Practical Electrics

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May 1924

EDITED BY H. GERNSBACK

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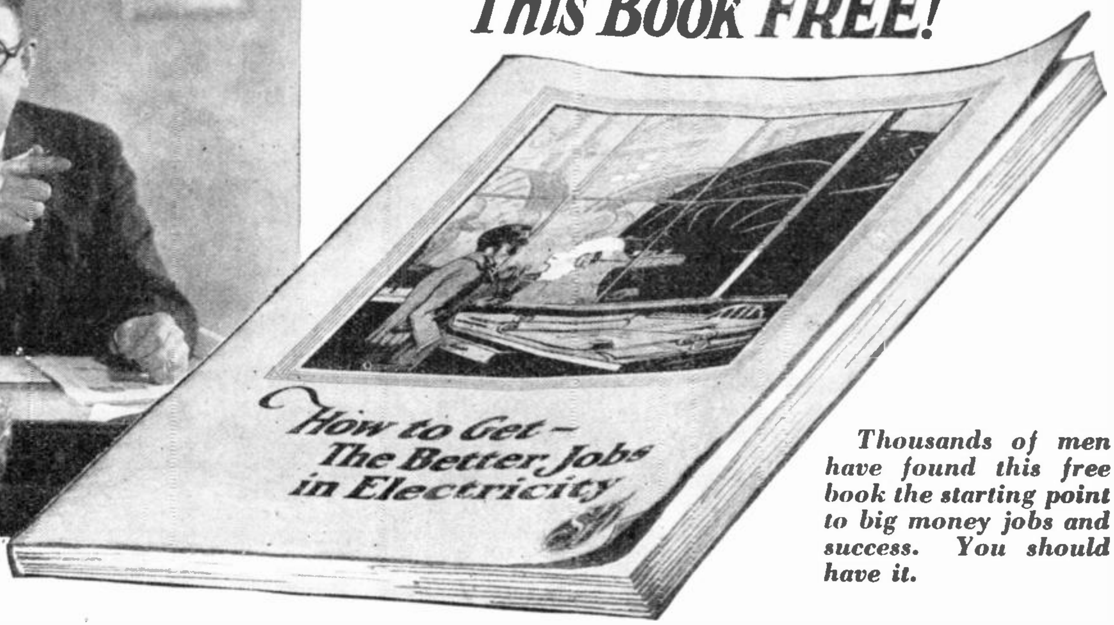

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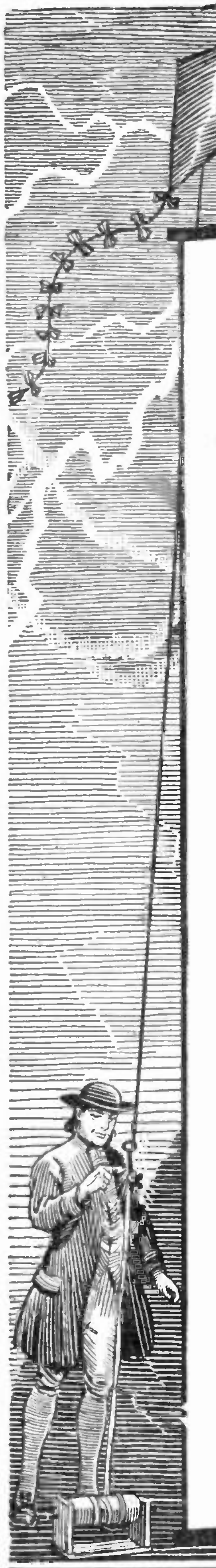

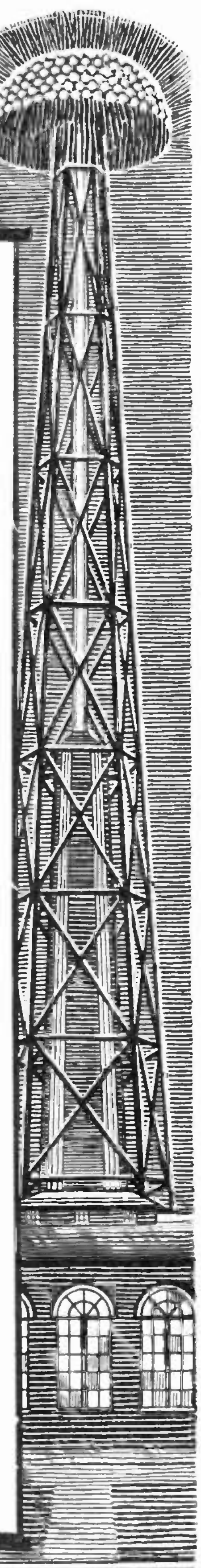

Practical Electrics

VOL. 3 **CONTENTS** NO. 7

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Practical Electrics

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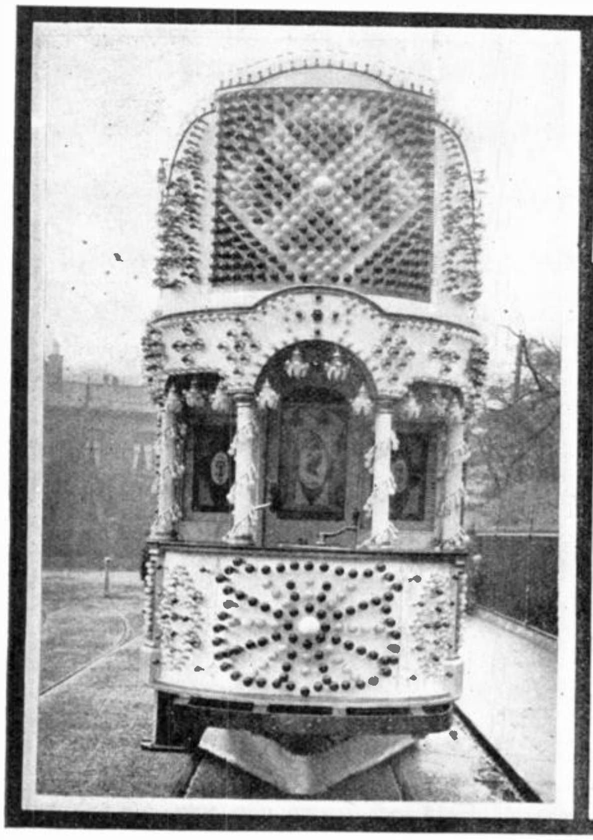
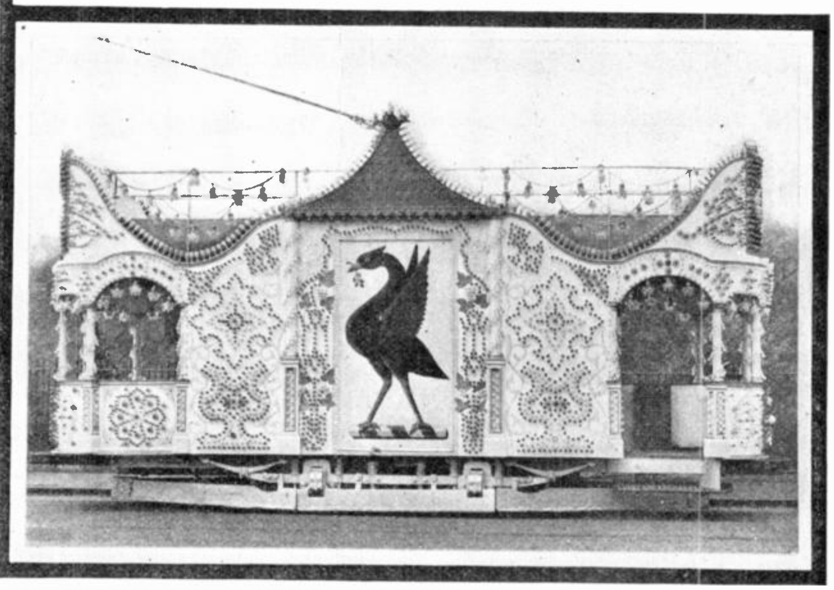
H. Gernsback, Editor and Publisher T. O'Conor Sloane, Ph.D., Associate Editor

Unique Illuminated Car



A very wonderful trolley car is shown in front and side view. Besides its decorative effect it carries a quantity of incandescent lamps and the panel on which the raven is drawn can be removed, allowing panels of other designs to be replaced. The bird is called the Liver Bird, a title undoubtedly derived from the first syllables of Liverpool, and which has no connection with the physical organ. It is supposed that the bird was originally the eagle of St. John the Evangelist, and in some heraldic statements it is termed as a lever or cormorant.



THE car illustrated here has been decorated lavishly in order that it may be displayed in connection with collections for local charities, such as hospitals, Red Cross funds, unemployment funds, disabled ex-service men's funds, etc.

The car is equipped with 5,209 incandescent lamps, and the wiring is so arranged that, by the insertion of automatic switches and rotating drums in the lighting circuits, no less than nineteen different designs can be shown. The center panel, which shows the city arms—composed of a liver bird, etc.—can be taken out and a special illuminated panel inserted in its place. On this panel descriptive matter can be displayed, showing for what purpose the particular collection is being made, e.g., on Armistice Day a panel will be fixed in the car showing the Flanders poppy, as a collection is being made on that day on behalf of the disabled ex-service men's fund.

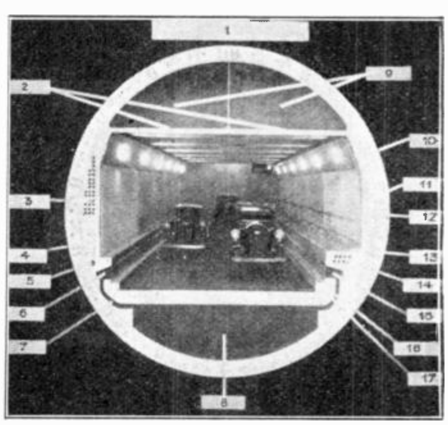
All the work in connection with the decorating, etc., of this car has been carried out by the Municipal Department. It has given very great satisfaction in the English city, and has helped to augment considerably the collections already made in aid of different charities.

Hudson River Vehicular Tunnel

TWO great tubes are being built across the Hudson River between New York City and Jersey City, deep down in its bed, to connect the two states. There will be a tunnel for east bound and a tunnel for west bound traffic, and each tunnel will have two roadways parallel to each other, one for fast and one for slow traffic, so that there will be virtually four divisions in the twin tunnels.

The width of the roadway is to be twenty feet and the circular contour of the tunnels, with its flooring and ceiling, gives a total clearance of 13½ feet. The maximum diameter will be 29 feet, and each tunnel will be 9,250 feet long.

The illustration shows a model of a portion of one of the tunnels, which was constructed under the auspices of the Westinghouse Lamp Company for the purpose of determining and illustrating the lighting system. The tunnel must be perfectly illuminated, without glare, for it is evident that there is every chance of collision if the drivers become confused. The fact that all are going in the same direction obviates the possibility of collision to a certain extent, but this effect is not complete, because the two lines of vehicles are moving at different speeds, so divergence from the proper course might bring about a bad side-wiping collision.



