equipment of tools can build the bench alone, it is suggested that he obtain help from someone with experience, if it is possible, as little attention to the proper use of tools will now be given.

A careful study of Fig. 4, and the bench assembly, Fig. 9, will undoubtedly make the construction clear. In the latter figure no dimensions are given, these being omitted for the sake of clearness. All dimensions will be found in Fig. 10.

Obtain the stock from the mill *exactly* as given in the following bill. This stock should be mill-planed but not sandpapered, as mill-marks are not objectionable on a rough work-bench.

These dimensions are *finished* sizes—impress this upon the mill man—absolutely no allowance made in any case for sawing or planing after the stock is cut.

The stock can be of any of the following woods: maple, beech, plain oak, birch, ash, or elm. A mixture of them is not objectionable, although if the top, *A*, is of maple, better results will be obtained. This top will give greater satisfaction if it is glued up from three or four pieces; and if

Mill Bill for Work-bench

1 pc.	2½ in. x	13 in. x	54 in.	top (A)
4 pcs.	1¾ in. x	3½ in. x	25 in.	legs (B)
1 pc.	1¾ in. x	2½ in. x	20¼ in.	rail (C)
1 pc.	1¾ in. x	2½ in. x	21 in.	rail (D)
2 pcs.	1¾ in. x	2½ in. x	21 in.	rails (E)
2 pcs.	1¾ in. x	3½ in. x	33 in.	braces (F)
1 pc.	¾ in. x	7¼ in. x	54 in.	tray bottom (G)
1 pc.	¾ in. x	2½ in. x	54 in.	tray back (H)
1 pc.	¾ in. x	11 in. x	28 in.	back (I)
1 pc.	¾ in. x	2½ in. x	25 in.	tool rack (J)
2 pcs.	1¾ in. x	3 in. x	7¼ in.	blocks (K)

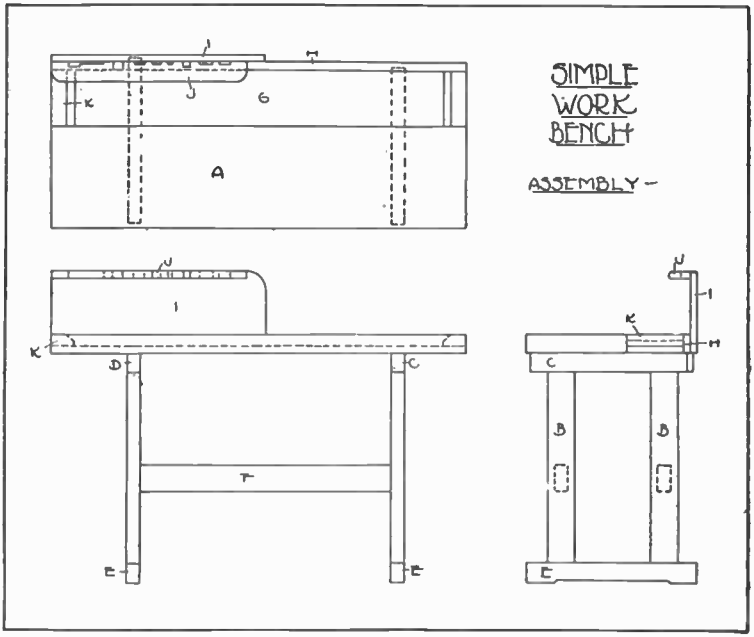


Fig. 9. Detail of construction of the bench shown in Fig. 4 of this series

it is made 48 in. long with 3 in. pieces tongued and grooved into each end, securely glued and doweled, a perfect top will result. Of course, this will cost more, but if the craftsman is going into this work for the best possible results, it will be worth the extra expense.

Constructing the Bench

Secure twelve lag screws, with washers, 6 in. long and ½ in. in diameter, two 4½ in. long and ⅜ in. in diameter; and a number of 2 in. No. 10 flat-head wood screws.

Begin with the bottom pieces, *E*. At 3½ in. in from each end, square lines across the bottom; ½ in. up, run a line across the piece and down to the bottom lines. When the wood between these has been removed, feet will result. The bench will stand more nearly level if this is done than it would if these pieces were left flat. The wood can be removed by sawing straight in to the line in a number of places,

and using the draw-knife or chisel, working with the grain. It does not need to be a smooth job, nor a perfectly square one, as it will not show when the bench is assembled.

Notice that the top rails *C* and *D* are of different lengths, *C* being ¾ in. shorter than *D*, as it is used on the right-hand end of the bench. With the 1 in. bit bore a hole 1 in. deep 4 in. from each end of *D*, 4 in. from one end of *C*, and 3¼ in. from the other end. See Fig. 10. The distance between centers on each set of holes should be 13 in. These holes are in the narrow—1¾ in.—side of the pieces. When the four 1 in. holes have been bored, finish boring through the piece with the ½ in. bit. The holes are bored in this fashion so that the heads of the lag-screws will be below the surface of the wood, permitting the top—to be put on later—to lay perfectly flat over them.

At a distance of 4 in. in from each end of pieces *E* bore ½ in holes through in a similar manner. There will be no need of the 1 in. holes here as the heads of the screws will enter the places already cut out.

If these holes have all been bored perfectly straight and true, when the lag-screws are inserted they will strike the exact centers of the ends of the legs, consequently, if holes are bored down into the ends of the legs at the exact center of each, these parts will go together with little trouble. If the holes have not been bored accurately, place the legs into position, and strike the screws run through the holes, marking on the ends of the legs the points where the screws will enter them. Bore these holes in the legs about 4½ in. deep with a ⅜ in. bit.

Now assemble these parts. Run the lag-screws through the holes in pieces *C* and *D*, and turn the legs onto the screws. The heads can be kept from turning in the large holes by driving a little piece of thin iron next to one side of each head. A washer filed flat on two opposite sides can be made to do the work. Of course, if the builder had a small socket wrench, it can be inserted and the screws tightened in this manner. Turn the legs onto the screws just as tight as possible, file off the little pieces of metal used even with the surface, and leave them in the holes. They will prevent the screws from working loose.

Screw the bottom to the legs in a similar manner, using a wrench to turn the heads, as they are now accessible.

Next fasten the braces *F* between the legs by boring four holes through the flat sides of the legs 11 in. up from their lower ends. These holes are ½ in. The holes in the braces are ⅜ in., and about 5 in. deep. Screw these parts together using the

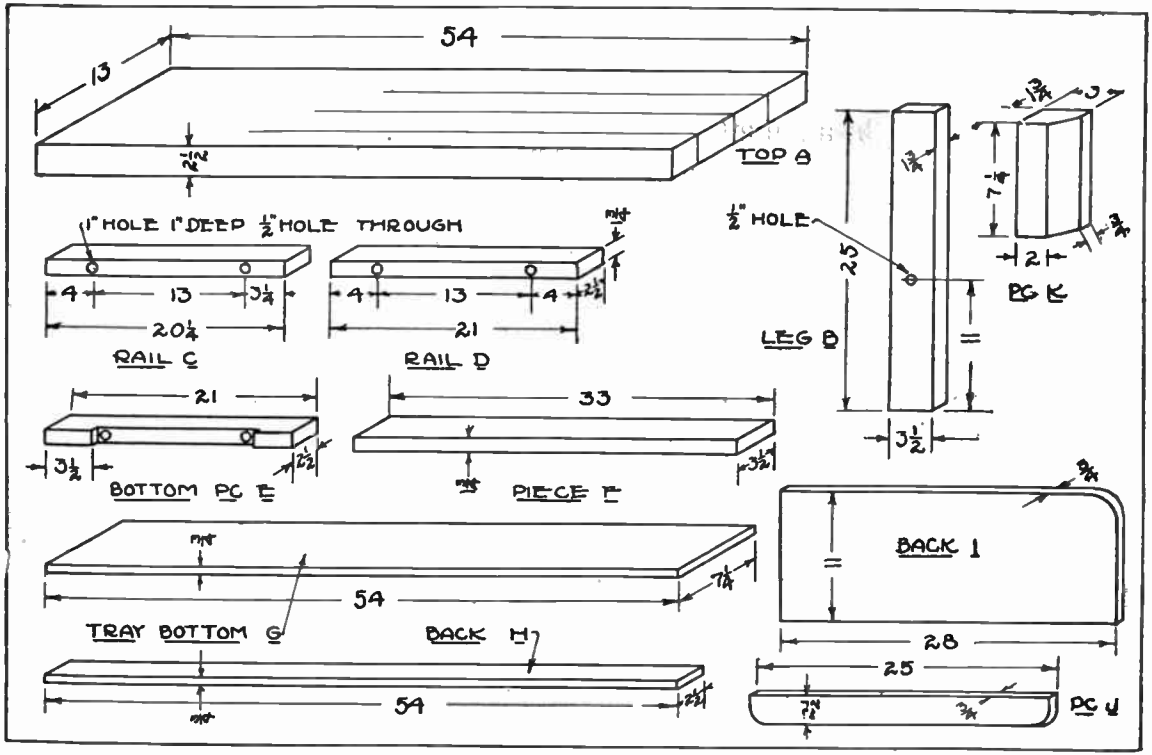


Fig. 10. Detail of parts for assembly of bench

wrench on the outside of the legs, and the frame is completed.

