Practical Electrics

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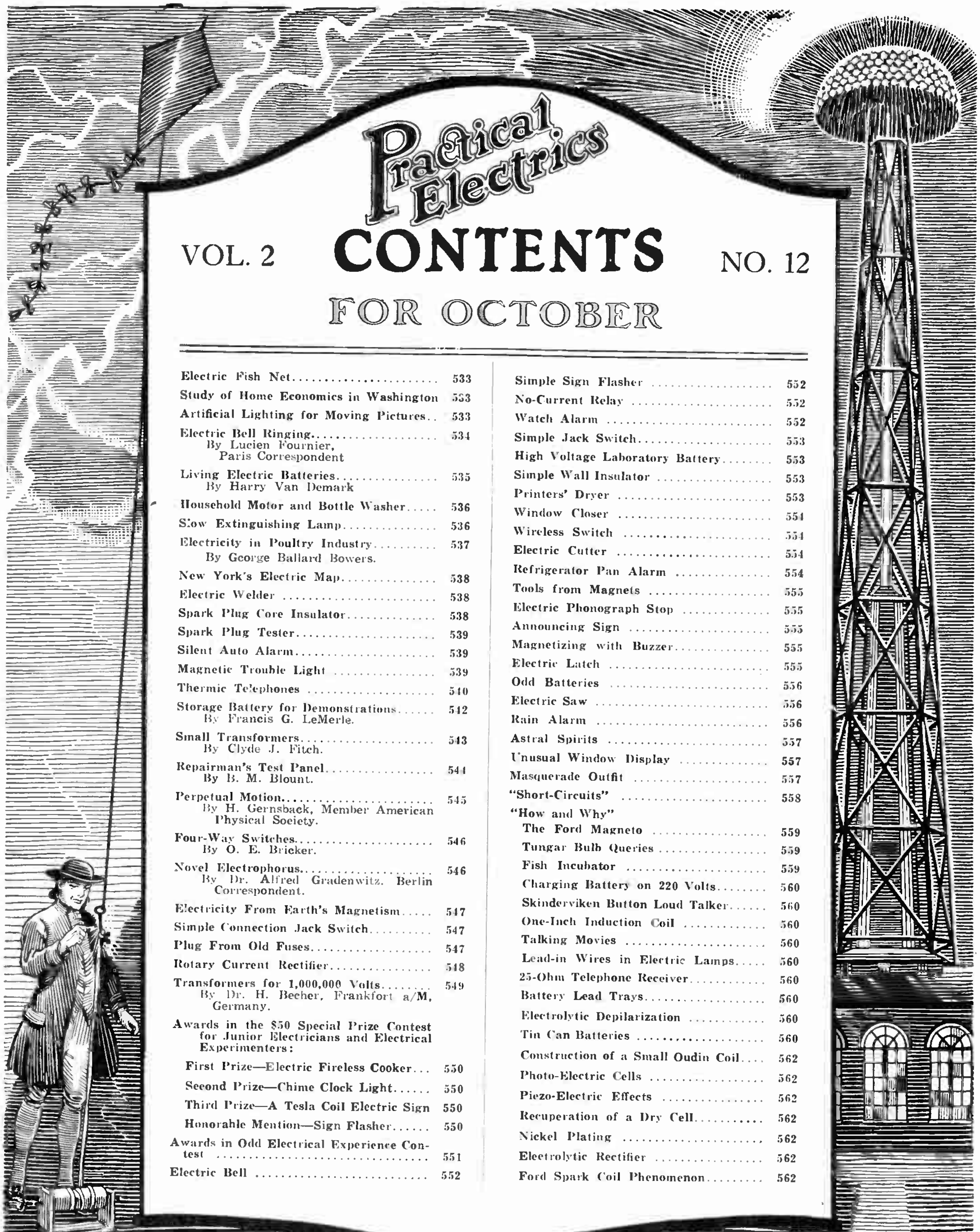
EDITED BY H. GERNSBACK

PERPETUAL MOTION?!

See Page 545



Practical Electrics

VOL. 2 **CONTENTS** NO. 12

FOR OCTOBER

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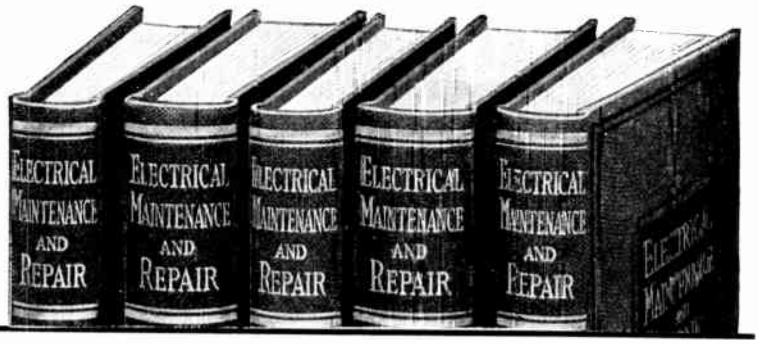

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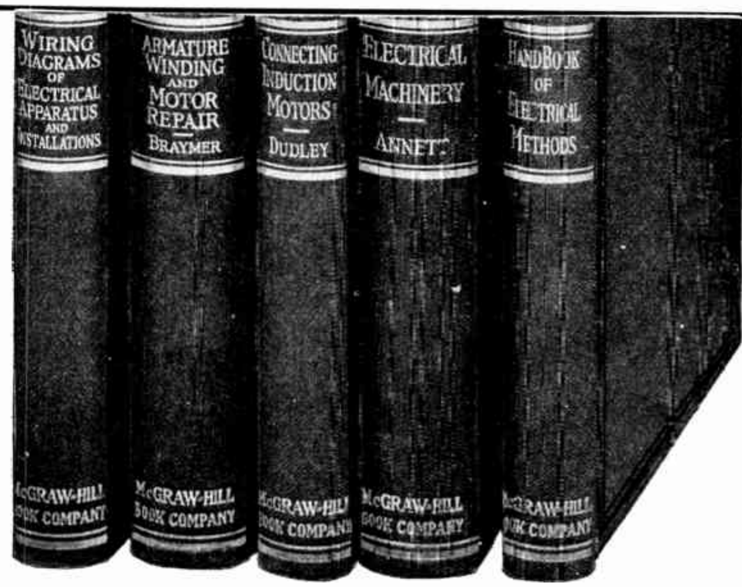

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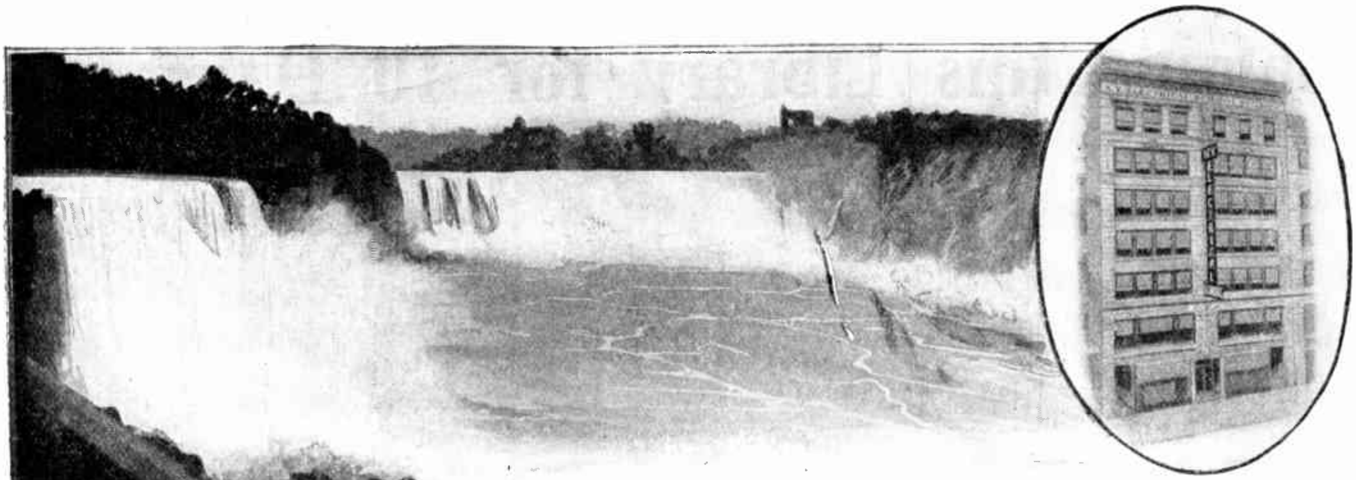

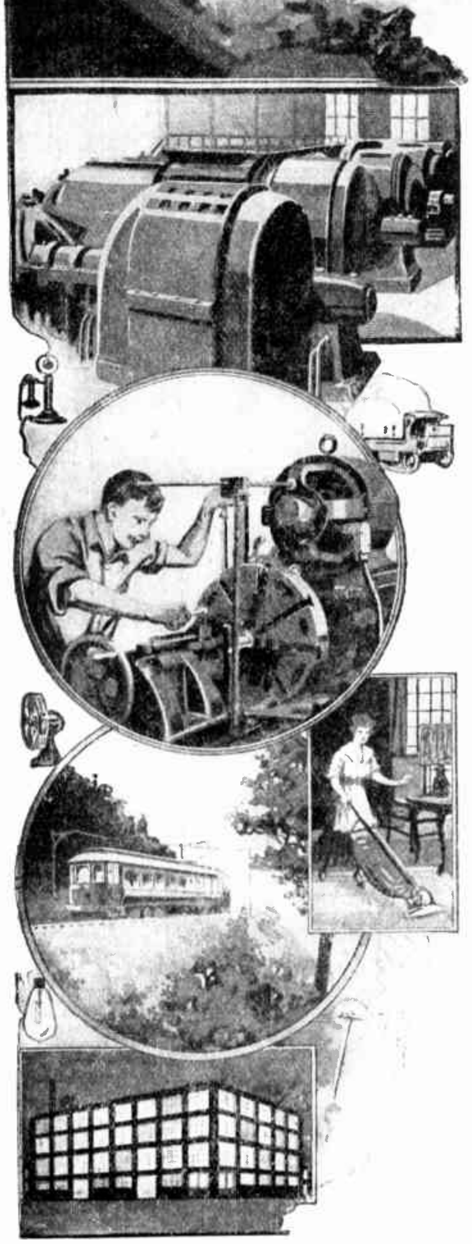

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Volume 2
No. 12

Practical Electrics

October
1923

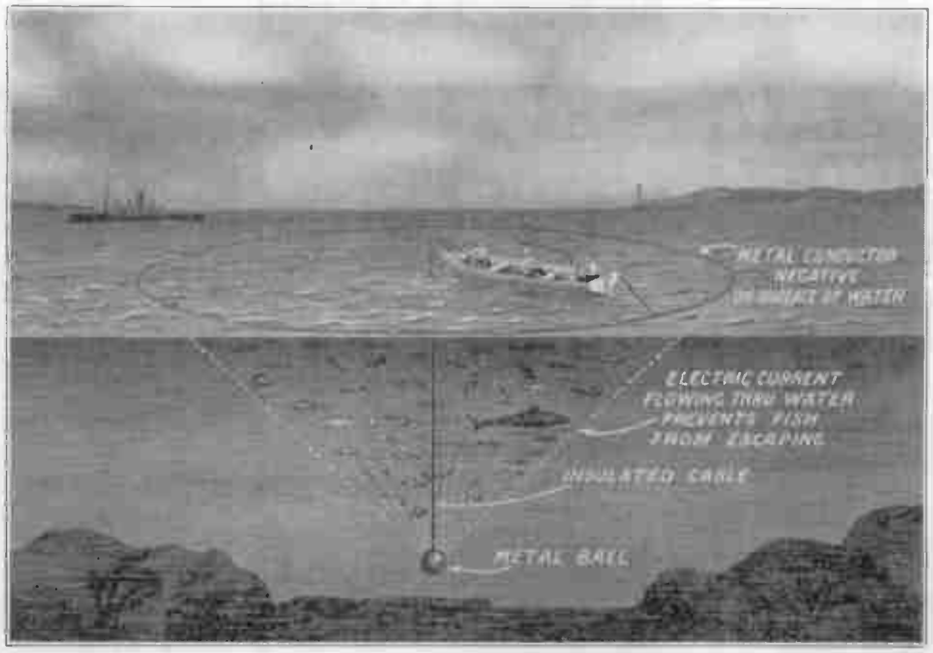
H. Gernsback, Editor and Publisher T. O'Conor Sloane, Ph.D., Associate Editor

Electric Fish Net

SOME things improve with time and others do not. A device which has not improved to any great extent is the fishing-net. This implement was used thousands of years ago.

The illustration shows a radical departure in fishing-nets. This net, practically invisible, is plainly shown in the picture. It is nothing more than a wall of electricity, in the shape of an inverted cone. The electric current passes from the metal ball at the apex of the cone to its base, a metal ring floated at the surface.

The ball is lowered to a suitable depth and is left there until the fish arrive.



Then the electric current is turned on. The result is that all of the fish that are within the electric cone are surrounded by a wall of electricity, through which they will not attempt to pass. Now the ball is slowly pulled up toward the surface, thus closing the net in on the fish and forcing them to the surface. The fish are either picked up with a scoop net and dropped into the boat, or the current may be increased until the shocks stun the fish and they float lifeless.

An electrical fish net. The problem is, whether the meshes are small enough to prevent fishes from escaping.

Study of Home Economics in Washington

Above: What the United States is doing for the housewife, studying with electrical apparatus the making of bread. Right: A simple apparatus for producing sheet-lightning for use in moving pictures.

THE United States Department of Agriculture has organized a bureau or division of Home Economics. In this division technical investigation of the work of the home, of the housewife and housekeeper, is scientifically investigated and the results are applied to acquiring a more intelligent conception of these operations than has hitherto prevailed.

All the processes of cookery even today are accomplished principally on a rule of thumb basis, and it is the amount of personal ability of the operator rather than any scientific carrying out of the process which governs the results.

Especially in studying the temperature question, electricity conduces to the formulation of methods, for the heat question is the all important one in bread making. Heat regulating affects the rising of the dough, whether yeast-raised or raised by baking powders, and also affects the relation of crust to crumb, a slow heat giving a lighter crust and a more evenly baked interior, while the strong, dark crust, with almost slack baked material within, would be given by a higher heat suddenly applied. It is such points as these of the baking action which have to be determined and reduced to a basis, so that the baking of good bread will be a certainty in the household, and no longer a matter of chance, as unfortunately has been too often the case in the past.

Artificial Lightning for Moving Pictures

OUR illustration shows a very simple apparatus for giving the effect of sheet lightning in the photography of moving pictures.

We have already described the work done in the production of electric discharges at high voltage in the experimental laboratories of some of the great electric companies. But here we have a far different thing, not the "forked lightning" of the story tellers, but the general illumination due to the less startling discharge.

What is wanted for the moving pictures is a great flash of light, and that is obtained by the production of a great arc at the desired instant. Referring to the picture, we see a bunch of carbons packed together and carried on the end of and upright post. A pivoted arm can be swung up so as to bring a single carbon which it carries into contact with the bunch of carbons on the fixed standard.

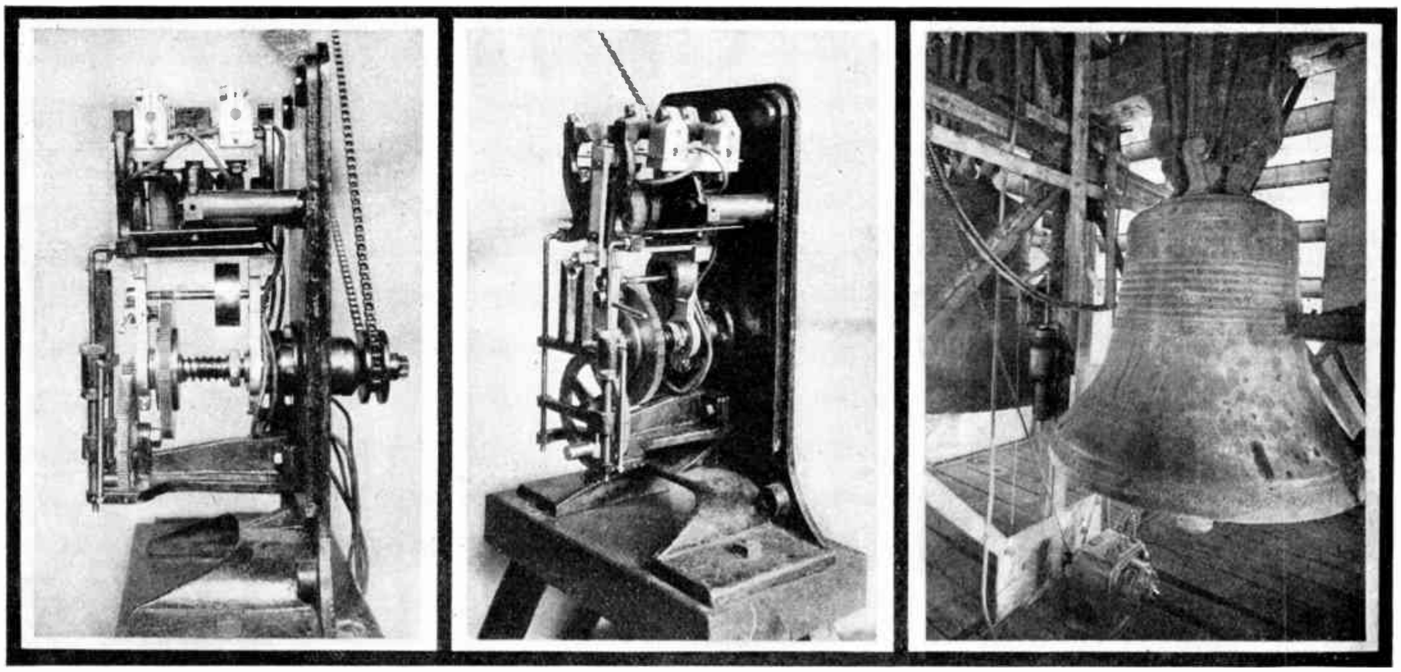
When one lead of the circuit is connected to the bunch of carbons on the standard, and the other to the single carbon carried on the pivoted arm, if the current is on, all is ready for the flash. To produce it, the pivoted arm is swung up so that the carbon comes in full contact with the bunch on the upright, and the current starts to go through. Then by releasing the pivoted arm the arc is drawn out and the brilliant flash is produced, giving the exact effect of sheet lightning. Pulling the cord swings the arm in towards the standard so as to make the contact.

Electric Bell Ringing

By Lucien Fournier

Paris Correspondent

(Abstract)



Electric machinery for ringing the large church and cathedral bells. They are rung by two methods; the one by swinging the bell itself, the other by causing a heavy hammer to impinge upon the bell at the proper place. The point of impact is of extreme importance, affecting the note given. It is all wholly operated by electricity; throwing the switch causes the chimes to peal out. The swinging bell is swung by an endless chain and another chain connection reverses the motor for the return stroke.

FOR what the French call ringing *en volée*, which means swinging a great bell to and fro, there is keyed on a shaft which carries the bell a large chain-gear pulley, and the chain belt connects it to an electric motor below. If the motor turns, it will swing the bell, direction depending upon its own direction of motion. Now the bell has to swing back and forward, therefore if it is to be operated by the one chain belt, it is obvious that the direction of the motor has to be reversed for each swing. Accordingly, there is a smaller pulley connected to the bell, and this, by a chain, operates a current changer which reverses the motor for each swing of the bell. As the bell swings, this chain causes a frame carrying four carbon brushes to oscillate, effecting two different contacts, one contact causes the motor to turn clockwise, the other causes it to turn in the reverse direction.

The bell pealing out notes acts as a commutating element or mechanism for the motor. It will be seen that the brush contact will not be for the entire time of a swing, but there will be a period when no current will pass. The effect of this is that the motor is not only supplied with current in constantly changing directions, but that part of the time it is left without any current at all. In this way a comparatively small expenditure of power keeps the bell ringing. When the bell is in fullest possible motion, going each time to the end of its swing, this reduction and cutting off of the current is greatest in amount.

The bell need not be swung, for there is another way of giving a stroke which consists in striking the bell near its rim, with a special hammer or tongue. This will operate on a motionless bell—some are rung only in this way and never move. This last system the French term *en tintement*.

Both kinds of strokes can be given simultaneously, as we may express it, while the bell is ringing. In all great installations there are a number of bells, each with its own note, and some of the bells may be rung by external hammers; these can be governed by the same motor, which operates the swinging bell by a chain connection. The timing is so arranged that the stroke *en tintement* is given to the other bell, when the swinging bell is at the bottom of its course, so that the second stationary bell gives its sound by a stroke exactly half way between the two strokes of the swinging bell.

The connections for three bells may be so arranged that as the swinging bell reaches the lowest point of its course in one direction the one fixed bell shall be struck by its hammer, and on the return swing the other fixed bell shall be struck. This gives one ringing *en volée*, and two ringings *en tintement*, employing three bells.

Our author cites a case of tolling for the dead with three bells, tuned to do, mi and sol. The do bell is arranged to swing, while the mi and sol bells are motionless and are struck each by its hammer. This will give, he says, the following succession of notes, carrying out the successive action we have just described. The swinging bell gives do; when its return swing is half completed the note mi is struck on its own bell; the swinging bell completes its stroke and gives do again. On the return swing in the reverse direction the sol bell is struck, giving that note. It will be seen that this succession will be repeated over and over again, as long as the motor runs. Each of the bells struck by the hammer blows has its own motor for actuating the hammer. These motors are brought successively into action as described above.

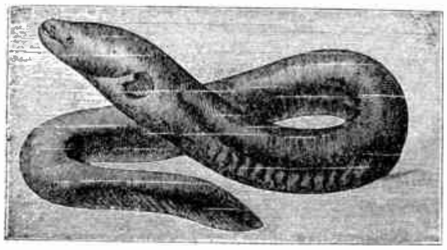
Our author remarks upon the certainty of the disappearance of the famous bell ringers of older times, who cannot compete with what he calls the fairy—electricity. He says that we will no longer see in our bell towers the traditional bell ringers pulling the bell ropes with all their power. A small electric motor will do the work as well, or even better. The parochial officials will thus be enabled to ring the bells in any desired way, from the sacristy or even from their homes. The turning of a switch will start the bells into action.

If the wire is cut the "curfew will not ring tonight."

Living Electric Batteries

By Harry Van Demark

OF all the wonders which have perplexed the wise men of the world, the origin of the mysterious electric current is probably the greatest. Second only to its baffling secret are the marvelous and astonishing living batteries of certain fishes which have the magical power of producing their own electricity at will and in quantities large enough to make them dangerous customers to meet.



The Electric Eel of South America can give a most severe shock when fresh.

These animated "induction coils" in the shape of fishes inhabit various parts of the seven seas, and although scientists have studied them assiduously for years, their secrets are still hidden in the microscopic cells of their electrical organs.

Foremost among these piscatorial dynamos is the electric eel of the brackish waters of South America. This eel is not unlike the common river eel familiar to everyone. It grows to the astonishing length of six and seven feet, but the average specimens of this species are about four feet long.

This eel is nothing more than a fish in an extended and elongated form, and possesses a powerful electric battery near the tail with which it stuns its prey and drives away its natural enemies. Few denizens of the deep, large or small, would relish a second encounter with an electric eel. When attacked it merely claps its "live-wire" caudal appendage against its enemy and presses the button.

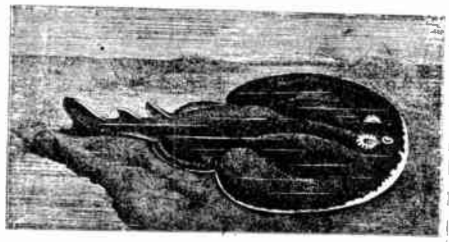
The victim instantly gets a powerful shock of electricity which is strong enough to knock a man down.

Scientists who have dissected these eels to discover "the reason" have been defied. They found that the electrical organs consist of two pairs of longitudinal organs located between the skin and the muscles of the caudal region, composed of 240 cells and supplied by more than 200 nerves.

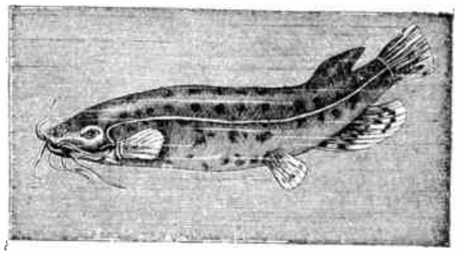
The eel can discharge current enough to kill an animal of considerable size, and can easily knock down a man or horse. After a few consecutive shocks the battery is exhausted and the eel has to retire to a nearby mud-bank to rest so that he can generate a new supply. In an hour or two he is ready for the next victim.

This eel is very good to eat, but no one cares to take them off the hooks, so the common way to catch them is to drive horses into the bayous where they are known to be plentiful. The eels attack the horses and quickly exhaust their batteries. When they are powerless to do any further electrocution they are speared by the natives. Not infrequently horses are lost in this manner of fishing.

The eel is not the only denizen of the deep to be safeguarded by powerful electric batteries. There is the torpedo ray, or skate, which looks like a three-cornered kite with a long tail, equally dangerous to handle without rubber gloves. There are also several quite unrelated fishes which possess the extraordinary property of communicating an electric shock to animals with which they come in contact.



The Torpedo is very dangerous for bathers.



An Arabian fish found in the Nile, the Electric Catfish.

In all cases the electric organs are modifications of muscular tissues, looking like a mass of closely packed prisms, each divided into a series of compartments filled with a gelatinous substance. The whole is like a group of voltaic piles.

The electric ray has its batteries located near the head. They are supplied with energy from large nerves proceeding from the brain. The ray is an ugly customer and can give as much trouble as the electric eel. A man receiving a shock from a large ray will remember it for a long time, if, indeed, it does not kill him outright.

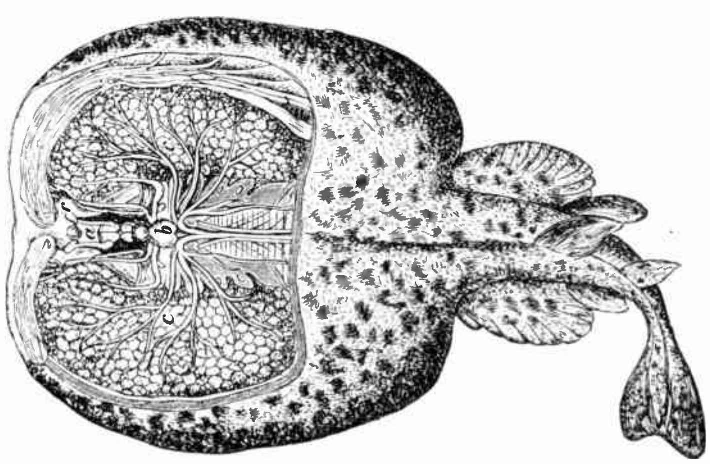
Even the little rays can give quite a shock when molested. The electric ray is a member of the skate family, and most skates can produce more or less electricity, but the ray is the only one of this species which is dangerous to handle.

Then there is the electric catfish from the Nile, which carries around a powerful storage battery concealed under its skin next to the muscles. This battery is a layer or blanket of electric cells covering most of the body. The charge can be delivered at will, and is quite powerful, but, as the fish never attains large proportions, its shock is not dangerous to anything except small animals.

While all the fish mentioned above are capable of producing electricity for hunting and defensive purposes, not one of them utilizes the current for electric lighting. And yet, strange as it may seem, there are plenty of other fishes who do use electricity produced by themselves for this very purpose.

Not until the last eight or ten years has any attempt been made to investigate the life of the deeper parts of the ocean. But the trawls and dragnets suspended a mile under the water, where it is necessarily total darkness all the time, reveal a multitude of small fishes each equipped with an electric light. Without this light they would, of course, be unable to see at all at that great depth where the sunlight can never penetrate. The nets bring up a host of these small fishes, and in nearly every case they are equipped with the brightest eyes and little individual lanterns to light their way along the dark pathways of the deep.

No man knows just how the electricity for this light is produced.



Electric shocking organs of the Torpedo. One of Nature's mysteries.

Household Motor and Bottle Washer

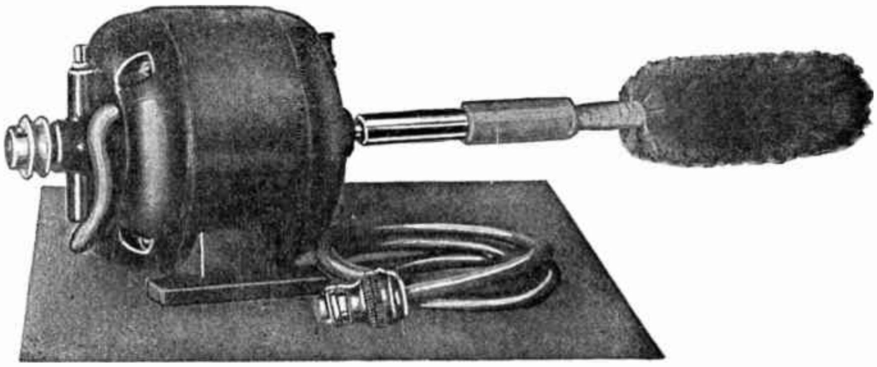
THE illustrations show a small motor for household use. As will be seen, there is connected to its shaft a brush for washing out milk bottles, Mason jars and the like. But, of course, by using various appliances, it can be adapted for different kinds of work.

One illustration shows the apparatus complete, while the second shows a rather interesting demonstration in which the motor with brush is immersed in an aquarium filled with water, in which it rotates. The action of the water on the filaments of the brush demonstrates its activity pictorially, because the reader will see how they are bent about by their rotation.

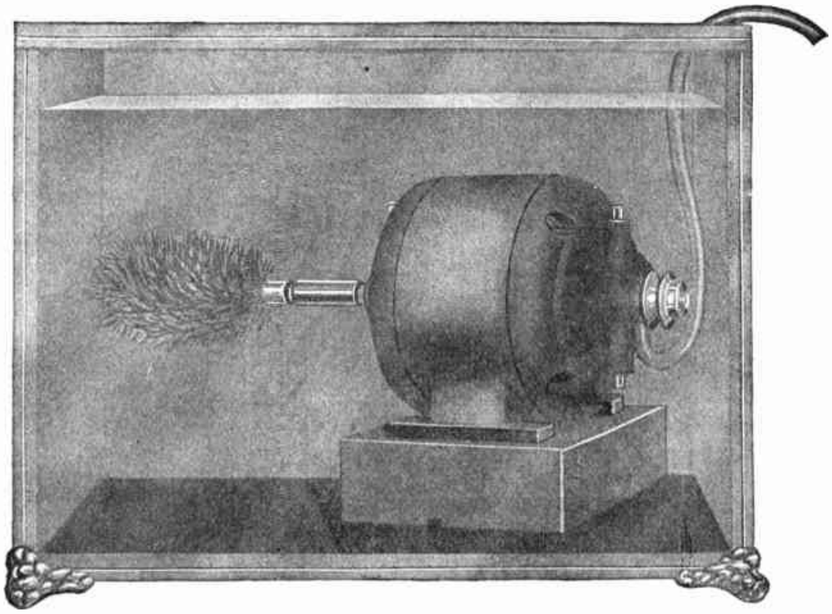
In using the apparatus for washing bottles and the like, the motor is mounted so that the brush will rotate over a tub or a sink. The bottle is filled about half full of water. The effect of the rapid rotation is to drive the water to the periphery of the brush by centrifugal force, so that as long as the motor is in action the water acts upon the interior of the bottle, giving absolutely positive cleaning. The process is much faster than hand work.