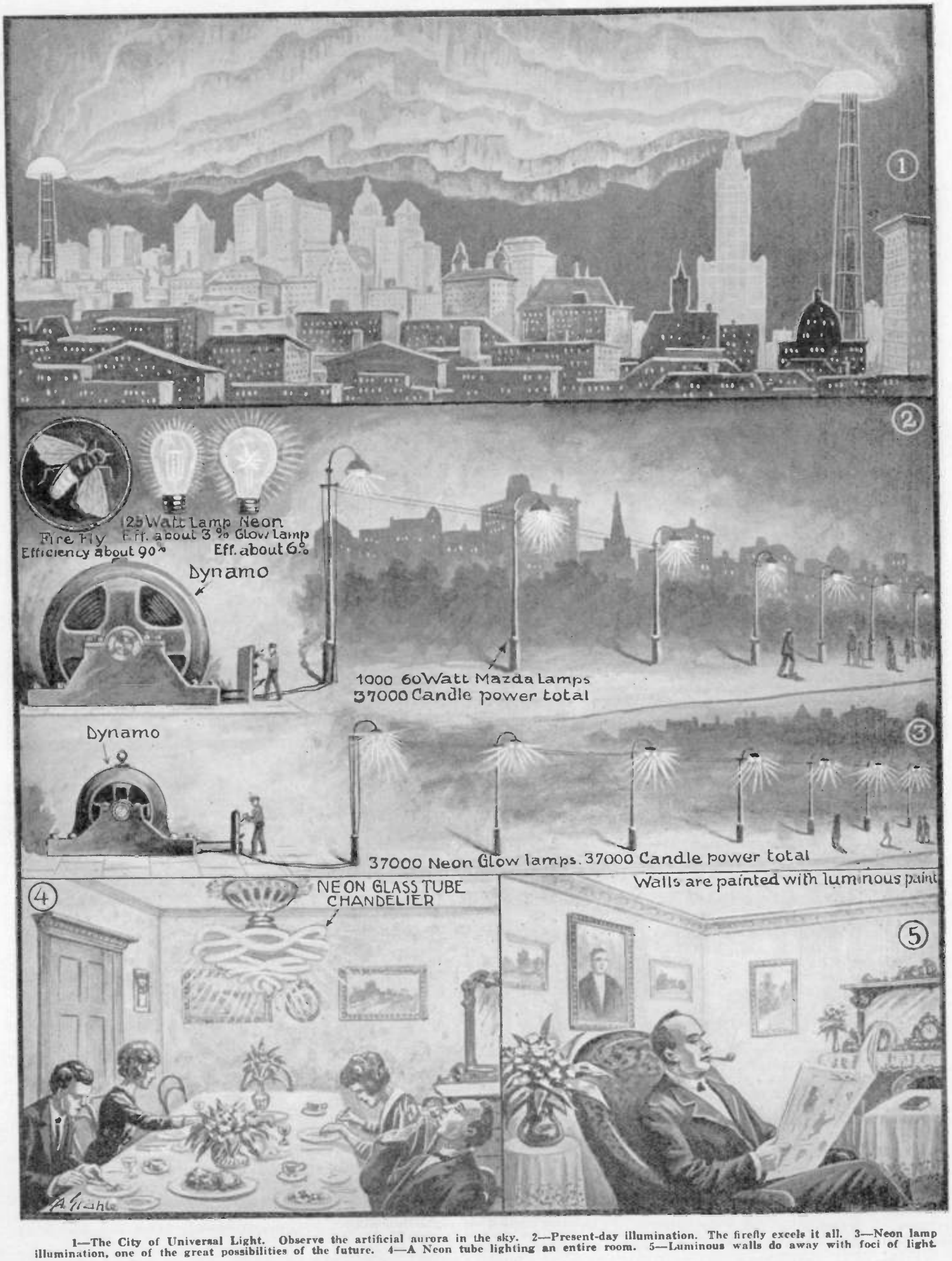
An elaborate model of one of the Hudson River Tubes. Note the tapes with tags designating each part.

The estimated cost of the tunnel is $42,000,000, and the income, presumably by a system of tolls, is estimated at $6,000,000 per year.

Cards and ribbons on the face of the model were used to explain each part of the construction, and the caption tells what each ribbon indicated. The model has been exhibited in a number of localities, and is a good example of the model maker's art.

Illumination

By Henry Harrison



1—The City of Universal Light. Observe the artificial aurora in the sky. 2—Present-day illumination. The firefly excels it all. 3—Neon lamp illumination, one of the great possibilities of the future. 4—A Neon tube lighting an entire room. 5—Luminous walls do away with foci of light.

Illumination

By Henry Harrison

THE history of illumination commences previous to 4000 B. C., when crude flaring torches were used. Gradually improvements were made, covering the use of oil, candles, gas, and finally electricity. Although from oil to gas was a great step, the most spectacular advances were made during the last half century, since electricity was made a practicable source of energy.

As a commercial proposition, electric lighting begins with the invention of the Gramme dynamo in 1870 together with the introduction of the Jablochkoff candle or light which was first announced to the public in 1876. In 1810 Sir Humphrey Davy had produced the first arc light of any magnitude, called the voltaic arc. It consisted of two charcoal pencils as electrodes connected to a powerful battery of voltaic cells. Many patents were taken out on arc lamps from 1840 to 1859 but none was successful as they depended upon primary cells for their source of current.

The incandescent lamp was a piece of laboratory equipment up to 1878, at which time Edison produced a lamp with a platinum filament. From this time on the development of electric lighting has been very rapid, and the consumption of incandescent lamps alone has reached several millions a year. Only by comparing our present lighting systems with those of 50 years ago are we able to imagine what we are likely to have 50 years hence.

J. B. S. Haldane, a biologist at Oxford University predicted that in the immediate future, as far as England was concerned, the cities of dreadful night would be replaced by cities of endless day. England, he says, will be covered with rows of metallic windmills working electric dynamos, which in turn will supply electric current for lighting purposes, and fifty years from now electric lighting will cost one-fiftieth of its present price.

Although England may reduce the cost of lighting by employing thousands of windmills scattered all over the country, such a system is of no scientific advancement over present methods and it is a system that could be installed today with present equipment. America has many small windmill plants in the farming districts. We would no sooner consider illuminating our cities by night fifty years from now with present equipment than the people of this day would think of lighting them with candles. What then are the possibilities of improved lighting systems?

The incandescent lamp today has perhaps a lower efficiency than any other electrical device. The best of incandescent lamps have an efficiency of only about 3 per cent. The other 97 per cent is wasted in heat and ultra visible rays. Other electrical apparatus, such as motors, generators, transformers, etc., have efficiencies ranging from 80 to 95 per cent. Therefore the electric lamp is still a crude piece of apparatus and can be greatly improved.

Nature is much more efficient in producing light than man. The firefly has an efficiency in the neighborhood of 90 per cent. The light rays emanate from a chemical substance called luciferin. It is the firefly's secret. In the form of a powder it glows brilliantly. The glow is produced without accompanying heat rays and soon fades out; it can easily be rejuvenated so that it will glow again. When the chemist can synthetize luciferin cheaply it will make the most efficient source of light we know of, and unlike luminous paints, does not require exposure to sunlight to energize it. It is cold light, or light without heat.

Neon gas lamps, which are now coming into extensive use for advertising purposes, are much more efficient than incandescent lamps, and represent a step in the right direction. This lamp derives its luminosity from an electric discharge between two electrodes enclosed in a rarefied atmosphere of neon gas. It will operate on about 180 volts D. C. minimum, the cathode only becoming luminous. On A. C., of course, both electrodes become luminous alternately. The light emitted is of a pleasing pinkish orange, and is very soft. These lamps are comparatively efficient, but a great number are required for sufficient lighting as each gives only about one candle power of light. A lamp of this type on a large scale may be developed in the near future.

The Aurora Borealis is an electric discharge through a rarefied gas on a large scale, and a comparable phenomenon may be used for lighting our cities in the future. The illustration shows two huge electric towers in the down town section of New York city illuminating the buildings by a luminous discharge through the atmosphere. The effect would be similar to that of the northern lights, and such a light would be very pleasing to the eye and would not have that intrinsic brightness so common with most of the present street lighting systems. With the development of higher and higher voltages, such a system may be possible in the near future.

With improved glow lamps many fancy chandeliers may be made for inside lighting. The illustration shows one of these in the shape of a long glass tube coiled in fancy designs. The light emitted is well diffused and very soothing. Lamps similar to these are now used in store windows as advertising signs, the glass tube being coiled into the shape of letters so as to spell out words.

By employing different rarefied gases in the tubes various colors may be produced. Neon gas gives a pinkish orange, while nitrogen glows with a beautiful yellow and helium yields a clear white light. An ordinary incandescent lamp will glow with a very pure blue when under the influence of a spark coil.

Another great possibility lies in the use of luminous paint. If the walls and ceilings are painted with luminous paint, they will emit enough light to read by. And once the paint is applied, the cost of the lighting is nothing, as when the light fades out, it is automatically replenished by exposure to sunlight. The paint practically absorbs the sunlight in day time and stores it up to be emitted for the night. When this paint is produced in sufficient quantities at a reasonable price, it may solve many of our illuminating problems. With the walls and ceilings luminous, there will be no shadows; light will come from all directions.

Turbine Flashlight

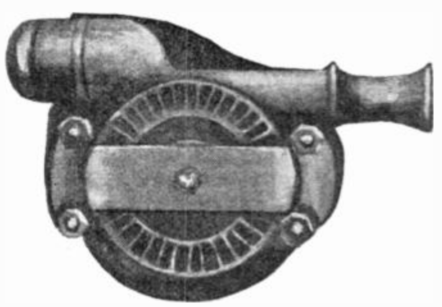
A NUMBER of flashlights have been produced without batteries. They contain a magneto operated by some kind of handle, as a rule, and in order to give the magneto proper speed, gearing has to be used. It may, of course, be only a rack and pinion gearing, the pinion on the shaft of a rotor, but in any case there is a large loss of power in such gearing.

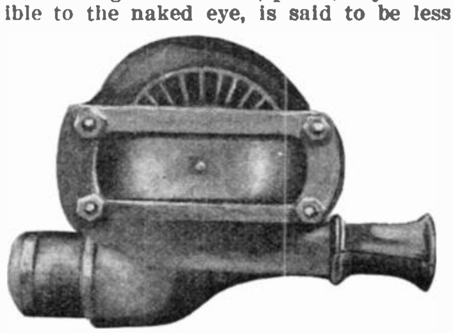
In the flashlight we now illustrate, for which we are indebted to our French contemporary *La Nature*, there are no gears. It contains a turbine which is operated by blowing through it. The little lamp weighs only four or five ounces and one of the illustrations shows how small it is. It is operated by blowing into the tube.

The little turbine contained within the case has sixty blades. A carefully designed tuyere leads the air in most advantageous form into the turbine. This gives high velocity without any gearing being connected directly to the magneto. To still further reduce the friction, there are no brushes to collect current for the lamp. The equivalent connections are made to the right and left hand bearings of the turbine. These bearings are slightly elastic, so as to secure contact, and it will be seen that the shaft of the motor, represented by the pivots, may be taken as in two parts, insulated one from the other.

The tungsten filament, practically invisible to the naked eye, is said to be less than a thousandth of an inch in diameter. It contains thorium, which improves its illuminating power at given amperage and the lamp uses a current of 0.06 ampere at a potential of 2.5 volts.

Once the turbine is started at full speed by blowing into the tube, it will run for nearly twenty seconds.

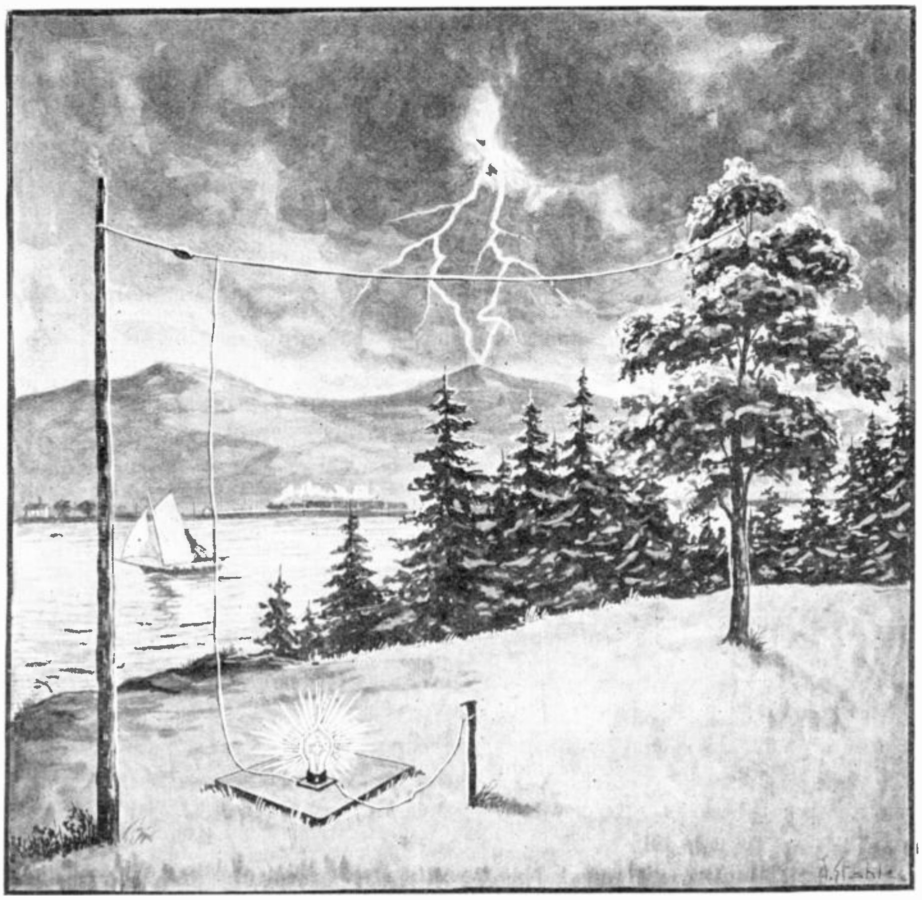




On the right and left are shown the front and rear views of the flash light which operates by blowing. Good results are obtained because there are no gears, as the little turbine wheel is directly connected to the rotor. The central views gives an idea of its size.