Next bore ⅜ in. holes through *C* and *D* about 9 in. in from the front ends, and place the top into position. It should extend over the front about ½ in., and over the left end about 10 in. Running the small lag-screws through the holes in *C* and *D* mark on the under side of the top where they will enter. Bore holes in the top with a 5-16 in. bit, about 2 in. deep. Screw these into place, using washers under the heads.

Place the tray bottom, *G*, into position and clamp it tight against *A*. Bore two 3-16 in. holes through *G* exactly over the center of *C* and *D*, and countersink them deep, so that the screw-heads will be a good depth below the surface of the wood. Dropping screws through these holes, mark on *C* and *D* where they will enter, remove *G* and bore the holes in *C* and *D* with a 5-32 in. twist-bit, gimlet, or drill. Screw these up tight.

The tray back, *H*, is fastened by screws in a similar manner, using about five screws.

The upper right-hand corner of *I* can be rounded with a saw and chisel, or it can be left square. There is no advantage outside of appearance to be gained by rounding it. Screw it into place through *H* and into the edge of *G*.

The tool-rack, *J*, must be cut before it is fastened in place, also the blocks *K*, and, since a vise will greatly facilitate the holding of these pieces while they are being worked, it is suggested that it be fastened in place at this point.

Fig. 11 illustrates two types of wood-working vises. The first, a rather small but very substantial rapid-acting vise, can be purchased for $4, and the second, a larger vise, for $12. The latter is adjustable. It can be swung at an angle, or in a vertical position. It is a very desirable tool, and one used a great deal by professional cabinet-makers, but its cost will probably be beyond the average amateur. The smaller vise will serve very well, and is highly recommended for work taken up in this series. The vises are attached according to the manufacturer's directions accompanying them, usually being screwed in place or bolted.

When the vise is ready, lay out the tool-holders in rack *J*, according to the dimensions of the tools to occupy the spaces. In Fig. 9, the first space on the left is for the back saw; second, the marking-gauge; third, fourth and fifth, the ¼ in. ½ in. and 1 in. chisels; sixth, screwdriver; seventh, rule; and eighth, try-square. These are the most commonly used tools, and for this reason should be placed close at hand. When carefully laid out with pencil and try-square, place the piece in the vise, and saw straight in to the proper

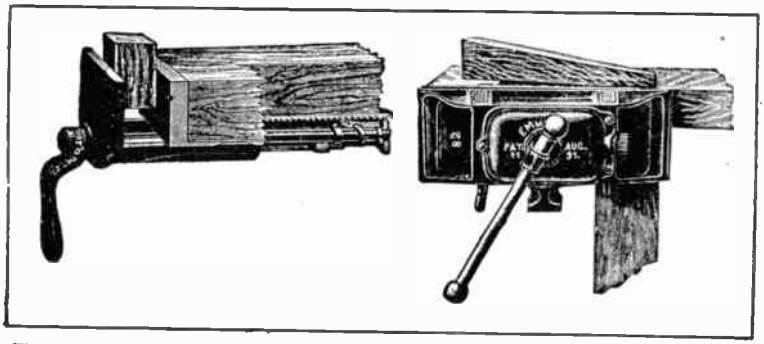


Fig. 11. Two types of wood-working vises. The one on the right is adjustable to any angle

depth. Work the waste wood out slowly with the chisels, being careful not to go below the lines. Round off the corners a little with the chisel, and screw the rack in place through the back of piece *I*.

The little blocks, *K*, should be laid out as in Fig. 10, and the corners chamfered off in the vise. These should be sawed down and planed, but if the amateur does not know how to sharpen a plane bit nor set the plane, and he has no one with experience to show him, they can be slowly chiseled. Screw them into place through the under side of piece *G*, using two screws in each.

All screws should be countersunk, whether the explicit direction for so doing has been given or not. Also, they should just *slip through* the *first* piece, and hold in the smaller holes bored in the second.

This completes the construction of the bench, but one more appliance will be needed before it can be called finished—the bench-stop, Fig. 12. There are a number of styles, the one illustrated being a common and reliable design. It should cost about 50 or 75

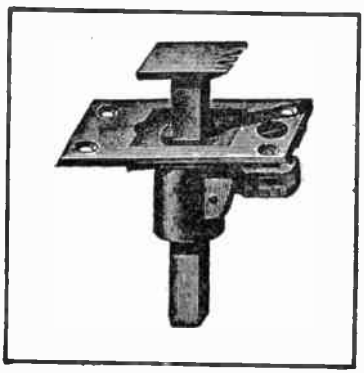


Fig. 12. The bench-stop. This is a reliable design

cents. It is attached by boring a rather large hole through the top at the center and about 5 in.

in from the left-hand end. Dropping the stop through this hole, the upper plate is marked out on the wood, and a shallow groove cut to let the plate in flush. Screws will hold it in place. If the groove is accidentally cut too deep, pieces of paper or cardboard can be inserted to force the stop up flush.

A coat or two of boiled linseed oil should be applied to the bench, under the top as well as elsewhere. It will give the bench a good working surface and prevent checking.

The planes, oiler and oilstone should be kept on top of the bench in the tray. On the right-hand end, nails can be driven to hold the hammer, mallet and duster. It is a rather good idea to nail four or five pieces on the under side of the braces to hold stock that is being worked upon, when not in use. Also, if the craftsman is capable, a drawer 33 in. wide can be built and slid in under the top. This will hold a number of tools that are not accommodated elsewhere.

(To be continued)

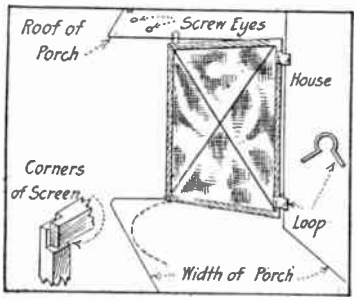
A PORCH SCREEN TO REGULATE DRAUGHTS

By Charles Alma Byers

THE L-shaped porch, perhaps extending across a portion of the front of the house and along a part of one side, is sometimes too draughty for complete comfort. For times when such is the case a screen of the kind herein described will be found quite desirable. Hinged to the corner of the house, it can be swung closely alongside the wall when not desired for use, and when wanted it can be swung outward to any angle that may be necessary to properly regulate the draught.

Supposing both the front and side portions of the porch are each 10 ft. deep and the ceiling is 9 ft. in height, the screen, when completed, will be about 1 ft. less in dimensions each way, so as to permit it to swing freely. The frame for the screen will consist of four pieces of wood for the outside edges, and two pieces extending from corner to corner and crossed in the center, for the bracing—all of material about 1½ in. square. Where the outside pieces are joined at the corners and the braces cross in the center, they may be doved together by cutting each to half thickness, so as to make them lap evenly on both sides. Over this frame is then stretched canvas or white muslin, completing the screen ready for hanging.

The screen is swung by fastening it at one edge to the corner of the house wall. The upright piece of the screen frame at this edge should have a short rounded incut, with square shoulders, at a point both near the top and near the bottom, and straps of sheet iron or heavy tin, fitted around these incuts and nailed at the



The screen is hung on the corner of the house

ends to the walls of the house will comprise the fastenings, forming a perfect hinge for swinging the screen like a door. This completes the arrangement, save in the matter of providing the outer top corner with a two-piece screw-hook, which hook will be used to hold the screen at the desired angle. Screw-eyes, placed at intervals in the ceiling, within reach of the hook at different angles, will hold the screen in position, either extended out across the porch space at various angles or close against the side wall of the house.

Instead of wood, iron pipe of small size can also be used for the screen frame, if preferred.

LINE CUTS FROM PHOTOGRAPHS

It is often desirable to make a line cut from a photograph, and the following is one of the easiest methods of accomplishing this.