For small work a small motor is made. The larger one is a ⅛-horse-power capacity, so that it represents a consumption of power between that used by one and by two 16-watt lamps. The waterproof feature is rather interesting, as of course in cleaning bottles water will be everywhere present, and a motor not waterproof would be quite unavailable for such purposes.

Sometimes for the adequate cleaning of bottles a more severe treatment than that of simple water or even soap and water is required. An old system was to shake lead shot along with water in the bottle and it will be seen that this brush can have its action greatly reinforced by the use of such adjunct to its operations. Great care must be exercised if lead shot are used, to see that every particle is removed so that no poisonous lead salt can ever be produced. Sand, which is perfectly safe, could be used for extreme cases. Other things than bottles have to be cleaned and for knives, more or less flat articles, a wheel made of discs of cotton or canton flannel can be attached to the spindle. Other uses in the household for such an apparatus may be left to the fertile imagination of the housekeeper, who is becoming quite adept in electricity.



A motor carrying a horizontal brush, designed for washing milk bottles, preserve jars and the like. The apparatus is quite waterproof.



Demonstration of the waterproof quality of this motor, in which the whole apparatus is immersed in a tank of water and rotated therein at high speed.

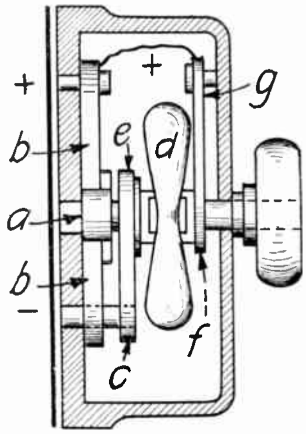
Slow Extinguishing Lamp

TO cause a light to remain bright for a short period after the switch is turned off, the following device, involving the principle of the sand-glass or hour-glass, is suggested by a correspondent of one of our contemporaries, *Die Umschau.*

Upon the shaft of a switch (a, b, b), of standard construction, a container of hour-glass shape is mounted. It is made of some insulating material such as glass, and is partly filled with metal filings, small steel balls or some finely divided conducting material. Terminals are soldered or cemented into and through the glass. These may be ends of copper wires. There is no question of air-tight sealing. If these ends are in electrical contact with each other they will connect (e, c) and (f, g) even if the switch is turned off. The filings normally lie in the lower part of the container (d) when the switch is open or closed.

Suppose the switch to be closed and current passing. If it is turned off through 180 degrees, the container will be reversed and the filings will close the gap between the wire ends, and current will continue to pass. But the filings keep passing down in a stream into the lower division of the container, and as they finally pass completely down, the circuit is opened and the current is cut off.

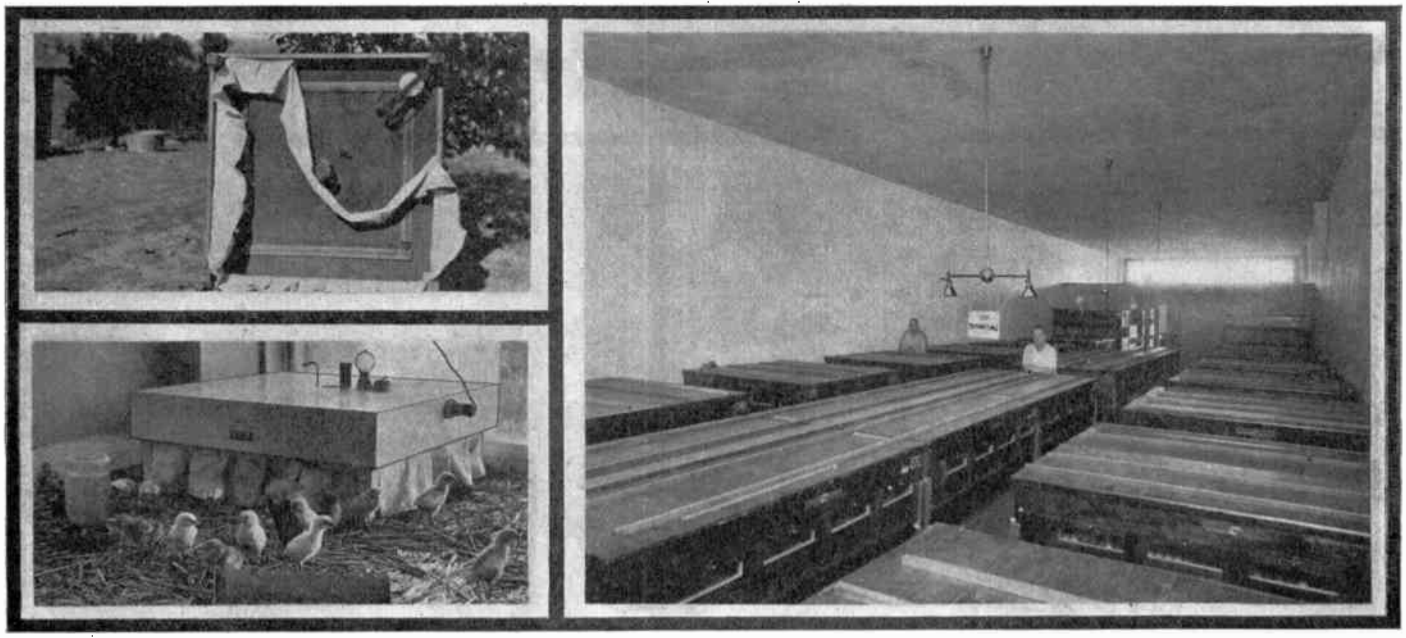
By varying the proportions of the container, the delay in action of the switch may be made long or short as desired.



Very ingenious slow-extinguishing lamp, operating on the principle of the well-known sand glass. The "sand" has, however, to be an electric conductor. Fine shot, carefully assorted steel filings, or the smallest size of steel ball may be used.

Electricity in Poultry Industry

By George Ballard Bowers and S. R. Winters



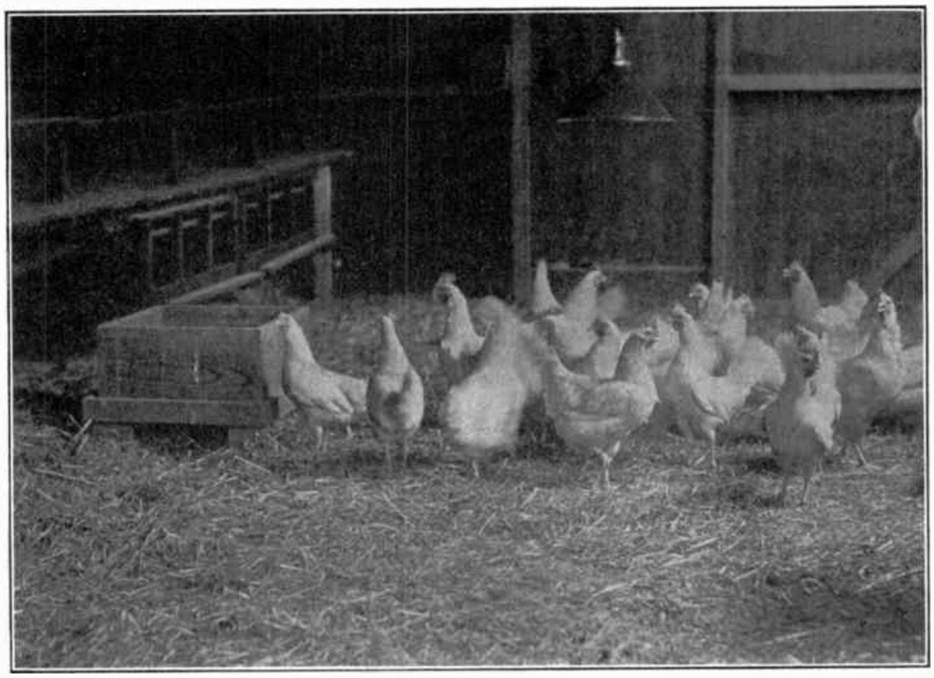
Electric poultry raising. Left, below is seen a brooder closed in with its curtains; left, above a brooder is raised on edge to show the interior. On the right are shown the great hatching incubators, operated by electricity like the brooder, putting the industry on a thoroughly electrical basis.

WHEREVER the poultry industry is engaged in as a livelihood, electricity has been found an indispensable aid. One reason for electricity being preferable in fuel systems is the reduced fire hazard.

Eggs are now most economically hatched in incubators heated by electricity. As a rule the large commercial hatcheries have incubators of 500-egg capacity, in order to eliminate the possibility of losing many eggs in case of accident to a regulator. The heat required to cause germination radiates from electrically heated coils over the eggs, controlled by an automatic thermostat. Incubators are opened daily to permit cooling and turning the eggs.

At intervals of a week the eggs are tested to determine their fertility or the vitality of the growing embryos. This operation is performed by means of a sort of periscope with an electric light within. The light rays penetrate the egg shell so as to disclose the interior, enabling the operator to determine at a glance which are the infertile eggs; those with dead germs are discarded. For this operation the eggs are not removed from the trays, as is necessary when "candled" by the old method. The entire tray is intersected in fifteen seconds. To forestall any interruption in the current the hatchery attendant has an alarm gong to warn him if the current fails, so repairs may be made, before the incubators have cooled.

Chicken eggs require three weeks to hatch. The baby chicks are not disturbed until they are at least 48 hours old, for it would be detrimental to give them either food or drink before that time has elapsed. As soon as the chicks are removed from the incubator, they are placed under an electrically heated brooder with an automatically regulated heat regulator such as that of the incubator.



View of the Federal Government's experimental chicken house, in which the effects of electric light on poultry products is being tried out.

Some rules follow, as examples of instruction for inexperienced attendants. A pilot light on top of the brooder lights only when the brooder is heated to 100 degrees F. To increase the heat the handle is turned to the right; to decrease, to the left.

A switch on top of the brooder turns on a light under the brooder. This light is to be used to entice the chicks under. When night begins to fall the chicks seek light, and when they are under the brooder the light is turned off. This interior light is useful for inspecting chicks at night.

The brooder is started at 100 degrees F. and after the second day cut down gradually a degree each day.

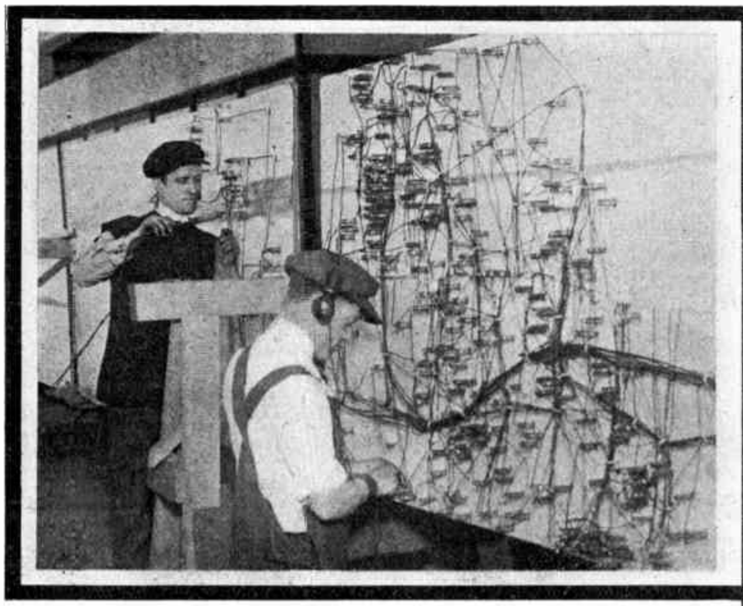
The brooder is blocked up an inch after the first week and thereafter as needed.

Before leaving the brooder at night the pilot light should be unscrewed a trifle so that its light will not disturb the chicks under the hover of the brooder.

Six weeks old chicks no longer require the brooder but are not yet through with electricity if winter is on. The pullets must be brought to maturity and laying as quickly as possible. To accomplish this end the young pullets are fed frequently. In the winter, the young hens neither grow rapidly nor are in a laying mood, so electric lights are installed in the hen house and yards. If the house and yard grows light suddenly at four A. M., electric light being turned on by a clock, the stupid hens think it is daybreak and leave the roost to search for food.

At Beltsville, Maryland, approximately a dozen miles from the White House—the Federal Government, Department of Agriculture, maintains a 60-acre experimental chicken farm, containing a flock of poultry varying in numbers from 4,000 to 4,500. Here, for the past two years, a flock of fifty pullets have had their waking hours extended by an electric light during the fall and winter months. These hens, responsive to this modern convenience, yield fifty dozen more eggs than the same number of pullets that went to roost and woke at normal hours. This increased contribution to the egg basket occurred during the first year of the experiment. In the course of the succeeding year the pullets in the electrically-lighted pen yielded sixty dozen more eggs than a like number of hens whose pen was unlighted electrically. The above lighting system was in operation from November 1 to March 20. One 75-watt incandescent electric light bulb hung in the pen where these fifty pullets roosted. It was operated two and one-half hours daily for 140 days.

New York's Electric Map



Above—Wiring up the great electric map of New York, which was seen and studied by so many at the Jubilee Exhibition of New York City.

Right—A lady electric welder, doing work of a type generally restricted to men; in our issue of January, 1923, will be found a very elaborate description of the art practiced by this representative of the trade.

A JUBILEE of the great metropolis of America was opened on the 26th of May of the present year, and a most interesting feature undoubtedly is an exposition of the work of the different city departments, now very numerous and very elaborately organized, and comprising relics of the past as well as present achievements. Statistical exhibits of all kinds of apparatus used by the scientists of the different departments, sample exhibits from the Metropolitan Museum of Art, the American Museum of Natural History, and the like, are included.

Above is shown the preparation of the great map, one of the most elaborate exhibits presented. This map is laid out on a scale of 400 feet to the inch, and the structure was designed by Thomas W. Rochester, E.E., one of the city engineers, and was built by the Croker Electric Company of this city.

There are a multiplicity of small-sized electric lights distributed over the surface of the map, which are turned on and off by a flasher, while at the side there is a directory of some thirty titles. When the directory shows Health Department, lights are turned on, one for each of the buildings, offices or laboratories of that department. When these are extinguished, another series of lights appear; if they are for the Police Department, they are green, and show the exact location of each station house and building under the police jurisdiction. A number of red lights are flashed on in their turn, indicating the multiplicity of buildings of the Fire Department. Each set of lights is turned on for a very short period to give the observer a conception of our municipal government.

Our illustration shows the wiring of the board by the electricians.

Electric Welder

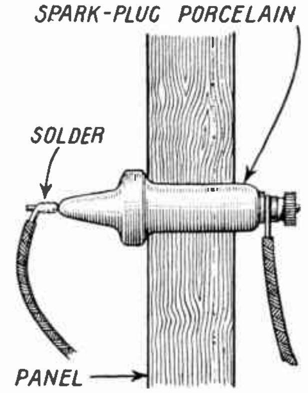
THE welder we refer to is neither a man nor a machine, but is a member of the weaker sex, who irrespective of equal rights and universal suffrage, has shown the good that is in her and her true ability by becoming one of the best electric welders in the country.

Some assert that she is perhaps the very best of all, and it is claimed that she is called upon for jobs, which men have refused to take as being too difficult or too dangerous.

This exemplary person did her first and foremost duty to the world when at about seventeen years of age she married. This was in Denmark, where her husband had a garage, and there she used to assist him and learned the mechanic's trade. Her husband died and she became a stewardess on an ocean liner, but eventually settled in America.

Availing herself of her knowledge of machinery, she obtained some kind of a machinist's position in the Erie Railroad shops, and very naturally became attracted to electric welding, with its great possibilities. She now devotes all her time to electric welding, and the photograph which we present is supposed to show her at work. The remuneration for this class of work is sometimes very high. In boiler work and the like very small manholes have to be passed through and apparently inaccessible places have to be got at, and there is no doubt that part of Mrs. Nelson's success is due to her ability in getting at such difficult places.

Spark Plug Core Insulator



Porcelain core from an old spark plug is used to provide a well insulated entrance for an electric wire to a house. It is also suggested that it may provide a useful form of binding post.

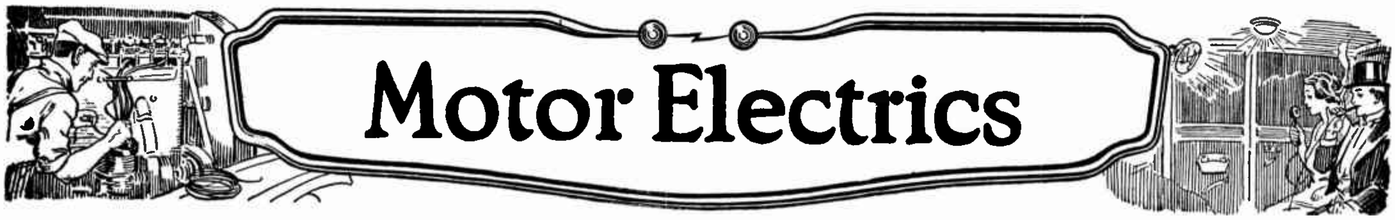
THE porcelain core of an old spark plug contains one of the electrodes running through its axis or center. This is the universal construction. Such may be used as an insulator or binding post.

When an electric lead-in comes through the frame of the window, or some other place, one of these plug cores makes not only a very neat looking job, but leaves an air-tight construction. It is much better practice than to have the wire come through the window glass, because this is a hindrance when raising the window.

These cores also make excellent binding posts, particularly for the amateur doing high voltage work.

To mount the core, drill a hole a trifle smaller than the neck of the core into the panel. Then force the core in and up to the shoulder. Solder the wire to the sparking end of the electrode, and use the other end as a binding post.

Contributed by RAYMOND CARLSON.



Motor Electrics

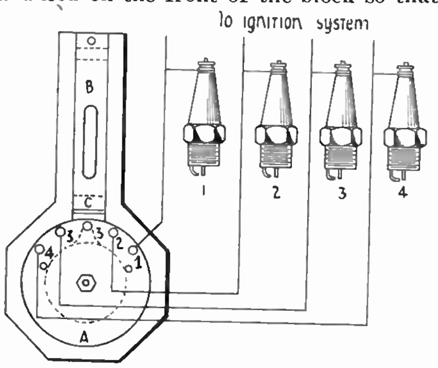
Spark Plug Tester

THIS spark plug tester, though simple in construction, will be found a handy instrument to have on the dashboard of any car.

A piece of wood 1 inch thick serves to mount the tester and selective switch upon. It can be cut in any desired shape or can be left square.

A hole (A) is drilled in the mounting block so that a spark plug tester of the Westinghouse type can be inserted therein. Next a hole is bored in the center of the lower circle of the board, with a bit having a radius of 1¾ inches. The edge of this hole should touch the bottom of hole (C) shown in the diagram.

A selective switch, 4, 6, 8 or 12 point, is mounted on the front of the block so that



A neon or similar type of spark plug tester is mounted so as to be thrown into circuit with any desired plug to test its condition.

its center will come at the center of the large hole in the rear of the mounting block.

The diagram shows the wiring of the tester very plainly. The switch is placed on the point connected to a plug and the tester indicates whether the plug is in good condition and if it is connected.

Contributed by HOWARD E. EARL.

Silent Auto Alarm

By PHILIPPE A. JUDD

THE alarm herein described operates on the principle of the effect of a colored light upon a complementary color, and though the thief is unaware of the fact, it indicates to any observer that the car is stolen property.

The device consists of a metal reflector (1) (Fig. 4), on the front of which a frame (3) is hinged at (8). Two lamp receptacles (7) are mounted on the reflector.

The frame carries a glass plate (5) of the same dimensions as the license plate. The window thus formed is painted on the outside (Fig. 1), in duplication of the license plate, using a semi-opaque white for a background (A) and a transparent red for the figures (B). On the inside (Fig. 2) the letters "Stolen" (C) are painted with a transparent blue. The letters must be reversed so that they may be read from the outside. A piece of stiff spring wire is bent so that it will hold the glass in the frame (4) (Fig. 4).

A bolt (6) is soldered to the reflector to hold the door closed. The two lamps (2), only one being shown, one blue and one red, are placed in the receptacles (7). (They may be dipped in the paint used on the glass window.)

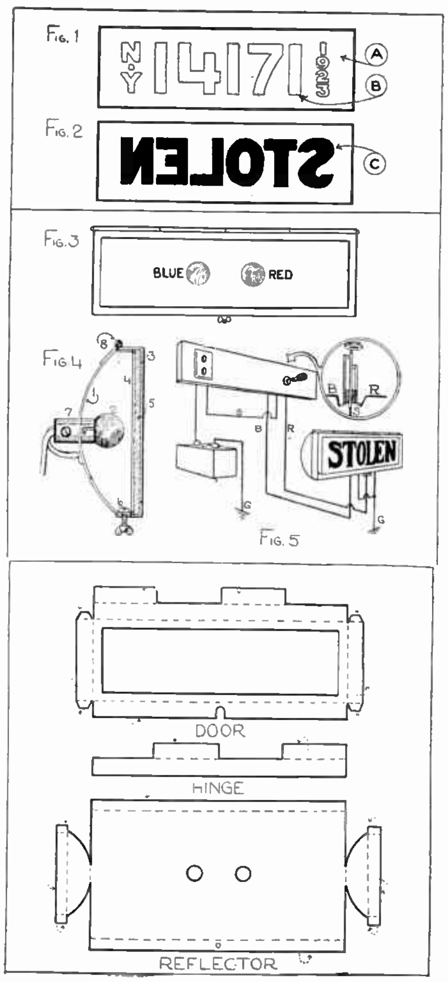
After painting the outside of the box to harmonize with the car, it is mounted in the place formerly occupied by the rear license plate.

One lead (G) (Fig. 5) from each lamp is grounded through the body of the car to the battery; the other two wires (R and B) are connected to a three-spring jack mounted on the dashboard. The third wire (S) from the jack completes the circuit to the battery through the ignition switch, lamp switch, or both. A thermo-flasher may be placed in the red lamp circuit, so that it will attract more attention by flashing intermittently.

When the car is in use the plug is inserted in the jack, thus lighting the blue lamp and causing the license to appear as black figures on a blue field.

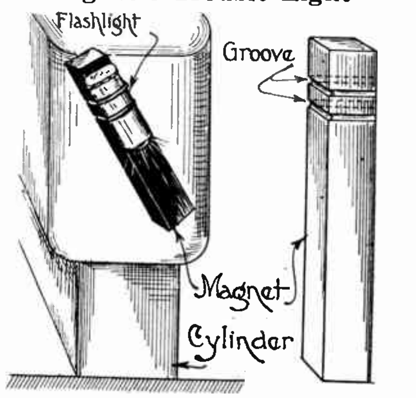
The plug is removed upon leaving the car, so that the would-be thief, upon closing the ignition or lamp switch, completes the circuit through the red lamp. The background becomes red; the red license numbers, being invisible on a red field, disappear, their place being taken by the word "Stolen" in large black letters.

Fig. 6 illustrates how the reflector and door are constructed. All joints should be soldered.



The general effect, the details of wiring and connections, and the lay-out of the case for a theft-preventive appliance for motor cars.

Magnetic Trouble Light



A bar-magnet carries a flashlight, battery and case so that it can be attached to any iron or steel part of an automobile to light up operations in the dark.

A TROUBLE lamp for use around an automobile is a practical necessity and its usefulness is increased by having an electromagnet attached to its base so that the lamp can be attached by magnetic attraction to any iron part of the car. This allows freedom of both hands for repairing. The usual fault encountered with a trouble lamp of this type is the long electric cord necessary, as considerable time is wasted in coiling and uncoiling the cord; this is especially annoying when the trouble happens to be only a loose nut to be tightened or other simple repairs.

The trouble lamp described in this article will not give as much light as the regular trouble lamp, but for illuminating close places is perfect. It is made by cutting two narrow slots, two or three inches apart, across a strong four or five inch bar magnet. To the bar magnet attach a very small flashlight by wrapping two short pieces of wire around both; the wires must lie in the slots, which are cut on the side of the magnet opposite the flashlight, so that the surface on that side will be smooth.

To use, lay the smooth side of the magnet against the iron parts of the car, directing the light where needed. The magnetism in a new bar magnet should be serviceable for several months, and then it can be remagnetized very easily. The flashlight, preferably, should be on the order of a fountain pen flashlight.

Another method of fastening the flashlight to the bar magnet is to use a springy U-shaped clamp which will allow the flashlight to be removed easily.

Contributed by H. P. CLAY.

Experimental Electrics

Thermic Telephones

THE experiments of Preece and Forbes have long ago proved that in changing the temperature of incandescent bodies, particularly of metallic wires, it is possible to produce

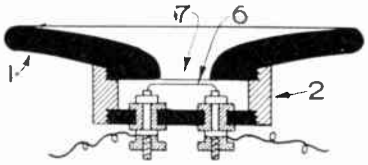


Fig. 1. A straight wire thermic telephone with outside ear-piece.

telephonic and microphonic effects in synchronism with acoustic vibrations; yet it is only lately that practical apparatus utilizing this phenomenon has been invented and constructed.

As the forerunner of modern apparatus, we may take the thermic telephone, invented by Abraham and Carpentier in

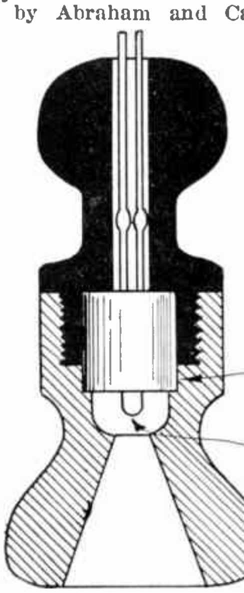


Fig. 2. Looped wire thermic telephone for the aural canal.

1907 (Fig. 1). The ear cap of ebonite (1), with an opening (7), which may be closed if desired by a membrane, is fastened to a metallic case (2), whose interior surface is nickel- or gold-plated. Two rods, insulated from the case and to

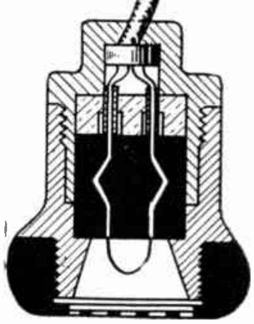


Fig. 3. A modification of the above, showing how the wires are secured.

which are connected the telephone lines, are connected within the case by an exteremely thin wire (6), which is called a Wollaston wire, or by a strip of gold leaf. To make a Wollaston wire a very thin wire of platinum is thickly silver-plated; this is drawn until extremely thin, and then the silver cylinder or coating is dissolved with nitric acid and disappears, leaving only the platinum core so thin as to be almost invisible.

The Wollaston wire (6), in alternately heating and cooling, communicates to the air or gas enclosed in the apparatus energy due to the speaking currents which pass through it; variations in the pressure of the gas are produced, and these variations are received by the ear as sounds.

These variations are due to the Joule effect, which is proportionate to the square of the intensity of the telephonic current. That is to say, at the crest of every wave, whether positive or negative, a sudden change in pressure of the air or of the gas is initiated. Assuming that every sound wave has two crests, one positive and one negative, it follows that the ther-

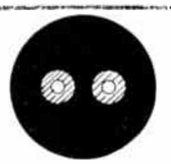


Fig. 5A. Section of Fig. 5, showing the wires surrounded by insulation.

mic receiver does not reproduce the voice of the original pitch, but an octave higher. There would be still a further inconvenience—the temperature produced varying with the square of the intensity, the more

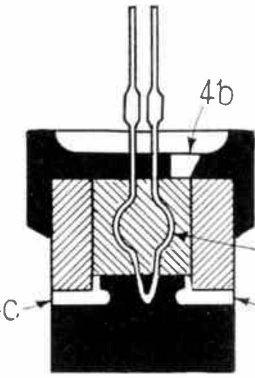
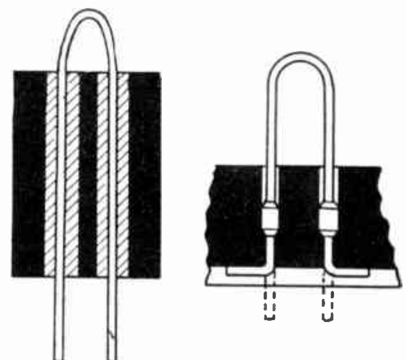


Fig. 4. The structure of the thermic telephone, showing the bends (3) which hold the wire in place.

intense currents would be emphasized over the feebler ones, outside of the repetition of simple sounds (vowels); consequently the different parts of a word would not be equally well produced.

To overcome these two troubles, it is necessary to pass through the thermic



Figs. 5 and 6. Two simple constructions of the thermic telephone, one using insulation.

receiver a constant current on which will be superimposed the speaking current. Here we find something analogous to the permanent magnet of an ordinary receiver. The arrangement is the following: A large storage battery produces a constant current whose circuit is connected to the terminals of the thermic telephone and which current keeps the wire incandescent; the transformer coil superimposes the speaking current upon the constant current.

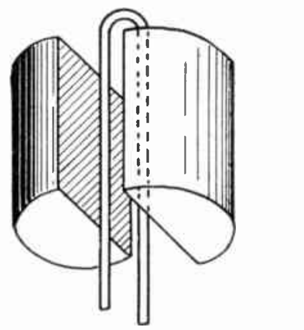


Fig. 7. The clamp method of constructing the telephone.

The cap (1) is dispensed with in another model of this apparatus, which is designed to be introduced into the auditory canal. The thermic telephone which we have described possesses all the essential organs; it is the foundation of all later developments.

The German patent No. 242,831, of October 31, 1909, describes the making of the Wollaston wire in the form of a set of loops. For this construction to be possible with such extremely fine wire, its final form must be given to it before treating it with acid; then there must be applied to its terminals or ends an insulating material not attacked by acids, which will protect the two extremities of the wire and leave the active loops unprotected for stripping in the acid.