Lightning Experiments

By Clyde J. Fitch



An aerial extemporized for the purpose catches enough potential to actuate a grounded neon "glim" lamp.

ONE afternoon in June, 1749, during a crashing electrical storm, Benjamin Franklin demonstrated to the world that lightning and electricity were the same. He was 43 years old at the time and was fully aware that lightning was an electrical phenomenon, but in order to prove his theories he conceived the simple experiment of sending a kite high into the air and allowing the electric current, which causes such disturbances during thunder storms, to flow down the wet kite string and manifest itself by minute sparks between the wet string and a grounded object. This was, no doubt a dangerous experiment, and one that it would not be advisable to repeat. However, Franklin's experiments can be safely repeated with the use of the apparatus shown in the illustration.

It requires about 500 volts between separated electrodes before a visible spark appears, and the gap must be shorter than the thickness of a sheet of paper. Some gaps of this kind used for lightning arresters, with a break down potential of 500 volts, are made of separating two carbon electrodes with a thin sheet of mica perforated with a number of holes, through which the sparks pass. Of course, a long arc can be drawn out on a 500 volt circuit, but the electrodes must be touched together in order to "strike the arc;" and the current in the arc flows through metallic vapor produced by the incandescent electrodes, and not through the air.

The great wonder is that Franklin in his experiments with the kite succeeded so well in his demonstration yet received no dangerous shock, for flying a kite in a storm may involve fatal casualties from lightning strokes. In recent years people are becoming more chary of playing with lightning, and the kite experiment is definitely dangerous.

But in Franklin's experiments a difference of a thousand volts or more between the kite string and the ground was required in order to make the experiment a success. By enclosing the spark gap in a bulb containing a rarefied gas, such as neon, a luminous discharge takes place at a much lower potential, in the neighborhood of 130 volts A. C. or 180 volts D. C. The so-called neon "glim" lamp is excellent for this purpose. Connected to a D. C. 180 or higher volt circuit the cathode becomes luminous, the anode remaining dark. If an alternating E. M. F. is applied, both electrodes appear simultaneously luminous. At commercial frequencies the alternations of light and dark occur so rapidly that the eye sees a permanent glow of both electrodes. The color of the luminous electrodes is a pleasing pinkish orange with a bluish-violet fringe at the edges.

A remarkable feature of these lamps is their extremely small current consumption. If one is connected to a wet kite string and the ground during an electric storm, very spectacular results will be obtained. They are so much more sensitive to voltage fluctuations than the ordinary air spark gap, that it will not be necessary to employ a highly elevated kite; any wire strung on insulators above ground will be sufficient. A radio antenna one hundred feet long will be ideal. It should be located about fifty feet above the ground level, and the longer and higher it is the more spectacular will be the results, and also the more dangerous. But with the usual radio antenna the experiment is perfectly safe.

The Neon lamp, the so-called glow lamp, is quite an interesting production, and one of rather recent development. Neon is like argon, helium and some of the other rare gases, a substance without chemical affinity. While it is not easy to trace any connection between this feature and its electric properties, it has most definite characteristics from the electrical standpoint.

Our readers, we are sure, have seen the beautiful glowing neon tubes, and elsewhere in this issue a presentation is given of the use of such a tube for lighting a room. In a sense, the pink color is an objection, but the Neon lamp, it is fair to say, has great possibilities before it.

The connections are clearly shown in the illustration. It will be noted that as the storm approaches there will be a number of flickers in the lamp, each corresponding to a distant lightning discharge. The frequency of the flickers gradually increases as the storm approaches, until the storm is very nearby and the flickering will soon occur at so rapid a rate that the lamp will appear to emit a steady glow. This may last ten minutes or longer while the storm is passing and then the lamp will be again dark and will flicker occasionally as the storm is leaving. The flickering occurs a much less number of times per second while the storm is leaving than while approaching.

The theory of the action is as follows: Every lightning discharge sends out powerful electromagnetic and electrostatic waves. These waves sweep across the elevated wire and induce currents therein which pass through the neon lamp and illuminate it. It is not a direct stroke that lights the lamp. If a direct stroke struck the wire the complete apparatus would be quickly disposed of. For this reason it is as safe to experiment with the apparatus as to be in the building without the apparatus, because if the lightning is going to strike it will do so regardless of whether the aerial and connecting wire is there or not. Hence, there is no special danger in watching the effect of the lightning discharge on the lamp.

A condenser discharge is oscillatory, and since a lightning flash is a condenser discharge on a large scale, it also is oscillatory. But due to the great resistance the oscillations are highly damped, and there are no more than one or two reversals of current in each discharge. Consequently there is no advantage in tuning the neon lamp circuit to the frequency of the lightning discharge, as currents will be induced in the circuit by shock excitation regardless of how it is tuned. This explains why static cannot be tuned out of a radio receiving set. To increase the effect on the lamp a longer wire may be used, which also illustrates why a long radio antenna picks up more static than a short one, thereby increasing the woes of the embryonic wireless expert.

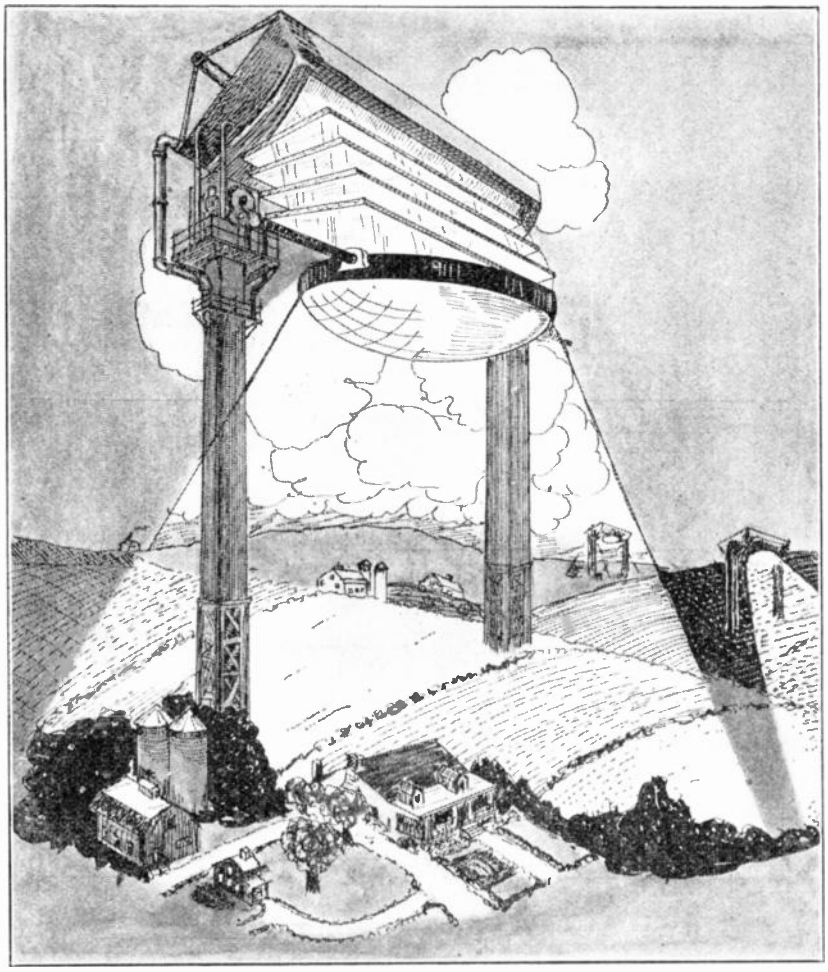
In carrying out such an experiment, a thoroughly good ground connection must first of all be secured and the lamp connected thereto. Then and then only should the connection of lamp and antenna be made, and even at that the connection should not be attempted while the storm is raging. We may assume that the storm can be seen approaching, and then is the time to connect the wires of the antenna and the leads of the lamp. An odd suggestion would be that a glim lamp be lighted in this way for some practical purpose.

Utilizing Solar Heat

THIS is what will take place, science tells us, if the sun goes on partial strike and some of the heat now given to the earth is withdrawn, as it has been withdrawn at earlier periods in the world's history—namely, the glacial ages. This is what will happen as man sees the world's oil supply and coal supply lessening. It is a gigantic experiment that man has worked on intermittently since the days of the early Greeks and the signs point to its early achievement.

Before each great scientific invention man has fuddled along apparently, for centuries, seeming to make no advance. It was true of the discovery of steam, of the flying machine, of the development of electricity. And then suddenly he has made the great discovery that solves his problem. Sometimes three or four men seem to come on the discovery at the same time.

History seems to be repeating itself in the gargantuan plans to harness the sun. Inventors throughout the world seem to be turning their efforts towards that end. Tesla in New York is known to be working on it. Dr. Giacomo Ciamician, distinguished scientist, of Bologna, sees the earth of the future covered with glass domes and roofs and enormous tubes that will be used to bottle the sun's energy.



The rays of the sun are caught by a system of prisms and are distributed by a huge lens over an area of the earth's surface.

Dr. Abbot puts an oil pipe about two inches in diameter along the focus of a large parabolic and cylindrical mirror.

To prevent heat losses in the oil pipe, a glass tube was placed around the metal tube and the piping system and the oil reservoir are covered with asbestos insulation. An arrangement was also made whereby the mirror turned constantly, so that the sun was constantly feeding it up until noon, when sufficient heat was gathered to last through the day.

Dr. Abbot has dilated on some of the possibilities of sun power as follows: "Scientists are agreed that the sun's temperature is about 10,800 degrees Fahrenheit. Of the radiant energy about 70 per cent gets through the atmospheric layer about the earth to the earth. There is about 5,000 horse power of energy per acre coming down to us. This is only theoretical power, however, for in Egypt, South America and Arizona, where the sun's energy has been turned directly into steam, the efficiency of the method has been only about 40 per cent. It was the parabolic mirror which raised the efficiency to 40 per cent. But of course, man has not given the attention to utilizing solar heat directly that he has to coal burning."

Abstract from LONDON POPULAR SCIENCE.

Our illustration is a suggestion from an English contemporary for making the sun work for us. The statement is given that it is "An artist's conception of the future when 'huge mirrors and lenses stand out glistering above the earth, bringing the sun nearer to us, intensifying its heat hundreds of times.'"