Such parts of the photograph as are desired in the line cut are inked in with regular waterproof India ink.

The photograph is then bleached out by immersing in a 10 per cent. solution of bichloride of mercury. The result is a line drawing on plain paper that is easily photographed for a line cut.

The explanation is simple. The silver present in the print combines with the bichloride of mercury to form chlorides of silver and mercury — both being white results in the print disappearing. The photo may be brought back by the regular hypo fixing solution.

Contributed by THOS. W. BENSON.

Cleaning Windows.—Wash in clear, warm water to which a little kerosene has been added. You will be surprised to see how much the labor is lightened by the addition of the kerosene.—F. H. SWEET.

HOW TO BUILD HIGH TENSION CONDENSERS OF ANY SPECIFIED CAPACITY

By the Laboratory Staff

HOW many of our readers know that by means of an astonishingly simple "rule of thumb" method they can build up high tension condensers of any desired or specified capacity with a certainty of results that defies the best efforts of the mathematical designer? True it is, and in this article we propose to tell our readers how we make experimental and standard high tension condensers in the Experiment Station and how we group them so that we know before testing that they are right for the transformer we are to use them with.

Our method is based upon the fact that photographic negatives of the 8 x 10 size are all of about the same thickness and quality; they are, furthermore, quite free from air bubbles and other imperfections. We know that one of these plates coated on both sides with tinfoil, the foil being cut 6 x 8 in. to leave a margin of an inch, has a capacity of approximately .0001 mfd. This is not exact, to be sure, but it is so near that it will answer for all practical purposes. Now, given this basis upon which to work, we may group these single plates into units of five or ten plates each and we have condensers of .005 or .01 mfd. capacity, respectively. By grouping these units into combinations of series or parallel, or both, we can obtain any capacity we require and can also provide the necessary current or "watts" capacity to take care of either large or small transformers.

While various authorities differ on the relative merits of condensers of one type and another, we have found the glass plate type, when built according to the specifications given herein, to be efficient, inexpensive, and durable. It is light in weight compared with the oil-immersed types and is easily constructed.

The first requisite is the photographic negative glass. This can usually be obtained from the local portrait photographer for from five to ten cents a plate. A year ago it could be purchased for half the lower figure, but glass, like everything else, has "gone up." The next will be the tinfoil, which comes in packages of a pound, which contains sufficient foil to cut twenty 6 x 8 in. sheets and sufficient 1 x 6 in. lugs to make up a section of ten plates. The third material entering the construction at present is shellac. The fluid should be thin rather than thick in order that it may spread in an

Fig 1. Rolling out the wrinkles and creases in the tinfoil. If no photographer's roller is available, a bottle will do

even coating over the glass. For tools, a good brush set in rubber, a sharp knife, a photographic print roller, and some scrap paper will suffice.

The worker begins his operations by spreading out the tinfoil into long strips, rolling out the creases and wrinkles as shown in the illustration. Fig. 1. The rolling should be done on one of the glass plates in order to afford a smooth

surface. When the strips are smooth they may be cut up into sheets 6 x 8 in. by laying the foil on one of the glass plates and using another plate as a straight-edge, running the point of the knife along the glass. This cuts and measures at the same time. For an aid to accuracy, measure off a sheet of the correct size and lay it beneath the glass upon which you do the cutting. This sheet showing up from below will provide the necessary guide. When twenty sheets and eleven lugs have been cut, the worker may turn his attention to the pasting.

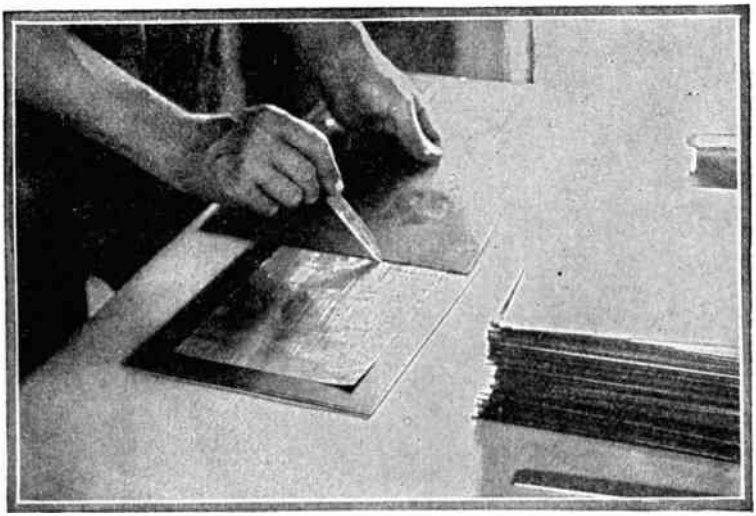


Fig. 2. Cutting the strips to the right size. A sheet placed under the glass is used as a guide

There is a knack in pasting condenser plates and also in laying the foil. One of our boys has worked out a little system that works well. He takes a batch of ten plates of glass (to make a .01 unit), and prepares all of his foil and lugs, and cleans the glass with a cloth slightly moistened in alcohol. The emulsion of the negative is left on the plate, as it does no harm and is troublesome to remove. He then starts coating one side of each plate with a thin, even coat of shellac until five plates have been coated; by the time the fifth plate is shellacked, the first one will be sufficiently "tacky" to take the foil. Fig. 3 shows how he lays this. A

spare glass is used in the right hand to hold the sheet of foil flat with the edge projecting a couple of inches. Upon the tacky shellac of the plate he then places the edge of the foil, gradually with-

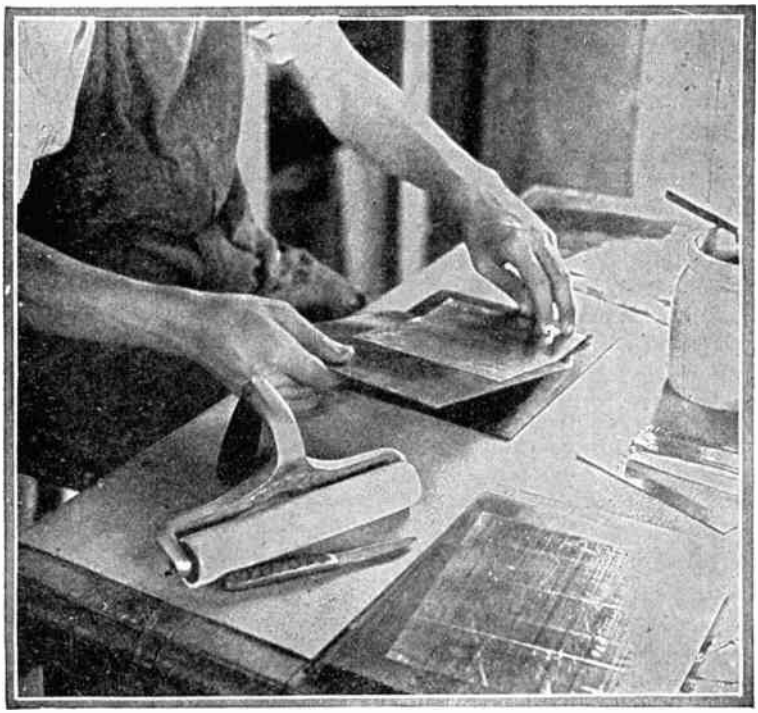


Fig. 3. When the plate has been shellacked, the sheet is held over it on a dry plate and slipped off, smoothing with the fingers as we go along

drawing the glass and sealing the foil with the fingers as he goes along. This method insures an accurately placed sheet of foil free from wrinkles. A final smoothing with the hand and the sheet is ready to be rolled or, as it is called by the photographer, "squeegeed." For this operation our worker places a sheet of paper over the foil to keep the surface of the roller clean and free from shellac.

This procedure is followed in the case of each succeeding plate until the five have been done on

one side. The next five are then pasted and coated with foil in the same manner. By this time the first five will have dried sufficiently for the worker to paste the reverse side of each, with the result that the work is continuous without any interruption for drying. When the ten plates have been pasted, they should be laid aside to dry over night before assembling.

In assembling the plates the worker will find that two plates of foil come together with a lug between them. This makes essentially one piece of foil electrically speaking. The object of coating both sides of the glass is solely to insure a perfect contact between the foil and the glass. Should any air spaces occur between glass and foil, a brush discharge takes place at that point. This gradually heats the glass, with the result that the uneven expansion causes a crack and an ultimate breakdown of the dielectric.