Fig. 2 shows a thermic receiver made to be introduced into the auditory canal; the thermic wire (6) projects from the insulating piece (5); the wire is connected

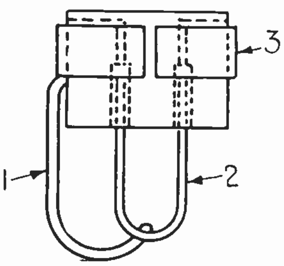


Fig. 8. How the loop can be supported at its center.

to the line wires by contact rods, as shown in Fig. 3. Fig. 4 shows the matrix used to make the insulating piece (5). The wire is shaped into the loop-form by means of pliers or otherwise; it is bent slightly, as is shown in Fig. 4 at (3), so that the wire can be more solidly held in place in the block. The wire is then placed in the matrix and the melted insulator is poured in by the opening (4*b*) of Fig. 4. (4*c*, 4*c*) are air vents; when cooled the block is taken out of the mould and the loop of wire is stripped by placing it in nitric acid. Following this process, it is clear that interchangeable parts can be constructed having the same length

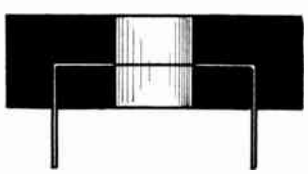


Fig. 9. A very simple construction this time, using a straight wire.

as the thermic wire. Fig. 5 from the patent 247,910 is a variation on the preceding system; the wire passes through two holes drilled through the block, which are afterwards filled with the melted insulator. Fig. 6 shows another method, patent 309,415: The wires and their prolongations are so placed as to retain themselves in the holes in the block. Fig. 7 (patent 247,911) shows how the wire can be placed between two half blocks, which

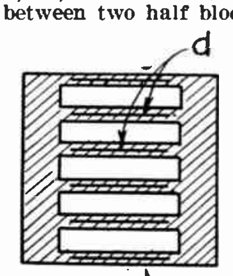
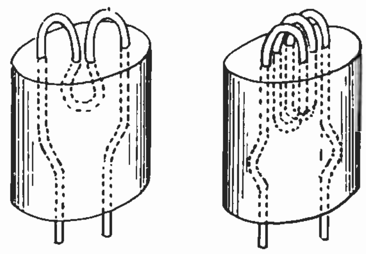


Fig. 10. Another departure, using a number of straight wires, side by side.

are then forced together and held in place by means of a collar.

When the thread is withdrawn from the nitric acid, great care is necessary to avoid bending or twisting under the effect of the drops of liquid adhering to it. According to patent 316,402, January 17, 1918, the nitric acid must be contained in a recipient, so that the level of the liquid can be lowered after stripping, and the wire emerges without disturbances; evaporation removes the last trace of acid from the filament; aspiration or any equivalent method can be used in addition for removing the last traces of acid.



Figs. 11 and 12. Examples of multiple loop construction, the loops being in series.

Danger of deterioration of the wire loops is still further reduced if instead of using liquid acid, the vapor of nitric acid is employed (patent 296,134).

Finally, Fig. 8 (patent 342,902), a supporting arrangement (1) for the wire (2) can be used; before stripping, it is secured to the block by a collar (3). This keeps the wire rigid during the operation; when this is finished the supporting arrangement is carefully removed.

In Fig. 9 is shown another type of Wollaston wire (patent 245,897) with a support, which can be used in such apparatus as is not designed to be introduced into the auditory canal.

According to patent 254,274, there are

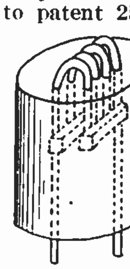


Fig. 13. Multiple loop construction with the loops in parallel.

other processes than the Wollaston system; such are electrolytic methods of making the thermic wire. A metallic plate of copper of proper form, as shown in Fig. 10, is covered with an insulating coating which is removed at the points (*d*), which later receive the thermic wire; consequently in these points the metal is bare and can receive an electrolytic deposit of platinum. Finally, the plate is surrounded by an insulating covering which only leaves exposed the parts which are to be attacked by the acid. The whole arrangement is placed in nitric acid,

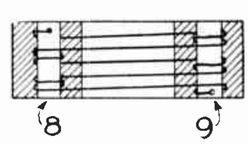


Fig. 14. The thermic wires are here supported by little cylinders of insulating material.

which dissolves the metal hitherto employed as a support, and the thin wires electrically formed are left. This process can be expected to give thermic wires of rigidly identical structure.

For mechanical reasons the thermic wires have to be rather short—they have to be very thin to do their work properly—because the stirrup-shaped wire, fragile as it is, could easily break or buckle, especially if the receiver is handled carelessly. On the other hand, for the hearing or reception to be satisfactory, it is necessary that the surface of the wire to be heated is not too small. This delicate problem receives various solutions; sometimes by one or another process the wire is supported which otherwise would be too long to sustain its weight; or again several short wires in parallel or in series may be used, or a combination of both methods.

Patent 247,152 describes a grouping in one block of several of the wires, connected either in series (Figs. 11 and 12) or in parallel (Fig. 13). Patents 247,912 (Fig. 14) and 247,914 (Fig. 15) describe another mounting of thermic wires. Supporting cylinders (8 and 9) of Fig. 14 supply the contacts effecting the connection with the telephonic circuit. In patent 247,913 enameled rods are used to

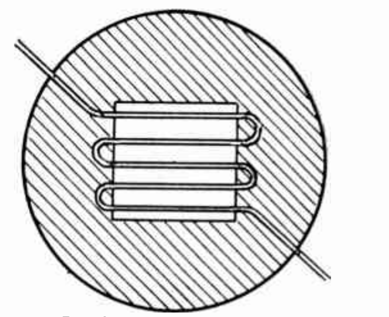
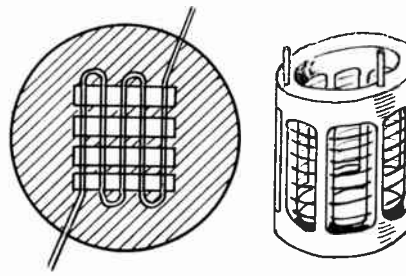


Fig. 15. In this construction the wires are brought close together to reinforce the action.

carry the wires, whose insulating surface makes it possible to mount the individual wires in series. To get a due number of these in a very small space, it is important to bring them close together, and to be certain that they do not touch each other when expanded by heat. This is why it is good practice to support the wires by means of several transverse supports; Figs. 16 and 17 are taken out of patent 249,192 which describes this sys-



Figs. 16 and 17. Here, again ,the wires are brought close together, but are supported by insulating material at their intermediate points.

tem and others of the same kind. Fig. 18 from patent 283,703 describes the variation on the systems described in the previous patent. Here the wires are attached to the insulating block (1), and in the middle are soldered to a junction bar (8). This construction should be easy to carry out. In patent 259,961 the thermic wire which has the form of a ring, is carried by two little wires or bus-bars which connect alternately with one or the other,

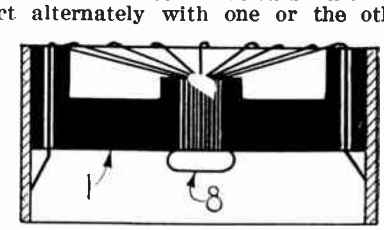


Fig. 18. A radial construction quite different from any of the others shown.

of the two bars, separated by an insulating substance. The current enters and leaves by these wires.*

(Concluded in November issue.)

*On receipt of stamped envelope we will send the name of manufacturers of Wollaston wire.

Storage Battery for Demonstrations

By Francis G. Le Merle

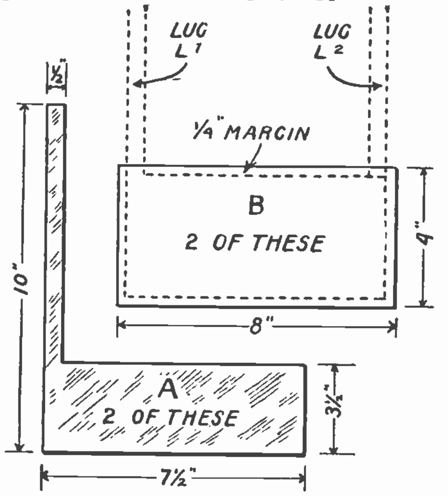
THE storage battery is really a wonderful piece of apparatus when one realizes how many chemical changes occur during the charge and discharge of a lead sulphuric acid cell.

The exact nature of these chemical changes is not yet fully established, but it has been conclusively shown that sulphate of lead (Pb SO4) enters largely into the composition of the once active material on both elements in a discharged lead cell.

Lead storage cells fall into two classes; those in which the active material is formed from the substance of the element itself, either by direct chemical or electro-chemical action, and those in which the chemical formation is accelerated by applying some easily reducible compound of lead to the elements in the form of a paste.

Elements that have the active material formed out of the elements themselves are known as the "Planté" type, and those that have an easily reducible lead compound applied to the elements in the form of a paste are known as the "Faure" or pasted type, Messrs. Planté and Faure being the respective inventors of the two different types of elements.

The illustrations show a very easily constructed storage cell of the "Planté" type which was made by the author and which will show the chemical changes made while the cell is being charged. This particular cell was made up with two pieces of thin lead foil, separated by two pieces of blotting paper, all of which were rolled up and placed in a small glass bottle as shown; it was charged at one-quarter of an ampere for ten minutes and the foil plate that was connected to the positive charging lead or terminal of the charging board was seen to turn a dark chocolate color, while the negative foil plate assumed a slate-gray appearance.



Patterns of the plates and separators, with dimensions, as required for the construction of the Plante battery.

Chemical analysis has shown that the surfaces of the elements in a new and fully charged storage cell of the "Planté" type consist of nearly pure peroxide of lead ($Pb\ O_2$) on the positive plate and spongy gray metallic lead (Pb) on the negative plate. During the discharge, or if the cell is allowed to remain at rest, the sulphuric acid ($H_2\ SO_4$) in the solution enters into combination with the peroxide of lead and the spongy gray metallic lead and partially converts them into lead sulphate. The acid being continually abstracted from the electrolyte as the discharge proceeds, the density of the solution becomes less. This is termed sulphating when it is of injurious degree.

In the charging operation the action is reversed, as the reducible sulphates of lead which have previously been formed are apparently decomposed, the acids being returned to the electrolyte, and therefore causing an increase in its density.

This peculiar alteration or change in the density of the electrolyte enables us to

Complete Plante storage battery set up; one which can be made by the amateur and which will give excellent results for the lighter class of work.

ascertain at any time the state of charge or discharge and the general condition of the cell by simply finding the density or specific gravity of the liquid, which is accomplished by the use of an instrument known as a hydrometer.

The illustrations show the elements and give the dimensions for constructing a cell of this kind. (A) being one of the two lead foil plates and (B) one of the two blotters used to separate the plates, the dotted outline shows the position the two plates will occupy in respect to the two blotters before they are rolled up and held in position by the rubber band as shown in the view of the complete cell. In assembling the element a blotter is laid down and one of the foil plates is laid upon same as shown by the dotted lines with the lug (L_1) to the left; then the other blotter and on top of this the other plate with the lug (L_2) to the right; they are then rolled up and held in position by a rubber band; the element is then placed in the glass jar or bottle and dilute sulphuric acid is added to just cover the plates or element about one-quarter inch with the foil lugs hanging over the sides; the specific gravity of the acid to be 1,300, which can be ascertained by measurement with the hydrometer after the acid has been slowly poured into the water in sufficient quantity to bring the specific gravity nearly up to 1,300. As quite an appreciable amount of heat is generated while mixing the acid with the water the solution should be allowed to completely cool before finally testing the specific gravity and putting the elements in the cell.

The cell is now ready for charging and after charging for ten minutes at one-quarter ampere, as did the author, take out the elements and take same apart. The chocolate colored element, which is the positive one, is coated with nearly pure peroxide of lead, as chemical analysis will show. The other element, which is the negative one, will prove to be coated with pure metallic spongy gray lead. Replace the elements and charge again for ten minutes, disconnect and then connect a small flashlight bulb of two volts to same as shown, and it will be seen to light up, which shows that a chemical action of some kind is going on in the battery which is thus causing a current of electricity to flow and light up the lamp. This chemical action is really the reverse of that which took place while the cell was charging.

The main object in constructing a cell of this kind is to enable one to get a large amount of plate area in as small a space as possible, as the larger the area of the plates the greater the ampere-hour capacity, and, further, the more the battery is charged and discharged the more the capacity will increase. Reversing the charging leads to the battery every time the battery is charged for about 25 times will materially increase the ampere-hour capacity or form the plates, after which the battery terminals are marked positive and negative and the charging leads connected accordingly for each and every charge thereafter.

The reason for this reversal of the charging leads is that there seems to be a greater amount of spongy gray lead and lead peroxide formed in a given time; that is, the chemical action seems to penetrate deeper into the plates, because the lead oxide on the positive plate after the cell has been discharged is changed into spongy gray lead on the next charge after the charging leads have been reversed, while the spongy gray lead is changed into peroxide of lead, and so on with each of the charges and reversal of the charging leads.

This method of reversing the charging leads every time the battery is charged is known as forming the plates and is only used on cells that are of the "Planté" type, but never on the "Faure" or pasted type. The charging leads are always connected to the same polarity of the battery as they are themselves in charging the pasted or "Faure" type of battery.

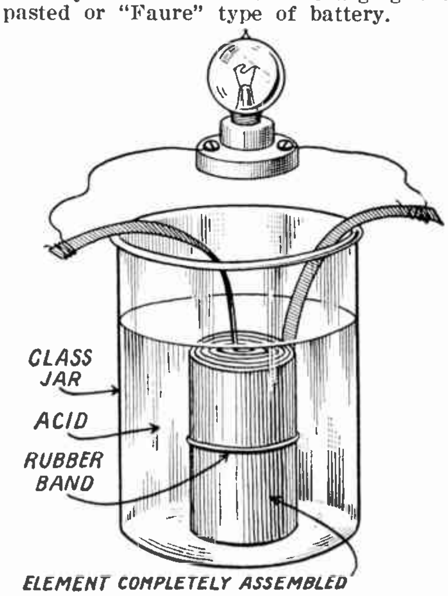
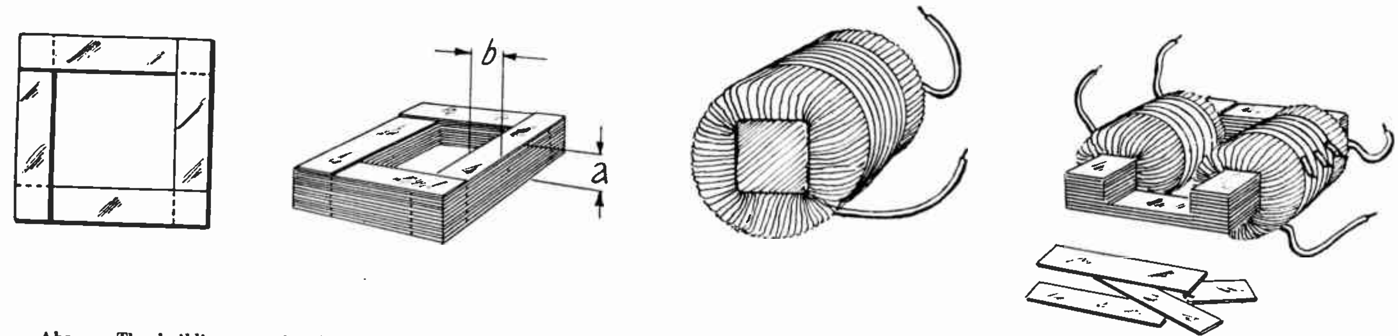


Diagram of assembly of the Plante cell, showing spiral construction of the plates. Note the rubber band for holding them together.

Any suitable source of direct current will do to charge these cells. A 23-watt lamp in series with a 110-volt direct current main, or a rectifier if the mains supply alternating current, and then a suitable resistance or lamp in series with the direct current side of the rectifier to limit the current to about one-quarter of an ampere; or if only one cell is to be charged, two standard dry cells in series can be used by connecting them directly to the cell.

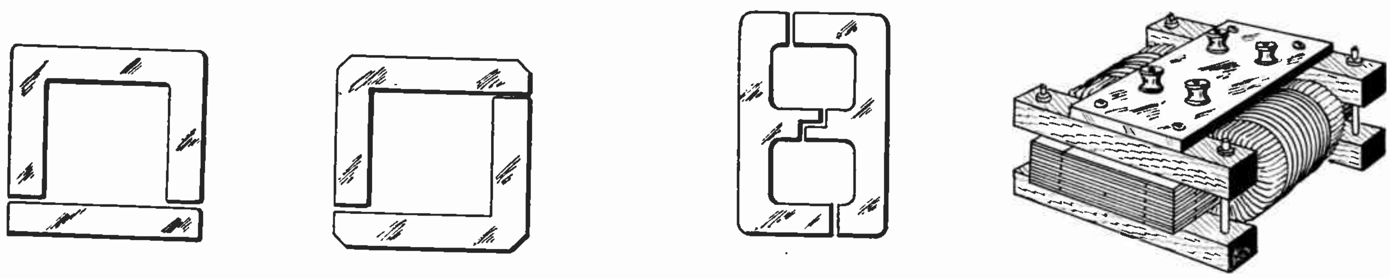
Small Transformers

By Clyde J. Fitch



Above.—The building up of a laminated core out of straight pieces of iron, the simplest possible construction practicable; winding the coil on a wooden core; mounting the parts. The straight strips of iron are passed into the square opening the coil.

Below.—Other designs of laminated cores for a similar coil, which are somewhat more secure; final clamping of the completed core illustrated.



HARDLY a day passes that does not bring forth an inquiry regarding the construction and design of small transformers capable of stepping down 110 volts to 6, 8, 10 volts, etc. Should our staff attempt to answer all of these queries, we would be kept busy designing small transformers, and the How AND WHY department would be flooded with transformer data.

For this reason we give a very simple method for calculating the number of turns, size of core, etc., of small transformers up to 500 watts capacity, to be used on 60 cycle circuits. By this method any one with a knowledge of multiplication and division can calculate transformers of various sizes. The transformers so designed will be in accordance with standard engineering practice and will have an efficiency of from 80 to 90 per cent. No complicated formulas will be given for calculating the efficiency, as only small transformers will be considered, for which the losses, from a financial point of view, are negligible.

In the first place it is well to keep in mind that the wattage of a transformer has nothing to do with the number of turns of wire in either the primary or secondary coils and the cross-sectional area of the core. In other words, the coils would have the same number of turns, and the core would have the same cross-sectional area whether the transformer was designed for 3 watts or for 3000 watts. It is only the size of the wire that determines the wattage of the transformer. Therefore if we determine the size of the core and the number of turns in the coils, we can make the transformer good for any wattage by choosing the correct sizes of wire.

The core of the transformer should be made up of a good grade of silicon steel laminations, which may be purchased in thicknesses of about .014 inches. Ordinary stove pipe iron may be used, however, and will give good results. The difficulty in using stove pipe iron is that the laminations must be cut out by hand with a hand shears, or cold chisel, which is a tedious job, whereas the silicon steel laminations may be purchased already punched out to the desired size.

First the cross-sectional area of the core must be determined, as this is the element of the transformer whereby we will calculate the number of turns. The cross-sectional area of the core is the width of the laminations multiplied by the height to which they are stacked. It is the distance "a" times the distance "b" in the figure. We can choose any value we wish for these dimensions to start with. The dimensions should preferably suit the size of the steel laminations available. For example, suppose we choose a core having a square cross-sectional area of 1¼ inches by 1¼ inches, or 1.5625 square inches. A core of square cross-section is preferable to one of oblong and rectangular cross-section, as the length of wire in the coils for the same number of turns is less.

Now that we have decided on the cross-sectional area of the core, or 1.5625 square inches, we can determine by means of the curve the number of turns required in the coils. The core areas are marked off at the bottom of the graph. At the point 1.5625, we draw a vertical line to intersect the curve, which point is indicated at "a" in the figure. From "a" we draw a line horizontally to the left, where we find the number of turns required for a 1 volt winding, which is 4.81 turns.

We desire a transformer having one 110 volt coil for the primary, so that the required number of turns in the 110 volt coil will be 110 times the number of turns required in a 1 volt coil. This gives 110 times 4.81 or 530 turns. If the primary voltage is of any other value, say 115 or 130 volts, simply multiply that value by 4.81 and the product will be the correct number of turns.

Suppose we want a 16 volt secondary winding; multiply 16 by 4.81 and we have the correct number of turns for the 16 volt secondary, which is 77 turns. By this method we can determine the correct number of turns for any secondary voltage by simply multiplying the desired voltage by 4.81. This number, 4.81, is, of course, the turns required for a 1 volt winding on a core having a cross-sectional area of 1.5625 square inches. The number of turns for a 1 volt winding on a core of a different cross-section may be obtained from the curve. If we desire to have a tap on the 16 volt secondary winding to obtain say 5 volts, multiply 5 by 4.81, which is 24. Then a tap on the 24th turn will deliver 5 volts.

For all practical purposes the core sizes within the limits of the curve may be used. The experimenter would do well to select two or three different sizes of core areas and then find the number of turns required for the various cores. In this way he can probably select a combination of core and wire that will suit the material on hand. Of course the larger the core is the less wire is required, and the cost of the transformer will be less. The disadvantage of using a large core is that the over-all dimensions and weight of the finished transformer will be greater than those of a transformer employing a smaller core and more wire.

Now we have the cross-sectional area of the core, which is 1¼ by 1¼ inches or 1.5625 square inches; the number of turns for a 110 volt primary, which is 530 turns, and the number of turns for the 16 volt secondary, or 77 turns. Next we must choose the capacity of wattage of the transformer, from which we can determine the size of wire from the wire table below. More extensive wire tables can be found in electrical handbooks.

Suppose, for example, we wish the transformer to have a capacity of 150 watts. The current or amperes flowing through each coil when the transformer is operating at full capacity will be the number of watts divided by the voltage of the coil. Therefore the 110 volt primary coil will have a current of 150 divided by 110, or 1.37 amperes. From the wire table we find that No. 16 B. & S. wire will safely carry 2 amperes, which is a good size for the wire of the primary coil, as it is better to use too large a wire than too small a one.

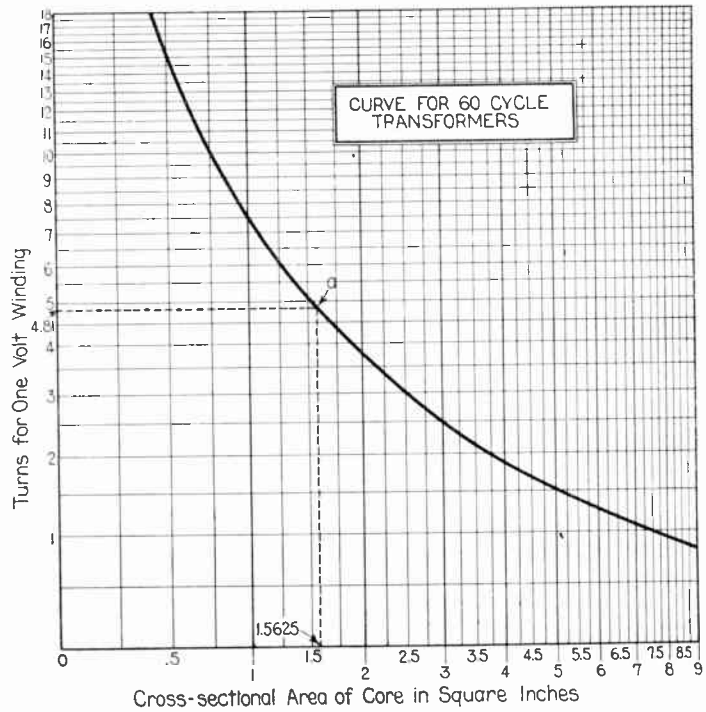
In the 16 volt secondary coil the current will be 150 divided by 16 or 9.4 amperes. From the table we find that No. 8 B. & S.

wire will carry 12.9 amperes, so we will use No. 8 for the 16 volt secondary winding. If we wish the 5 volt tap, we should be able to withdraw 150 divided by 5 or 22 amperes, so that the first 24 turns of the 16 volt winding should be of No. 5 B. & S. wire, which is good for 26 amperes. Either enamel and cotton, or double cotton covered copper wire should be used for all of the above windings.

Now that we know the number of turns and the size of wire in the coils, we can calculate the space occupied by the finished coils, and then determine the opening or window in the iron core. Knowing this, we can calculate the size of the steel laminations.

From the wire table we find that No. 16 D. C. C. wire winds 16.35 turns per inch. If we make the primary coil 2 inches long, we can wind 33 turns per layer, and 16 layers will give us the required 530 turns. The secondary coil can be calculated in the same way. By making a square window in the core, 2½ inches by 2½ inches, we will have ample room for the coils, and all of the punchings will be of the same size, or 1¼ by 3¾ inches.

The average length of each turn on the primary coil is nearly a foot, so that we will require about 500 feet of wire. From the table we find that there are 127.9 feet per pound, so that 4 pounds of wire will be sufficient. The amount of wire required for the secondary coils can be calculated in the same way.



The illustrations show very clearly the construction of the transformer. The coils are to be wound on a wooden form, 1½ inches square, and then, after removing the form, they should be bound with white cotton tape and impregnated with shellac. Three sides of the core are built up first and the coils placed on the core legs as shown, after which the fourth leg is built up and the core is clamped. Connections are brought out to the terminals on the terminal board as shown.

Although the transformer may be made more compact by winding the primary coil directly over the secondary coil so that both windings will be placed on the same leg of the core, the coils are more accessible when placed on opposite legs, which is of advantage if any changes are to be made in the windings.

Those who wish to design transformers for different frequencies may use the following formula, from which the curve was obtained:

$$T = \frac{E \times 100,000,000}{4.44 \times A \times f \times F}$$

where T = turns in coil
E = voltage of coil (for plotting the curve E was taken as 1).
A = cross-sectional area of core in square inches.
f = frequency in cycles per second of circuit.
F = magnetic flux in lines per square inch in the core. This varies from 30,000 to 60,000 lines with different grades of iron. For plotting the curve 50,000 lines per square inch was taken.

WIRE TABLE

Size B. & S. Gauge	Ampere Carrying Capacity	Turns per Inch D.C.C.	Feet per Pound
0	82	2.65	3.13
1	65	2.99	3.947
2	52	3.36	4.977
3	41	3.80	6.276
4	32	4.28	7.914
5	26	4.83	9.980
6	20	5.44	12.58
7	16	6.08	15.87
8	12	6.80	20.01
10	8	8.51	31.82
12	5	10.60	50.59
14	3	13.10	80.44
16	2	16.35	127.9
18	1.2	19.50	203.4
20	.8	23	323.4
22	.5	28	514.2
24	.3	33	817.7
26	.19	39	1,300
28	.125	45	2,067
30	.0789	57	3,287
32	.0496	60	5,227
34	.0312	68	8,310
36	.01964	78	13,210
38	.01235	89	21,010
40	.007766	102	33,410

Repairman's Test Panel

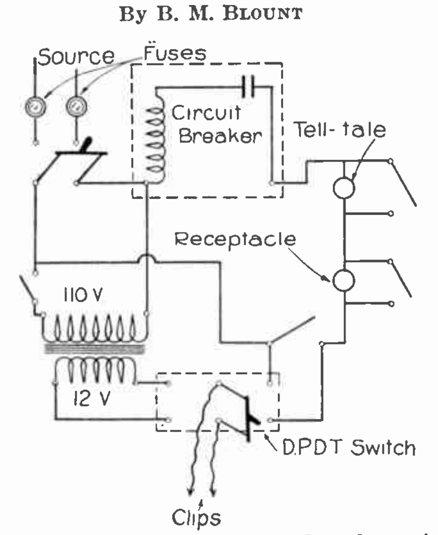
By B. M. Blount

THE test panel described in this article is the outgrowth of several years of experiment and use in the shop of an electrical contractor-dealer.

A panel of wood or other non-conducting material about 16 by 20 inches is secured. The layout may be arranged to suit individual tastes and conditions, and either concealed or exposed wiring may be used—the former is neater, but the latter is easier to trace out, especially until the repair man becomes accustomed to using the test board. In the upper left corner is mounted a 30-ampere fused double-pole knife switch, such as are used for entrance switches.

At the right edge of the panel and about six inches from the top is mounted a small 10-watt test lamp or telltale. A few inches below is mounted a receptacle, which should be able to take attachment plugs of three classes—standard medium screw (Edison), parallel blades and tandem blades. Near the lower edge of the board are the test clips. These clips are on flexible cords about 3 or 4 feet long, and arranged so that the cords are pulled back behind the board by weighted pulleys.

The reader will note from the diagram that the circuit breaker, telltale, receptacle and test clips are all in series, and that each device except the circuit breaker is arranged to be short-circuited by a single-pole switch. When these three switches are all closed a "dead short" is formed; this should be avoided, but will cause no damage, as the house circuit is protected.



Complete plan of the circuit used on the repairman's test panel described in the article, one whose freedom from complication makes it particularly useful.

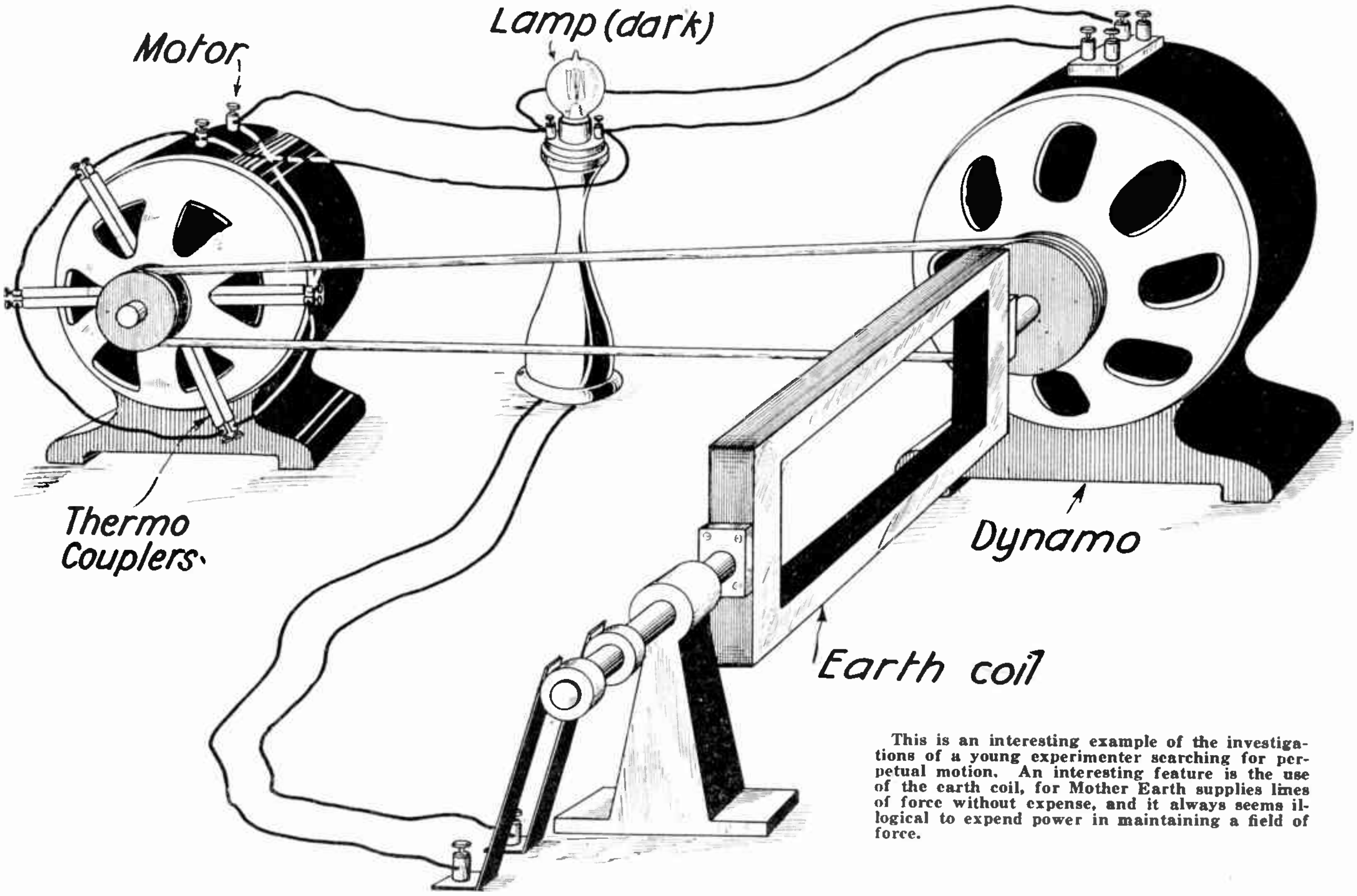
A recent flood of repair work on toy electric trains accounts for the addition of the small bell-ringing transformer, and the double-pole double-throw switch enables the tester to use the same test leads for either 110 volts or 12 volts. The primary of the transformer may be connected directly to the main feeder switch, or may carry a switch in its leads if desired.