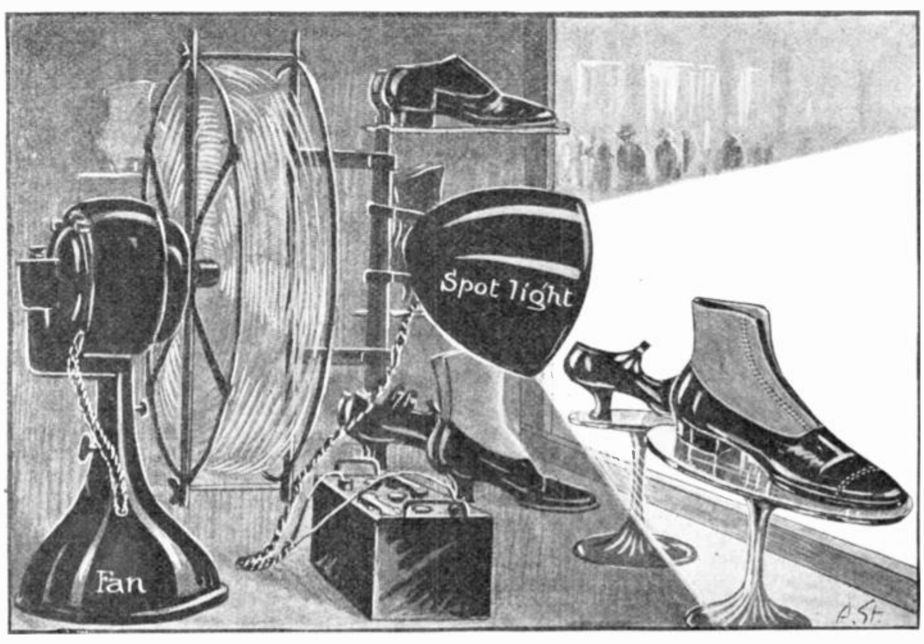
It suggests the creation of tropical areas.

Window Attraction

By Roy C. Hunter

HERE is a good idea for putting the electric fan to work. It must be one of the kind that swings back and forth. A spotlight is mounted on the fan and the fan placed in the center of the front window of the store. It throws a beam of light across the display of goods which moves back and forth, showing up the various articles. It is an excellent attraction for a store where the merchandise can be effectively displayed at night.

A small fan is used so that it will not consume much current. The cage around the fan and the fan may be removed.



An ordinary oscillating fan keeps a spotlight in motion so as to light up goods on display.

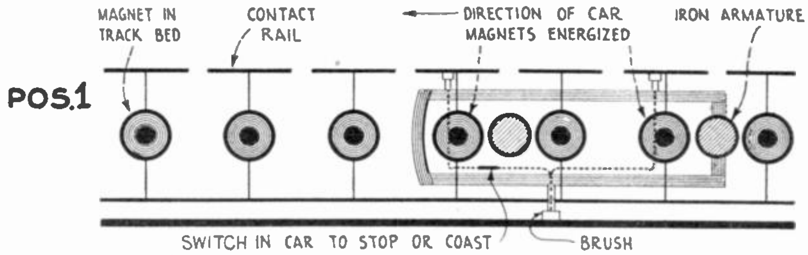
The fan is mounted on a base which can be a board one foot square, and is placed in the middle of the window. Its height above the floor can be decided upon according to the nature of the display.

The spotlight may be an ordinary spotlight such as used on automobiles. It is clamped to the iron rod. If such a light is used a storage battery will be needed. The reason a fan is used here is because it furnishes a simple method of producing the oscillating motion. It may be connected to the ordinary 110 volt line if built for such potential. If it turns too fast, it can be regulated by its speed attachment or by a rheostat.

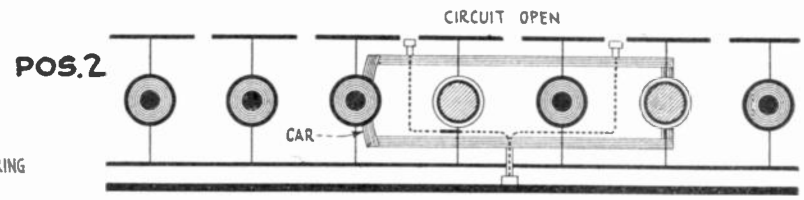
Wheel-less Electro-Magnetic Coaster

By H. Gernsback

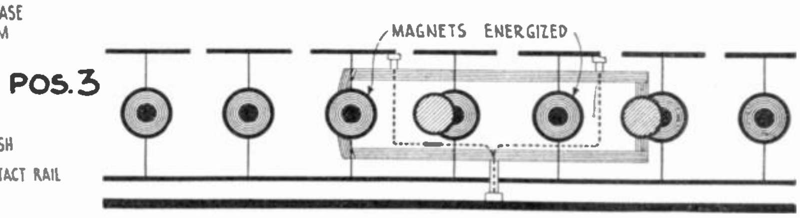
Member American Physical Society



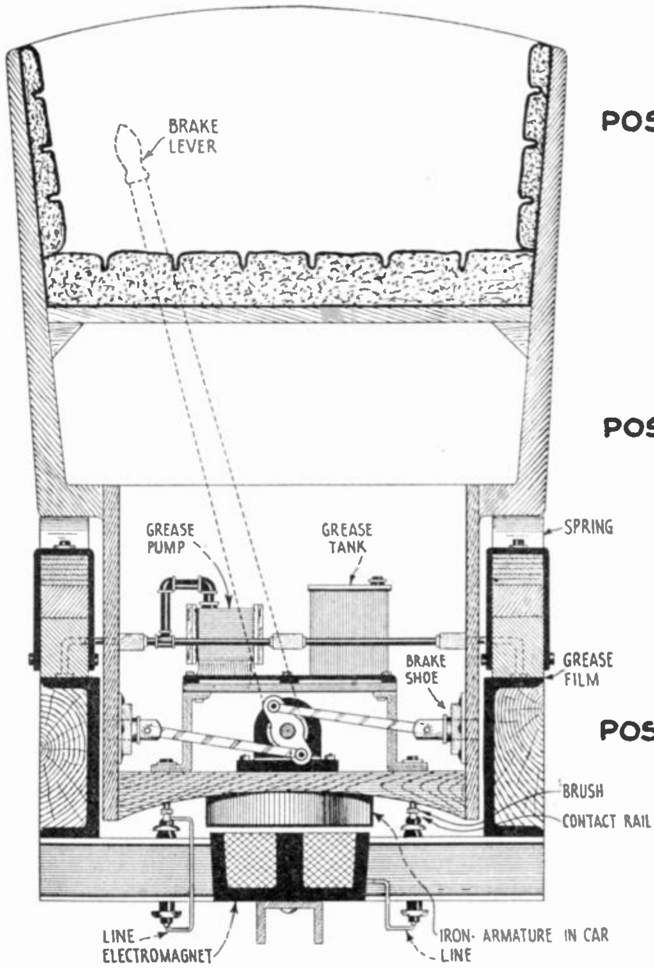
The smaller circle between two of the magnets in position 1 represents the armature being drawn to the left.



In position 2 the car is moved to the left so as to bring its armature directly over one of the electro-magnets, which then has its current cut off.



In position 3 the advancing car is carrying its armature away from the idle magnet, and the armature is now attracted by the one in front of it to the left.



On the left is shown a cross-section of the car and the powerful brake gear will be observed. The grease cup and grease tank supply not so much a lubrication, as a film of grease, so that metal will not touch metal. Below the brake shaft is seen the armature of the car and one of the electro-magnets.

THE electrical engineer often ponders why electro-magnetism is not employed more generally for traction. Here we have a force that is pliable, easy to apply and which, moreover, can be applied through intervening space without difficulty.

In the wheel-less electro-magnetic glider suggested in this article, the writer has thought of several advantages which would be derived from such a system. For instance, roller coasters as is well known are highly dangerous vehicles by reason of the flimsy construction of the road-bed, making it possible all too often for the car to jump the track, with resulting casualties.

In the writer's proposed coaster, wheels are omitted entirely. The construction of the car, as will be seen from the illustration, is such that it cannot possibly jump the track, being guided *at all times* by front and back steel panels, making a lateral displacement almost an impossibility. Steel tracks are provided over which certain steel shoes described below, travel. These shoes overlie the rails as shown in one of the illustrations.

The secret of the entire propulsion is that a heavy grease is forced from under the shoe with a constant pressure, and a small amount of the grease is thereby lost as it oozes out laterally; but this amount is very small. This grease keeps the rails slippery and the car travels along the track at a high speed with very little friction. The grease flow is regulated by the car attendant.

This scheme is not new as a similar system was in actual use in Paris in the early fifties. In 1852 M. Girard proposed to replace the original railways by means of hydraulic propulsion. He did not use wheels on his trains, but used a sort of skate which was directly over the track. Through this skate he applied water at high pressure. The result was that the shoe or skate never actually came in contact with the rail itself, the train really running on a thin film of water. Due to this practically frictionless gliding very little power was required to propel the train; but other mechanical troubles arose and the system, although experimentally tried out in Paris with actual trains, never was used on a large scale.

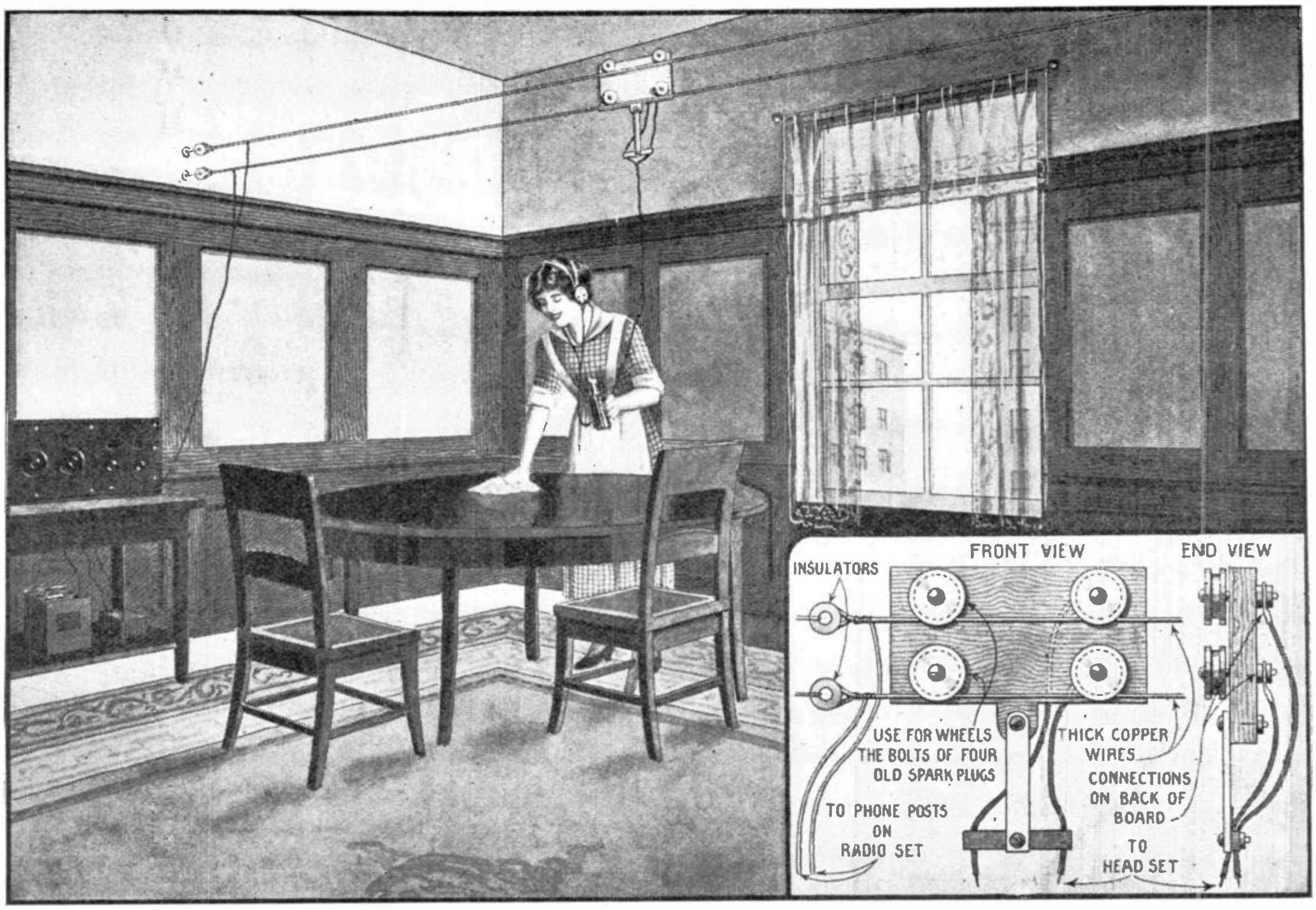
By using a heavy grease in the writer's project, which constantly keeps the entire track well greased, it is not necessary to continuously force grease out through the shoe, and it is only fed by the operator of the car as required. The propulsion of the coaster car is effected by means of electro-magnets placed in the road as shown in our illustration. We now have practically done away with all friction and the car is propelled as follows:

It will be seen that each car has two round iron pieces (armatures) which come within one inch or less of the electro-magnets placed in the road-bed. The magnets themselves are not energized until the car actually approaches over them. By means of a contact arrangement as shown, it will be seen that when the car armatures are *directly* over the two electro-magnets the current is shut off from these two electro-magnets while the two electro-magnets in advance of them will become active. This means that the car will be pulled forward by the attraction of the two forward magnets. The instant that the car's armatures are exactly above the electro-magnets, however, the power again is turned off and the two next electro-magnets are energized. This is repeated again and again, from which it will be seen that the car must be propelled with a continuous tractive force. If the operator desires to reduce the speed, all he has to do is to move a lever which will lift up the contact arrangement from the third rail contact track and the car will then glide along on its own momentum. If a quick stop is desired a braking arrangement, also shown in one of the illustrations, is used to bring the car to a quick stop.