When the assembly is started, the worker should follow the instructions given to the letter, in order to insure correct connections, unless he is familiar with condenser construction. Let us paste a tinfoil lug on the left-hand end of a foil sheet on one plate. Next we place this plate upon the table with the lug *down* and projecting toward us and on the left-hand side. Upon the top tinfoil sheet of the plate, and on the right-hand side, we paste a second lug also projecting toward us. This gives us a lug from the bottom sheet on the left side and one from the top sheet on the right side. Next we place a second condenser plate on top of the first and paste a lug on the *left* side of its exposed tinfoil sheet. Our connections now embrace two lugs on the left and one on the right, but these three lugs give us a connection which places both condenser plates in multiple. The next plate is placed in position, and a lug pasted to the right side of its exposed sheet of foil. This process is repeated until the ten plates are in position and a final lug is pasted upon the uppermost sheet of foil on the left-hand side. This gives us six lugs on the left and five on the right.

The unit thus formed is now to be stood on edge and the six lugs on the left folded together with a piece of flexible wire between them. A length of either friction tape or linotape is then used to bind both plates and the union of the lugs in a compact unit. The same treatment is accorded the lugs on the right side. This unit is then to be immersed in a tank of melted beeswax and rosin (equal parts) for an hour, after which it is removed and stood aside to drain and harden.

We now have a complete unit strong mechanically and electrically and impervious to moisture. This unit has a capacity of

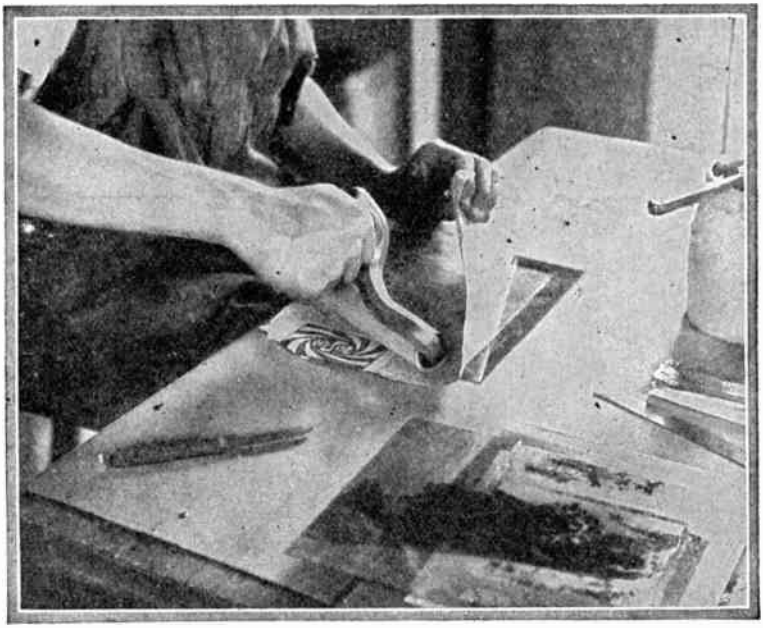


Fig. 4. Rolling the plate to insure perfect contact. Paper is used to keep shellac from the roller

.01 mfd., which is about the correct capacity for most standard ½-kilowatt wireless transformers adopted for 200-meter wavelength. If the set is to be used for any great length of time or if the condenser is to excite high frequency coils where the operation continues for hours, it is well to make up four of these units, placing two multiple sets of two each in series. This gives the same capacity, namely .01 mfd., but reduces the strain on each condenser to a quarter of that formerly imposed. We have used these single sections for hours at a time and have seldom had breakdowns, but we do not recommend such severe strain unless weight is an object and the operator can afford to carry an extra section or two in case one breaks down.

Fig. 6 shows how one manufacturer provides an admirable mounting for condensers of this type. The units are made up into sections of .01 mfd., but the ten plates in each unit are divided into two parts of five plates each and between the two sections a

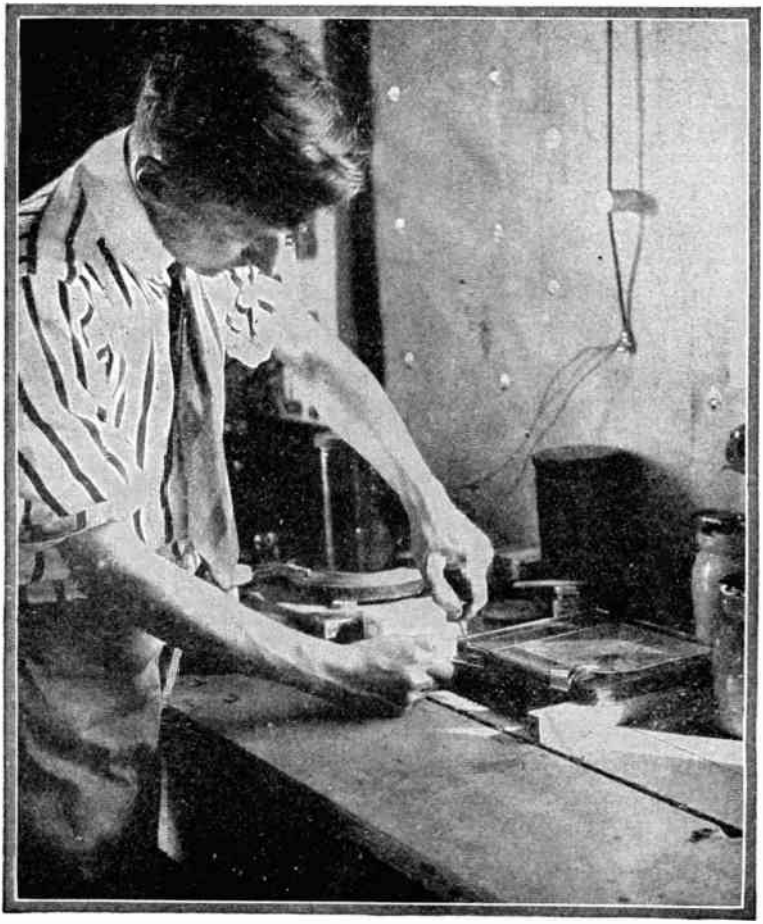


Fig. 5. Binding the unit and lead from lugs with linotape

sheet of ¼ in. thick wall board or whitewood is interposed. This partition projects all around and affords a mechanically good support for the unit.

Most good manufacturers specify the capacity required for use with their transformers. The average will be in the proximity of .01 mfd. For use with the

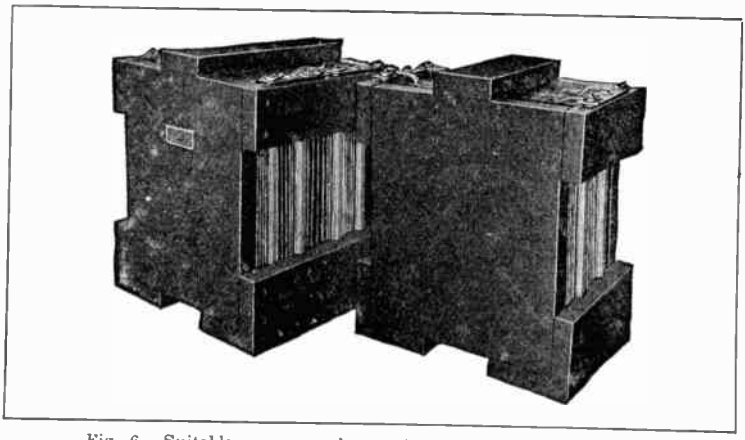


Fig. 6. Suitable cases may be constructed for a group of units

rotary gap, a somewhat smaller capacity will be found suitable.

Broadly speaking, the higher the voltage of the transformer the smaller the capacity need be in the condenser. For instance, in one well-known magnetic leakage transformer, the voltage a few years ago was something like 4000 and 6000 volts in the ¼- and ½-kilowatt transformers, respectively. Now, to conform with the law which prescribes a 200-meter wavelength as a maximum, the voltages have been increased to 9000 and 11000 volts respectively. Whereas, the old style transformer required a condenser of .03 mfd. to bring it to resonance, the new type requires a capacity of .01 mfd. In making up the condenser, therefore, it is well to ascertain the transformer voltage before starting work. The manufacturer is always glad to give this information.

For high frequency coils, the capacity may be varied to give different effects. Hence it is well to make up four or five sections in view of their cheapness, combining the units as occasion requires to perform various experiments.