With this test panel an appliance may be tested for open or short circuit either with its cord and attachment plug or with the test clips, by opening or closing the proper by-pass switches. The appliance can then be tested under load by merely closing the by-pass switch to the telltale. Should the appliance be short circuited, the circuit breaker saves the main fuses, and since the cost is less than 20 cents' worth of new material, each time it "blows" half its cost is saved.

The solenoid has about 90 turns of No. 18 D. C. C. annunciator wire, wound on a piece of one-inch diameter brass tubing about 3½ inches long, whose ends were first split with a number of parallel cuts and spread to form a spool. The two levers are of ¼-inch brass rod, the springs from an old snap switch, the reset handle being a machine screw with a composition nut from a binding post. The armature is a piece of ⅝-inch square-head bolt, one side of the head being drilled and tapped to form a pivot where it fastens to the trigger lever. Since there is no dash-pot, the action of the breaker is instantaneous. The contacts are of sheet copper and have a tendency to arc and pit, but not enough to warrant making carbon contacts. The whole breaker is mounted on an old slat switch base.

Perpetual Motion?!!

By H. Gernsback
Member American Physical Society



This is an interesting example of the investigations of a young experimenter searching for perpetual motion. An interesting feature is the use of the earth coil, for Mother Earth supplies lines of force without expense, and it always seems illogical to expend power in maintaining a field of force.

EVERY real experimenter worth his salt, at some period or another of his career, is struck by one of the most brilliant ideas in the universe. His age may be six or sixty, but sooner or later it will occur to him, and the mere contemplation of the idea will raise his blood pressure several dozen points. If he is a real live experimenter, he will not rest until he has tried out the scheme.

The brilliant thought is nothing less, nothing more, than hitching a dynamo to a motor electrically and also mechanically by means of a belt (see illustration). This scheme crops up regularly not less than three times a month, and the Editors have already encountered it ten times in a month.

The underlying idea is simply this:—The dynamo gives electric current. Suppose we connect the terminals of the dynamo to the motor. The dynamo, providing it runs, furnishes the current to run the motor. The motor, to return the compliment, if we connect it with a belt to the dynamo, will naturally feel obliged to run the dynamo in turn — a sort of dog trying to run after its own tail and keeping up its revolution.

The reason for failure is, first, that there is heat dissipation, and second, that no piece of machinery, no matter what its make or type, can render 100 per cent efficiency. Even if we had started the dynamo at full speed by an outside source, and then attached it electrically and mechanically to the motor, it would not run for two seconds, because the current developed by the dynamo would be just about 20 per cent less than the energy required to drive it. Then there are losses in the motor as well, so we can figure that the actual losses in the transformation between the two machines will run over 35 per cent. In other words, you cannot lift yourself up by your own boot-straps.

When the Editor was a budding experimenter at the age of nine or ten, the big idea struck *him*, as it has hit many others. He tried the experiment, of course, and was very much crestfallen at its failure to work. Not possessing extensive knowledge of electrical and mechanical efficiencies at that tender age, he consulted with an older friend who was high up in knowledge of these matters, and this worthy of course laughed and explained just why the scheme was not feasible.

First of all, your young experimenter was informed that there were great heat losses in the bearings, and many other losses due to heating of the windings, friction at the bearings, and several other minor items, all of which tended to make the success of the experiment nil.

Nothing daunted, the writer believed that somehow or other he would foil nature in the end. So he rigged up the contrivance illustrated here and also shown on our cover. The scheme was very simple. The writer at that time had read about thermo-couples and knew that when you heated a metal junction you would get electric current. "So," said he, "why not put these thermo-couples on all the bearings, collect the heat and feed it into the circuit?" It seemed plausible, and accordingly, was done. But strange to say, even with about a dozen thermo-couples sprouting out all around the bearings, nature persistently refused to be thwarted, and the contraption did not become *mobile*, much less *perpetuum mobile*.

After this disillusion, we waded laboriously through several electrical textbooks and finally stumbled across another hint that looked promising. It had to do with a so-called *earth coil*. The magnetism of the earth is there to be tapped. Now if you rotate or swing a square frame, on which there are wound many turns of fine wire, in the earth's magnetic field, this coil will generate electric current. So far, so good. Said we to our young selves, why not hitch one of these coils to the shaft of the motor, and as it revolves quickly it will cut sufficient magnetic lines and give a tremendous amount of current, which when fed into the main circuit will be enough to overcome all the losses of the combination, consequently the device must work!

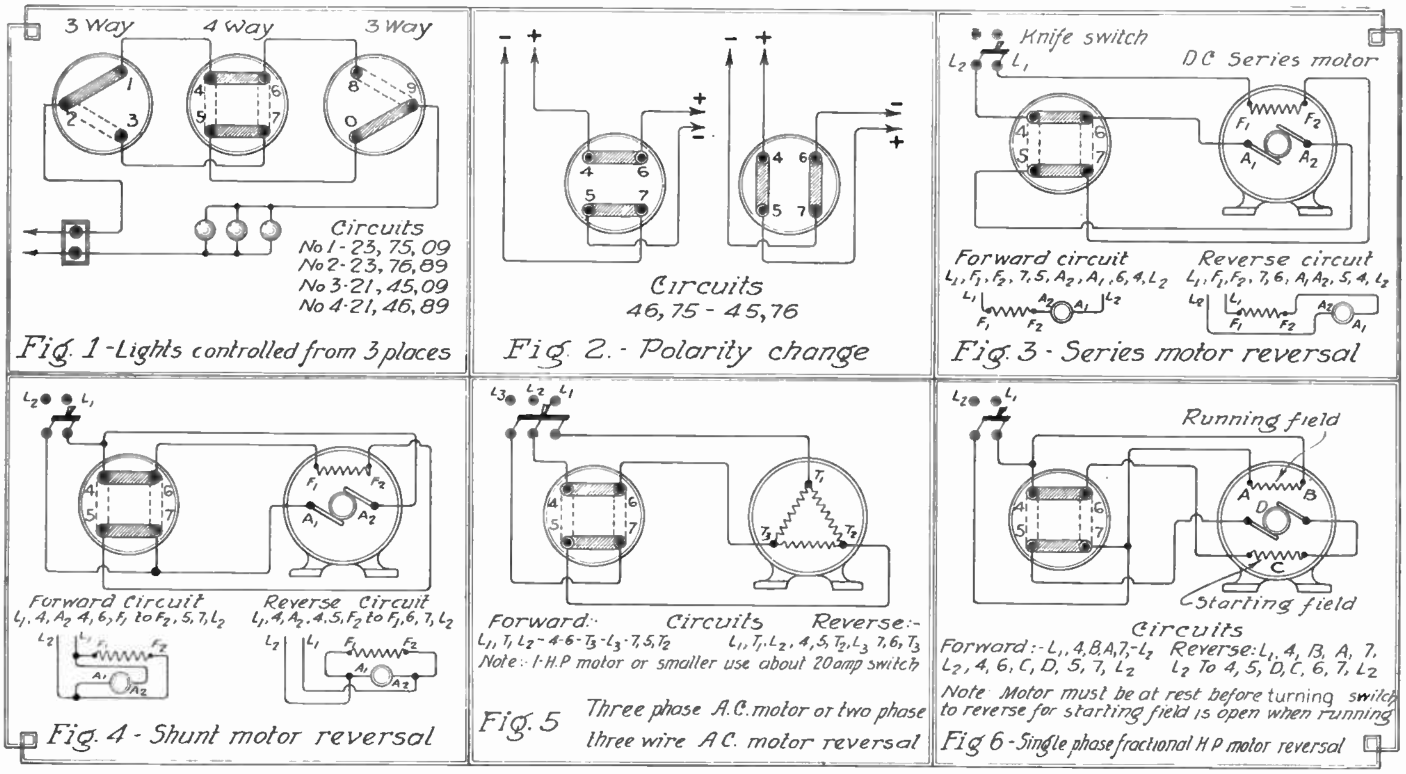
The great day arrived and we started to crank her up. We worked fast and furiously for many hours, but somehow or other the moment we stopped cranking, the device would sink into a perpetually motionless state. Much hurt, we gave it up.

Our expert friend to whom we showed the great invention later had the time of his life. When he finally stopped laughing, he explained to the dispirited experimenter that the loss of transformation in a thermo-couple is much greater than in any other electrical instrument: in other words, out of 100 units of heat you obtain less than 3 per cent of electric power that you can use.

As to the rotating earth-coil inspiration, this was not quite so bad, but even here, the current of a quickly rotating earth-coil, although it may be a pretty big affair, is only miscroscopic. In other words, the electric energy that was recovered from the thermo-couples plus the earth coil was less than one-thousandth of one per cent.

Four-Way Switches

By O. E. Bricker



Six interesting diagrams showing what can be done with four-way switches, each diagram having its own caption, which tells just what each switch is designed to effect.

SOME applications of four-way switches are described here.

Fig. 1.—This is a wiring diagram showing the general use of the switch to control a light or lights from three or more places. For more than three places add one 4-way switch between the 3-way switches for each number of places desired.

Fig. 2.—Having seen several different home-made switches in the column of PRACTICAL ELECTRICS for current reversing, I would suggest the single 4-way switch as a convenient means of accomplishing this result.

Fig. 3.—Shows clearly the application of the 4-way switch as used to reverse a small series wound D. C. motor. The switch is so constructed that it has a quick mechanical break, making it very serviceable.

Fig. 4.—Shows the 4-way switch applied to a shunt wound D. C. motor.

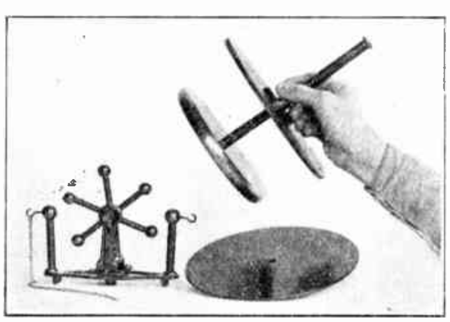
Fig. 5.—We here have the same switch used to reverse a three-phase motor of the induction type, or two-phase if a three-wire connection is made.

Fig. 6.—In this case we reverse with the 4-way switch the single-phase motor such as used on washing machines, small blowers, fans, etc. It will be seen that the switch changes the relation of the starting field to the running field. The motor, of course, must be at rest to reverse, as while running the starting field is open, due to the action of the centrifugal switch on the rotor.

Novel Electrophorus

By DR. ALFRED GRADENWITZ, *Berlin Correspondent*, PRACTICAL ELECTRICS

OUR readers are no doubt familiar with that simple apparatus called the "electrophorus," which, designed by Volta, in 1770, until the invention of the electro-static machine, constituted the most efficient means of generating static electricity. In order to produce sufficient amounts of the electric fluid, its dimensions were made as great as possible, and one electrophorus on record had a conductor 1.50 meter (nearly five feet) in diameter and required a set of pulley-blocks for moving it up and down. Since the advent of other and more powerful means of producing electricity, the electrophorus has been confined to a rather modest part in class rooms and scientific cabinets and has not undergone any alteration of shape or design.

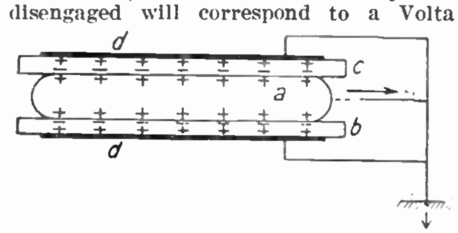


New type of electrophorus from Germany, which is said to have achieved very remarkable results in the use of the almost obsolete apparatus in improved form.

A Berlin physicist, Dr. H. Wommelsdorf, the inventor of the condenser machine, which is an improvement on the familiar influence machine, is of the opinion that this time-honored device can be of active use in the laboratory. The writer has had the good fortune of acquainting himself with the new electrophorus just brought out by that inventor and had it photographed specially for the readers of PRACTICAL ELECTRICS. Fig. 1 will best illustrate the underlying principle.

The new electrophorus comprises a conductor (a) which, instead of being placed on a single insulating layer, is inserted between two such layers (b and c). A simple test, which consists of applying to the conductor first one, then both of the insulating layers, strikingly shows that the spark length (ca) in the latter case is three times, and the voltage produced is twice as great as in the former. The disproportionate increase of spark length and voltage, of course, is due to the fact that the spark length, as the discharge potential rises, will grow considerably faster than the latter.

Moreover, the amount of electricity thus disengaged will correspond to a Volta



Sectional view of the new electrophorus, illustrating its operation and showing connections, the vertical lead going to a ground.

electrophorus with a much larger insulating layer without any corresponding increase in the diameter of the conductor.

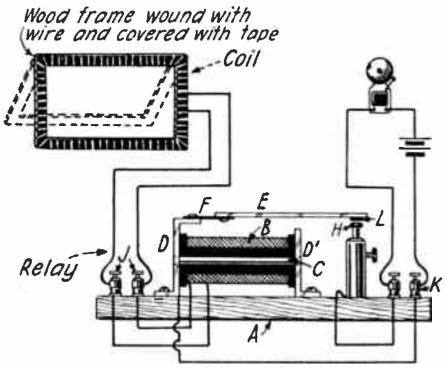
In order to actuate the new electrophorus, both insulating layers are rubbed and, as seen from Fig. 1, placed on one another, when the electrons, on account of the negative charges of the two layers (b and c), are energetically driven away from (a). If now the conductor (c) be touched with the finger, a wire, or the like, the electrons will flow off to the ground. On being next withdrawn, the conductor will be found to possess a free positive charge which can be utilized in any suitable manner, *e. g.*, for the charging of Leyden jars or for the operation of any convenient apparatus. The same phenomenon of electric influence can be repeated many times with a single rubbing of the insulating layers. A strip of tinfoil pasted on the upper insulating layer (c) enables the conductor to be earthed without any contact with the finger, so that the electrophorus can be operated simply by moving the insulating discs up and down.

The electrophorus represented in our illustration comprises two insulating discs of hard rubber. Dr. Wommelsdorf has, however, designed electrophoruses with such poor insulating layers, *e. g.*, of wood, paper and the like, as no longer to be electrified by friction. These had to be operated by exciting the layers from outside and enabled the output of the little attachment to be raised considerably.

The new electrophorus is powerful enough, even with its discs only 15 cms., or 6 inches in diameter, to operate many large rotating apparatus, the spark length being 6 cms., 2½ inches, and the potential about 50,000 volts. It is thus a cheap and welcome substitute for a small influence machine, superior because of simplicity and its certainty of starting.

Electricity from Earth's Magnetism

EVERYONE knows that the earth is a huge magnet and that the lines of force surround the earth everywhere except at the magnetic poles. When a coil



A simple method of carrying out this classic demonstration by using a sensitive relay.

of wire is moved so as to cut the lines of force of the earth a feeble electromotive force is produced and a current can be caused to flow if there is a closed circuit. In this experiment the current thus generated is used to operate a sensitive relay which in turn closes another circuit so as to produce a good effect.

The coil of wire used is wound on a thin rectangular wooden frame 24 by 18 inches in size. Two hundred turns of No. 22 or No. 24 gauge insulated or enameled copper wire are wound on it and taped. The ends of the coil are connected to an extension cord.

The complete relay is shown in the illustration. It should be finished as neatly as possible. The base of wood (A) is 6 inches by 3 inches and ½ inch thick. The wire of the electromagnet (B) is wound on a wooden bobbin. The bobbin can be turned out on a small wood turning lathe. The dimensions are given in the drawing. The core (C) is a Swedish charcoal soft iron bar 2½ inches long by ⅝ inch in diameter.

The brackets or angles (D and D'), and the armature (E) are also of the same metal. The armature is 3 inches long by ⅜ inch wide by 1/16 inch thick. It is connected with the bracket (D) by a piece of No. 28 gauge spring tempered brass (F). A hole is drilled down the center of the binding post (G). A small brass rod (H) with a contact point on it is placed in the hole. It is adjusted and locked by a thumb-screw. A corresponding contact point is fixed to the armature as shown. The contact points can be taken from an old spark coil.

The bobbin is wound almost to the top of the sides with No. 34 gauge single silk covered copper magnet wire. Two binding posts are mounted and connected to the electromagnet. The binding posts (K, K) are mounted at the left-hand end and connected to the rod (G) and bracket (D).

A bell or similar apparatus and a battery are connected in series to the binding posts (K) and the coil is connected to binding posts (I). The contact points at (L) are adjusted until they are not more than one-sixteenth of an inch apart.

The coil is grasped loosely in the hands and swung to and fro, the bottom swinging in a semicircle, in a north and south oscillation, so as to cut the lines of force of the earth. A feeble current is generated which operates the relay and closes the external circuit. It will only be closed, however, when the coil is swung in one direction. The coil can be fixed so it can be revolved by turning a handle, thus generating a stronger current. A short-circuiting relay can be connected to close the circuit permanently if desired.

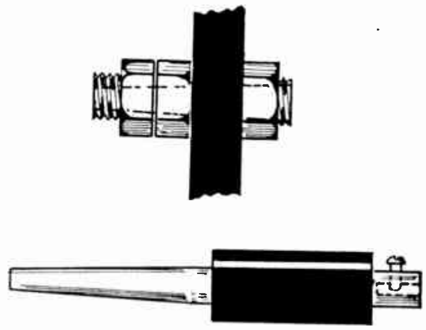
Contributed by ROY C. HUNTER.

BINDING posts do not make very satisfactory terminals on switchboards that carry rather high currents or voltages. To receive the heavy wires necessary to carry strong currents, binding posts must be very large and clumsy; but even then it is not easy to fasten the wires in place, and it is rather a nuisance where they have to be connected and disconnected often.

In the plug and jack system herein described, it is very easy to change connections, and, because of the large surfaces of the plug and jack which make contact, this system will carry a very heavy current. The dimensions given are for a jack and plug system which is very strong and also simple. The jack is designed to be mounted on a 1-inch marble panel. This system of connections is used in the electrical engineering laboratory of a prominent Los Angeles high school with complete success.

A 2½-inch length of threaded half-inch round brass rod is placed in a lathe and drilled through its entire length with a quarter-inch drill. The hole is reamed out with a taper reamer until the larger end of the hole is three-eighths of an inch in diameter. The jack is now done and is mounted on the panel with the large opening on the front of the panel and held in place with one nut on the front of the panel and two behind it. The wire lead is fastened to the jack by the two nuts at the back of the panel. The plug is made of a piece of three-eighths-inch round brass rod, 6½ inches long. It is placed in a lathe, and 2½ inches of it at the end tapered to correspond accurately with the tapering of the socket. There must not be the least shake.

Simple Connection Jack Switch



A solid construction of a plug or jack switch of wide applicability for experimenters.

A piece of wood three inches long is turned out in the lathe to a diameter of one inch, and a hole bored through it with a diameter to make it a driving fit over the untapered part of the brass rod. This is the handle. It is driven over the rod, leaving three inches of the rod projecting at the tapered end and one-half inch at the other end. The half-inch length of rod which projects from the handle is drilled to a depth of half an inch from the end by a 5/32-inch drill, and a hole for a set-screw is drilled and tapped in one side of the hole. This hole is to receive the connecting wire.

When a half dozen jacks have been connected to the different sources of power, and a corresponding number of plugs connected to the different electrical machines it is desired to run, we have a very versatile and easily-changed combination.

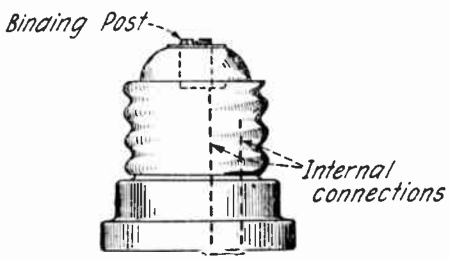
Contributed by CHARLES F. FILSTEAD.

Plug from Old Fuses

A PLUG which will fit any electric light socket can be made from an old burnt-out screw-type fuse.

Remove the mica and the brass ring that holds it. Then take a pair of pliers and pull out the end contact (if this cannot be done file it off). This will leave a hole large enough to insert a binding post screw through. Then pry loose the flange that holds the brass threaded portion and unscrew it.

The plug can now be connected up by putting a binding post in the lower part of the plug, letting the head of the screw act as the contact, then lay the wire on the porcelain part and replace the screw bushing; screw it on, firmly gripping the wire, and the plug "*est fini.*"



A plug made from an old blown-out fuse by slight alterations only.

Contributed by HOWARD L. BABCOCK.

Rotary Current Rectifier

THIS apparatus is designed for the charging of storage batteries when alternating current from the service line is all that is available. The construction is very simple; the number of pieces should not frighten the amateur who would wish to construct it. We give the following figures:

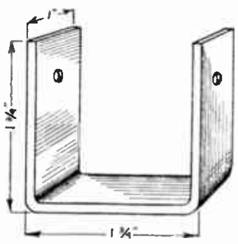


Fig. 1

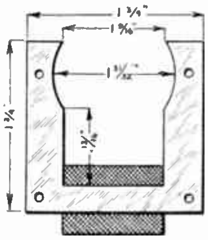


Fig. 2

Fig. 1 represents the standard for the shaft of this apparatus.
Fig. 2 gives the template for cutting out the field core laminations and also shows the windings.

Connected to a 110 volt, 50 cycle circuit, the potential is reduced to 25 volts. The apparatus requires 2 amperes for its rotation, and can give a useful rendition of 6 amperes at 10 volts. The efficiency is about 55 per cent. It is clear that if one has no transformer the efficiency will be lower. The choke coil is more economical than a rheostat for reducing the line voltage.

Principle of construction: Assume a synchronous motor, driving a reversing commutator; at each half turn the current will be reversed so that there will be two half periods in each revolution. Now, as the synchronous motor follows the periodicity of the exciting circuit, the current delivered by the commutator will always be in the same direction.

We will then have to construct a synchronous motor and reversing commutator.

The base will be made of wood, marble, or brass as desired, wood being the best. A plank of oak 8 inches by 3 inches and ¾ inch thick will answer. On this are mounted the bearings and their support; the support will be made with .2 inch iron, 10 inches long, bent up into the shape of a letter U, preferably while heated. Four holes are bored in the bottom part as shown, .2 inch in diameter, and two other holes above, a trifle over .3 inch in diameter. The whole is shown in Fig. 1; the frame is supposed to be fastened on the support as shown in the other diagrams.

Fig. 3

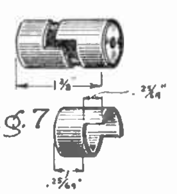


Fig. 7

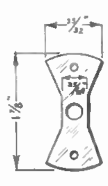


Fig. 5

Fig 3 is the strap for sustaining the magnet.
Fig. 7 shows the commutator sections.
Fig. 5 is the template for the rotor.

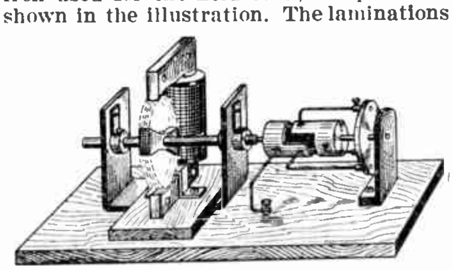
The field core is cut out of thin sheet iron, its thickness not being vital; 1/50th of an inch is a good thickness. Fig. 3 gives the profile by which the field core is to be cut. Twenty-five of these pieces are required. They are clamped together as accurately as possible and ¼-inch holes are drilled as shown. They are then bolted together and a coarse file is used to finish them, and when the proper form is reached the bundle is dismounted and all small asperities can be removed by a fine cut file. The pieces are then put together with thin paper between each pair of plates. The fine file gives the last finish.

The core now has to receive the field coil. The core is first wrapped with oiled silk or cloth and is then wound with 100 feet of No. 22 insulated wire, silk or cotton covered, or enameled. It is unnecessary to use insulating cloth between all of the layers, but such cloth should be used between every five layers. The completed field structure can now be secured to the base by a piece cut out of the same sheet iron as shown in one of the figures.

The only delicate part of the rotor is the shaft. It will be advantageous to have the shaft turned out by a regular machinist. The shaft must be of soft steel and of the form shown.

Bearings can easily be made of bronze or brass; a bronze bar ⅜ inch in diameter is cut to give two pieces each nearly ½ inch long, through whose centers quarter-inch holes are drilled. A second hole about .1 inch in diameter is drilled radially near one end of each.

The armature or rotor is made of 25 laminations of the same thickness of sheet iron used for the field core; the profile is shown in the illustration. The laminations are put together exactly as described for the field core. There is no winding on the rotor.



Perspective view of entire layout of rectifier, showing clearly the relation of all parts.

Mounting. The frame carrying the bearings is screwed down on the wooden support and the bearings are thrust upon the axle ends. If the play is insufficient they can be reamed out with the tang of a file, or better yet, with a piece of hard wood supplied with emery paste, the wood being of such a size as to enter the hole without forcing. If, on the contrary, there is too much play, which can be avoided by having the axle turned up a little bit too large, other holes one-fiftieth of an inch smaller must be drilled in new bearings. At last when the shaft turns smoothly, the bearings are placed in the holes in the frame and are soldered in place, care being taken not to fill up the radial holes with solder. These holes are for oiling. When this much is done, the laminated core is slipped on the shaft. To do this it is best to prepare the bronze bearings like those used on other machinery, or to cut a thread in the radial hole. They will then act as collars to keep the rotor in place. To stop the rotor from turning independently of the shaft, two sheet iron angles are bolted to it as shown in the illustration, which in turn are bolted to the collars. A third collar is mounted on one side outside of the frame.

Now the field is put in place and held there by the piece of sheet iron shown. The field must be centered accurately and wedged in place with wood. It will be attached not directly upon the support, but will rest upon a piece of wood 3½ by 2¼ by ½ inches cut out to accommodate the bearing frame. The thickness will be about ½ inch so that the field will be at the proper height. The centering will have to be done by experimenting. A little filing may be required to give the last fine adjustment.

We now have to build the commutator, which is turned by the motor. A piece of round ebonite 1¼ inches by ¾ inch is

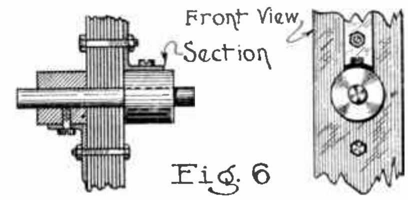


Fig. 6

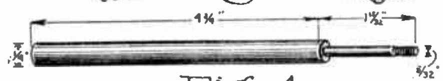


Fig. 4

Fig. 6 shows section and front view of the rotor and its support.
Fig. 4 is the shaft.

perforated by a ½-inch hole. Two special pieces of copper, which are to be described later, are put on with a driving fit. Finally, a brass washer is put against the shoulder, then the piece of ebonite, and the whole is secured by a nut upon the threaded part.

The commutator plates are made of a copper tube ¾ inch inside diameter; two ¾-inch pieces are cut off and a piece cut off the end of each. A transverse cut a little more than one-half the circumference in depth is made, and the larger piece removed by cutting parallel to the axis.

Having progressed thus far, to test the apparatus the terminals of the winding are connected to an alternating current circuit at about 25 volts. The apparatus is started by hand, which may be done by winding a string around the shaft, starting it top-fashion, or with a little motor. The apparatus is supposed to rotate at 3,000 turns per minute on a 50 cycle circuit. If a 60 cycle circuit is employed, the speed will be 3,600 r.p.m.

A certain amount of experience is necessary to succeed in starting the motor. If it does not start off in the first trials no discouragement need be felt.

When the motor is found to run well, the brushes are to be made. The following is the simplest construction:

One of the brushes makes contact with the complete circle of the commutator nearest the bend. A terminal that is screwed down on the base and a heavy copper wire .1 inch or more in diameter, is passed through the hole in the binding post which is set parallel to the axle. The

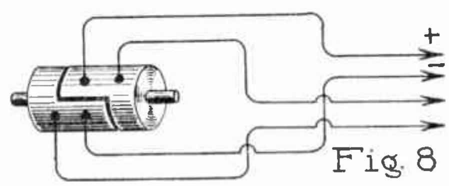


Fig. 8

Fig. 8. This shows the commutator with its connections, for rectifying the current.

terminal is bent up so as to come within half an inch of the commutator. An eye is bent upon the end and filled with a brush of copper wire made from flexible cord stripped and doubled as required. The wire brush is soldered in the eye and the end is evened off. The brush presses against the commutator ring as adjusted by the binding post.

Three other brushes are held by a wooden disk carried by a prolongation of the shaft of the motor, and quite near the end. There are three binding posts attached to this disk, one is in contact with the outer end of the other half of the commutator, the two others with the intermediate part, with the two brushes diametrically opposite each other. The pressure should be very light and the brushes should each be about 1½ inches long. The current is received by the ring shaped portion of the commutator and leaves by the intermediate brushes which are in contact with the cut off portions of the commutators. The whole is explained in the drawing of the assembly.