Inasmuch as such a train system has very little friction, the cars should be able to attain great speed and the acceleration should be very speedy as well. There is no reason why such a system could not be a success and we hope that some of our readers will be interested in building actual working models of an electro-magnetic glider. We shall be glad to publish photographs and descriptions for the benefit of our readers. The writer will be very glad to assist in the building of such models, by giving various details of construction and will discuss any suggestions from his readers.

Telephone Trolley

By Isaac Ceballos



A trolley car runs on insulated wires, each connected to the terminals of a telephone box or of a radio set, so that the message or music may be heard as the wearer of the head-set moves about the room.

THE appliance illustrated is one which will enable a person moving about a room to wear a head-set and be ready to receive telephone messages or radio broadcasting while doing household work, or while engaged otherwise and moving about.

The diagram annexed to the larger illustration shows the construction very clearly. A couple of wires are stretched across the room so as to give a double trolley line and on them a little car, constructed as shown, rolls back and forth freely.

One of each of the wires is connected to a terminal of the telephone or radio circuit, the wires being insulated from the room. The wheels of the little trolley car on one side are insulated from those on the other. A flexible cord has its terminals at one end attached respectively to the right and left hand wheels. The other end of the flexible cord carries a head-set.

Thus the occupant of the room can move about without having to look after a long flexible cord, always a troublesome thing, and can hear anything from the latest opera to the dispute between the fundamentals and the modernists while engaged in the prosaic duties of housework. It is quite obvious that if used in offices this appliance might be a convenience, enabling the switchboard operator to have freedom of movement.

Electric Washer Clamps on Any Tub

THE small electric washer shown in this illustration fits any tub and is secured to it by means of an easily adjusted clamp.

Its shape is cylindrical, and within the tank is the motor and an electric fan. Water enters through the perforations near the bottom. The fan actuated by the motor sends out a strong stream of water which hits the sides of the tub, tending to swirl the clothes. This starts the soapy water through the articles of clothing and in a very short time all dirt disappears.

The motor is said not to drip oil and not to send it through the wash water. Very little noise is made by the operation of the motor.

The weight is such that a woman of average size can carry it from one place to another, down in the basement, or upstairs as needed.

The multiplicity of clothes washers may fairly be divided into two classes; one in which mechanical agitators or paddles come into contact with the clothes with the idea of cleaning them, somewhat along the lines of the old washboard; and the other in which the mere motion of the clothes and their contact with fixed pieces in the washer, are supposed to do the cleaning.

A compact and simple electric washer, which makes the goods wash themselves by the vigorous agitation it imparts.

The washer here described is simply an appendix to the regular tub already in place. It swirls the clothes about violently, thereby in a sense causing them to wash themselves. It is certainly simplification as far as the machinery aspect is concerned, and this is emphasized by the fact that the apparatus is so light that it can be carried about very readily.

It tends to reduce the expense of the household plant which now assumes sometimes a formidable figure when too large or too elaborate electrical machinery is installed.

There is a great contrast between a machine which makes the clothes wash themselves, and the old-fashioned system.

Contributed by M. M. HUNTING.

Awards in Odd Electrical Experience Contest

First Prize, $20.	Second Prize, $10.	Third Prize, $5.	Fourth Prize, $2.50.
Edward M. MacDonald	William R. Walton,	Sidney Breslow,	Edward M. Wyland,
16 Boyd St.,	Sheldon Jackson School	2418 Florida Terrace,	608½ St. Joe St.,
Bangor, Me.	Sitka, Alaska.	Atlantic City, N. J.	Rapid City, S. D.

First Honorable Mention—D. O. McAllister, 5th St., Braddock, Pa.
Second Honorable Mention—D. O. McAllister, 5th St., Braddock, Pa.

First Prize

A Shocking Stretcher

By Edward M. MacDonald

I AM employed in a large hospital and my duties take me through every part of the buildings.

While going down a corridor one day near the operating room I saw a stretcher standing near the wall. When going back

Drawing a sheet from a bed with India rubber cover thereon, produced so much static electric excitation as to give a violent shock.

the same way an orderly was engaged in making up the stretcher with clean linen. He yanked the sheet off and went into a linen closet, leaving the stretcher in my way. I proposed to wheel the stretcher to one side and was just going to take hold of one of the steel hand grips, when a flash of fire flew out of the handle and entered my hand and I was knocked against the wall by one of the worst electric shocks I have ever experienced.

I called the orderly, had him replace the sheet and pull it off quickly and had him touch his hand to one of the wheels, when he received a terrific shock.

These hospital stretchers are fitted with an India rubber covered mattress and the rest of the stretcher is tubular steel. The wheels are rubber tired. It is therefore insulated from the ground.

When the cotton sheet was pulled off quickly a positive charge of static electricity was induced on the rubber mattress.

When the hand approached the stretcher the charge jumped to the person's body and thence to the ground.

Let those who doubt this story try the experiment, which if done successfully, will be very convincing. I am sure that no encores will be called for.

Second Prize

A Couple of Crows Make Up

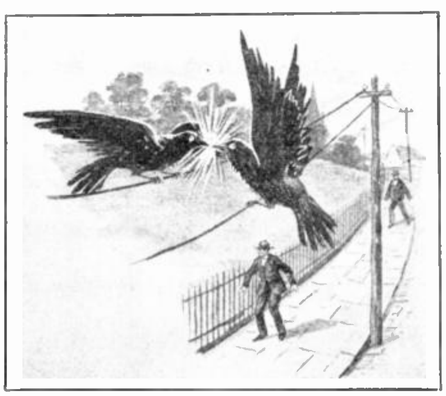
By William R. Walton

ONE rainy afernoon walking up the hill along the line of our school electric main supply circuit, I happened to notice two crows sitting face to face on the high tension wires. Each crow sat on its own wire.

Crows sitting in this position were an unusual sight, and this pair were cackling loudly. They seemed to be quarrelling. After I watched them for a while they stopped. They looked at each other and then they touched their beaks, as if kissing; the result was just the opposite of what I expected. They produced such a flash, it looked like lightning.

They flew or jumped apart making an arc, and both fell to the ground and crawled away like two scared to death crows.

They had shorted the circuit, which made the powerhouse squeak.



Two crows, each mounted on their own wire, by putting their beaks together brought death upon themselves.

Third Prize

A Doggone Shock

By Sidney Breslow

I STILL remember an odd experience which happened to me some time ago. I was waiting for a friend who was expected on the next train. While strolling around the depot followed by my dog

Patting a dog gave a man a violent shock, because the dog was not standing on the protective board.

Turk, I felt thirsty and decided to get a drink at the water fountain. When I reached my destination I saw an electrician fixing a wire nearby, while on the fountain was the following sign:

"Please stand on the board when drinking or you will get a shock."

After reading the sign, I stepped on the board and started to drink, while my dog sat down on the pavement near the board to wait for me. While drinking I wanted to make sure that my dog was still there, so I stretched out my hand to pat him, and then the fun began.

The minute I touched my dog, I felt paralyzed and could not remove my hand. I felt my dog quiver and his hair rose up like arrows. We stood like that for a couple of seconds and then with a wild and frightened yelp Turk dashed away. The minute Turk had run away the circuit was broken and I no longer felt the shock.

After straightening up and making sure that I was none the worse for my experience I ran after my dog who was not caught until nearly everybody in the station house had joined in the chase.

Fourth Prize

Devotion

By Edward M. Wyland

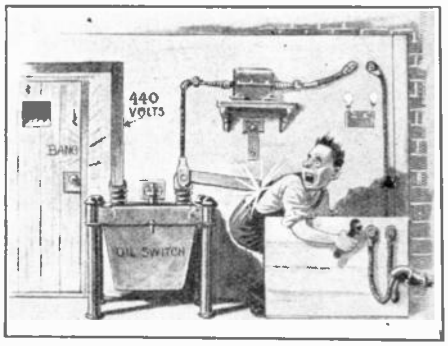
THIS is what happened to me while doing some work back of a switchboard. A small door was in the center of the board and thereon hangs a tale.

I was behind the board making a connection next the wall and was cramped in back of an oil switch in a stooped position.

We had just cut a pair of current transformers into the circuit for a test and had left the busbar open, as shown at (B) in the picture.

After finishing this I sent my helper to the shop for something and turned around myself to make a connection on another part of the board.

When "Slivers" returned he discovered



This self-sacrificing individual is supposed to have held up the switch-bar for an hour, in order to prevent a dangerous short-circuit.

that he had forgotten the most important things he had gone after. It made him mad and starting back he gave the door a terrible slam.

The jar loosened the none too tight connection at (A) and the busbar dropped on my back.

Well, when it hit me I jumped as far as I could, which was only one inch or so because of my cramped position.

All I could do was to stand there and hold the bus because if I let it down it would touch on the iron frame work and do serious damage and if I raised up the corners of the bus would dig in and I would get the whole 440.

When my helper arrived at the shop the boss sent him off on another errand and he was gone nearly an hour; all I could do was to stay under that bus as I had no way of getting out and it was no use to call for help as the nail mill beside the substation made more noise than I could.

To say that I was glad when my helper finally arrived is putting it mildly.

1st Hon. Mention

Queer Feelings

By D. O. McAllister

A CERTAIN branch railroad served two purposes. At night it carried coal from the mines, and during the day it was used to test electric locomotives. Midway of the two traction rails, was the third rail, which the locomotive's magnetic circuit would cut-in and cut-out, in 400-foot sections; that is, connect and disconnect the rail from the overhead feed wire.

At night, much coal would fall from the recently loaded cars, as they were shifted about, and during the day, a colored woman replenished her coal bin by gathering this coal. On one occasion as she was accumulating some coal, the electric locomotive came toward her in a leisurely manner. She stepped to one side to let it go by. And when the locomotive passed, she spied a fat lump of coal on the opposite side, which she proceeded to get by placing one foot on the traction rail, and stepped with her other foot to the third rail. This was just a convenient step, providing the electric locomotive wasn't hovering around within the 400 feet. Now, when the colored woman stepped on the third rail, the locomotive had not passed from this section. Instantly, the 550 volts from the direct current circuit hurled her down over the embankment, among the cinders and elderberry bushes.

The one who observed the plunge, hastened to her aid. When the first-aider arrived at her side, she was picking

A locomotive activated the third rail in 400 foot stretches. The lady tried to gather coal while the engine was on the same block.

cinders from her ears and spitting them from her mouth.

"Are you hurt?" queried he on taking hold of her.