Protector Cap for Chisel Handle

A chisel handle or screwdriver cap when subjected to the continuous blows from a mallet will soon show a tendency to split. To eliminate this, put a patent bottle cap over the end of the handle. Blows will give this cap a tendency to bind, thus preventing the handle from expanding and later cracking.

Contributed by Wm. Wernecke.

DESIGN FOR A SMALL FLOCK POULTRY HOUSE

By Chesla C. Sherlock

THE accompanying photo and drawing give a very good idea of a small flock laying house which I have used for some time to good advantage.

The house is 6 x 8 feet in size It was made from cheap lumber stock and covered with heavy tar paper roofing material. It will accommodate from six to eight hens comfortably, and in every sense of the word is a very economical house for a small flock of hens.

The cost was about $11, although this will vary in different localities. The picture shows two windows in front close to the ground. The object of these windows is to furnish light in the winter time and air in the summer.

The house is so built that it is practically a fresh air house in good weather. The two upper windows are open all the time when the weather is good, no matter how cold it may be.

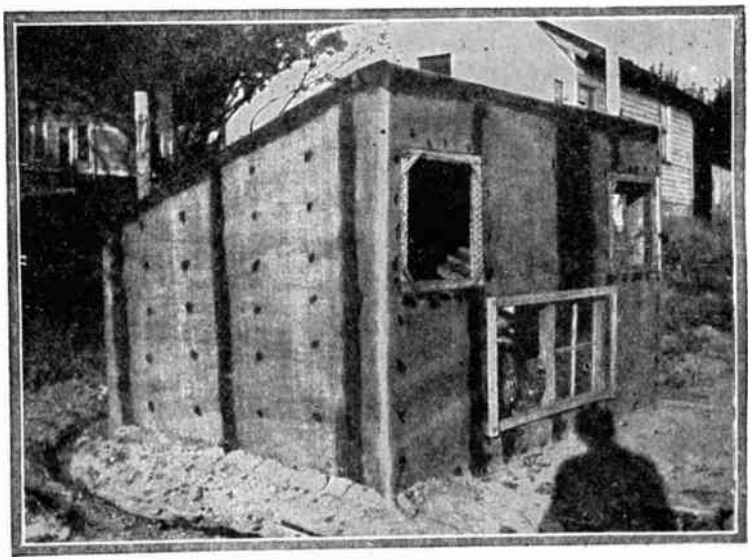


Fig. 1. A small flock laying house.

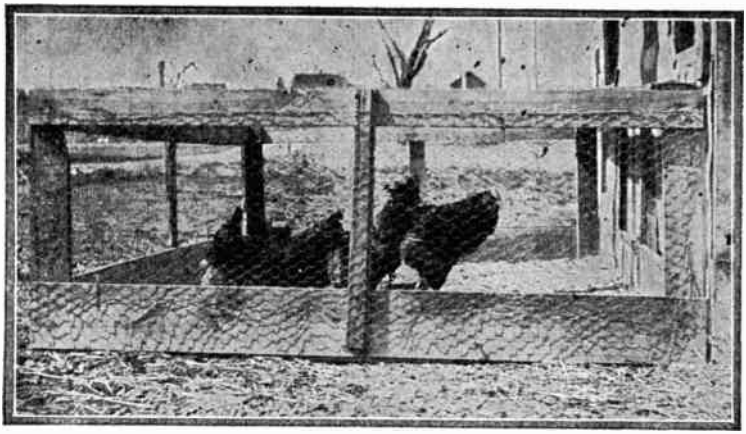


Fig. 2. A wire run may be added with profit

When it is storming, there is a secondary window frame attached to each window, covered with muslin, which is fastened down to prevent the rain or snow drifting in on the fowls. The door is nothing but wire netting.

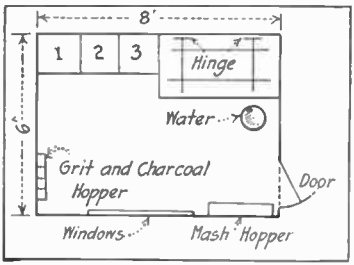


Fig. 3. Plan of the chicken house

In cold weather this is covered with muslin also.

The windows and muslin frames are on hinges, and can be placed at any position in order to protect the flocks or to give them the best of light and air.

The house may be constructed just as cheaply as one wishes, as the covering of tar paper will hide all defects in lumber or workmanship, and also it adds to the warmth and serviceability of the house.

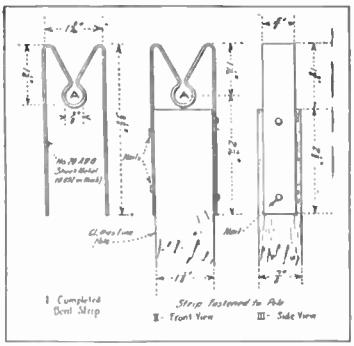
There is a floor of boards, and this, also, is covered with the tar paper, so as to prevent the grain fed the fowls from sifting through the floor to the ground underneath.

Clothes pegs dipped in white enamel and dried in the sun can be kept perfectly clean and will not split or mark the clothes.—MARY F. SCOTT.

PRACTICAL MECHANICS FOR EVERYDAY MEN

Clip for Clothes-line Pole

An easily-made clip for attachment to the top of a clothes-line pole is shown in Fig. 1. The clip



The metal strip is bent as shown, and fastened to the wood

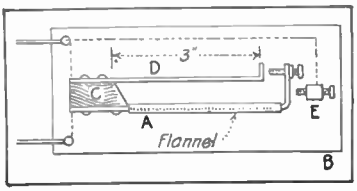
here illustrated is fashioned from a strip of No. 20 gage sheet metal (approximately 0.0320 in. thick), ⅝ in. wide and 10 in. long, bent as shown at *I*. When the clip has been bent to shape it is attached to the top of the pole with four 2d nails, as shown at *II* and *III*. The clothes-line is held in place in the circular loop, *A*. The clip should preferably be of galvanized iron to prevent against rusting and consequent soiling of clothes which might brush against it.

Contributed by Charles H. Trapp.

Automatic Fire Alarm

Fire alarms have been developed in many forms, the commonest being those depending on the expansion of mercury, air or other fluid, the bending of a compound metal strip, or the melting of a readily fusible substance. They all possess one defect, namely, they operate at a certain *fixed* maximum temperature.

Conditions of heat that are not caused by fire will affect them



One of the metal strips is covered with flannel

and cause their operation. The alarm described herewith detects *sudden* rises in temperature as

would be the case in a fire. The principle taken advantage of is that property possessed by woolen and flannel cloth of transmitting gradual changes of heat and cold, but of resisting a sudden change. As shown in the illustration, it consists of two strips of zinc, this metal having the highest coefficient of expansion. These strips are fastened to an insulating block, *C*, mounted on the base *B*. Strip *A* is covered with a layer of heavy flannel stitched into place, the bent end being equipped with an adjustable contact. Strip *D* is left uncovered.

An extra contact, *E*, is also provided, so that in case the rise should be gradual the alarm will be sounded at a fixed maximum.

Any number of such devices may be connected in parallel to protect a large building.

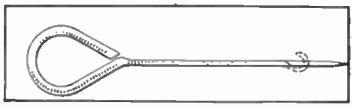
The operation is evident. As long as the temperature changes are gradual, the circuit will not close, since both strips expand and contract at the same rate. Should a fire break out strip *D* will expand faster than *A*, thus making contact.

Should the temperature of the room be nearly zero a sudden rise would affect the alarm, whereas, in the regular type, it is necessary for the fire to heat the apparatus up to the maximum to cause an alarm.

Contributed by THOS. W. BENSON.

MILK BOTTLE OPENER

Here is a handy little wrinkle for the boss of the kitchen. It is made from one of the button-



Hammer the hook out straight and sharpen it to a point

hooks given away by many shoe stores as an advertising novelty. The hook is hammered out straight, and the tip filed to a rather blunt point. This point is easily pushed through the paper cap of a milk bottle, when a downward movement removes the stopper.

Contributed by CHESTER H. DISQUE.

THE SILENCE CLOTH

If one uses tablecloths, the canton flannel silence cloth often develops exasperating qualities. Almost every hot dish placed over it causes it to stick closer than a brother to the polished table and to leave white, fuzzy rings on the wood. Instead, make a silence cloth out of cheesecloth or other washable material, with several layers of paper between the two folds. Overcast the edges and knot here and there as in a quilt.

Contributed by MARY F. SCOTT.