The apparatus has given great satisfaction to its constructor; it gives 6 amperes almost without sparking, and by setting the brushes one way or the other sparking can be almost completely prevented. Some parts must be made by a machinist, but the cost will be very low. The whole bill came to about $5.00 and the construction involved about twelve hours of work. The apparatus makes little noise and will operate as long as there is current to drive it.

M. Rouviere in *La Nature.*

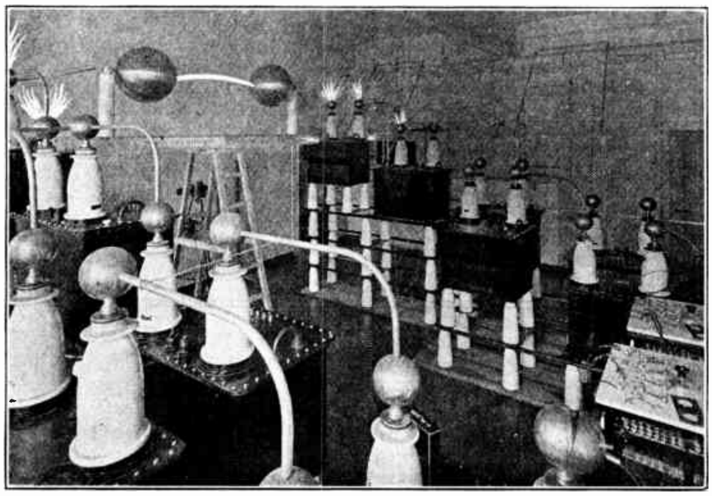
Transformers for 1,000,000 Volts

By Dr. H. Becher
Frankfort a/M, Germany

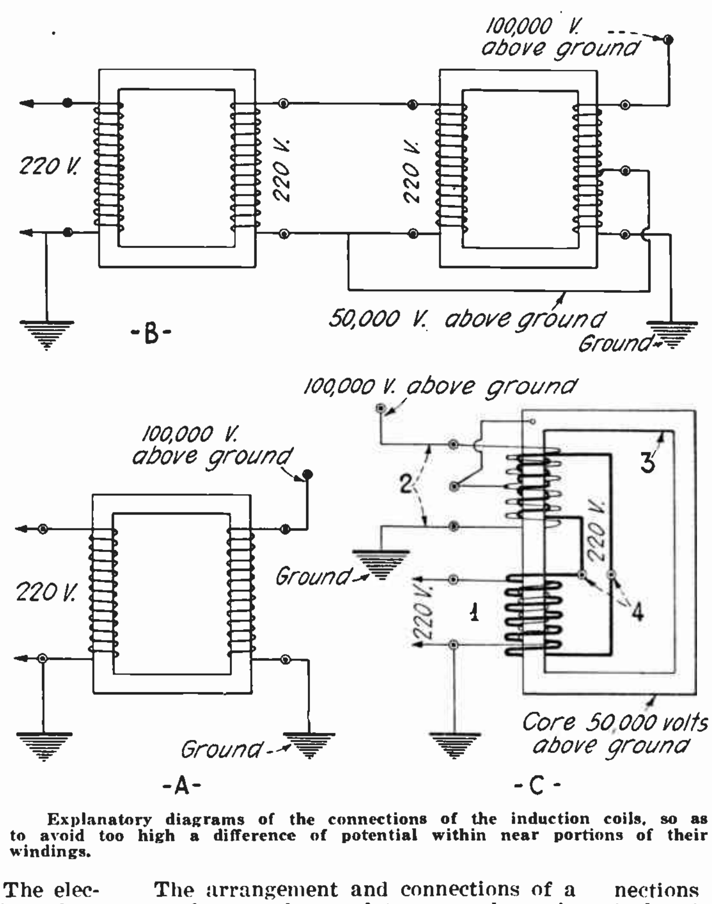
In the construction of transformers for very high tension considerable difficulties arise. A tension of 100,000 volts may discharge through air about 7½ inches between points, or about 1½ inches between spheres of 20 inches in diameter, while a tension of 500,000 volts discharges through an air distance of about 37½ inches between points and a tension of one million volts will discharge through 75 inches of air between points and 37½ inches between spheres of 20 inches diameter. One can imagine that even by using very good insulation and complete immersion of the transformer in oil it will still require considerable space between sucessive layers and between these and the iron core of the transformer to prevent disruptive discharge. The unavoidable consequence of a 500,000 or 1,000,000-volt transformer would seem to be extreme dimensions and high cost.

A German scientist, Dr. Friedrich Dessauer, has discovered a way of obtaining very high tensions with small and relatively low priced transformers. This idea was evolved at the very moment when it became necessary to have tensions of 200,000 volts and upwards for continuous working apparatus to be placed in the small rooms of hospitals for the purpose of producing extremely penetrating Röntgen rays, such as are used in the treatment of cancer.

The new system was based upon the following considerations: It is not difficult to construct a transformer for 100,000 volts, but for 200,000 volts about double the strength of insulation is necessary in every direction. This would amount to about eight times the volume even if two transformers, connected in series, are used, each of which would have to produce but half of the tension. If however, a group of transformers, connected as a whole, are utilized for the purpose, it is only necessary to insulate each of these transformers for a certain part of the entire tension. The electric energy thus transformed through a certain number of transformers will finally be brought to the full high tension in the so-called high-tension transformers to which it is delivered and the number of which may be taken at will. In this manner, it is possible to produce tensions of almost unlimited strength with a number of feebly insulated small transformers.



View of the great transformer set constructed in Germany for the development of a million-volt potential.



Explanatory diagrams of the connections of the induction coils, so as to avoid too high a difference of potential within near portions of their windings.

The arrangement and connections of a transformer of normal type are shown in the diagram (A). In one field of a closed iron core the winding for low tension is placed, over this the winding for high tension, the one end of which is grounded. The windings are shown on opposite legs of the core for clearness. Consequently the other end must be insulated from the low tension winding and from the iron core for the full tension of the 100,000 volts. This means that the air space and material inserted must be sufficient to prevent even in continuous working any glowing or sparking. In comparison with this the arrangement of a transformer system according to the device of Professor Dessauer is shown at (C). In front of the high tension transformer an insulating transformer is placed which has to take upon itself part of the electric strain. The intermediate circuit is connected to the center of the high tension winding of the 100,000 volt transformer, thus placing this circuit 50,000 volts above ground potential. Each transformer now must be insulated for 50,000 volts, which is half of the entire tension. But even this arrangement may be still more simplified by combining the two transformers according to a device of Professor Petersen and Mr. Welter, engineers; this is shown in diagram (C). Here the low tension winding (1) and the high tension winding (2) are placed side by side upon the same iron core (3), which, by means of a connection with the center of the high tension winding, as in (B), now gets a tension of 50,000 volts above the earth. An equipotential winding (4), which is placed immediately on the iron core, operates to reduce the leakage. In this case, too, there is nowhere a tension above 50,000 volts for between any two adjacent parts of the outfit although a total of 100,000 volts is obtained.

A plant of this kind has been constructed by the Veifa works at Frankfort a/M for an institution in Japan, for the production of a tension of one million volts maximum value, which means 707,000 effective volts. It consists of two symmetrical halves, each containing four high tension transformers and two straining links. The high tension transformers, all of equal size, are immersed in oil tanks, each oil vessel being 23 inches in height, 27 inches in width and 23 inches in length. The insulators carrying the connections have a height of about 18½ inches, including the terminal balls. Each link produces a tension of 125,000 volts maximum value, but their insulation, according to the Dessauer principle, was calculated for only 62,500 volts. Thus all the four units of each side produce together 500,000 volts. The connection of both halves was grounded and the successive units were mounted step-fashion upon porcelain insulators.

Awards in the $50 Special Prize Contest

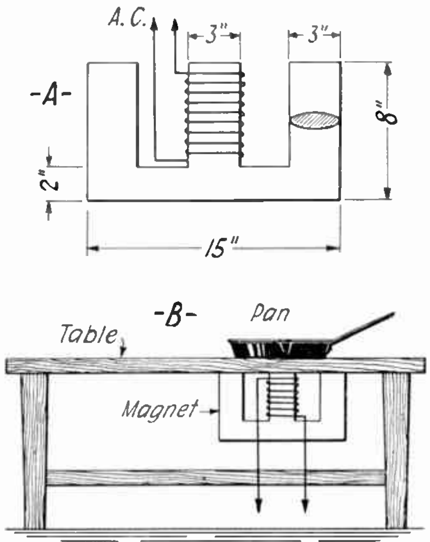
For Junior Electricians and Electrical Experimenters

First Prize, $25,	Second Prize, $15	Third Prize, $10,	Hon. Mention,
Wilbur H. Yost,	Michael B. Cohan,	Philo T. Farnsworth,	Lionel Nault,
742 Bowdoin St.,	1009 Wolf St.,	639 No. 6th West,	80 Murray St.,
Portland, Oregon.	Philadelphia, Pa.	Provo, Utah.	Sherbrooke, P. Q.

First Prize

Electric Fireless Cooker

By Wilbur H. Yost



This apparatus by the action of an alternating current, produces heat sufficient for cooking. The currents induced in the core of the magnet do the work.

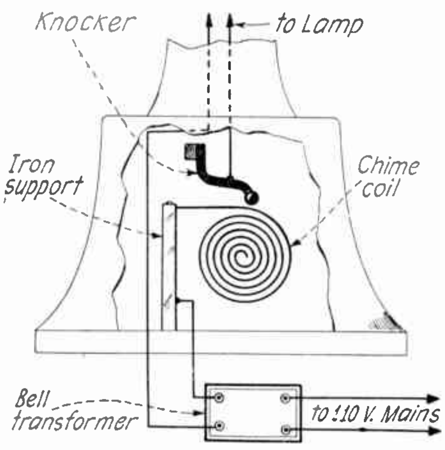
FIRST wind a powerful electromagnet with No. 6 or 8 cotton covered wire, on a frame of silicon steel, cut as in (A). Wind for 110 volts alternating current.

Mount this magnet underneath a wooden table as in (B). Leave top of table free. Connect the magnet coil with a concealed switch. Set an aluminum pan, over this magnet, on top of the table; and when an alternating current is turned on the pan will get hot enough to fry ham and eggs. This is due to the heating effect of the eddy currents set up in the pan.

Second Prize

Chime Clock Light

By Michael B. Cohan



Attachment for a chime clock which causes a lamp to be lighted; each time the ring is given the contact between the hammer and the gong closes the circuit.

A NOVEL and somewhat mystifying light can be produced on a chime clock in the following manner:

First of all take the back of the clock off and look at the "works." Usually in a clock of this sort there is a heavy coil of steel, which is its gong, supported by an iron rod with the hammer above. Under the hammer head is a small piece of felt which should be removed. This is only placed there to give a softer ring to the chimes. A light (40 candlepower, 6-volt) which is supplied with current from a bell-transformer is concealed in the ornament.

$50 IN PRIZES

A special prize contest for Junior Electricians and Electrical Experimenters will be held each month. There will be three monthly prizes as follows:

First Prize $25.00 in gold
Second Prize $15.00 in gold
Third Prize $10.00 in gold

Total $50.00 in gold

This department desires particularly to publish new and original ideas on how to make things electrical, new electrical wrinkles and ideas that are of benefit to the user of electricity, be he a householder, business man, or in a factory.

There are dozens of valuable little stunts and ideas that we young men run across every month, and we mean to publish these for the benefit of all electrical experimenters.

If in any way possible, a clear photograph should be sent with the idea; but if that is not possible, a good sketch will do.

This prize contest is open to everyone. All prizes will be paid upon publication. If two contestants submit the same idea, both will receive the same prize.

Address all manuscripts, photos, models, etc., to *Editor, Electrical Wrinkle Contest*, in care of this publication.

The effect can be readily imagined. When the clock is about to strike, say ten, the knocker hits the gong, ringing it and also closing the circuit and lighting the lamp, once for each stroke of the hour.

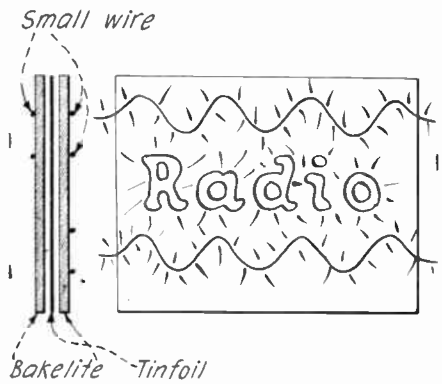
Third Prize

A Tesla Coil Electric Sign

By Philo T. Farnsworth

OF the many uses of the Tesla coil perhaps the most important is for advertising. It is at any rate a most effective means of advertising all electrical apparatus. The possibilities are endless. Almost every experiment performed with the Tesla coil serves for advertising purposes.

The construction is shown in the diagrams. Two sheets of bakelite about one-eighth inch thick are coated on one side with tinfoil and shellacked together with the foil in the center. Figures are then painted on the outside to the outline of which fine wires are cemented. Many beautiful effects can be obtained in this manner, such as waves, aurora, and lightning. The coil can also be made to show various trade-marks, names of magazines, etc.



Electric sign which produces an effective display of letters or other desired description or design, utilizing high frequency current.

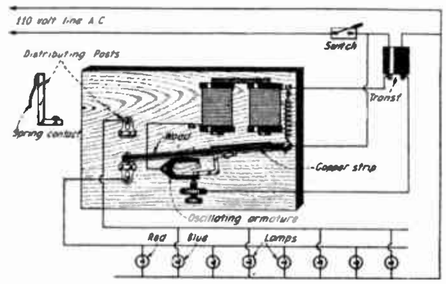
Wire ranging from No. 20 to No. 30 is used, depending upon the capacity of the Tesla coil.

Honorable Mention

Sign Flasher

By Lionel Nault

IN the illustration is shown a simple and practical way of making a sign flasher. Except for the two distributing posts (A) and (B) and the oscillating distributing arm (C), the idea is the same as that of a slow ringing bell.



Sign flasher operating by an oscillating distributor actuated by an electro-magnet.

The arm (C) is of wood with a copper strip or even a copper wire run along the edge, free from contact with any other part. This is connected to the two screws on the ends of the arm. The distributing posts are easily made, either of metal or wood.

The apparatus works in the following manner: In turning on the current, the effect is the same as that of an ordinary door bell, but the current passing through the distributing arm is interrupted every time it leaves one distributing post to go to the other. By this movement, the lights are lighted and turned out in succession, and the action is repeated as long as the current is allowed to pass.

Awards in Odd Electrical Experience Contest

First Prize, $20	Second Prize, $10	Third Prize, $5,	Fourth Prize
Arthur Flinner, Wichita Kansas	Arthur A. Kremer St. Cloud Minn.	Harold Hughes Worcester Mass.	Ferral De Smith Richmond Mo.

First Prize, $20

Ball Lightning

By Arthur Flinner

Ball lightning has been one of the world's meteorological mysteries, and this experience proves that there was a real electric discharge.

MY grandfather was sitting in the dining room of his house on a farm when lightning struck the house. A ball of fire as big as a man's two fists rolled across the room in front of him. The door leading outside was open and a dog was lying on the steps. The ball of fire killed that dog, then rolled down into the cellar, where it killed another one.

While there it split a heavy sill, making a bump in the floor. It also magnetized all the steel in the house. It seemed to have a grudge against dogs, because little else was harmed.

Second Prize, $10

The Three-Brush Dynamo

By Arthur A. Kremer

IT was about a year ago, during the month of August, that I had an odd electrical experience. While the motor of our Dort car was running I thought that I might as well try to stop the motor by disconnecting the battery terminals. When I had disconnected them I found, to my surprise, that the engine did not stop.

The third brush dynamo is known to be the source of various surprises. Here one of our readers tells one of his.

I next thought of turning on the electric lights. All the lights went on. I also turned on the dash lamp. But there was a difference in the lights. They all flickered, and were unusually bright.

Next I thought I could make the lights still brighter. So I opened the throttle of the engine a little more. But then all the lights went out; the current destroyed the filament.

From that time on I made up my mind never again to try that particular stunt.

$37.50 IN PRIZES

We take pleasure in offering a series of prizes for letters giving odd and unusual electrical experiences.

First Prize	$20.00
Second Prize	$10.00
Third Prize	$5.00
Fourth Prize	$2.50

Nearly every one of us has had an odd or unusual experience in electricity, sometimes humorous, sometimes pathetic, sometimes puzzling, and it would appear that our readers should let us have some of their personal experiences for the benefit of all.

The more unusual the experience, the more chance you have to win a prize.

Illustrations are not necessary, but the letter should be either typewritten or written in ink. No penciled matter can be considered. Write only on one side of the paper.

If two contestants should send in the same winning experience, both will receive the same prize. In the event of two or more persons sending in the same as best, second best, etc., each tying contestant will receive the prize tied for.

Prize winning letters will be judged as follows: The first prize will be awarded for the letter giving the oddest or most unusual experience. The second prize to the one considered next best, and so on.

Communications to this department should be addressed *Editor, Odd Electrical Experiences,* care Practical Electrics, 53 Park Place, New York City, N. Y.

To burn out four lights at once was too much for me.

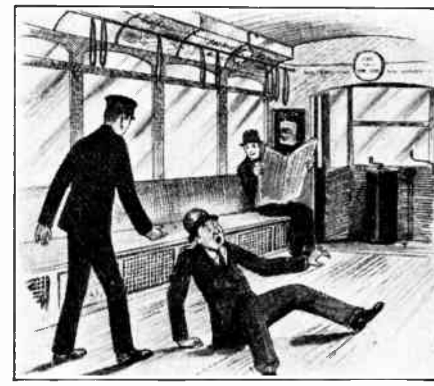
(Our readers are referred to Mr. H. Highstone's valuable article on the "Three-Brush Automobile Generator" in Practical Electrics, June, 1923, p. 357.)

Third Prize, $5

A Trolley Car Shock

By Harold Hughes

THE following incident occurred about two years ago on an electric steel body car. One winter morning I took a seat in the car and as my feet were cold I put them on the heater and rested my hand on the window-sill. At once I was thrown out into the aisle. The conductor came over and asked me how it happened. I told him I did not know, so he sat in the seat, but was not affected in any way, and he asked me if I was fooling. I said no, and that I would show him how it happened; putting my feet on the heater



In one of DeMorgan's novels, "Somehow Good," a shock received in a trolley car, produces amnesia. Our contributor's memory was certainly not affected by the shock he received.

and one hand on the sill I was again thrown out into the aisle. I found out that the heater was grounded. The car was made of steel and was grounded by the track, so that when I put my hand on the window-sill I came between the heater and the grounded car.

Fourth Prize, $2.50

Live Dead Wires

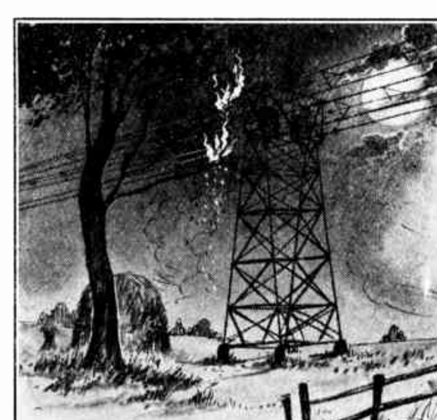
By Ferral De Smith

WE had strung about a mile of No. 8 bare copper wire four feet below a transmission line of 33,000 volts. Our bare wire was well insulated from the cross-arms by 5,000-volt insulators, and was not connected at either end.

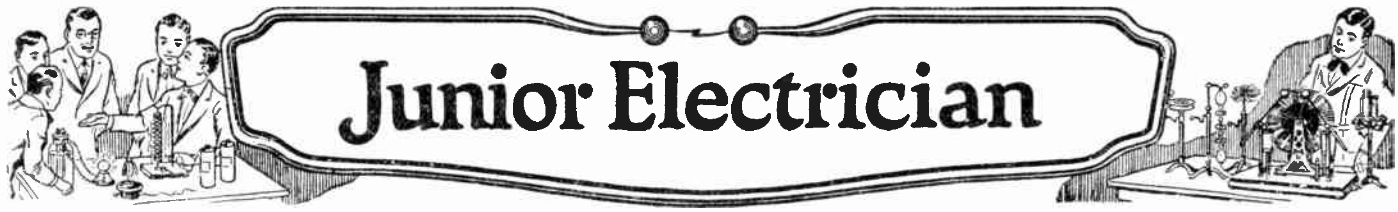
During the night a farmer called and said that the wires had set fire to a dead tree and embers were flying toward his haystack.

When I got there I found the supposedly dead wire would rub the limb and sparks would fly and the limb would blaze.

The trouble was only the induction from the transmission line above. After the supposedly dead wire was grounded all trouble ceased.

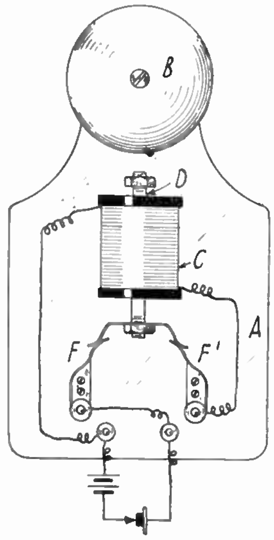


A presumably dead wire was the cause of a dangerous discharge when it touched a tree, so as to threaten the setting on fire of an adjoining hay stack. Grounding the wire did away with the trouble.



Electric Bell

A VERY simple single coil direct stroke bell is shown in the accompanying illustration.



A direct-stroke bell of very simple construction, one which a junior electrician can build for himself.

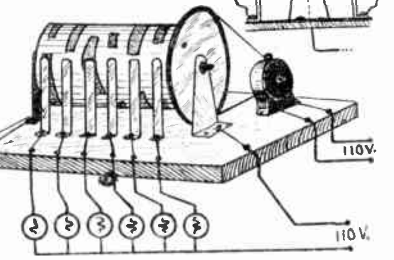
The wooden base (A) is cut out as shown and the gong (B) is bolted to it. A solenoid (C) is fixed to the base about one-quarter inch from the gong. (D) is the solenoid core, which may be an iron bolt about three-quarters inch longer than the solenoid. A piece of spring brass is bent as shown and fixed to the lower end of the core. (F) and (F[1]) are pieces of brass bent to make contact with this piece. Two binding posts are mounted on the base and the bell is connected up as shown.

When the circuit is closed the solenoid core is pulled up and strikes the gong, being raised by the attraction of the coil. When the core rises it breaks the contact at (F) and (F[1]), opening the circuit, allowing the core to fall and to make contacts at (F) and (F[1]) again. This action is repeated as long as the external circuit is closed.

Contributed by ROY C. HUNTER.

Simple Sign Flasher

HEREWITH is a simple device which will control a number of lights, and



A sign flasher operated by the commutating drum principle, and turned by a miniature electric motor.

may be easily made from parts found lying around almost any shop.

A cylinder is made from insulating material such as wood or fiber, and is mounted on a shaft, which in turn is mounted on a wooden base. On the same shaft with the cylinder is placed a large pulley which is connected with a motor by a belt. On the cylinder are fastened a number of metal pieces (preferably copper or brass). These may be fastened with small wood screws. All the pieces of metal on the cylinder are connected together with wire and connected to the metal shaft. The shaft is supported by two metal pieces through which the current passes as shown by dotted lines, Fig. 1.

On the side of the cylinder are placed a row of metal pieces which serve as brushes, each being connected to one or more lights. If desired, two rows of the brushes may be used. The illustration shows how the connections are made.

Contributed by EVERMONT FISEL.

WHEN this number will have reached the hands of our readers, the $100 Spark Plug Contest announced in our September issue will be open for some time, as it does not close until October 15, 1923; the results will be published in our November issue.

We hope that this will have the same interesting and widely distributed response which has attended all our other contests.

The prizes have been already announced, and while the winners will be gratified by the reception thereof, they will also be interested in having their articles published by us, to be read by our many readers.

No-Current Relay

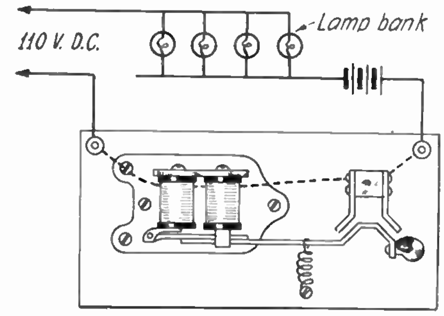
RECENTLY I had occasion to build a little charging board to "kick juice" into the radio battery and improvised a little no-current relay that might interest the great fraternity of wire twisters. As we all know, a storage battery works both ways; it takes stuff while the charging current is on, and should the charging current be cut off accidentally or otherwise, it kindly gives back all the current and then some, and has to be recharged.

A no-current relay prevents this nicely and one can readily be constructed from a bell or buzzer and a few odds and ends. As shown in the illustration a stiff arm is riveted to the armature of a buzzer. A strip of heavy brass bent at the end as shown does the trick. Two contacts are attached to a wood block in such a position that the bent part closes the circuit when raised into place. A small knob from a pot lid fastened to the end of the strips makes it look complete.

Now the winding must be suited to the current to be handled by the relay. Determine the amount of current to be used and allow 1,000 circular mils for each ampere and select the size of wire having this area from a wire table. Wind the coils full and connect the ends as shown in the wiring diagram.

The relay is simply connected in series with the source of current and the battery. When you want to charge push the arm up into place and it will stay there. A break in the current lets it drop under the influence of the spring shown and the circuit is open and stays so. Be careful that the armature does not touch the poles of the coils when the relay is closed or it might stick and then Battery-Blooie.

Contributed by M. R. MCCABE.



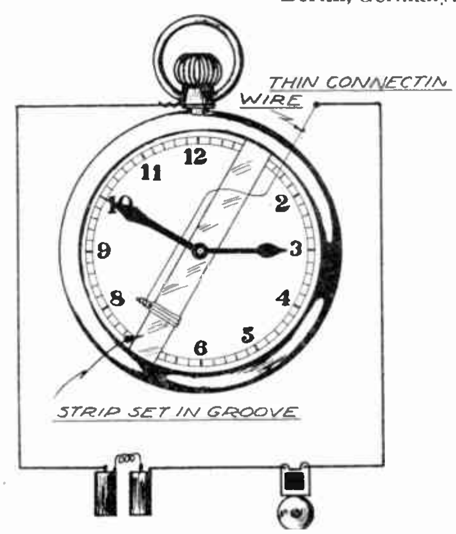
An apparatus called a no-current relay. It cuts off a storage battery from the charging circuit, when there is danger of its discharging itself through the same. The cessation of the charging current from any cause opens the circuit by electro-magnetic action.

Watch Alarm

A SIMPLE alarm can be made in the following way: Remove the glass, the minute and the second hand from a watch. Then take a strip of springy brass, a little longer than the diameter of the glass. Wind a few turns of insulated bell wire on this, removing the insulation from the ends and twisting them together. Bend the brass slightly and spring it into the groove originally meant for the glass. Bend the twisted ends of the wire downwards so that the hour hand will touch them on its way around. The watch is now placed in circuit with the bell and battery, as shown in the diagram, and the alarm is finished.

By turning the strip around in the groove the alarm can be set for any hour desired. The bell can be left out and a buzzer used instead. With this under one's pillow there is no disagreeable noise to waken the rest of the household.

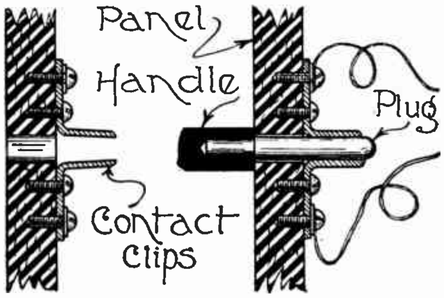
Contributed by ERNEST FREDERICK, Berlin, Germany.



A ordinary watch arranged to close a bell circuit, so as to give an alarm for awakening the sleeper.

Simple Jack Switch

WHEN one possesses a small switchboard to control motors, testers, bells, etc., it is somewhat costly to use either snap-switches or knife-switches. However, this cost may be reduced a bit by the use of a small piece of mechanism which I am about to describe.



Very simple jack switch made out of every-day material, yet which, with a little taste, can be made to rival the purchased ones in appearance.

In the panel of the control board a hole about ¼ of an inch is made. On the back of the board two pieces of quite stiff brass or copper are placed, one just above and one just below the hole. They are placed as shown, and are about three-sixteenths of an inch apart. This can be termed a "jack." One wire is soldered to the one strip and the other wire is soldered to the remaining piece. Now it is necessary to make a plug. To do this, obtain a bright, long copper rivet just ¼ of an inch in diameter, and to the end where the head is, attach a neat-looking handle of some insulating material.

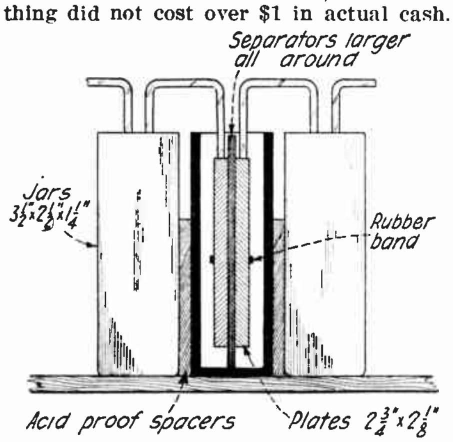
To make a connection, push the plug into the hole. It will come in contact with the two strips of metal and the current will flow through the plug to the other side.

This little connector can be made at a minimum cost, and is quite efficient. Of course, the greater the current the larger the jack and plug must be made.

Contributed by LLOYD L. CHAFFEE.

High Voltage Laboratory Battery

THE author has recently constructed a storage battery which has given very good results. It consists of ten cells giving over 20 volts and about 4 ampere hours. Due to the method of construction and materials used, the entire thing did not cost over $1 in actual cash.



The making of a storage battery with small square jars designed to give high voltage rather than high amperage.

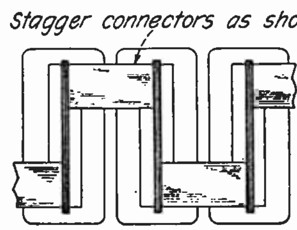
It will be noted that square jars are utilized. These are medicine bottles, all of the same size, with the tops cut off. The ones used were approximately 7½" high, 2½" wide, and 1¼" thick. They were cut off 3½" from the bottom, giving jars 3½" by 2½" by 1¼".

Any method of bottle cutting may be employed, but the author secured good results by the following procedure: First, a file is moistened with turpentine and a fairly deep scratch is made where the bottle is to be cut. Then a piece of iron wire is heated to a red heat and held on the file mark in the direction that the cut is to go. The bottle will crack just where the hot wire was placed. This is repeated until a crack is made all around the bottle, after which the top will drop off. The sharp edges of the glass are smoothed with a carborundum slip or whetstone.

The jars are coated with paraffin at the top to prevent the acid from creeping.