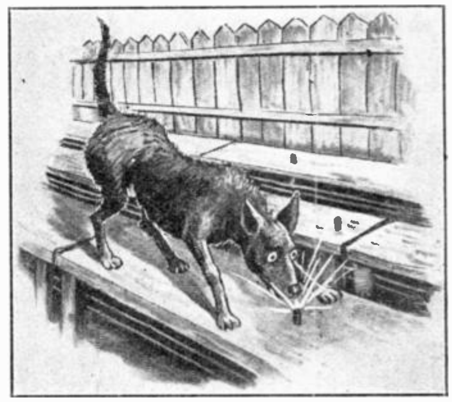
The query was slow in taking hold, as she brushed her hand across her face as if removing cobwebs, and her eyes as large as butter plates.

"No, captain," replied she, and then wagged her head, "I'se ain't hurted. But I'se sure had a queer feelins in my own laigs, whens I'se was comins down here."

2d Hon. Mention

Nosed Once Too Often

By D. O. McAllister



The curiosity of this dog led to his summary electrocution. One should not be too much of an investigator of electric shocks.

SCENE: A manufacturing plant's storage yard. Tarred planks placed in a straight line with electric wires between. And at every few feet surface contacts were brought through the upper plank.

On all damp days, many of these surface contacts would permit the current to leak. It was great sport for the young fellows, who worked at this plant, to tip-toe and skip around over these leaks at the noon hour. It was just a good tingle for humans.

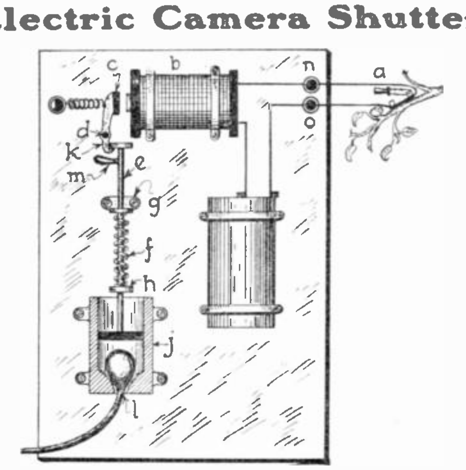
So, on one of these days a dog made his way up from a small stream which passed close by, and took a short cut across the company's property toward home. No one observed the dog, until he ki-yi'd and became all speed, fleeing across the storage yard. It was now great glee for those who saw, for it was surmised the dog had bumped a leg against or set a foot on to a leaking contact. When the dog had covered about 200 feet, he stopped and looked himself over, fore and aft, to see whether he was all here or there. Then shaking himself and wagging his tail he caused observers to decree that he felt satisfied with himself. But the dog decided otherwise, for he came back to the place where he had been shocked, as it appeared, to investigate and find out what had hit him.

As the dog nosed around the place he had fled from, his nose came in contact with the leak, and he was instantly killed.

Electric Camera Shutter

IT is often desirable to operate a camera shutter from a distance, especially in photographing birds and animals. The device shown in the accompanying illustration serves the above purpose very nicely, and its construction and operation are extremely simple. In brief, the operation is as follows:

The switch (A) is mounted on the limb of a tree, in such a manner that it is not conspicuous, and connected in series with a magnet (B) and a battery by means of a flexible conductor, such as lamp cord. The magnet (B) is energized when the switch is closed and attracts the iron armature (C), which is mounted on an arm pivoted at (D). The lower end of the arm is in the form of a latch which supports the rod (E) when it is raised to its upper position. The rod (E), when it is raised, compresses the coiled spring (F), which is held between the gauge (G)



An electrically operated shutter for a camera; it compresses the air-bulb as if by hand.

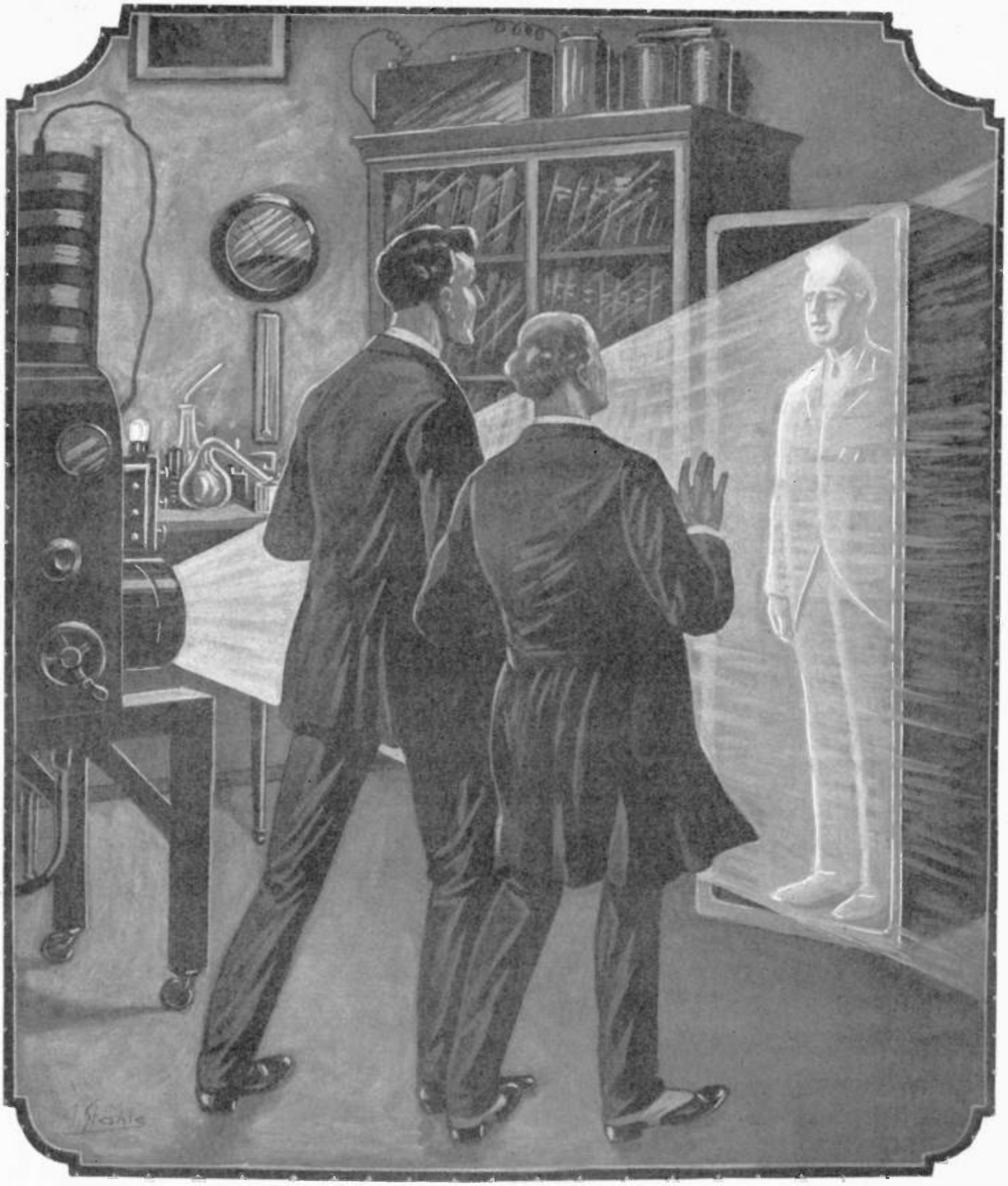
and the washer (H), mounted on the rod. A small coil spring holds the armature (C) away from the core at the magnet (B). The lower end of the rod (E) is in the form of a piston (F) operating in the wooden cylinder (J).

The rubber bulb at the end of the tube leading to the camera shutter is located in the lower end of the cylinder (J). When the rod (E) is released by the catch (K) it moves downward with the cylinder (J), due to the action of the spring (F) and compresses the bulb (L), causing the camera shutter to be operated. A small handle (M) may be mounted on the rod to be used in raising it to the upper position. The components of this device can be mounted on a small board by means of brass straps and the terminals of the electrical circuit go to the binding posts (N and O) as shown.

Contributed by A. McFeeters.

The Man Who Saw Beyond

By James Pevey



"The figure of Palmer became transformed, even as had Morton's hand. Where he had stood, remained only that weird, radiant mass, bearing the outlines of a human body."

An Unexpected Telephone Call

BR-R-R-RING-G. The telephone shrilled its signal. I reluctantly climbed out of bed and picked up the receiver.

"Hello, Doctor Graham? Will you kindly come out to Green Terrace, at once?"

"At once?" I answered. "Is it important, my friend?"

"I assure you that it is," answered the voice. "I am not exaggerating when I say that it is a case of life or death."

"Be with you soon as possible," I snapped, and jumped for my clothes.

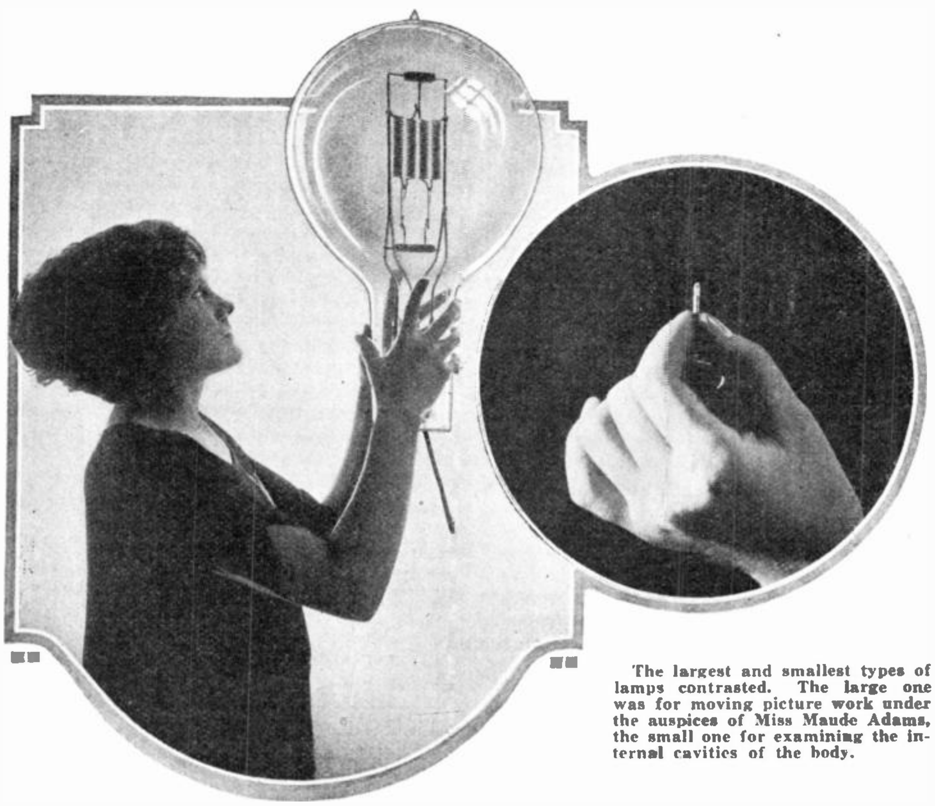
I can not say that I exactly relished the idea of starting out, at three o'clock in the morning, for Green Terrace, a large estate, some ten miles out of town. However, one of the medical profession sets aside all personal feelings at the call of life or death.

In a few minutes I was gliding swifty

(*Continued on page 400*)

New Things Electric

Dwarf and Giant Lamps



The largest and smallest types of lamps contrasted. The large one was for moving picture work under the auspices of Miss Maude Adams, the small one for examining the internal cavities of the body.

THE smallest and the largest incandescent lamps in the world, one rated at about one-quarter candlepower and the other at about 100,000 candlepower, are shown here. They were made by the General Electric Company.

The large lamp has a bulb 12 inches in diameter and is 18½ inches high and was developed primarily for motion picture studio use. It is rated at 30,000 watts, over 40 horsepower or 1,200 times more than the average household lamp. The electric current required to operate three of these lamps would be equivalent to the power used to operate the average streetcar. It gives about 100,000 candlepower. It is considered to approach nearer to sunlight than any other lamp does.

The small lamp, known as the "Grain of Wheat," is but one-quarter of an inch in diameter and uses but one-fifth of a volt of electricity. It was designed for use in hospitals and by physicians.