Protection from a Pin Point

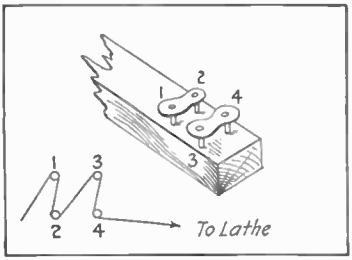
In fastening papers together with a pin, as a general rule, we run the pin through the paper twice, leaving the point in a dangerous position, for if the paper is handled very many times, sore fingers will result.

To do away with this, lift the top sheet and push the point on through. This will leave a safe fastening.

Contributed by Alfred R. Wagstaff.

Tension for Winding Springs

When winding spring wire or banding armatures, the worker should have some means of keeping a definite tension constantly



Pass the wire over the pins as shown in the diagram

on the wire. This insures a tight and even winding. The device illustrated herewith has given the writer good service in this connection. It consists of two links from the chain of an automobile or bicycle fastened to a small block of hardwood or dimensions approximating ¾ x 1 x 2 in. The nails holding the links are driven just far enough to permit the wire to be passed beneath the links and around the nails, as suggested in the illustration. The block may be held either in the hands or else in the toolpost of the lathe.

Contributed by M. F. Van Orsdale.

Egg Case from Apple Box

The standard apple box measures 18 in. long, 11½ in. wide and 10½ in. deep, inside measurements. When this box is cut down to 11½ in. long, it makes an excellent egg case for twelve dozen eggs, having room for packing at the top and bottom and using the regular cardboard liners such as are used in the standard thirty-dozen egg cases. Contributed by Ewell C. Black.

Care of Brushes and Commutators

Excessive sparking is the enemy of brushes and commutators, the heat developed oxidizing the copper and carbon, which forms a film that ofttimes short circuits several bars on the commutator. The sparking is then increased until it results in destructive arcing.

Sparking brushes are caused in several ways, but overloads are the most common. Most ma-

chines stand overloads of 30 per cent. without damage, and if it exceeds this continuously it may be necessary to install a larger motor.

In remedying sparking, it should first be determined if the brushes are large enough to carry the load; if not, larger ones should be installed.

If the brushes are large enough, make sure they touch the commutator at all points. If unevenly worn they may be ground by fastening a strip of sandpaper around the commutator by means of string and revolving the armature by hand till a hollow is worn in the brush that just fits the commutator.

Brushes loosely mounted or unevenly spaced are also the cause of sparking, and this should also be considered in examining the motor for troubles. The setting of the brushes is very important; heavy sparking may often be cured by merely shifting the brush holder a trifle one way or the other.

An irregular commutator will cause sparking and chattering of the brushes. This can be remedied by driving the bars that have become too high back into place or by turning the entire commutator down on the lathe.

A bluish bronze or chocolate color indicates good commutation; a shiny or charred commutator indicates just the opposite. The former is caused by brushes being too tight; the latter from sparking and arcing.

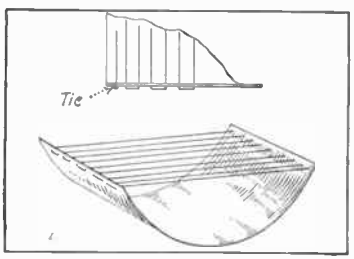
Charred commutators may be cleaned with sand-paper, a little alcohol being used if oil has gummed on the surface. Emery paper should never be used for this purpose.

A daily examination of motors and an occasional application of vaseline or pure paraffin will result in high efficiency and prevention of sparking.

Contributed by Thos. W. Benson.

A Comb Cleaning Device

Take a piece of heavy tin and bend into a half-cylinder, as suggested in the drawing. The tin should be about 6 in. long and 5



Bend the sheet of tin as shown and draw the thread tight

wide. Punch holes on two sides near the edges, and run a strong thread from the holes on one side to those on the other. The thread should be tied at the first and last holes to keep it in place. The holes must be close

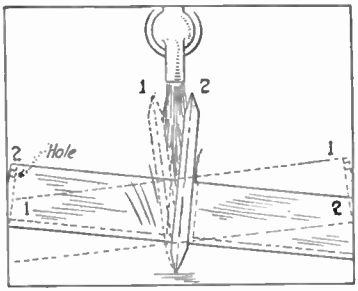
together, and all burrs and rough places must be filed off to prevent cutting the thread. The comb is cleaned by drawing the comb across the threads, the latter effectually working out the accumulated matter between the teeth.

Contributed by LEE A. COLLINS.

A PRINT WASHER

A very novel and effective print washer can be made according to the following plan:

The two boxes should be about twice as large as the largest print



When correctly balanced, this tilts alternately to left and right

you expect to wash, and watertight. The center piece should extend upward about 10 in. in the 4 x 5 in. washer. Two ¼ in. holes are bored near the top on each end. If more holes are necessary, use as many as you need.

Set the apparatus under a faucet and balance it up so the water alternately runs into each side. When correctly balanced it should alternate slowly and steadily, and is as automatic as any print washer can be.

Contributed by G. W. GREENE.

CLEANING ALUMINUM

Aluminum sheeting is being used to a great extent for flooring automobiles and enginerooms on small yachts. Though admirable for these purposes, it is ofttimes difficult to clean; in fact, some stains defy all attempts at removal.

Every tarnish or stain may be removed by using varnish remover applied in the usual manner. This treatment will make the flooring look like new. This cleaner was discovered by accident in the engineroom of a powerful yacht, and actually worked wonders.

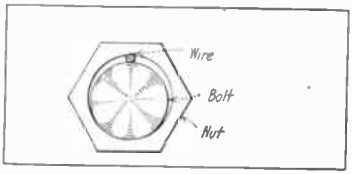
It may be used for cleaning utensils used in cooking, and is somewhat easier than the usual procedure of heating the pans to redness, which chars the particles of food adhering to them and makes possible removal by mere brushing.

LARGE NUT ON SMALL SCREW

A few days ago I had occasion to use a few machine screws. The ones I had on hand were too small to fit in the nuts. It was

necessary to have them immediately, as I did not have the time to go out and purchase the right sized nut I did as follows:

I took a short piece of No. 22



The wire is passed through the nut, which is then forced on the small bolt

bare copper wire and inserted it in the nut; then I screwed the screw in as though the screw was the right size. The screw cut its own threads and remained a tight fit.

Contributed by GEO. MASCHKE.

HORN FOR LOUD-TALKING WIRELESS RECEIVER

It has been found by actual experiment that the horn on the loud-talking receiver should not be extremely large. In other words, a small horn gives best results, being more in resonance with the high-pitch notes used by most stations than a large one would be.

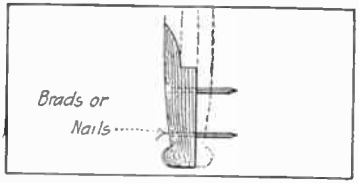
By sawing off the small end of a telephone receiver shell an excellent horn results. The resonant properties of hard rubber come into play, and the resultant tones are rich and clear.

Contributed by THOS. W. BENSON.

HANDY PICTURE HOOK

Cut away that portion of a clothespin shown by the dotted lines in the illustration, and nail the remaining piece to the wall. You will have a strong and good-looking hook from which to hang pictures or the mirror. If it be painted the color of the wall, the hook is scarcely noticeable.

To drive the nails in a plaster wall, or if a heavy weight is to be supported, to secure screws in the same base, first dip the nail or screw in hot water. It will drive easily without cracking the



Cut away the unshaded portion of the clothespin

plaster, and when the moisture has dried the metal will be firmly imbedded.

Contributed by THOMAS DEAN.

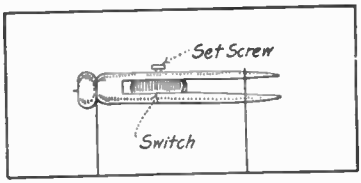
REPAIRING DATING STAMPS

Sometimes when using a rubber dating or paid stamp the dating strip will come loose. To repair, clean both ends and cement them together again with rubber cement, the same kind as is used to repair bicycle tires.

Contributed by ALFRED R. WAGSTAFF.

Improvised Pull Chain Socket

Place a clothespin over the socket key, tie a cord to either end of the clothespin, and insert a small screw to bear upon the



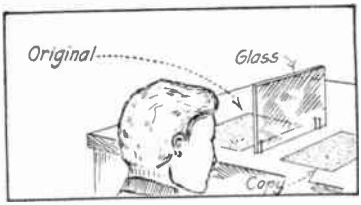
A set screw holds the clothespin in place

rubber socket key, and you will have a rig that will answer the purposes of a pull chain socket in an emergency.

Contributed by George Maschke.