The plates are cut from discarded automobile battery negative plates which can be obtained at any battery station for the asking. Pick out the best plates and a few good separators. The plates are cut into four pieces with large tin snips. The plates are 2¾" high and 2⅛" wide to fit a jar of the size mentioned. Negative plates are used for both the negative and positive plates of the battery. This is the easiest and most satisfactory way as they form very quickly. It will be found that after about five hours at 1 ampere the battery will hold a good charge.

Lead strips about 3/32" thick, ¾" wide, 3" long, are used to connect the cells. These must be "burned," not soldered, to the plates. A sort of half mould is used as shown. The connector and plate should be filed to a bright surface and then placed in the mould as indicated. A soldering iron is heated to nearly a red heat and then held on the joint just long enough so



Connections for the storage battery illustrated in the preceding column, showing how the connections are to be staggered.

that the two ends melt and run together. The connectors can be cut from sheet material or moulded from scrap lead in a mould also shown. Two plates should be burned on the end of each connector except the end ones. Be sure to burn the connector on the corner of the original auto battery plate so that there will be some metal to melt upon the strip.

Sulphuric acid and water are mixed to give a specific gravity of 1.300 to provide the electrolyte. Be sure to pour the acid into water slowly and stir constantly. Enough should be put in each cell so as to cover the plates. Put it in when cold.

The plates are assembled by placing a separator between them, grooved side to the positive, and binding the pair with a rubber band. The separator extends further down than the bottom of the plates, so as to keep them from touching the bottom of the jar where sediment is likely to collect and short circuit the plates if it connects adjacent ones. The end connectors have binding posts as shown in the illustration.

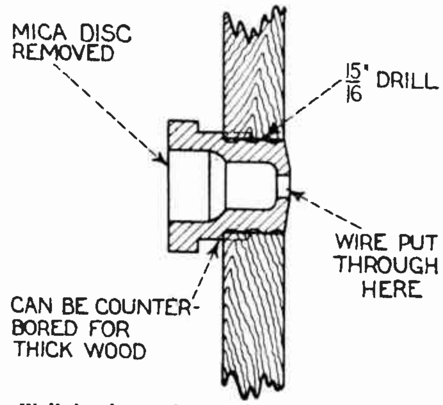
The cells are kept in a box of proper size, which has been given a good coat of acid proof paint or varnish. The author used a cigar box, 7½" long, 5" wide and 2" high, inside measurements. The cover of the box was used as a cover for the unit, as individual covers would be too complicated.

Do not charge at a rate of over 1 ampere. An electrolytic rectifier provides a simple and cheap means of charging from an A. C. circuit.

If more than 20 volts is needed, extra cells can be made and hooked up in series. Twenty cells (40 volts) will easily run a small arc light. This is not a so-called storage "B" battery as used in radio, this one being much larger and having greater capacity, although it may be used in radio work if desired.

Contributed by HARRY R. LUBCKE.

Simple Wall Insulator



Wall insulators for passing a wire through a partition with perfect insulation, using an old plug fuse socket.

AN old plug fuse forms the base of a very simple and efficient wall insulator which can be made in a few minutes.

As will be seen in the diagram, it is only necessary to remove the mica disk and the brass connection at the bottom of the fuse. The fuse should also be cleaned of any fuse wire that might remain.

To install the insulator a fifteen-sixteenth inch hole is drilled at the desired place through panel or wall and the insulator is screwed in as if it were being screwed into a regular socket. The wire is put through the hole in the center.

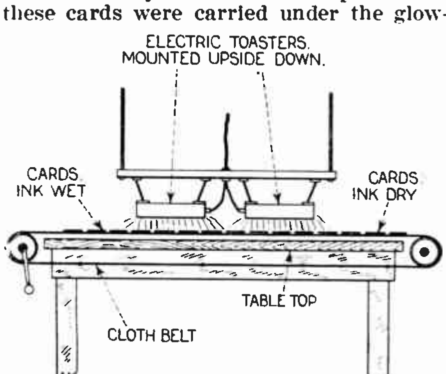
This insulator has an advantage over the porcelain tube variety in that it is held solidly in the wall.

Contributed by HARRY R. LUBCKE.

Printers' Dryer

IN a job printer's shop I visited, the other day, I noticed that the printer had taken two open-coil flat-bed electric toasters or toaster stoves, and had mounted them upside down so that their heated surfaces were lifted about one inch above the table top.

Traveling across the table he had then arranged a wide cloth belt on which, at one side, he laid the "wet" cards or small sheets as they came from the press. As these cards were carried under the glowing toasters, the ink on them was quickly dried and they emerged at the far side, ready for use, without "offsetting."



Two electric toasters inverted above a traveling band are used to dry pictures for printers or photographers.

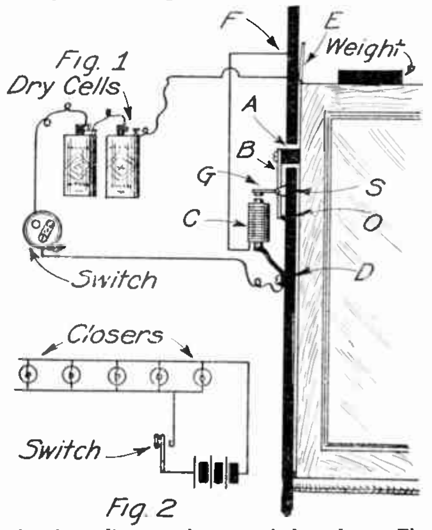
This home-made electric drying outfit enables this printer to handle many rush jobs, which would otherwise take several hours extra to dry sufficiently to be handled.

It is evident that there are many operations to which this arrangement could be applied.—*Electrical Merchandizing.*

Window Closer

A WINDOW closer to be operated by an electric circuit, is shown here; the closer is always out of sight and allows the window to be raised to any height.

Fig. 1 (A) is a piece of india rubber fastened to the brass bar (B). (S) is a support on which (B) is pivoted. The spring (O) presses against (B) and holds (A) pressing against the window. An



The above diagram shows a window closer. Fig. 1 shows the India rubber piece (A), which holds the sash up or down and when released the sash falls. Fig. 2 shows how a number of windows may be connected and operated from the one switch.

armature (G) is fastened in the middle of (B). The electromagnet is fastened under (G) so that when current passes (G) will be attracted. This draws the india rubber back and the sash is free to descend.

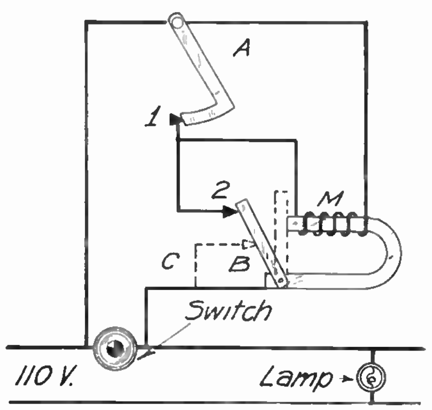
Fig. 2 shows the connection of five closers operated by one switch. The switch may be placed on the first floor of the house so that during a rain the windows may be closed all at once from the first floor; or it may be used in connection with a rain alarm. A weight is placed on top of the window sash so that it will descend.

Contributed by WILLIAM MEAGHER.

Wireless Switch

THE diagram illustrates a wireless switch which is operated by clapping the hands or producing other vibration.

The arm (A) is similar to the arm found in the Radio Rex, a toy dog which jumps out of his house when the hands



This switch is based upon the use of a delicately poised gravity connection such as utilized in the well-known radio-rex toy. Clapping the hands opens the switch. The magnet attracts its armature and the light is extinguished.

are clapped. (A) should be delicately suspended so that it makes a light contact with (1).

The main switch can be turned off and yet the light burns as shown by the diagram.

Then after the person is, say, in bed, he claps his hands and out goes the light. The clapping vibrates (A), which opens that circuit and causes the current to flow through magnet (M). The said magnet then draws over its armature (B), thereby turning out the light. (B) is part of the magnetic circuit of (M).

Needless to say, the magnet (M) must be well insulated from the core so as to prevent the current from flowing through it, or the circuit can be arranged as shown by dotted lines (C).

The whole secret lies in the arm (A) and one must experiment to cause it to jump easily. It will help some to mount the apparatus on a sounding board such as a cigar box.

Contributed by WALTER LINDQUIST.

Interesting Articles to Appear In November Issue of Practical Electrics

Mercury Vapor Arcs.
By Allan R. Kenworthy.

Floating Needles and the Magnet. By Dr. Albert Neuburger, Berlin.

Carbon Disc Rheostat.

Finding Positive Pole.

Thermic Telephones.
Concluded.

Little Known Methods of Producing Electricity. By Raymond B. Wailes.

Electric Cutter

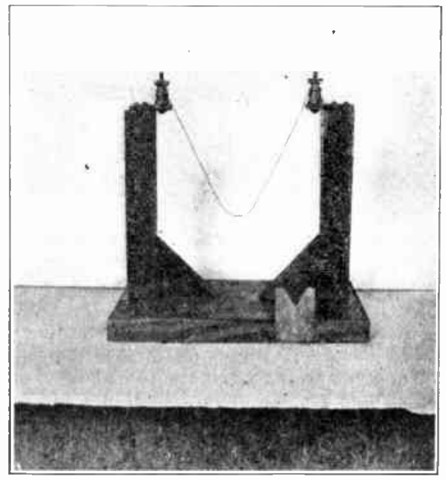
THE electric cutter described here has been used with great success for cutting jars, bottles, large diameter glass tubing and gauge glasses, to any desired length.

The appliance consists of a high resistance wire strung between two upright supports mounted on a base. Fiber arms fastened to the tops of the supports and carrying binding posts hold the strung wire securely. A short length of nichrome, silchrome, kromore, or other high temperature nickel- or silicon-chromium resistance wire serves admirably for the cutting element. German silver wire cannot be used for any length of time, for it slowly oxidizes and breaks.

A resistance composed of several turns of the same resistance wire wound upon an asbestos or slate form is used in series with the wire cutter, the cutter and the resistance being inserted in series with the 110-volt A. C. or D. C. circuit. Enough wire should be wound upon the resistance so that when the current is passing through it and the cutting wire, an almost bright red heat is obtained on both. The resistance should be enclosed in a tin box containing asbestos so that fire danger is eliminated.

To cut a bottle or large diameter glass tube, file a mark half an inch long on the piece where the cut is to be made and in the direction the cut is to follow. Now with the cutter wire heated apply the file mark to the wire and rotate the article. The crack produced can be easily led around the entire diameter by rotating the bottle, if a steady hand is used, always coming exactly even with the starting crack. The sharp edge of the article can be smoothed with emery paper, with a whetstone or on a plate of glass with turpentine and sand.

A small metal saddle fastened upon the



The apparatus shown is for the purpose of cutting bottles. It maintains a wire at red heat and when the bottle has a little scratch made upon it, it can be cut very accurately by the effect of the heated wire on the glass.

front of the electric cutter, as shown, enables very short lengths of tubing to be cut from glass tubing or rod. After filing a starting mark upon the tube, the tube is laid in the saddle, with the filed portion upon the metal saddle. A sharp rap with the file will break off the portion protruding upon the opposite side of the saddle.

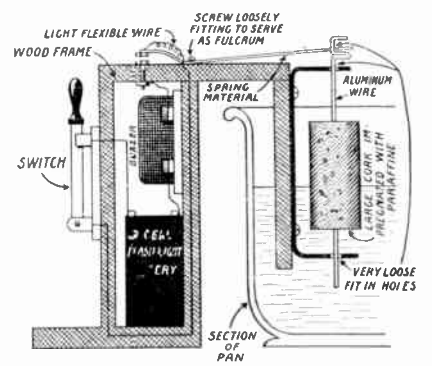
Contributed by RAYMOND B. WAILES.

Refrigerator Pan Alarm

IN view of the inconvenience caused by refrigerator water overflow, the alarm illustrated herewith may interest many of our readers.

Being composed of a single unit standing on the floor, and designed to extend over the edge of the pan, the device can be pushed in and out as well as set to one side when emptying the water.

The diagram is fully explanatory; most of the necessary material, with the exception of the battery, is likely to be



An elaborate water alarm which is supposed to be for a refrigerator pan, to warn of danger of overflowing, but will have numerous other applications. This apparatus can be adjusted for different levels.

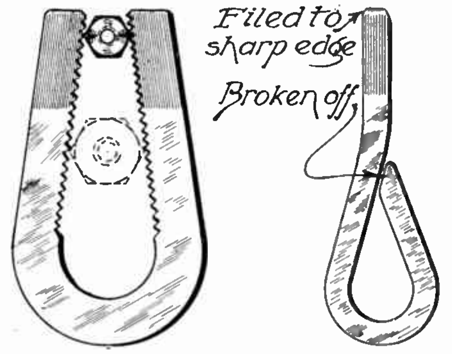
found in the junk corner of nearly any workshop.

The device is adjustable as to the water level at which the contacts are closed, by sliding the cork up or down the float rod.

Contributed by JOHN W. KRONS.

Tools From Magnets

An old telephone magnet can be utilized in constructing this wrench. The ends of the magnet are to be forced together, so as to make it fit the smallest nut necessary. The magnetic force of the magnet helps to keep the magnet in place on the nut. Notches should be filed in



Magnetized screw-driver and wrench made out of discarded magnets; the quality of the steel and the magnetization of the tools given them value.

the magnet as shown in the illustration.

A handy screw-driver can also be made from an old magnet by remodelling it in the manner shown in the next illustration. This is an ordinary magnet bought in a toy store. The force of the magnet helps to keep the tool's edge in the notch of the iron screw.

Contributed by Donald Johnston.

Electric Phonograph Stop

(E) IS the top of the phonograph, (A) is the turntable, (C) the reproducer, (B) the stop.

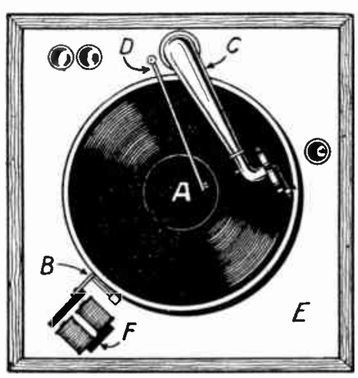
A pair of bell magnets are mounted so that they will draw evenly on the handle of the regular stop. They are shown at (F) in the diagram.

A brass strip is next bent as shown in the small figure. Place it on the machine as shown at (D) and fasten one of the electric circuit wires to it.

Fasten a wire to the reproducer arm in series with a couple of dry cells and the magnet. Connect the wire from the brass strip to the other terminal of the magnet.

The operation is as follows: When the reproducer reaches the end of the record, it touches the brass strip and closes the circuit, exciting the magnet. The magnet draws the stop or brake arm, which stops the phonograph.

Contributed by Fred Hall.



Very simple electric stop for arresting a phonograph when it reaches the end of the piece it is playing.

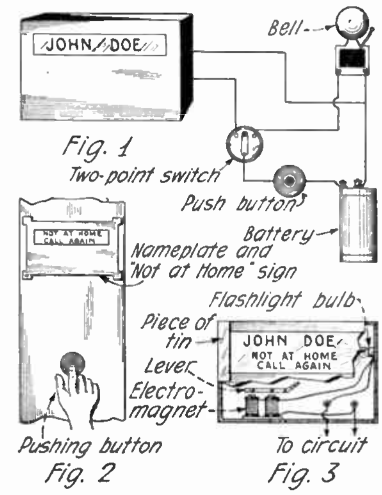
Announcing Sign

THE following materials are required to make this combination name-plate and "Not at Home" sign:

An old tin box about six inches long, four inches wide and one inch high, an electromagnet, a flashlight reflector and bulb, two binding posts (from a worn-out dry cell), a piece of soft iron bent in the shape of the lever in the diagram (Figure 2), a piece of light metal (such as tin or aluminum) about five inches long and one and one-half inches wide, two pieces of tin about three inches long and one-half inch wide, enough screws to put the contrivance together and fasten it above the push-button.

First cut a piece of tin about three-fourths of an inch wide and five inches long from the front of the box, three-fourths of an inch below the top of the box. On the inside of the box put a piece of glass over the hole and fasten by bending about one-fourth of an inch of tin at each end of the slit, over it. After supporting the glass tight, procure an old electromagnet from a worn-out electric bell and fasten this to the bottom of the tin box, inside and about in the center.

Next put a bolt about three-fourths of an inch long in from the back of the box, and fasten it to the back by soldering. Put a nut on the screw, then the lever (which has a hole in the center) the screw, and then a second nut to keep the lever in place. One end of the lever has a piece of cardboard glued to the bottom to keep it from sticking to the electromagnet



Door sign operated by electricity, so as to indicate when the occupant is out or when he will return, and to give any other information of that character by the touching of a button.

when the current is off, and is placed so that it is about three-eighths of an inch above the electromagnet. The other end of the lever is fastened with a bolt or rivet to the center of the bottom of the long piece of tin. This lever is so pivoted that when the magnet pulls the armature end down three-eighths of an inch, the end fastened to the piece of tin will rise three-fourths of an inch. On the lower three-quarters inch of this piece of tin are printed the words "Not at home, Call Again." On the upper three-quarters inch is printed the name of the person residing at the house.

Two small pieces of tin are bent so as to form a vertical groove to guide the large piece of tin when being raised by the electromagnet or lowered. The flashlight bulb in the reflector is placed at the side and in the front of the box, out of sight, but so that it will throw light on the large piece of tin when the button is depressed. The electromagnet and flashlight bulb are connected in series and the wires go to the insulated binding posts at the back of the box.

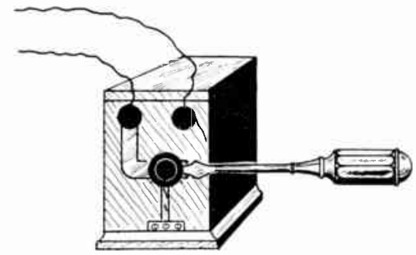
The combination name-plate and "Not at Home" sign is then connected as shown in the diagram with the bell, push-button, battery and two-point switch.

When you are at home, and the button is depressed, the bell will ring, but the name-plate will show your name only.

When you are not at home, and the two-point switch is turned to the other side, and the button is depressed, the bell will not ring, but will raise up the piece of tin high enough by means of the electromagnet to show the words "Not at Home, Call Again." When the button is released, the piece of tin will fall again so as to show only the name.

Contributed by Joe Cleveland.

Magnetizing With Buzzer



Magnetizing a screw-driver with a buzzer or electric bell—a rather interesting experiment and one which is easily tried.

THE blade of a knife or the end of a screwdriver can be magnetized quickly by using a spark coil and four dry cells, or, better yet, a 6-volt storage battery. One or the other of these is to be found in most homes or workshops.

When the battery is connected to the spark coil the buzzer will operate: then hold the handle with a piece of rubber, run the blade between the two points of the buzzer several times, and it will be magnetized. The blade is to be held so as to barely touch the contact points, so that they can be working constantly.

While it is hard to believe that anything can be magnetized in this way, one can easily be convinced by trying it.

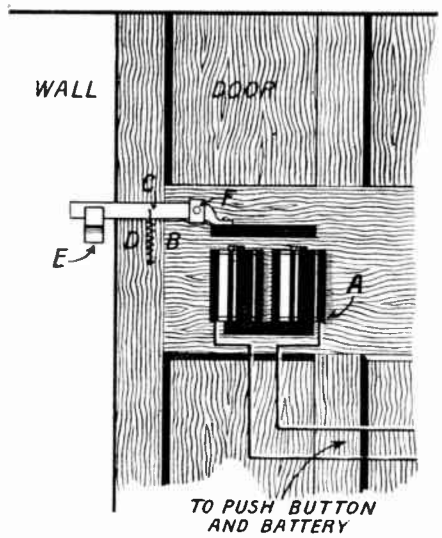
Contributed by Edward Hilbert.

Electric Latch

BY placing this contrivance on the door of my laboratory, I am enabled to leave or enter by simply stepping on a button and pushing the door open with my foot. This, of course, is a convenience when both arms are occupied.

(C) is an iron rod pivoted at (A), so it can work freely up and down; (B) is a spring; (D) is a stop; (E) is the hasp; (A) is an electromagnet. The wires from the electromagnet connect in series with a push-button and battery.

When the button is pressed, the electro-



Electric door latch which is released by closing an electric circuit, either by an ordinary button or a concealed key.

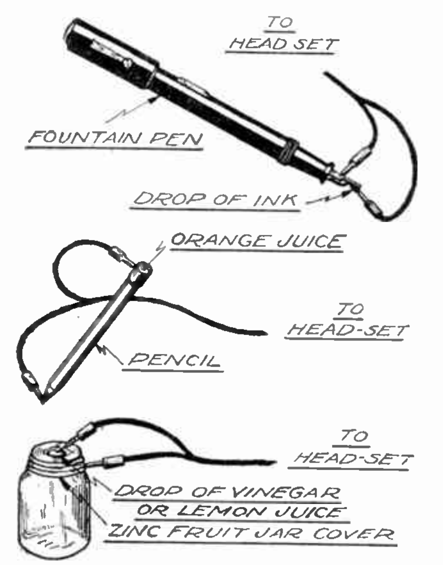
magnet is excited and pulls the iron bar (C) down, thereby lifting its other end from the hasp. The door may then be pushed open.

Contributed by Fred Hall.

Odd Batteries

THERE are numerous places about the house where the electrical experimenter possessing a radio head set can find or produce minute currents of electricity.

It is quite well known that a dime and a copper cent separated by a small corner



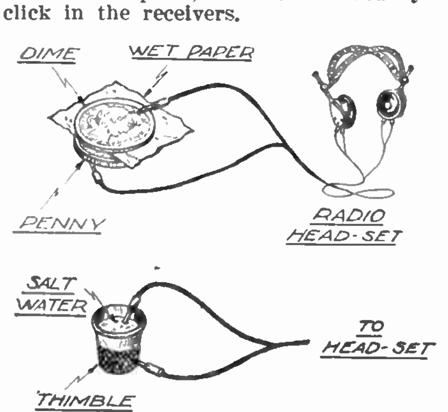
Three examples of the production of currents of electricity from unusual sources, such as a fountain pen, a lead pencil, or the cover of a fruit jar, which class of experiments can be extended to many other objects.

of wet newspaper constitute a miniature battery, and will produce enough current to make a very audible click in a telephone receiver. The sensitive radio head set will detect the current in quite a number of other places or arrangements.

A thimble partly full of salt water may be set on one terminal and a click will be heard whenever the other terminal of the head set is plunged in the water.

A fountain pen containing ink is also a battery. Shake out a big drop to the end of the pen and touch one terminal to the drop and the other terminal to the metal pen above the drop. A click will be heard in the receivers.

A lead pencil with metal ferrule and rubber eraser gives another element for a battery. Remove the rubber eraser from its holder and squeeze a drop of orange juice into the recess left on the pencil top. One terminal touched to the metal of the holder, and the other to the lead at the point, will be followed by a click in the receivers.



A thimble, with salt water, are elements in one little battery; the upper figure shows a coin battery, and the general way in which the miniature batteries are connected to the head-set.

A zinc fruit jar cover will also yield a wee bit of electric current. A drop of lemon juice is placed on the zinc cover. A small piece of copper wire wrapped around one terminal of the receivers and held in the drop of lemon juice, but not touching the cover, is the first requirement. Rasping the other terminal on the zinc cover will produce a corresponding rasping sound in the receivers. This experiment is equally successful using the zinc lining to the refrigerator and a drop of vinegar as the electrolyte.

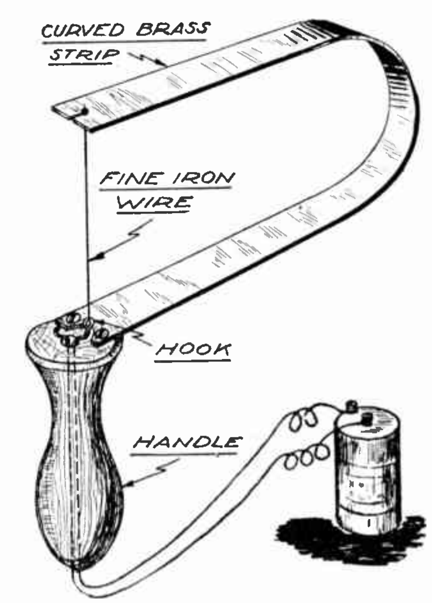
In connection with the short list of experiments I have outlined, I am wondering if some of the readers of PRACTICAL ELECTRICS would not find it possible to find a number of other places about the house where minute currents can be produced, using simple materials.

Contributed by B. W. CURRY.

Electric Saw

AT first glance the electric saw described in this article appears to be nothing more than a novelty. But despite its looks it is really a very useful device for certain classes of work.

This apparatus operates by the utilization of a heated wire; the wire, maintained at a red heat, burns its way through anything inflammable, or possessing a low melting point. Although best adapted for light work such as cardboard, hard rubber or other similar substance, bristol board, thin wood like cigar boxes and the like, it has under test cut an inch square piece of hard wood in two. A slight sawing motion makes it cut several times faster.



An electric saw, a very interesting and in many cases exceedingly useful article, for cutting wood and similar materials by a hot wire.

The surface of the material cut has a brown, highly polished look, due to the heat, but a rub with fine sandpaper will remove this. The feature that makes it practical is that the frailty of the substance to be severed is no hindrance to smooth cutting. The saw "eats" its way through without the harmful pressure and motion of the regular toothed saw. As an example of the delicate work possible the fact may be cited that as a "trick" I was able to cut a match stick into four parts lengthways.

It takes but a few minutes to construct. The materials necessary are a 10-inch strip of brass or tin, a wooden handle and two or three dry cells for current. As shown in the illustration the metal strip is bent double and at one end a fine slot one-fourth inch long is cut, while the other end has a slot a half inch long and one-fourth inch wide cut out. The end with the large slot is fastened on the end of the handle with two small screws.

Next a hole is bored through the handle at a slight slant so as to miss the end of the strip. A tiny screw hook or small bent nail is driven in the wood at the end of the handle exactly in the center of the slot or opening in the strip. Two wires from the dry cells are brought through the hole in the handle and then one wire is soldered to the strip and the other to the hook. Heavily insulated wire is best to prevent a short circuit. A thin piece of iron wire (a piece of screen wire will serve excellently), one-inch long has a small loop at one end and a knot at the other. The loop is slipped over the hook and the knot is pushed into the small slot so that it is held straight by the springiness of the metal strip.

When the current is turned on from the batteries the iron wire will glow at red heat, if the current is strong enough; a rheostat should be placed on the circuit to regulate the current. I have found that the best temperature for use at all times is not a full red heat, but where the wire is just on the point of becoming red, while still black in color.

Contributed by H. P. CLAY.

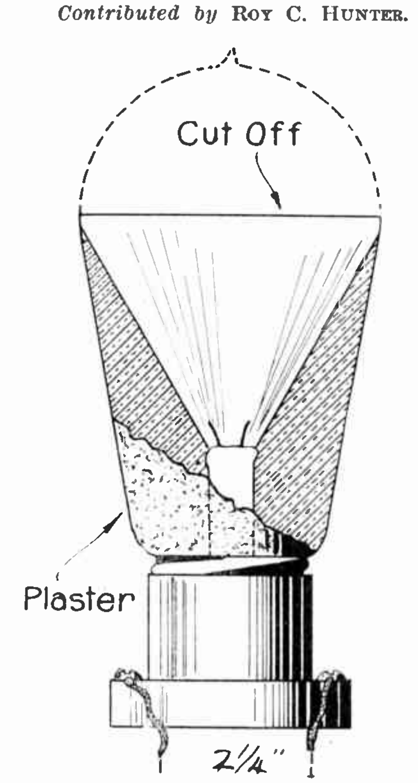
Rain Alarm

A VERY simple and efficient rain alarm can be made from an old burnt-out incandescent lamp.

A 75- or 100-watt incandescent lamp is obtained. It should be an old style tungsten lamp. The top is cut off as shown in the illustration. The filament is then taken out and the wires that are connected to it are broken off even with the glass inner stem. The inside of the bulb is filled with plaster of Paris, as shown. This is in order that the first few drops of rain that fall within the bulb will run down and close the circuit between the two wires.

For a super-sensitive alarm, cover the ends of the wires in the bulb with table salt. To use the device, place the bulb in a socket and put it outside where the first few drops of rain will fall upon it. The wires from the socket are connected in series with a battery and bell or any other kind of alarm.

Contributed by ROY C. HUNTER.



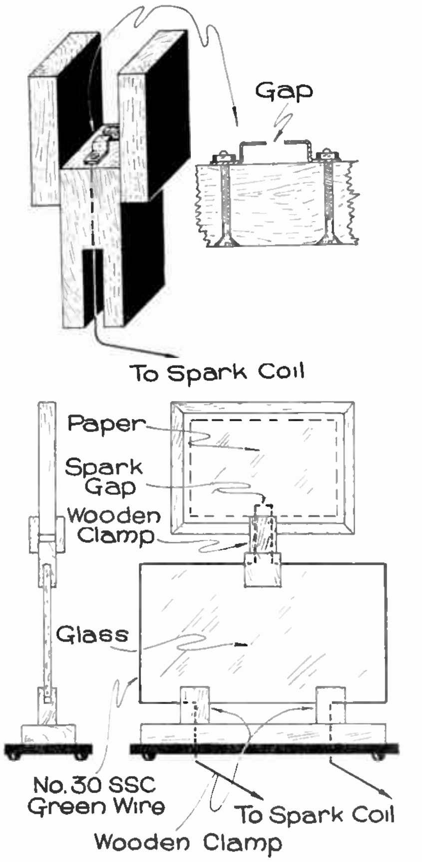
An incandescent lamp after the top is cut off is partly filled with plaster of Paris and acts as a sensitive rain gauge.

IN this department are published various tricks that can be performed by means of the electrical current. Such tricks may be used for entertaining, for window displays, or for any other purpose. This department will pay monthly a first prize of $3.00 for the best electrical trick, and the Editor invites manuscripts from contributors.

To win the first prize, the trick must necessarily be new and original. All other Elec-Tricks published are paid for at regular space rates.

Astral Spirits

THE magician calls attention to a large, unprepared wooden frame, to which he affixes a piece of white paper. He then sets this frame in a clamp, which in turn he attaches to the top of a sheet of glass held in a vertical position. He then emphasizes the fact that the glass rests on a wooden base entirely insulated.



A mysterious production of the name of a card chosen by one of the audience upon an apparently disconnected sheet of paper carried on the edge of a glass pane to suggest insulation.