The light from the big lamp is equal to the combined light from 2,400 electric lamps of the size commonly used in the home. The filament is made of tungsten wire one-tenth of an inch in diameter and 93 inches long, constructed in four coils. This wire, if drawn into filament wire of the size used in the 25 watt household lamps, would supply filaments for 55,000 such lamps. These great lamps are classified as the Mazda C type, being gas filled, and are lighted from a 120 volt, 250 ampere circuit. Consuming 30 kilowatts, the cost to operate such a lamp with current at 10 cents per kilowatt would be $3 per hour.

Lamp from Telephone

A SNAPPY table-lamp made from a regular desk-telephone pillar or swivel, is illustrated here.

The stand is made from a nickelplated desk telephone, the only change necessary to attach the socket, is to change the lug. The lug originally was the means of holding the transmitter shell. The top of the lug is filed down to a three-eighths inch round and threaded to fit a three-eighths inch lamp socket.

The socket is attached and the cord is run down through the original hole in the lug, through the pillar and comes out through the hole which is in the base. The socket is nickelplated and of the pull-chain type.

A parchment shade will rest nicely on the lamp or can be fastened to the socket.

Contributed by GEORGE H. STEVENS.

Interesting standard table lamp using an old telephone support to carry the burner.

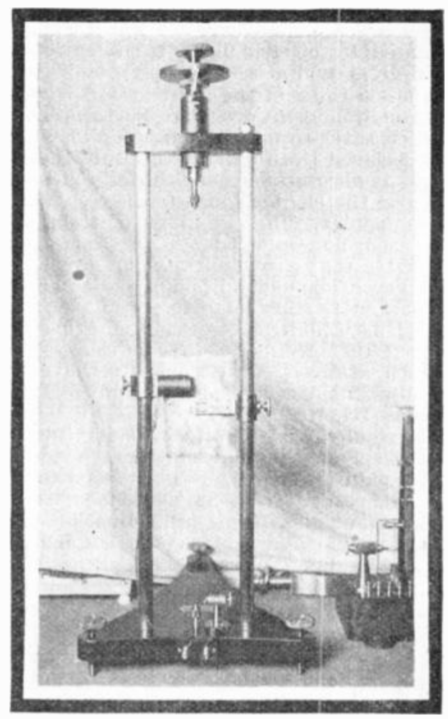
Cord Stroboscope

IN mechanics it is often necessary to study the action of pieces of a machine in a very rapid movement.

The stroboscope which we describe is adapted for such studies; it comprises a vertical cord which is kept in continuous vibration electrically by an electro-magnet, the circuit being opened and closed by the cord itself by its vibrations.

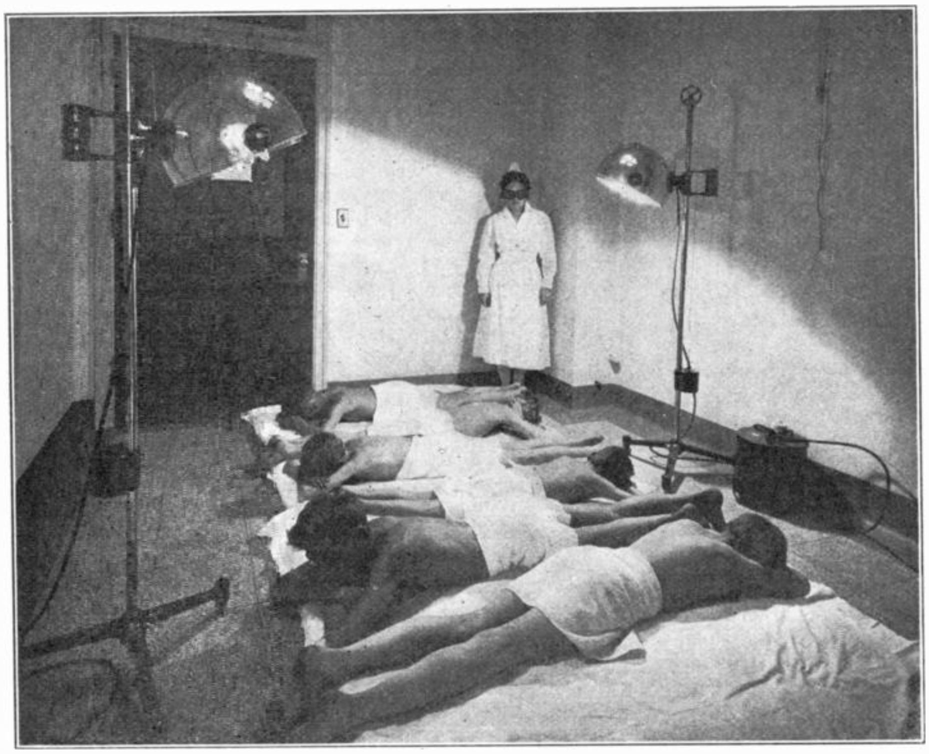
Marvelous results are said to be attained by this simple machine, which enables the most rapid movements to be studied. The moving piece is inspected through an opening in the center of the apparatus, through which the stroboscope cord passes. This opening is kept in such rapid vibration that the eye sees successive positions of the part being studied, the continuity of motion seems to disappear and all sorts of effects, some may be those of backward motion or retrogression, may be produced.

By LUCIEN FOURNIER, Paris Correspondent of PRACTICAL ELECTRICS



A cord stroboscope, a very interesting simplification and development of the well known rotating stroboscope, used for investigating the action of moving machinery.

Healing Rays



One of the great elements in the cure of consumption and for fighting the great white plague is sunlight. Although the rays of the sun are screened or sifted by the atmosphere, they possess "sun-burning" qualities, and in the electric lamp shown here some of these qualities of sunlight are called upon to destroy the germs.

FROM Minneapolis comes the interesting illustration which we reproduce here, of the treatment of school children for tuberculosis. It is the Lymanhurst School of Minneapolis which practices this treatment.

The children lie down, as seen, in the glare of strong electric lamps, in which of course there is a certain amount of ultra violet rays, in order to destroy the germs. The school is conducted jointly by the Board of Education and Department of Public Welfare.

So much has been done for consumptives in the last few years in the shape of out of door cure, and here we see it supplemented by electric light treatment, that the great white scourge may yet become almost a thing of the past.

The wonderful work at Saranac Lake which saves so many lives was started by the beloved Doctor Trudeau. But Minneapolis is not Saranac, so electricity steps in to give the healing touch to the treatment.

Of course, different kinds of light can be used, and in extreme cases it is conceivable that a real ultra-violet ray lamp might be adopted, although the sun-burn produced by this lamp is very severe, so much so that it has even been tried for curing the effects of X-rays on the system, which are very disastrous and have already killed some people and maimed others frightfully.

The ultra-violet rays have so intense an effect on the epidermis that a severe and painful sun-burn, as it has to be called, results from unguarded exposure. A sheet of glass gives protection, because ultra-violet rays cannot pass through it.

In the lamp works where ultra-violet lamps are manufactured, precautions against their effects are taken. It is a curious fact that the mercury vapor arc in a glass tube is a particularly safe light from the physiological standpoint, while the same arc in a tube of quartz glass (melted quartz) pours out the ultra-violet rays in profusion.

Then again, there are the violet rays, the electrical successor to the old blue glass treatment of the past generation, so that within this room with its standards for the lamps quite a variety of applications can be given.

In connection with the above, it is interesting to see on this page a surgical application of the electric light, although not exactly in line with what is now described.

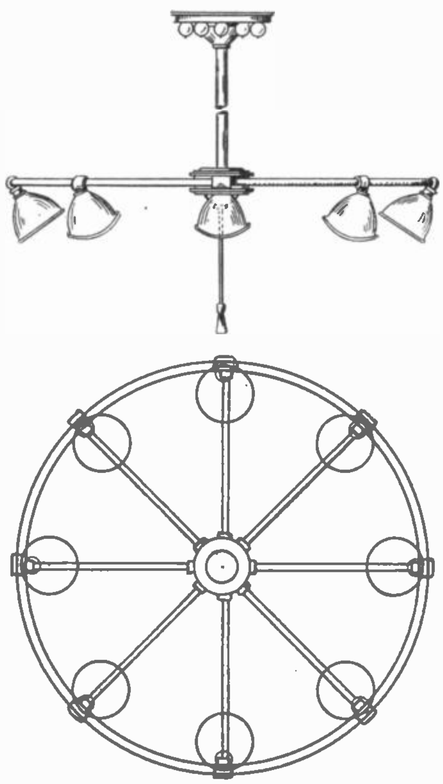
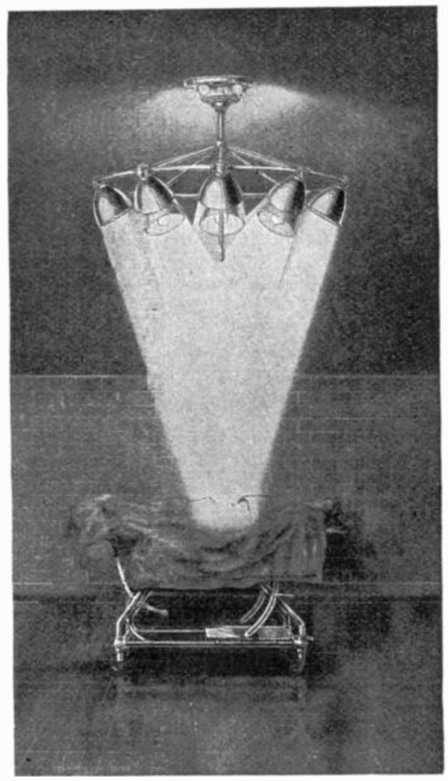


Diagram of the frame for carrying the lights of the so-called surgical chandelier. The simplicity and rigidity of construction are both apparent. The important feature is the diameter of the circle with regard to its height from the subject.

Surgical Chandelier



Surgical chandelier in use, giving a presentation of the cone of rays which fall upon the subjects on an area restricted to the necessities of the surgeon. The angles of the individual lamps can be changed to suit each case.

IN performing surgical operations it is most important to have a perfect light or rather as nearly perfect as may be contrived. In conducting such operations upon a patient, the light we illustrate may be said in a sense to approach perfection, as shadows are absent.

The illustration shows a new type of light called the Noshadowlite, an electrical installation, comprising eight lamps evenly placed and carried by a horizontal circle of metal, each lamp with a parabolic reflector; the rays all concentrated upon the surgical table and the patient thereon.

By setting the reflectors at the proper angle, it will be seen that a very strong light will thus be produced, and in order to prevent its being too glaring, frosted lamps are sometimes used. The fitting depends from the ceiling by a heavy stem, and where the stem leaves the ceiling there is a canopy around whose outer circle eight lamps may also be evenly distributed, giving a ceiling light and acting to secure illumination for the rest of the room.

The perfect light for drawing or writing should not cast a shadow on the work. The effort is generally to have the light come over the left shoulder, casting the shadow of the hand away from the lines which it is drawing or inscribing. The sun having a visible magnitude, casting a shadow borders it with a margin of diminished intensity called the penumbra, which mitigates the effects of shadows. In some cases the electric light produces so sharp a shadow that there is practically no penumbra produced and this illumination is not at all desirable. But by having the light come down on the subject from all sides, there is no question of a penumbra, as shadows are simply absent or annihilated, and the surgeon has a perfect view, therefore, of his field of operation.

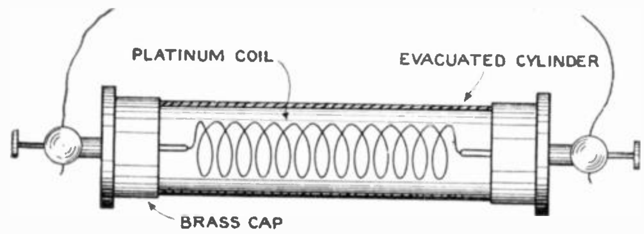
The ceiling lights shown are of relatively small intensity, but their intensity may be changed for each case.