To Copy Sketches Without Tracing

A sheet of carbon paper and a pane of glass will enable you to copy sketches rapidly and accu-



A reflection of both the original and the blank paper may be seen in the glass

rately, and without the necessity of making tracings. Mount the glass on edge and lay the sketch at the left hand side of it, as shown in the illustration. Lay the carbon paper on the other side of the glass, face up, and cover this with a piece of blank paper. By holding the head in the proper position, it is possible to see the reflection of the sketch in the glass and to follow its outlines on the paper with a very hard pencil or a sharp-pointed stylus. The copy will, of course, appear on the underside of the blank paper. The carbon paper is used so that the copy will be exactly like the original. If the sketch were copied direct, it would be reversed. Advantage may be taken of this fact in drawing balanced architectural figures, etc.

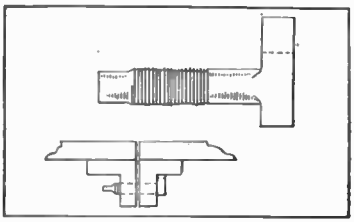
A good substitute for the conventional carbon paper may be made by rubbing a soft lead pencil over a sheet of unglazed paper, completely covering the surface with the lead. The advantage of this type of carbon paper is that the marks are easily erased should an error occur.

Contributed by Thos. W. Benson.

Improvements in Bolts

The ordinary stock bolt, when it is to be used in bolting together flanges, can be much improved by being made with a nipple upon the small end. Especially is this the case for under-water work, where much time is wasted and thousands of nuts

lost when using the ordinary bolt. The plan of having bolts made thus has been tried with great success.



The oblong head and the nippled end improves the bolt

Another valuable improvement is effected by having the head made oblong, the projection being all on one side. This projection lodges against the side of the flange and prevents the bolt turning around when pressure is exerted to tighten the nut.

Contributed by J. SKELTON.

TO REMOVE DIFFERENT KINDS OF STAINS

To remove kerosene, cover the spot with cornmeal and lay a paper over it and rub with a moderately heated iron. Two or three applications will remove the stains.

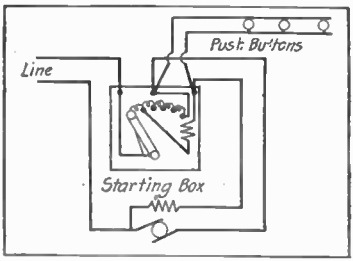
In ironing white goods, if they get scorched, rub the places with the cut edges of an iron and then lay the garment in the sun, and, presto! the scorch is gone.

Use salt and lemon for ink spots. Bathe the stains freely with lemon juice, sprinkle thickly with fine salt and place in the sun a few hours.

Contributed by MARY F. SCOTT.

EMERGENCY STOP FOR MOTOR

In case of accident, it is well to have some means of stopping electric motors driving line shafting from any one of many points around a shop or factory. This can be provided by arranging a series of push buttons at various convenient points, and connecting the buttons in multiple on a pair of wires which lead to the electro-magnet on the starting-box of the motor. Any button that may be pressed will short circuit the magnet of the starting-box, causing the release of the



How pushing the button will stop the motor by short circuiting the magnet of the starting-box.

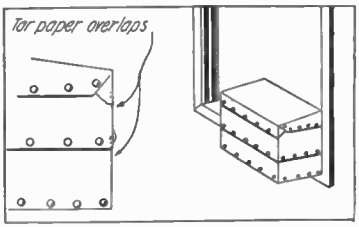
arm and, of course, shutting off the current. This scheme is of use only in the case of a direct current motor with magnetic release starting-box.

Contributed by THOS. W. BENSON.

HOW TO MAKE A COLD-STORAGE BOX

By Frederic M. Nettleship

THE writer lives in a modern apartment house, without the individual cold storage common to many. The problem of taking ice all winter confronted him unless means for keeping the food cool could be devised. Looking at the array of unsightly boxes of all sizes and shapes stuck against the side of the apartment, it was resolved to take ice rather than add to the blots on the landscape. A window box seemed the only solution, so one was planned that would not appear as hideous as the rest. No special tools were available, just a saw, hammer and nails. Several boxes that had contained books were carefully taken apart, as none of them were large enough for the window. Then a box of the following dimensions was built: Width, 30 in.; height, front, 17 in.; rear, 16 in.; depth, 16 in. Not being a carpenter I had my troubles, but managed to build a fairly creditable box. To make the exterior waterproof, I purchased twenty cents' worth of single-ply tar paper. The hardware man suggested short nails and tin caps to tack it on with. I covered the box all over except the opening, with the tar paper, being careful to fold over downward in such a manner that the rain would drain off instead of finding a space to enter. The tin caps were used in an orderly design to tack the paper down, and the exterior was not at all bad to behold. I then placed a thin shelf about half way, having it fit



To make the covering absolutely waterproof, each strip should lap over the one below

snug, as well as supported by large tacks driven in underneath. Ten cents' worth of white oilcloth lined the lower half inside very nicely, and the finished product has proven very handy, besides meeting with the admiration of all who have seen it. No doubt a carpenter would find that I had broken half the rules of his craft, but they are happily hidden under the friendly cover of tar paper and oilcloth. The box rests on three strong strips nailed to the base of the window, which extend out from the side of the house.

A Chat With the Editor

What Is in Store for You

This is the seventh number of your little magazine, and I feel that in it I can tell you of some of the many interesting things we have in store for you. I can now say things that I could not have said in earlier issues.

Everyday has had its ups and downs; it has missed its scheduled date of publication by weeks at a time; it has, indeed, had a struggle for existence. However, thanks to the loyalty of both the readers and the creditors who had an equal faith in the soundness of the idea back of it, the little magazine has pulled past the worst of the storm and is still in the running.

The circulation has reached the fifty-thousand mark by actual count. The September issue was distributed to newsdealers in more than 500 cities and towns in the United States. There are no back numbers, every edition since the first one having been sold out completely. We cannot even hope to make up bound volumes, for we cannot get the magazines unless some readers are willing to part with their copies.

In the face of this, I can say to you that we have in course of development in the Experiment Station, Van Nest, N. Y., models of radio transmitting and receiving apparatus, model aeroplanes, steam engines, gasoline engines, direct and alternating current generators, oxy-acetylene welding apparatus, etc. We are also developing a racing body for a Ford chassis, and will have the data ready with photographs in time for construction during the long winter months.

We get the ideas for these articles from the reader at large. If you are interested in some particular line of work, write me a letter stating clearly what you want and I will try to give it to you. It may not appear in the following issue, but you will see your favorite topic discussed in an early number after your request is made, providing, of course, the subject is one that would be of general interest to the readers.

We have now caught up with our schedule, but in order to do this I had to leave out the concluding instalment of the Model Submarine series, the second part of the Home Craftsman, His Shop and Laboratory, and the article describing the gasoline engine for the Small Lighting Plant. All three of these will appear in the November issue.

which will be out promptly October 20th. The gasoline engine is now being constructed with a modification in its design to meet the requirements of the amateur, with special reference to the difficulty of obtaining certain materials owing to wartime conditions. The work is in charge of Prof. Wm. C. Houghton, whose excellent articles of a few years ago you must surely remember. Prof. Houghton has spent most of his mature years in teaching young mechanics to do real machine work, and when he performs the trick and tells the story you know just what he means.

Prof. A. E. Watson of Brown University is building us a Sixty-Cycle Alternator of about ¾ kilowatt capacity. This design will be ready for publication, I hope, in the November issue, but surely in December. You will remember that Prof. Watson is the foremost writer of small dynamo and motor books in this country, if not in the world. His works are known in every land where small dynamos have been built by amateurs, and in offering this latest product of his ingenuity I am satisfied that you will say it is fully up to his usual high standard.

There are many other things of which I might speak, but I believe this is enough to show you that even though you do have to pay ten cents for your little magazine in the future, you will get your money's worth.

THOMAS STANLEY CURTIS.
Your Editor.

What Our Readers Think

Here is one from a Company that we hope *you, the reader*, will remember. We have been waiting for a letter like this for a good many months, and now that it has come we must do our part:

EVERYDAY MECHANICS, *New York City.*

Gentlemen—We have just received a sample copy of the May issue of your magazine. A few days ago we received a letter, we believe, enclosing advertising rates, but this letter has been mislaid.

The writer read with interest a number of the letters written to you by many of your loyal subscribers concerning the litigation which has so unfortunately and unkindly been thrust

upon you, and also your appeal to your subscribers upon the first pages of your magazine.