He now shows the audience a pack of ordinary playing cards and requests that some one in the audience will kindly come up and choose a card. He announces that by the aid of spirits and divers other things known only to men of his profession, he will have the name of the chosen card written in letters of fire on the piece of paper, which is fastened to the wooden frame and faces the audience, and immediately the astounding thing takes place. The audience sees the name of the chosen card appear written in letters of fire that light up the whole room with a weird, ghost-like glow upon the paper. The explanation is:

The card chosen is "forced," that is to say, it is a card which the operator in the well known adroit manner causes the person to choose without his design being detected. The name of the card to be forced has been written on the piece of paper with a solution of six measures of potassium nitrate and one-half measure of gum arabic in enough water to dissolve them. It is applied with a camel's hair brush. This writing when dry will be invisible, but when a flame or spark is touched to any part of the writing the rest will ignite instantly and will produce the letters in sparkling effect. The ignition is produced by means of a one-half inch spark coil.

The electrical current is carried to the frame through a concealed arrangement of contacts and breaks as illustrated. The wire connects with ends of a No. 36 green silk covered wire which is glued to the edge of the glass. The wiring at the double clamp is arranged to make contact with the wire on the frame. The spark occurs at the ends of the wires in the frame and at this point it would be well to place a tiny piece of flash paper to insure quick results. If care is taken so that the spark will not touch the paper outside the letters, there will be no danger of the rest of the paper catching fire. However, to be positive that the fire will not spread from the writing, it would be well to paint the area bordering the letters with water glass or sodium phosphate solution. The writing is done in huge letters, making sure that they are all joined together, also that the spark is produced upon the part of the paper written on. A larger conductor may be used to surround the glass, such as a ribbon of copper, and instead of the spark, a short piece of thin wire may be ignited to start the letters to forming.

Contributed by HOWARD HUGHES.

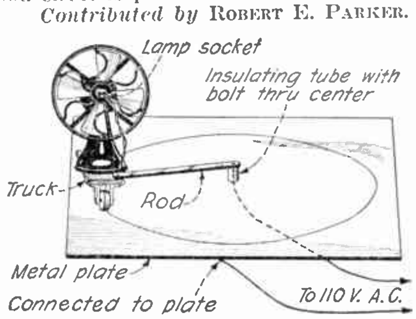
Unusual Window Display

A WINDOW display which gives a rather mysterious effect has recently attracted attention.

A two-wheeled truck on which a fan has been fastened is pivoted with a rod to the center of a metal plate. The rod is insulated from both the truck and the metal plate. One wire from the fan motor is run underneath the truck and fastened. The other wire is fastened to the rod. All wires are concealed. The fan acts as a propeller and causes the truck to move around very rapidly.

A small lamp socket is fastened to the fan's guard frame and connected in the circuit. A colored lamp is put in the socket. When the display is operated at night with no other illumination a very good effect is produced.

Contributed by ROBERT E. PARKER.

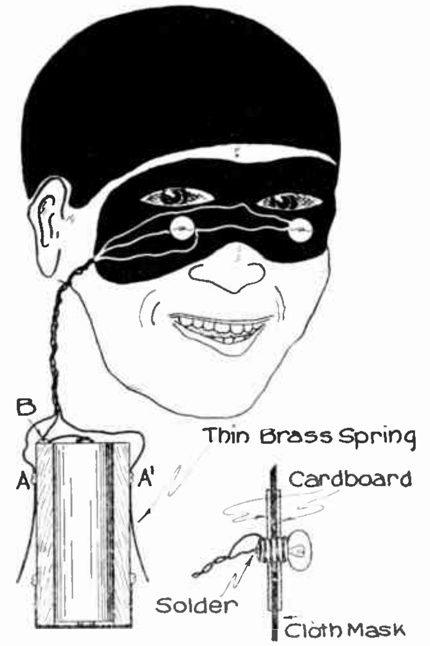


A fan mounted on a circular railroad as long as it whirls around follows the track as long as current is maintained; a very attractive window display.

Masquerade Outfit

BESIDES furnishing amusement for the wearer, the masquerade outfit shown here often secures the prizes in competitive masquerades.

An ordinary half-mask or domino is fitted with flashlight bulbs, one to each eye. The method of securing the bulb in the mask is clearly shown in the sectional view. Small circles of light cardboard are perforated in the center and made to fit tightly around the threaded end of the globe, thus eliminating the use of sockets.



This mask in a dark room presents the appearance of two mysterious burning eyes. To make it still more odd one eye can be lighted at a time, a sort of electric winking.

Three strands of very light silk covered wire are twisted together and fastened to the ends and sides of the bulbs with single drops of solder. The proper wiring of the globes to the battery case is obtained by trials; when finished, switch (A) should light globe (A); (A') should light (A'). and pressing (A) and (A') simultaneously should light both bulbs at once.

The battery receptacle should accommodate two cells of a dry battery. The case is made of wood and is open on both ends. The battery is held in place by the two pieces of spring brass shown in the diagram.

After connecting to the mask the wires are run over the left ear and down through the lining of the coat into the side pocket, where they are attached to the battery. A slight pressure of the arm against the side causes either globe to light up at will, while heavier pressure causes them to light simultaneously.

If dipped in solutions of different colors and dried, the appearance of the globes will be rendered still more effective.

Contributed by HAROLD FUSGARD.

Short-Circuits

THE idea of this department is to present to the layman the dangers of the electrical current in a manner that can be understood by everyone, and that will be instructive too. There is a monthly prize of $3.00 for the best idea on "short-circuits." Look at the illustrations and then send us your own particular "Short-Circuit." It is understood that the idea must be possible or probable. If it shows something that occurs as a regular thing, such an idea will have a good chance to win the prize. It is not necessary to make an elaborate sketch, or to write the verses. We will attend to that. Now, let's see what you can do!

Here beneath this flower
Rests Master John Brown.
He climbed an electric tower
And never climbed down.
—George C. Reed.

RAT STOPS OPERATIONS AT TWO BIG COLLERIES

Rodent Gets Into Fatal Mix-Up With High Tension System.

A Mauch Chunk, Pa., special of April 13 says: A monster rat crawling into the circuit breaker at Nesquehoning some time during the night caused a short circuit of the high tension system between the Hauto plant and the Nesquehoning colliery of the Lehigh Coal & Navigation Company. By means of the failure of the system to function both the Nesquehoning and Hauto operations were compelled to remain idle all day yesterday.

These are the bones
Of Mrs. Nosey Rat.
There was a flash when
On the breaker she sat.
—*As Reported by* W. B. Kennedy.

This grave holds
Marmaduke Slaughter,
While carrying a line
He stepped in the water.
—Harold J. Clark.

Here lies the remains
Of Abdullah Norman.
Who thought he'd monkey
With the electric fan.
—N. Del Vecchio.

LEFT FATAL BARE WIRE; IS HELD FOR KILLING

Stanley Sanders, a Pittsburgh Worker, Accused of Manslaughter in Mrs. Smith's Death.

Special to The New York Times.

PITTSBURGH, Aug. 8.—Stanley Sanders, an electrician employed by the Duquesne Light Company, will face a jury in the Criminal Court on a charge of manslaughter growing out of the death of Mrs. Katherine Smith, who was electrocuted at her home several weeks ago. Sanders was held by a Coroner's jury today.

It developed at the inquest that Sanders had been called to the Smith home to do some electrical repair work. Before he could finish the work, according to the story he told, he was ordered away on an emergency job and left several wires carrying the usual house current without insulation in the basement of the home.

Several days later Mrs. Smith was doing laundry work in the basement and slipped on the damp floor, falling and touching the bare wires. She died almost instantly. Stanley said that while he left the wires bare he told Mrs. Smith that it would be dangerous for her to go near them.

Lies sleeping here
Jeremiah Klein.
He sprayed the tree,
Also the line.
—Gordon Callender.

? How and Why ?

THIS department is conducted for the benefit of everyone interested in electricity in all its phases. We are glad to answer questions for the benefit of all, but necessarily can only publish such matter as interests the majority of readers.

1. Not more than three questions can be answered for each correspondent.
2. Write on only one side of the paper; all matter should be typewritten, or else written in ink. No attention can be paid to penciled letters.
3. Sketches, diagrams, etc., must always be on separate sheets.
4. This department does not answer questions by mail free of charge. The editor will, however, be glad to answer special questions at the rate of 25 cents for each. On questions entailing research work, intricate calculations, patent research work, etc., a special charge will be made. Correspondents will be informed as to such charge.

Kindly oblige us by making your letter as short as possible.

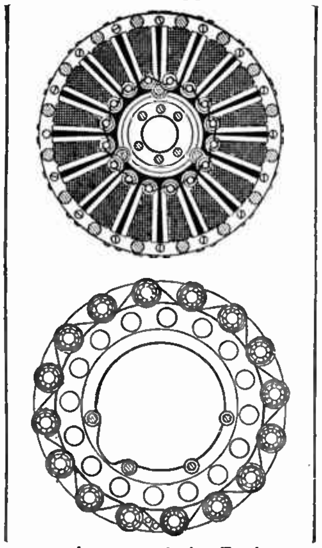
The Ford Magneto

(321)—G. W. Wise, Strafford, Mo., writes:

Q. 1.—Please publish a diagram of the armature winding of the generator which is standard equipment on Ford cars at this time. I wish to know how the armature coils are connected to the commutator, how spaced, and the number of turns.

A. 1.—The illustration shows a very ingenious type of dynamo which is used on Ford cars only. Sixteen permanent magnets attached directly to the fly wheel of the engine produce a revolving magnetic field which acts upon as many coils attached to a fixed plate supported by the engine base. This forms a magneto having a revolving field and a fixed armature.

As the coils are stationary, no commutator or brushes are required, as the current can be taken from the fixed coils by a direct connection. Although this type of a magneto is not as efficient as the conventional design because more metal and wire are required to produce the same power, this disadvantage is not serious when used as in the Ford car, as the magnets which form the greatest weight are joined to the fly wheel, which can be correspondingly lighter. The advantages of not having a commutator and brushes to cause trouble are apparent.



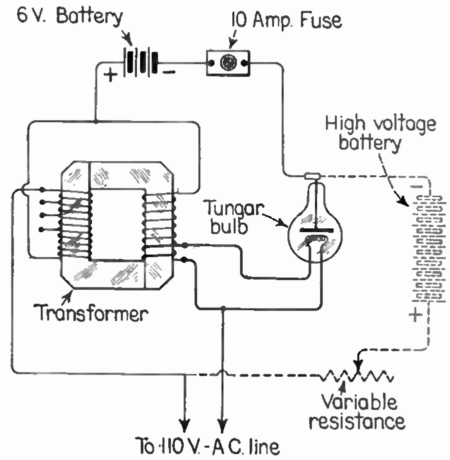
The rotor and stator of the Ford magneto are shown in the diagram above. The 16 permanent magnets shown are attached to the flywheel and revolve therewith exciting the stationary coils.

Tungar Bulb Queries

(322)—We have received inquiries from several sources regarding the Home Battery Charger employing a Tungar bulb which appeared in the March issue of PRACTICAL ELECTRICS.

Q. 1.—I have constructed the battery charger according to directions and find that the bulb gets very hot. How hot can it get without burning out?

A. 1.—The bulb does get very hot when operating under normal conditions, but just how hot it gets, under such conditions, we do not know. The manufacturers of these chargers place the bulb in a well ventilated metal box, to allow free circulation of the air as well as protection from mechanical injury. The best way to determine if the bulb is not overloaded is to connect a D. C. ammeter in series with the battery being charged. If the current flowing is not over six amperes, there is no danger of the bulb getting too hot. The bulb should then be removed and an A. C. voltmeter should be connected to the filament winding. This should indicate 2½ volts, or less. If the voltage is over 2½ the life of the bulb will be shortened.



The diagram shows a connection for a tungar rectifier which by means of a transformer is arranged for charging high and low voltage batteries.

Q. 2.—Are there different sizes of Tungar bulbs? The electric company here asks me what size outfit the bulb is for.

A. 2.—There are several sizes of Tungar bulbs. This charger was designed for use with Tungar bulb Cat. No. 189048, manufactured by the General Electric Company.

Q. 3.—Will you show a diagram whereby I can charge ten 6-volt batteries with the same bulb.

A. 3.—This connection was clearly shown in the original article, the diagram of which we are reproducing here. For charging the ten 6-volt batteries the connections shown in dotted lines should be used. In this case the transformer is used merely to light the filament of the bulb, and the 6-volt battery, shown in the diagram, is, of course, removed. The ten 6-volt batteries are connected as shown in dotted lines with a resistance in series, which may be a large lamp bank. This resistance need not be very high but should safely pass 6 amperes. Transformer steel laminations of various shapes may be purchased from almost every large electrical supply house, especially from those who manufacture small transformers.

Q. 4.—The drawing calls for 73 turns of No. 8, 6 turns of No. 6, and 197 turns of No. 10 B. & S. gage magnet wire, while in the text 73 turns of No. 10, 6 turns of No. 6, and 197 turns of No. 14 are called for. Which is correct?

A. 4.—The smaller sizes of wire, as called for in the text are correct. The weights given in the text are also correct for the smaller sizes of wire. The larger sizes may be used, of course, and will give a little higher efficiency than the smaller wire.

Q. 5.—The drawing of the core shows the core legs butted up against each other in two corners. Shouldn't the laminations be interleaved at all corners?

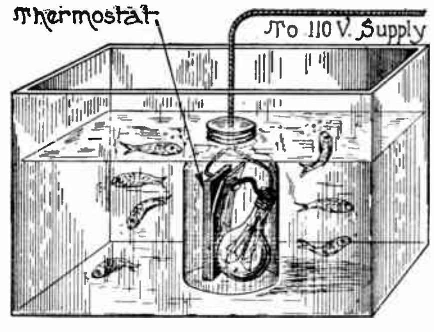
A. 5.—If you will carefully read the text you will find that the laminations used in the transformer shown in the reproduced photograph are "L" shaped, and not rectangular as you probably assumed. If four rectangular shaped laminations were used in place of two "L" shaped laminations they should interleave at the four corners as you say. The "L" shaped laminations form a dove-tailed joint at the two corners and build up in a solid core, of excellent magnetic joints.

Fish Incubator

(323)—Walter A. Cohen, Bronxboro, N. Y., writes:

Q. 1.—Will you please show me how I may use a thermostat and electric heater for heating and maintaining the temperature of an aquarium for tropical fish?

A. 1.—This apparatus may be obtained from concerns who manufacture electrical incubators. A small aquarium may be kept warm by simply immersing a lamp globe hermetically sealed in a glass fruit jar in the water. A suitable thermostat may be placed in the jar with the lamp and connected in the lamp circuit for controlling the temperature. The jar should be painted black on the inside so that the light from the lamp will not affect the fishes and also the black coating will absorb the light and produce heat. By experimenting with different sizes of lamp bulbs the correct one can be determined. The lamp cord running from the 110-volt socket through the water to the lamp in the jar should be thoroughly insulated so that the water will not soak into the copper wires. The illustration shows the arrangement of the parts.



An incandescent lamp in a water-tight vessel is used to keep up the temperature of water in an aquarium to any desired degree.

Charging Battery on 220 Volts

(324)—L. King, Corning, Ark., asks:

Q. 1.—How many 50-watt 220-volt lamps must I use in a 220-volt D. C. circuit to reduce the current to charge a 6-volt storage battery?

A. 1.—This depends upon the ampere carrying capacity of the 220-volt circuit and the time within which you wish to charge the battery. If you wish to charge the battery at a 6-ampere rate you will require enough 50-watt lamps in parallel to pass 6 amperes at 220 volts. Six amperes at 220 volts represents 1,320 watts. 1,320 divided by 50 is 26.4, or 27 lamps as by Ohm's law. If the 220-volt line will not carry 6 amperes you will have to use less in the circuit. We do not advise charging a u-volt battery on a 220-volt circuit, as the efficiency is less than one-half of 1 per cent.

Q. 2.—How many lamps will I have to use to charge a 24-volt "B" battery?

A. 2.—The charging rate of a "B" battery is about one-quarter ampere. As one 50-watt lamp on a 220-volt circuit will pass about .227 amperes, one of these lamps in series with the "B" battery will be sufficient. We are assuming, of course, that the 50-watt lamps you are using are designed to be operated on 220 volts, and not 110.

Q. 3.—How many lamps should be used on a 110-volt A. C. line with an electrolytic rectifier or on a 110-volt D. C. line without the rectifier, for charging a 6-volt battery at a 5-ampere rate?

A. 3.—Twelve 110-volt 50-watt lamps connected in parallel and the whole connected to the line in series with the battery and rectifier if used on an A. C. line will allow for charging at about the 5-ampere rate.

Skinderviken Button Loud Talker

(325)—J. Malakin, Scranton, Pa., asks:

Q. 1.—Tell me how I can make a loud talker to transmit phonograph music using the Skinderviken button to collect the sound waves.

A. 1.—You may use a Skinderviken transmitter button to transmit phonograph music by attaching the same to the tone arm of the phonograph. The button may then be connected in series with two dry cells and the primary of an induction coil, and the secondary connected to an ordinary radio loud talker.

A small induction coil may be made as follows: Form a core of soft iron wires 3 inches long by ¼ inch in diameter. Insulate this with tape or Empire cloth. Next wind two layers of No. 23 S.S.C. wire, which composes the primary, and slip over this an insulating tube with a one thirty-second-inch wall. Tape or Empire cloth may be substituted for the insulating tube. Over this wind ¼ pound of No. 34 wire in even layers.

Q. 2.—How can I make a simple induction coil?

A. 2.—If you wish to use this induction coil with a vibrator, build up a condenser composed of 30 tinfoil sheets 4 inches long by 2 inches wide. This is to be connected across the vibrator. Using a primary voltage of 3, this coil will give a ⅛-inch spark. If you wish to use this coil in connection with the Skinderviken button above mentioned, the vibrator and condenser will not be necessary.

One-Inch Induction Coil

(326)—J. K. Moore, Andover, Mass., asks:

Q. 1.—How can I make an induction coil that will give a 1-inch spark?

A. 1.—We are giving you herewith data on a 1-inch spark coil as requested by you. Six to eight volts will be necessary for the operation of this coil. The core is composed of a bundle of iron wires, 8½ inches long by ½ inch in diameter. This is covered with several layers of Empire cloth or a hard rubber tube. On this is wound two layers of No. 16 D.C.C. wire, over which are placed several more layers of Empire cloth or another hard rubber tube. On this wind the secondary, which is composed of two pounds of No. 34 S.S.C. or enameled wire.

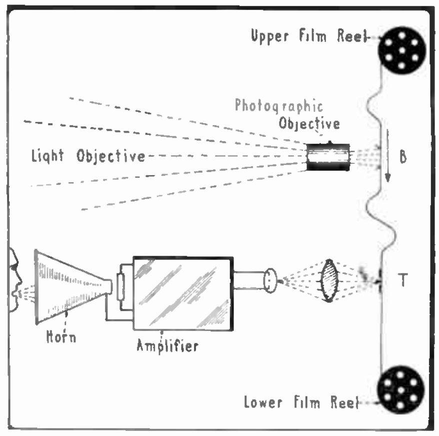
The winding of the secondary coil is a very tedious job and we suggest that you purchase this coil already wound.

The condenser for use across the vibrator of this coil contains 120 sheets of tinfoil 5 x 7 inches.

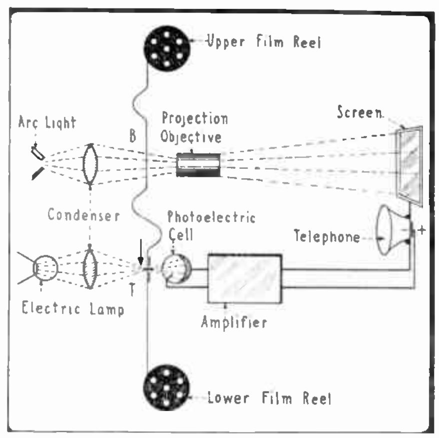
Talking Movies

(327)—Harold Williams, Detroit, Mich., asks:

Q. 1.—How is it possible to accurately record sound waves on a moving picture film when the film is passing by the objective lens in jerks?



Photographing the voice on a moving picture film. The film moves continuously.



Projecting the voice sounds from a moving picture film. In both cases the speaking film moves continuously.

A. 1.—Although the film is passing by the lenses in jerks, it does not necessarily pass by the sound recording or reproducing apparatus in jerks. As shown in the illustration, the film is slack both above and below the photographic objective. The slack is sufficient to allow for a uniform motion by the portion of the film recording or reproducing the sound, although it is passing by the photographic or projecting objective, as the case may be, in jerks. The recorded sounds will be not really a few feet in advance of the pictures, but as they were photographed in the way described, the reproduced sounds will always be in synchronism with the reproduced pictures.

Lead-in Wires in Electric Lamps

(328)—H. J. Linkins, Springfield, Ill., asks:

Q. 1.—Of what metal are the wires that support the filament in nitrogen lamps?

A. 1.—The wire originally used for the leads from the filament of an electric light bulb was platinum at the point where it passes through the glass stem. However, there has lately been found a combination of metals known as Dumet, which has the same coefficient of expansion as glass, and this metal is now being used.

25-Ohm Telephone Receiver

(329)—Harry J. Kelly, Lowell, Mass., asks:

Q. 1.—Where can I obtain a 25-ohm receiver for use with a microphone button?

A. 1.—We believe that an ordinary 75-ohm receiver will function very well with your microphone button. We do not know of any concern manufacturing a 25-ohm receiver, consequently an ordinary receiver would have to be rewound to satisfy your demands. We would suggest that you use a small induction coil in series with the transmitter button, stepping up the voltage and employing a 75-ohm receiver in series with the secondary of this transformer.

Battery Lead Trays

(330)—C. A. Kemnitz, Eldorado, Wis., asks:

Q. 1.—Where can I obtain lead trays for constructing the battery shown on page 353 of the July, 1922, issue of Practical Electrics?

A. 1.—The lead trays to which you refer in your recent communication would have to be built by yourself. The simple mold of clay or plaster, or even wood, could be employed for that purpose. If you have sheet lead on hand, a die could be built for pressing or beating up the trays out of the sheet material. A wooden mallet such as plumbers use will be best for heating up the sheet lead.

Electrolytic Depilarization

(331)—J. E. Duffy, Sawtelle, Cal., asks:

Q. 1.—How can I make an electric needle for the purpose of destroying superfluous hairs?

A. 1.—Make up a sharp gold needle out of fine wire; mount this in a suitable holder, and connect to the negative side of a six-volt storage battery with a variable resistance in series. A sponge electrode is connected to the positive side of this battery. The method of manipulation is as follows:

The needle is inserted into the hair follicle; the patient then grasps the sponge electrode until a small trace of bubbles exudes from the hair follicle. The patient releases the sponge electrode, and the needle is then withdrawn. A pair of tweezers easily removes the hair without pain. If the operation is painful, the gold needle has not been inserted properly.

Tin Can Batteries

(332)—M. F. Corbett, Syracuse, asks:

Q. 1.—Please show how to make sal ammoniac voltaire cells out of tin cans.

A. 1.—For making wet batteries out of tin cans you should first clean the latter thoroughly inside and fill within one inch of the top with a concentrated solution of sal ammoniac. Provide a wooden cover for the can and through the center of the latter drill a hole of sufficient size to introduce an ordinary No. 6 dry cell carbon.

The cell will then be ready for use. It will give from 1.1 to 1.6 volts. The amperage, however, will not be very great, but will serve for experimental purposes. In using the cells, they should be placed in such a position that they will not cause injury to any surrounding objects if they should happen to leak. You will find a tin can copper sulphate cell described in Practical Electrics, September, 1923, page 514. The illustration shows clearly the construction of either cell.

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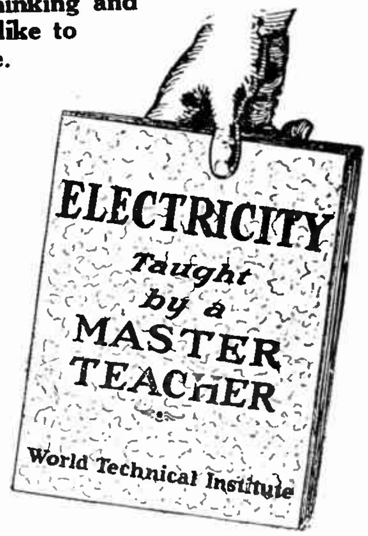

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How and Why?

(Continued from page 560)

Construction of a Small Oudin Coil

(333)—Arthur E. Newlon, New Lexington, Ohio, asks:

Q. 1.—Will you please give details of the construction of a small Oudin coil?

A. 1.—We would suggest that you build an Oudin coil as follows:

On a cardboard tube 18 inches long and 3½ inches in diameter, wind one layer of No. 32 single silk covered wire, each turn being separated from the preceding turn by a space of one-sixteenth of an inch. This is mounted upright on a base. On another drum about 10 inches in diameter, wind 11 turns of No. 2 aluminum wire, or copper wire may be employed. If wire is unobtainable, tubing or ribbon may be used. The turns on this coil are separated one-half inch from each other. A ½ to a 1 kw. transformer is used to excite this Oudin, or a 3-inch spark coil may be so employed. Connect up the apparatus, as shown in the accompanying illustration.

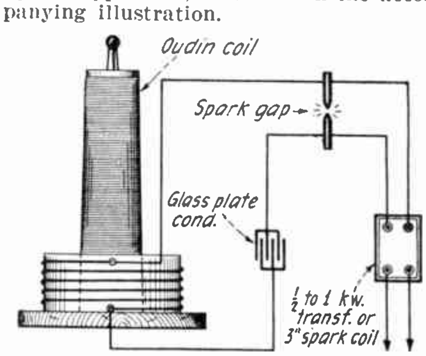

Diagram of connections of an Oudin coil, giving general hook-up and disposition of parts.

Photo-Electric Cells

(334)—O. C. Williamson, Mountain View, Cal., writes:

Q. 1.—Please give data on a photoelectric cell which is instantaneous in its action and will pass absolutely no current when no light is directed upon it.

A. 1.—Photoelectric cells are almost absolutely instantaneous, and pass such an infinitesimal amount of current at a high voltage when not affected by light that the amount may be assumed to be negligible. This refers to the Kuntz and other rubidium screen cells, not to selenium cells.

Piezo-Electric Effects

(335)—C. G. Taylor, Rochester, N. Y., asks:

Q. 1.—What solution is used in growing Rochelle salt crystals for piezo-electric effects?

A. 1.—Rochelle salt crystals are grown from a supersaturated solution of Rochelle salt in distilled water.

In making these crystals, Rochelle salt is added to boiling water until no more of the salt will dissolve. The solution is then placed in a container and allowed to cool; during the cooling process it must neither be shaken nor otherwise disturbed in the least degree. Crystals will form within ten or twelve hours.

Another solution is then similarly made or else the first solution is again used but some of the crystals are removed, and the rest dissolved in the hot liquid. Several of the crystals obtained during the first growth are then placed upon an inverted tumbler in the solution just prepared, after the same is cooled to about 12 degrees above room temperature. These crystals will then grow larger.

The same method is repeated until a crystal 1 to 1½ inches long and about 1 inch across is obtained. Long hexagonal crystals or triangular crystals are the best. The crystal must be employed while still fresh.

Recuperation of a Dry Cell

(336)—Dale Pollack, Weehawken, N. J., writes:

Q. 1.—I have a 2-cell, 3-volt flashlight with a 2½-volt bulb. This was in use until the battery was completely worn out and the bulb failed to light. After standing idle for several days I noticed that the battery would light the bulb up brightly again. Will you explain this?

A. 1.—The cause of the action you have noticed in connection with your flashlight battery is due to the recuperating powers of dry cells. During use the cell becomes polarized, and if the use is kept up long enough, the cell ceases to give any current. However, upon standing, the cell depolarizes, and can be used over again for short periods.

Nickel Plating

(337)—Martin Johnson, Cook, Minn., asks:

Q. 1.—How can I nickel-plate small articles, using a 6-volt automobile battery?

A. 1.—Nickel plating with a 6-volt storage battery may be accomplished in a small jar made of glass or earthenware. The solution used should consist of 1 gallon of water, 14 ounces of nickel ammonium sulphate double salt, and 2 ounces of boric acid. The resulting solution should show a hydrometer reading of 7 degrees Baumé. The anode should consist of 99 per cent pure nickel bar or plate and the cathode is the article to be plated.

It will be well to insert a rheostat in series with your battery, for nickel plating requires a quite careful regulation. A heavy current will result in a coarse crystalline deposit which will crack and peel readily.

Electrolytic Rectifier

(338)—F. G. Cameron, New York City, inquires:

Q. 1.—Will you kindly give me details for constructing an electrolytic rectifier for charging storage batteries from alternating current?

A. 1.—We are giving herewith the method of making a rectifier for charging batteries.

Four plates of aluminum and four of lead, each 4½ inches by 6 inches, are separated a distance of 1 inch by means of wooden blocks. They are suspended in a saturated solution of ammonium phosphate, Rochelle salts or slightly acidulated water. A resistance is placed in series with the same, this generally being a lamp bank. The circuit diagram has been often given by us.

Ford Spark Coil Phenomenon

(339)—J. D. Lassiter, Picher, Okla., inquires:

Q. 1.—By placing the lead-in wire and the ground wire of a radio aerial near the secondary terminals of a Ford spark coil I find that a spark will jump from each. As the aerial is well insulated from the ground, how can they form a circuit?

A. 1.—The reason that a spark jumps from your Ford spark coil to the aerial and ground terminals is because of the fact that both act as the plates of a condenser, the air between the aerial and the ground being the dielectric. Consequently, you are charging your aerial, and at the same time causing waves to be radiated into space, which waves are called Hertzian waves.

Tidal Power

IN a Paris message dated December 30th, Reuter states that the French Chamber has passed without discussion a Bill for the erection of an experimental tidal electric-power station at Aber-Wrach (Finistere). It is proposed to build a barrage of 150 m. across the estuary, the top of which will be level with the land at either end and 4 m. above the spring tides high-water mark.

The barrage is to be constructed of hollow reinforced concrete blocks. The center block will be 35 m. long and 22 m. broad, and will contain the turbines and alternators; on the right hand side of the barrage a lock will be constructed to allow the fishing craft to pass. It is thought that, according to the height of the tide, the barrage will retain from 2,000,000 to 3,000,000 cub. m. of water. The turbines will work on difference in level between the water inside and outside the barrage, and will act whether the tide is flowing or ebbing, except for a short time when the water is nearly the same height on both sides. A difference of 70 cub. m. or so (it is stated) is all that is necessary to set them in motion.

Four turbines will be used, and the two alternators attached to them will furnish a current at 1,500 V. Owing to the fact that the turbines will each furnish from 75 to 1,200 horsepower, according to the state of the tide, it has been necessary to evolve some scheme for making the power obtained less irregular. It is proposed to build across the river Diouris, above tide level, a dam which will store 12,000,000 c. m. of river water, and which, even at high water will give the river a fall of 8 m., and at low water a fall of 29 m.

It is estimated that a maximum of 4,800 horsepower will be furnished by the installation and the regular production will be 1,600 horsepower. It is hoped that the annual output of the power station will be 11 million kilowatt. The expenditure will probably amount to 20 million francs.

Electric Drive on Ships

THE following comes from the commander of the U. S. S. "Maryland," Captain Sellers:

"The storm proved the value of the electric drive. That is automatically regulated, so that no matter what seas we plow into the speed of the ship is maintained. During the storm we sometimes brought up against seas as if they were brick walls, but the 'Maryland' went right through them.

"The engineer officer told me that at one time when we ran up against seas that checked our course there was 8,000 more horsepower generated to bring the speed up to the normal of 18 knots and keep it there. The automatic governor takes care of that, and all that is necessary is to set the motors at the desired number of revolutions and they keep that speed."

Electric Power Development

By M. H. Aylesworth,
Executive Manager, National Electric Light Association

WITH an output of approximately 51 billion kilowatt hours and with over $750,000,000 raised for refunding, new construction, extensions and betterments, the electric light and power companies of the country during 1922 continued the same steady march of progress and growth maintained by them for the past 15 years.

While the appropriations for new construction in 1922 made a new record, the industry is in reality only on the threshold of a great comprehensive and complete development era.

The harnessing of the nation's water powers alone and the contribution of their energy to the productive wealth and prosperity of the country will require vast sums of money every year for the next decade or two. Already applications are on file with the federal power commission involving 17,692,000 primary horsepower and projects aggregating 2,500,000 primary horsepower are now under construction. The estimated capital involved in the projects granted preliminary or final permits and licenses is $778,000,000, and the transmission, distribution, and ultimate utilization of the electricity generated by them will involve an additional expenditure approaching five billion dollars.

But 2,500,000 horsepower is only a small part of the whole. The total hydro-electric horsepower awaiting development is 54,000,000, and it is expected that in the ordinary course of events all of the 17,692,000 horsepower applied for will be in operation by 1930, with many new projects under construction or in contemplation.

While much of this hydro-electric energy will be used to replace the electricity now generated in coal-burning power stations, there will be no let-up in the erection of huge steam turbine stations, particularly in the great industrial centers in the East. Here there is only water power enough to supply a small part of the available load, and the great bulk of electricity will have to be generated as it is at present, in large, modern, coal-burning power houses. The tendency, however, will be to replace the many small stations, by a few larger ones and to locate these whenever possible close to the coal mines. This in turn will give impetus to the construction of high-tension transmission systems with potentials ranging as high as 220,000 volts.

As to the possible market for all this electricity, there is every indication that it will develop faster than the facilities for supplying it can be brought into operation. The field of railroad electrification has hardly been touched, and opportunities equally attractive are to be found in the industrial world. There is approximately 65,000,000 horsepower in steam locomotives on the railroads of the United States which will eventually be displaced by electric equipment, and there is 26,000,000 horsepower awaiting conversion in the manufacturing industries. Then there are the millions of homes still to be reached with electric service and the tens of millions that are potential users of electric washing machines, vacuum cleaners, refrigerating machines, electric ranges and numerous other labor-saving and convenience devices.

A New Electric Furnace

THE electrical home has arrived—and the electrical factory is on the threshold. Surprising accomplishments have come to light with the entrance of electricity more and more fully into industry. The most recent is the appearance of a new and particularly efficient style of electric furnace for melting non-ferrous metals. This furnace is of the induction type. The first installations have revealed possibilities in the melting of brass that have never before been realized with the old style of crucible and oil-fired furnaces. Actual operation has demonstrated that whereas it costs $16 per ton to melt brass in a coal-fired furnace, and $14 in an oil-fired furnace, the cost with the new electric furnace is only $8 per ton, or .4 cents per pound.

Metal is also saved, for this electric furnace, working tests show, melts brass with a distinct reduction of zinc waste; and at the same time the product turned out is finer in quality than was the case when the old-style furnaces were used.

Laymen no doubt may fail to grasp the significance of all this. If so, it is only necessary to glance at the findings just published by the United States Bureau of Mines after an investigation of brass furnace practice in the United States. This statement proclaims that if electric furnaces were substituted entirely for the old types, the saving in the brass melting industry would run to between two and three million dollars a year.

"If all the brass made in the country could have been melted electrically in 1917 and 1918," the Bureau adds, "the war expenses of the country would have been reduced some $20,000,000."

The secret is that with the old-style furnaces there are certain serious wastes, which are practically done away with in the electric furnace. These wastes include enormous losses of zinc by vaporization.

Possibly as much as 6 per cent of the metal is lost in making brass castings, and 10 per cent is lost in making wrought brass. At the brass casting shops of one large plant, it is estimated, 7500 pounds of zinc pass from the stacks into the atmosphere every day in the form of zinc oxides—literally vanish into thin air.

Electric furnaces for brass melting, the Bureau of Mines estimates, would mean that six thousand tons less of metal would be required, releasing labor and railroad rolling stock for other needs. The health and safety of the workmen is incidentally increased by the cooler and cleaner character of the work.

Lectures for the Deaf

A GOOD deal of attention has been devoted in late years to the development of the telephone transmitter and receiver.

The requirements of radio operators have brought forward new receivers and special ones have been devised for the deaf. A sensitive microphone is part of the apparatus, the speaker stands well back of the microphone case, so that he can lecture with comparative ease, and not feel any annoyance due to the impression that he is talking through a contracted microphone. He can hold himself back from the transmitter and speak exactly as if he were addressing a hearing audience, with the certainty that his words are reaching every person present.

The improved microphone transmitters of the present day and the sensitive receiver specially designed for the deaf have made this system of lecturing to the deaf possible and practical.

Electric Locomotive Repairs

In the *American Machinist* Mr. Frank C. Hudson states that the electric locomotive brings entirely new problems to the railway repair shops, involving the need of men who understand electric motor work, such as winding armatures, caring for commutators, and the like. But electric motors require much less attention than their steam-driven predecessors, and a general overhaul can be made in about one-third the time formerly required. This is partly attributable to the absence of reciprocating parts in the transmission of power. The substitution of rotary motion eliminates the pound on the wheel bearings and entirely does away with the wear on main and side rod bearings. Another noticeable effect is the reduced wear on driving box thrust-plates and hub-liners, the life being incresed from 50 to 100 per cent over that of the steam locomotives.

Static Spark and Gasoline Tanks

In a recent inquiry at Bridgeport into the death of an occupant of a closed automobile by fire resulting from the explosion of a gasoline tank, the explosion was due to static electricity induced by the flow of gasoline into the tank.

The tank was being filled at the time of the accident and until experts testified before the coroner the cause of the explosion was a mystery. The expert witnesses gave it as their opinion that a static electrical discharge was the cause of the explosion.

The flow of gasoline from the hose into the tank was sufficient to set up static electrical potential, they said, and a spark leaping from the nozzle of the hose to the metal tank would ignite the gasoline vapor, causing the explosion.

It was recommended, however, that occupants of closed automobiles, whose gasoline tanks are in the body of the car, leave the vehicle while the tank is being filled. It was suggested also that a chain be fastened to the gasoline tank of such a car which could be lowered to the road when the tank is being filled, thus grounding any current that might be set up.

Joseph Bazatta, it was learned after the hearing, was severely burned this morning in Westport in an unexplained explosion that occurred while the tank of his automobile was being filled.

Two members of an automobile party from Watertown, N. Y., were burned to death and three others were injured when the gasoline tank exploded while being refilled.

Great carelessness prevails in garages in the handling of gasoline. The wonder is that more accidents do not happen. Cigarettes are smoked by those about the cars and this action involves lighted matches. It therefore is no wonder that the fortunately rare static spark is forgotten until it does its work. This article is valuable in pointing out the danger.

In our issue of June, 1923, page 356, we described the grounding of gasoline tanks, where in handling the fluid on the large or commercial scale danger of conflagration from the static spark was anticipated.

Electro-Photograph of Anxiety

A WOMAN patient was being examined in the office of a heart specialist. The test at the moment under way consisted of the taking of what is known as an electro-cardiagram—a photographic record of the electrical currents generated by the heart beat.

The patient sat motionless in a chair at one end of a long room. At the other end of the room a man was looking at a little spot that danced about on a screen. The man's back was toward the patient. Apparently he was disregarding her altogether, yet presently he said:

"Madam, you are worried about something. What is it?"

And the patient replied, rather shamefacedly: "Why, I left my purse, with my rings, in the dressing room, and I just heard steps in the hall as if someone were going that way. I was a little afraid the jewels might not be safe."

The physician directed an assistant to get the purse. Then he proceeded with the electric test.

"Ah, that is quite different," he said presently. And when the negative was printed, it plainly revealed that the electrical conditions of the heart were modified when the patient had been worried even in that small degree.—*New York American.*

Electric Hay Curing in Germany and Austria

THE green crop is placed in large containers built up of reinforced artificial stone of an insulating nature both as regards electricity and heat. The walls are varnished on the inside to prevent current leakage. The capacity of a container varies greatly—some being as small as five cubic yards and others as large as 175 cubic yards. The floor electrode of the container is formed of galvanized sheet iron or of a grid of iron rods. The crop is spread out uniformly and trodden down, and is then covered by a metal-built lid acting as the second electrode. Alternating current at 220 to 500 volts is employed—the higher the voltage the shorter the time taken for the curing process. Neither the current nor the voltage requires any regulation during the treatment. Investigation has shown that as soon as the current is applied, a sort of paralysis or suspension of organic life takes place in the mass of material, and it is due to this fact that no deleterious effects are set up tending to lessen the food value of the product. It is especially advantageous as regards the albumen content.

A change of resistance occurs at or about the temperature of 50 degrees Centigrade (122 degrees Fahrenheit), which, as stated above, is also the temperature of sterilization. At this temperature the plant cells and bacteria collapse, and the whole mass sinters together, and most of the internal air spaces disappear. After this, very little further heat is generated because of the low resistance of the material, and in this way the process is practically self-regulating. As soon as the whole mass is found to have reached about 122° Fahrenheit, the current can be switched off.

Experiment has shown that about 23 kwh are required per ton of green material treated. Before the actual curing process can be commenced, the crop must be subjected to a preliminary treatment to give it the necessary conductivity.

Freshly-reaped, undamaged crops offer a very high resistance to the passage of a current owing to the protective covering of hairs, waxes, gums, etc., on the outer surface. For instance, a mass of such material 20 inches thick required the application of nearly 8,000 volts before any appreciable current would pass. It is the inner, juicy portions of the plant which conduct well, and the best and simplest way of exposing these parts to the action of the current is found to be by chopping up the material. This chopping is in any case desirable in material intended for cattle food, and it also greatly facilitates the handling throughout. After treatment, the hay is left carefully covered up in the containers until wanted for use.

The chief advantages claimed for the process are:

(1) The whole hay crop becomes independent of weather conditions.

(2) The crop can be treated at almost any stage of ripeness, and is not liable to damage through rain, dew or frost. Also such very juicy materials as turnip leaves, turnip tops and coarsely-chopped turnips, potatoes, carrots, etc., can be stored indefinitely without deterioration after the treatment.

(3) Independence of weather conditions allows more crops to be raised from a given area. The crops can be cut when in their most nourishing stage (just before flowering).

(4) The retention of the protein in the hay makes clover and leguminous crops serve as real sources of albumen throughout the winter, and it has been found in practice that very satisfactory milk returns have been obtained by the use of the process. The cured crop has been found very suitable for horses, sheep, goats and fowls—in fact, all animals like it because of its aromatic taste.

(5) The process enables better use to be made of the available labor on the farm, and so leads to economies which more than cover the cost of the electricity.

(6) The load is a desirable one from the power-station point of view, because it is, to a large extent, an all-night load—the work of transporting the crops and loading the containers being done in the daytime, and the current being allowed to do its part at night.—*Elektrotechnik und Maschinenbau.*

Storage Battery Repairs

A COMMITTEE of the Associated Advertising Clubs of the World have investigated the repairing and charging of storage batteries for automobile owners and others. We quote:

"The automobile owner is at the mercy of a battery station in the matter of having his battery charged, changed, rebuilt or repaired, for the reason that it is impractical to dissemble a battery and identify the parts.

"If the owner wants the repair parts put out by the maker of his battery, he is entitled to receive them, even though there may be repair parts made by others which could be used just as efficiently. Substitution under such circumstances constitutes a fraud upon the public and jeopardizes the good will and reputation of the battery manufacturer which the service station purports to represent."

The committee states that complaints have come to it from many sources to the effect that the motoring public is being imposed upon from time to time by unscrupulous concerns which offer a remedy for all battery troubles through the medium of pastes, fillers, solutions and other compounds to take the place of regular electrolytes. Tests and analyses of several of these "dope" solutions indicate that, while they apparently give a battery greater momentary "kick," they ofttimes

How to Hook-Up A Transmitter Button to Make an Efficient Loud Talker

A Transmitter button with a few dry cells and a telephone receiver will make a remarkably simple and efficient loud talker. A Microphonic amplifier of this type is just the thing for use with a radio set. The weak music and signals may be amplified many times their original value. It is possible to entertain a large audience with a simple radio equipment if a transmitter button is used in the circuit as explained in diagram A.

The cost is extremely low, and the results are comparable with those produced by highest grade of expensive loud talkers.

As may be seen in the diagram, two dry cells or a small storage battery are connected in series with the transmitter button and a 4 to 75 ohm telephone receiver. The transmitter button is secured to the diaphragm of the telephone in the radio receiving set. To accomplish this properly, scrape off the enamel (if diaphragm is enameled) on the face of the diaphragm and solder the small hexagon nut supplied with the button to the exact center. Care should be taken that the thin diaphragm is not bent or otherwise harmed. The transmitter button is then screwed into place. Connections, as shown in the diagram, are made with flexible wire. A horn may be placed over the low resistance receiver if desired. When the radio set is properly tuned and signals are being received, the transmitter button is operated by the vibration of the diaphragm of the receiver. As the receiver diaphragm vibrates, the mica diaphragm on the transmitter button also vibrates. The carbon grains are compressed at varying pressure; the current flowing through the local battery circuit is thus varied and results in an amplification of the sounds in the low resistance telephone loud-talker.

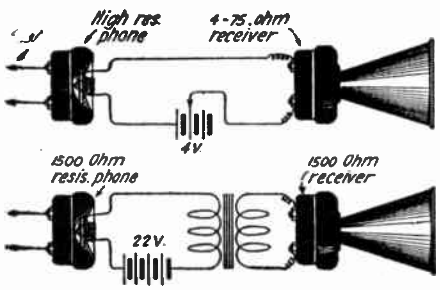

Diagram B, which includes a step-up transformer, is to be used with loud talking receivers of high resistance. The primary of the transformers should have a resistance of about 75 ohms. An ordinary telephone induction coil will serve as the transformer in this circuit.

You can get the above-described transmitter button FREE in subscribing to PRACTICAL ELECTRICS Magazine at $2.00 per year (12 months). Send your subscriptions today.

Make all remittances payable to Practical Electrics Co., 53 Park Place, New York City.

—Adv.

contain ingredients which are absolutely ruinous to the plates and separators, thereby shortening the life of the battery from 50 to 75 per cent.

Purchasers are warned to inquire carefully regarding such solutions, and assure themselves that the substitute they are procuring has real merit and will not damage the battery, before placing their orders.

Another misleading and sometimes fraudulent feature attends the manner in which many so-called "dry batteries" are advertised, the committee says. Some of these are exploited as "new and wonderful" inventions that "never need to be taken to a service station," that "require no water" nor added charge "no matter how long in use," "cannot freeze," etc.

Elaborate Lighting Spectacles Planned for Illuminating Engineering Society Meeting

DETAILED plans for the special features which will mark the 1923 convention of the Illuminating Engineering Society meeting at Lake George, N. Y., September 24 to 28, are nearing completion and promise to surpass in spectacular effect and all-around interest anything yet attempted by the society.

A battery of great searchlights forming a scintillator of moving colored beams will be the big event of the convention. This scintillator, it is announced, will be located on the wharf in front of the Fort William Henry Hotel, convention headquarters, and will send a multitude of powerful rays into the sky in a fan-like formation. By means of colored slides the beams will be constantly changed in colors, one blending into another to give a startling and beautiful rainbow effect.

An elaborate program of fireworks is another feature, a high point of which will be the explosion of the largest bomb used in such displays. A jeweled emblem of the society, illuminated in various colors by floodlights, is another thing of interest on which the committee is working. This will be placed on the grounds near the hotel.

Large, beautifully colored lanterns will dot the groves and walks surrounding the hotel and water's edge, while negotiations are on for securing a special battery of the largest searchlights, about 60 inches in diameter, which will cross in the sky in front of the headquarters from strategic points on the hills surrounding the southern end of the lake.

W. D'A. Ryan, chairman of the general convention committee, under whose direction the lighting effects are being worked out, believes the illumination features of this meeting will compare favorably with the largest spectacles of the kind. The scintillator of colored searchlight beams is patterned after that used with such wonderful effect during the Panama Pacific International Exposition.

The officers of the convention committee consist of Mr. Ryan as chairman, Henry W. Peck, vice-chairman, and H. E. Mahan, secretary.

Gases Liberated by High-Voltage Insulator Testing Apparatus

By G. W. Jones and W. P. Yant,
U. S. Bureau of Mines

DURING the testing of porcelain insulators with a 60-cycle flash-over apparatus, gases are liberated having an odor greatly resembling that of ozone. Since the two main constituents of normal air are nitrogen and oxygen, and high voltages (approximately 90,000 volts) are used during the tests, the conditions are favorable for the production

of ozone or oxides of nitrogen, and perhaps both simultaneously.

The presence of these gases is only noticeable during the testing period. They soon disappear after the test is over. No fatalities have ever resulted from these gases at the plant visited, nor are there any records of any of the men who worked on the tests being confined to their homes from this cause. New employes sometimes complain of a depressed feeling and shortness of breath, which is most noticeable after leaving work and getting into fresh air, but they soon become accustomed to it and no ill effects are noticed.

In view of previous work which the Bureau of mines has done on oxides of nitrogen in connection with mine gases and problems in gas analysis, tests were made at the plant of the Westinghouse High Voltage Insulator Company at Derry, Pa., to determine the kind and amount of gases liberated.

Before the insulators are shipped from the plant, each is tested for its insulating properties in the above-mentioned 60-cycle flash-over apparatus. The insulators are placed on specially constructed racks or tables of such size that 150 units can be tested at one time. The racks form a terminal of the source of power, while the other terminal is connected by chains or other metallic connectors to the other side of the insulators. When the insulators have been prepared for testing, safety gates are closed, and from 90,000 to 100,000 volts are impressed on the insulators for five to seven minutes. If any one of the insulators fails, this is quickly shown by a current flow across a spark gap above that particular insulator. During the testing there is continual sparking about the insulators which causes a rather deafening noise. The workmen are exposed to the gases mainly while the test is in progress, after the test when the insulators are being removed, and while a new supply is being prepared for testing.

Oxides of Nitrogen.—Samples of the gases were taken during testing periods in one-liter evacuated sample tubes, and several additional samples were obtained by aspirating five liters of the gas during testing through dilute caustic potash solutions. These were tested for oxides of nitrogen by the diphenolsulphonic acid method.

Ozone.—Five-liter samples of the gas were aspirated through potassium iodide, and analyzed by the method of titrating both the iodine liberated and the KOH formed.

The quantity of oxides of nitrogen was never greater than 0.2 part per million, the limit of accuracy for the method. It is doubtful whether any oxides of nitrogen were present at all. If they were present, even in amounts several times that shown by the tests, these would still be well within the safety limit, because Lehman found that as high as 39 parts per million of oxides of nitrogen can be tolerated by many individuals for many hours; 78 parts can be borne for only a half hour, while 117 to 156 parts are directly dangerous.

For ozone, the maximum concentration will be noted as 10 parts per million, and then only when the samples were taken directly over the rack during testing, when the maximum quantity of ozone was being liberated. A sample taken on the windward side over the rack showed only 2 parts per million. When the insulator tests are completed the concentration falls quickly as shown by the disappearance of odor.

There is some question as to the physiological effects of ozone in concentrations such as found in these tests. Some tests

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reported by Hill and Aeberly may be of interest. They found, using a testing chamber, that 3 parts per million in normal air caused smarting of the eyes and nose, and finally a coughing spell, which compelled the subject to leave the chamber after 10 minutes' exposure. In another test, a subject remained for 12 minutes in the chamber containing from 3 to 6 parts per million. Operating a pump for taking samples caused frequent coughing, which continued for some time after leaving the chamber. No lasting ill effects were experienced after the immediate effects had disappeared. In conclusion, they state that 6 parts per million causes coughing after moderate exercise. Jordan and Carlson found that 10 parts per million for a 15-minute exposure caused sore throat, and that exposure for two hours to 20 parts (Hill and Flack) may prove fatal.

No mention is made by Hill and Aeberly of any serious after-effects resulting from exposure to ozone in concentrations of 10 parts per million or less.

Hindoos Using More Electricity

A RAPID increase is reported in municipal installations in small towns of Madras Presidency, India.

General increases in the use of electricity throughout this presidency are shown by the last report of the electrical engineer to the Madras Government reviewing the Administration of the Indian Electricity Act of 1922, says Consul H. A. Doolittle in a report to the U. S. Department of Commerce. The number of both private and municipal installations in the smaller towns is rapidly growing and a greater interest is being shown in electrical projects in all areas. The superiority of electric fans to the hand-pulled punkah and of electric lights to cocoanut oil lamps in the hot, humid climate of India is rapidly overcoming the conservatism of India, which has operated against the adoption of these modern improvements.

At the end of the fiscal year 1922 there were 169 private installations in Madras City, 76 in outside districts, and 20 municipal electric plants. There were also 138 privately-owned power stations in operation. This is an increase of some 125 plants over the number in operation in 1918 and 1919.

New Power Station for Johannesburg, Africa

RECOMMENDATIONS contained in the report of the independent consulting engineers, appointed to investigate the question of Johannesburg's electric power needs, indicate the possibility of a 10,000-kilowatt generating set being installed within the next two years. A further installation involving two 10,000-kilowatt sets is contemplated between 1925 and 1927, Consul G. K. Donald, Johannesburg, reports to the Department of Commerce.

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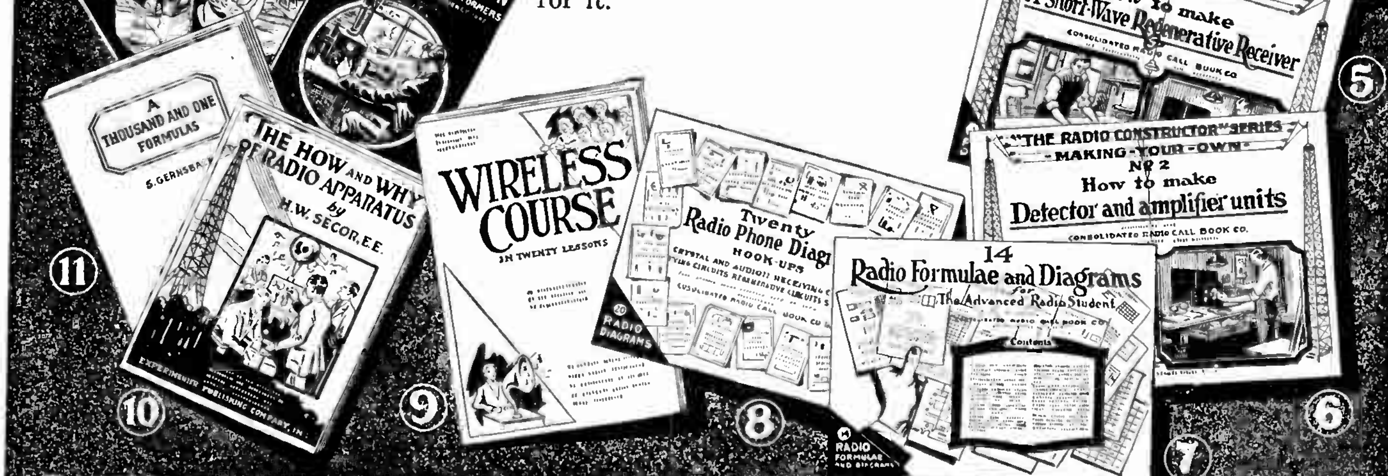

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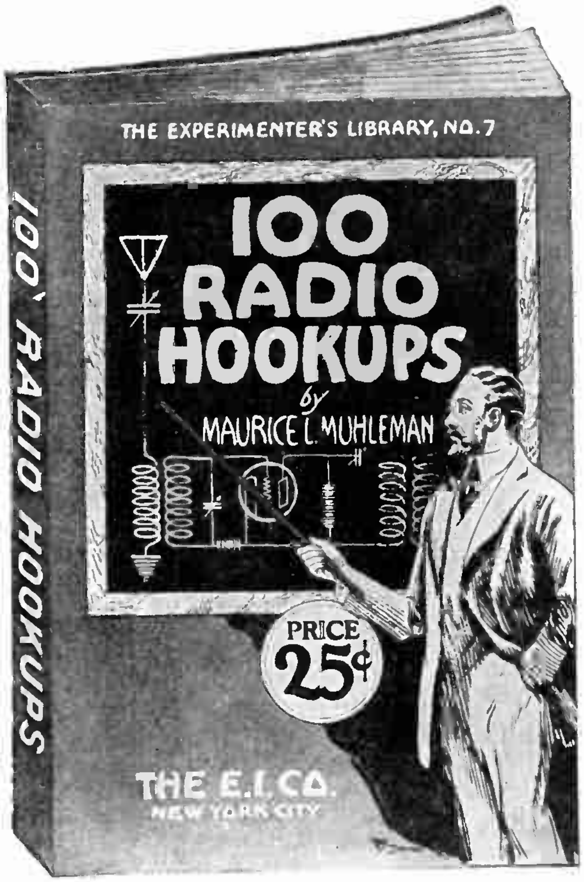

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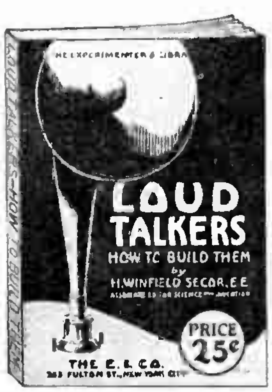

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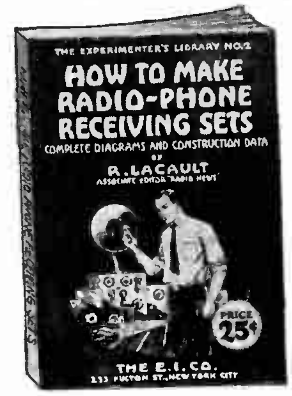

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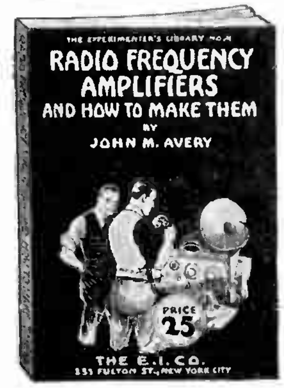

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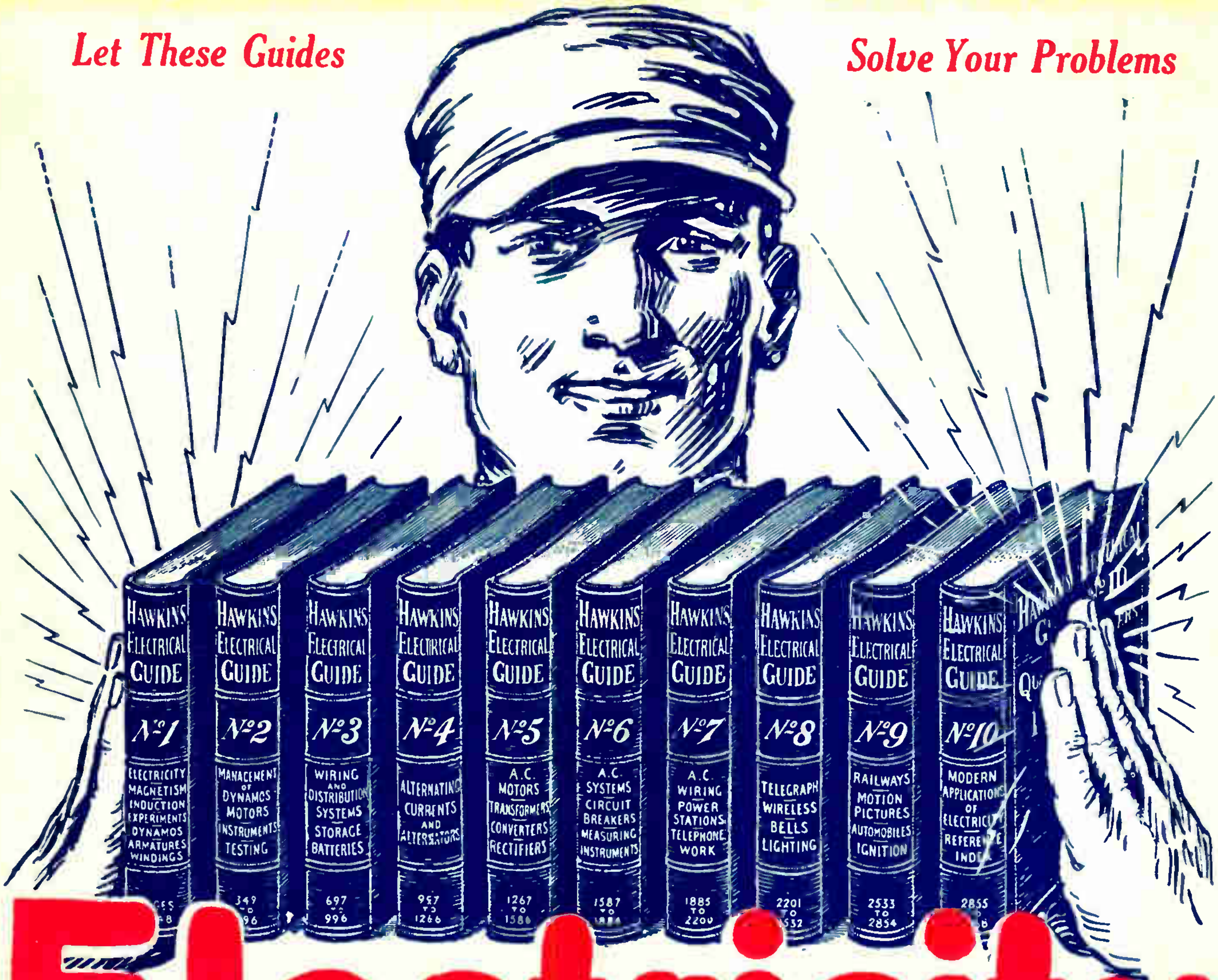

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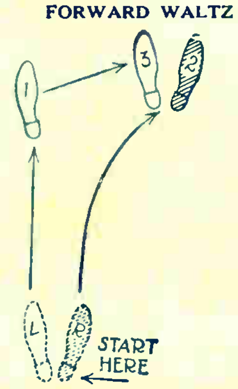

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