We assure you that we were immediately moved to a sense of our responsibility in reading these letters and your appeal. They made a profound impression upon the writer.

You will please enter our contract for advertising in your magazine for a period of one year, duplicating in the next issue our ad. which appears on page 120 in the July issue of Popular Science Monthly. They will no doubt loan you the cut. If you can improve upon the copy, do so. The writer is satisfied that you can write a good ad. Send all bills to the Arkenberg-Machen Company, Toledo, Ohio.

The writer will today write to several leading wireless manufacturers and endeavor to prevail upon them to use space in your magazine. We believe it has a great future, and should appeal particularly to wireless experimenters.

We believe you wrote us sometime ago with regard to enclosing your coupons with our catalog. We have always been opposed to doing anything like this, but lately have co-operated with QST with more or less success, and shall be glad to distribute leaflets concerning your publication on the plan outlined by you.

Yours very truly,

(Signed) THE WILLIAM B. DUCK COMPANY,
Per William B. Duck.

Enclosed with the letter was a carbon copy of the one Mr. Duck sent to the following manufacturers: Clapp-Eastham Company, Wm. J. Murdock Co., C. Brandes, Inc., Thordarson Electric and Mfg. Co., Multi-Audi-Fone, and J. H. Bunnell & Co. The letter follows:

Gentlemen—I think it would be a capital idea if we would all lend our assistance toward making a big success of the magazine entitled "EVERYDAY MECHANICS," edited by Stanley Curtis. We believe it has a big future and he is deserving of our support. He is having an uphill fight in litigation with *Popular Mechanics* magazine. We have contracted for a year's space. Am writing a similar letter to several other concerns, and if we all get together and boost this magazine we will be doing the magazine a good turn and at the same time helping ourselves. Yours very truly,

THE WILLIAM B. DUCK COMPANY,
Per William B. Duck.

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.

33. **J. F., Marion, Ohio,** writes: Please explain the ultra violet ray and give data for construction of the apparatus used in its production. Ans.—This is quite a mouthful for the Technical Adviser section to handle, but we will do our best in the limited space available. The assumption is that you mean the true ultra violet ray and not the atrocious fake labeled "violet ray" by many manufacturers of small high frequency apparatus in which the vacuum electrode giving forth a pale lavender light is supposed to possess certain curative powers through the agency of the alleged violet rays passing through the bulb. For the latter, the less we say the better, for we cannot say anything very good. It is true that the vacuum electrode treatment, even with a very small coil, is possessed of real medicinal value, and it is a distinct success when used as a high frequency modality. We simply do not agree with the manufacturers who swindle the public by selling them violet ray machines, so-called, and giving the impression that the treatment is similar to that advocated by the great Finsen.

The true ultra violet ray possesses many peculiar characteristics. It penetrates certain opaque substances in a manner somewhat similar to the X-Ray to which it is related. The ultra violet ray, or "light," is quite invisible to the human eye, and it only makes its presence known to the observer through the medium of certain fluorescent substances which shine or glow in the darkness under the influence of the rays. The peculiar ray has also a most pronounced effect upon the photographic plate.

Ordinary glass is quite opaque to the ultra violet ray, and in making ultra violet lamps and cameras the lenses must be of quartz, as this substance passes the rays without very much resistance.

The apparatus required for the production of ultra violet rays in abundant quantities is quite simple. The best method for the ex-

perimenter is to use the discharge of a high tension condenser between iron electrodes. This form of lamp is easily constructed, and it produces a surprising volume of the rays. An experimental lamp can be made up by mounting two oval-head carriage bolts in a holder that will permit of a variation in the gap between them. The bolts should be at about a ninety degree angle so the rays will be projected from the apex of the triangle thus formed.

The exciting apparatus may be a standard wireless transformer and condenser with the ultra violet lamp substituted for the spark gap. We cannot take more space to describe the apparatus in this department, but you will find a most complete article with photographs and suggestions for experiments in an early issue of the magazine.

34. **M. R., Glasford, Ill.,** writes: Could you publish plans for building a racer from a Ford engine and chassis? I have seen a number of them in Peoria, built by amateurs, and I believe such an article would be of general interest to your readers. I have seen several plans for building such a car from motorcycle engines, but they are not serviceable enough to be of much value. Ans.—Your suggestion is a happy one, and we shall act upon it in an early issue. In accordance with our established policy, we shall first "do the trick" ourselves

35 **A. C. M., Baltimore, Md.,** asks whether a 30-volt, "40-ampere" storage battery can be charged with a dynamo having an output of 30 volts, 40 amperes. Ans.—Your question is not quite clear We presume you mean a 30-volt, 40-ampere hour battery. In this event, your dynamo could certainly be used if you slightly increase the speed to exceed by five or ten volts the figure you have specified. This you can accomplish by using a pulley slightly larger on the engine or else a somewhat smaller pulley on the shaft of the generator. If your battery is of 40 ampere hours' capacity, you should permit a current of not more than 4 amperes to pass through it while charging. At this rate, the battery would be completely charged in about ten hours. You can limit the amount of current flowing through the battery from the dynamo by means of a variable resistance inserted either in the field circuit of the generator or else in series with the battery and the generator terminals.

36 **A. R. M., St. Louis, Mo.,** asks (1) if the aerial described for use with the Transatlantic Receiving Set in the March issue would exceed the government limit of 200 meters if used for transmitting, and (2) how much wire could be added to an aerial 50 ft long and 40 ft. high and still keep it within the specified limit Ans—Yes, this aerial would greatly exceed the limit You will have to use a duplex aerial, that is, one for sending and the other for receiving. (2) You might safely increase the length to 75 ft., assuming that you have the average length of lead-in

37 **E. B. B., Portland Harbor, Portland, Me.,** writes for design of an audion receiving set. Ans.—See article by Mr. Burckett in this issue.

38. **M. E., Baltimore, Md.,** asks how to flatten out a slightly warped table top of one-inch oak. Ans.—The warp may have been caused by a spell of damp

weather or especially a series of days when the humidity in the air was abnormally high. If this is the case, the top will gradually readjust itself as the wood dries out. Then again, the top is probably glued up and permanently secured to the rails with screws from beneath. It is possible that the screws are not properly placed. See if the edges are secured while the center is left free to warp if it will. If so, remove the top and place it in a dry, fairly warm room, possibly on the floor or on another table. Let the convex or outward curve come on top, and on this pile all of the weights, such as books, flat irons, etc., you can conveniently secure and abide your soul in patience for a few days. The result will quite likely be a perfectly flat top.

If the work so far has been successful, you may proceed to give the top a finish that will tend to prevent future warping in a measure. One of the best ways to do this is to varnish the wood on both sides with shellac or furniture varnish. The top may then be replaced on the rails, screws being placed first in the center and then toward the edges. The fastening in the center should be generous, while, as the edges are approached, the screws need not be so numerous.

We have succeeded in resurrecting an old oak table in the Experiment Station through the medium of the suggestions given herewith, and our efforts have been quite successful.

39. **E. K., Wheaton, Ill.,** wishes to know whether we intend to publish designs for the building of model steam engines, and also inquires the address of *The Model Engineer*. Ans.—Yes, we have two designs under development at present. One is a model yacht engine, while the other is of the stationary type, to be driven from steam generated in a "flash" boiler. We doubt if these articles will appear much inside of three months, as there is still much work to be done on the models. (2) The American agents of that admirable paper, *The Model Engineer*, are Spon & Chamberlain, 123 E. Liberty St., New York. You can find no better exponent of the model steam engine than this excellent magazine, which is the standby of the thousands of model engineers in England.

40. **L. D. F., Apalachee, Ga.,** asks if the following outfit can be used successfully to operate the 18-inch Tesla high frequency coil described in Mr. Curtis's book: 6-volt, 40-ampere hour storage battery; ½-kilowatt transformer coil; 12-plate condenser of high capacity; included in the outfit is also a rotary spark gap. The coil can be operated from the 110-volt alternating current circuit as well. Ans.—You can operate the coil with this outfit, and you may possibly get a six-inch spark if your transformer-coil (so called) is well designed. To assume that you can get half a kilowatt of energy from a 6-volt, 40-ampere hour storage battery, however, is a little too much. However did that coil get its rating, anyway?

Our advice to you, if you have access to the city lighting current, is to dispose of your transformer-coil at the best figure you can get for it and to buy with the money the materials to make a ½-kilowatt transformer of the magnetic leakage type described in the book you mention. With this transformer you can get the maximum output from the coil.