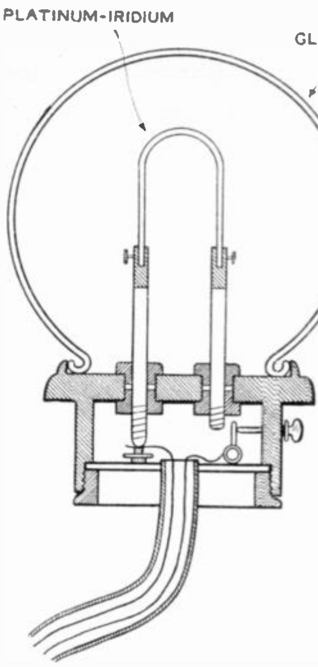
One of the lamps showed a falling-in of the glass at the top as if it had been softened while a vacuum existed in it. Like the popular governor of New York State, Henry Goebel had his home on the East Side of New York, and it is said that he operated an arc lamp on the roof of his house in Monroe Street.

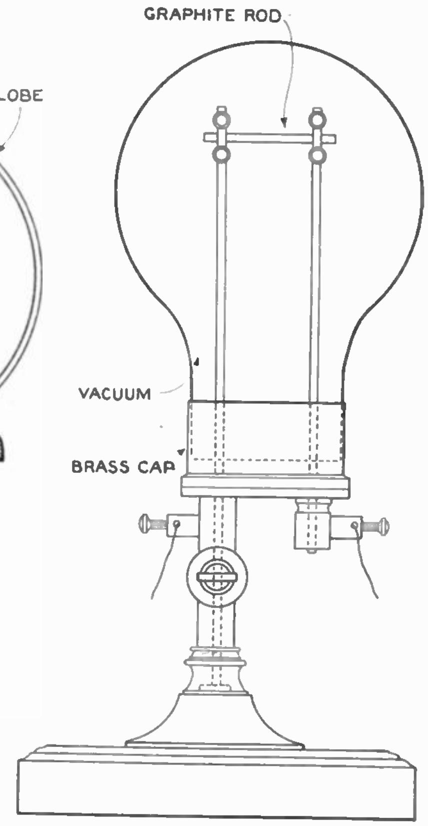
One of his ways of earning a living was to exhibit a telescope of his own construction, mounted on a wagon, and to let people take a glimpse through it for a consideration. Traveling the streets at night, he mounted on the wagon some of his electric lamps, and a primary battery, and used to turn on the current so as to attract attention and get customers. From a very old illustration we reproduce a view of his astronomical outfit, with the lamps carried on a frame and the telescope mounted and extending above them.

All sorts of details were given of how he connected the filament to its support by a sort of carbon cement using stove polish. His telescope is said to have had a lens some twelve inches in diameter and was nearly eighteen feet long. On the wagon he had a sixty cell battery contained in two wooden boxes, and as long as the battery was fresh or newly filled, he could light two or three lamps for a short period, while a single lamp could be lighted for about half an hour.

Three early incandescent lamps. Below, the De la Rue lamp, in the center the States lamp, and to the right the Roberts lamp, carrying us back to the first half of the last century.

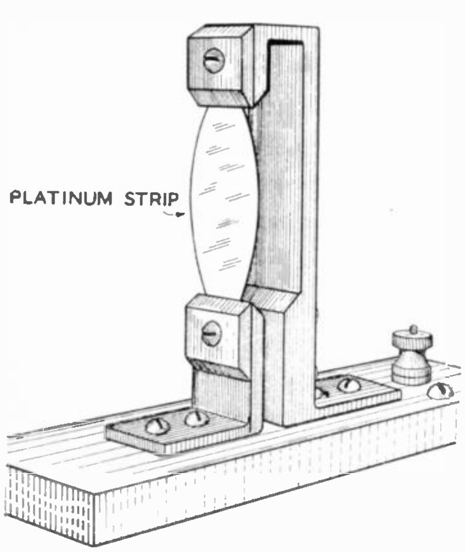






He never attempted to patent his lamps; in the absence of any practical source of electric power the lamps were perfectly futile and only a curiosity, and it is even claimed that his ignorance of English interfered with his applying for a patent.

In some of his early work he is said to have filled his lamp tube with mercury before sealing it, having it attached to a long tube also filled with mercury, open at the end. By immersion of the lower end of the tube in a cistern of mercury he produced a Torrecellian vacuum when the tube was inverted and then sealed off the tube. It is claimed that he avoided amalgamation of the copper by using chemically pure mercury. Afterwards he is said to have used a mercury pump. Curiously enough, his use of a carbonized bamboo filament, which he is said to have obtained from pipe stems, resembles the Edison bamboo filament, which for a while the great inventor adopted in his lamps.



The Farmer lamp, going back to 1859. This lamp used a heavy strip of platinum to be ignited, and made no pretence of protecting it by a globe or bulb.

Sir William Robert Grove at this epoch brought out the Grove battery which for many years played so important a part in the electrical field. He used a platinum electrode in strong nitric acid within a porous cup, surrounded by dilute sulphuric acid, in which the zinc electrode was placed. He nearly doubled the voltage of previous batteries and made some attempt at depolarization which, however, was effected by the reduction of nitric acid and the development and evolution of very disagreeable fumes.

It was in demonstrating this battery before the Royal Society that he incidentally heated a number of coils of platinum wire, which he covered with glass tumblers to keep them from any draft. A number of these were placed about the auditorium so as to light it up.

The first English patent on the incandescent lamp dates back to 1841 and in 1845 J. W. Starr, an American inventor, obtained a British patent on his lamp. In one he used a strip of platinum and in the other he used a rod of carbon in a barometric vacuum. The De la Rue lamp, a straight tube containing a platinum coil in a vacuum as good as could be produced in those days, is supposed to date back to 1820. This seems impossible as the battery of those days was so poor and inefficient.

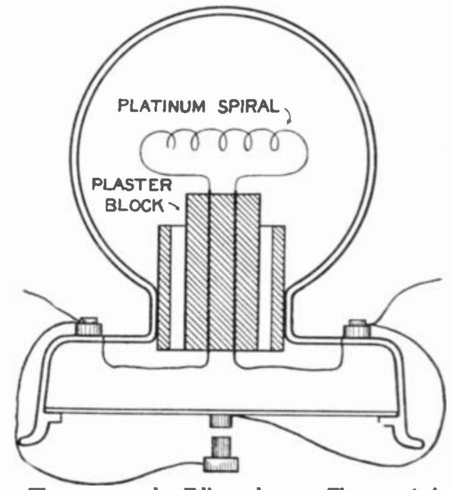
Staite's incandescent lamp using a platinum-iridium wire in an air-filled globe goes back to 1848, and four years later, 1852, the Roberts lamp appeared, in which a graphite rod was ignited by the current, which rod was enclosed in an exhausted glass bulb.

An early lamp is Farmer's, which goes back to 1859, and which employed a heavy strip of platinum, comparatively speaking, in the open air. Lodyguine's incandescent lamp of 1872 with a nitrogen filled bulb and a heavy shaped carbon filament or plate is interesting. Three years later comes Kohn's incandescent lamp with rods of graphite in a vacuum. It will be seen that one rod is lighted at a time and when that one burns out a tumbling or spring switch makes contact with the end of the other one to prolong the operation of the lamp.

An inventor may produce most ingenious and invaluable devices, but if he produces them at the wrong time they are of no value. The incandescent lamp which effected the subdivision of electric light perfectly, was entirely useless and nothing more than a curiosity, until some practical way of producing electric power was developed.

And now we come to the early Edison lamps. A platinum spiral is shown in the first of them, contained within a bulb, and with an expansion chamber at the base. If the spiral became so hot as to threaten melting of the bulb, the air in the bulb expanded, pushed down the diaphragm at the bottom, and short-circuited the filament.

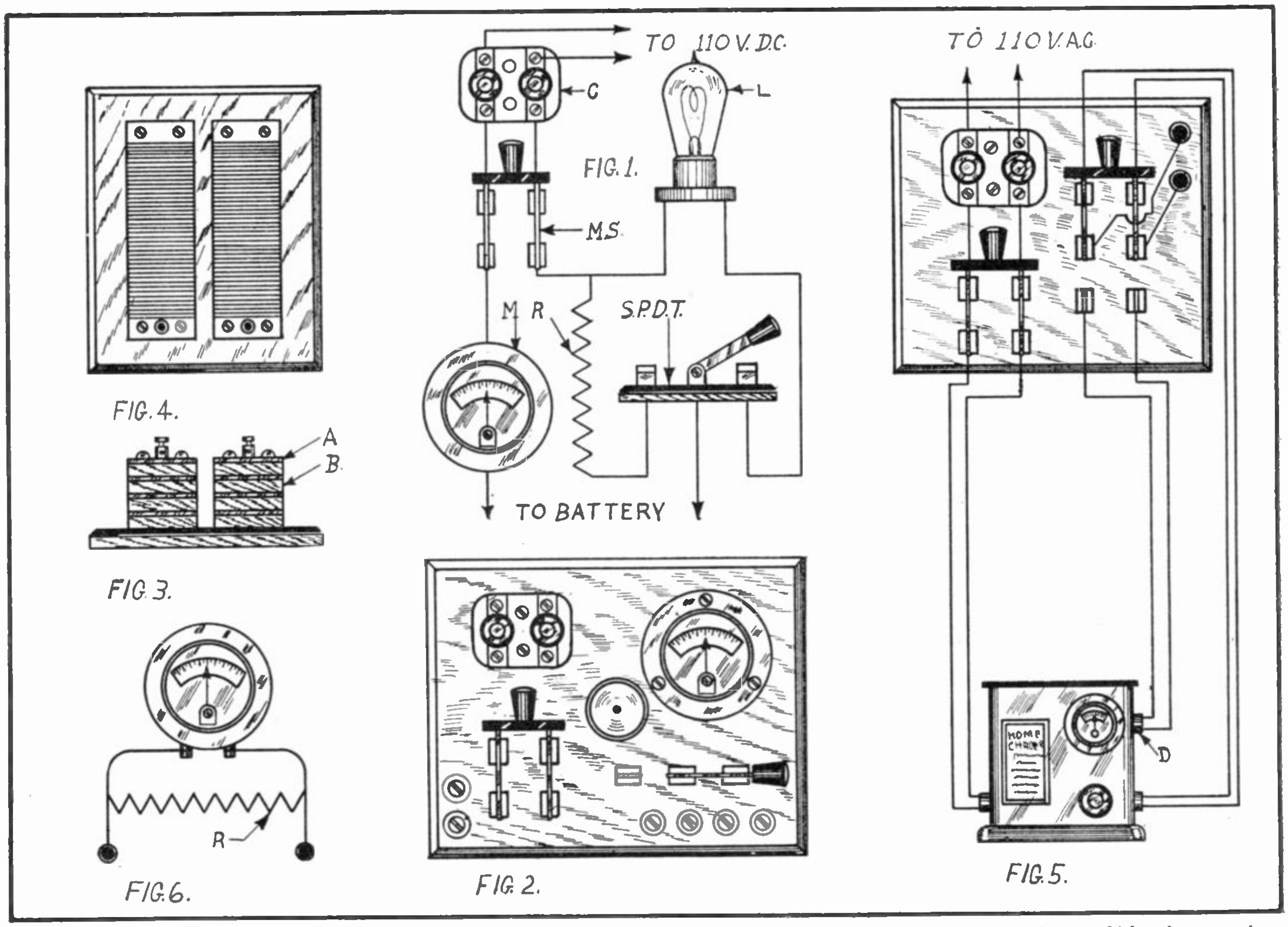
(*continued in the June Issue*)



The very early Edison lamp. The great inventor's first work was done with platinum wire and here we have a sort of aneroid base to the lamp, opening and closing the circuit to prevent the wire from obtaining a fusing temperature.

Battery Charging Switchboards

By A. Giolitto



Above are shown various details and front view of a very complete switchboard for battery charging purposes, and one which, of course, is applicable to other purposes in the experimenter's laboratory.

WHEN charging storage batteries it is convenient to have some form of switching arrangement between the battery and source of current. Several practical battery charging arrangements are illustrated in the accompanying illustrations. The construction of a suitable resistance to be used in connection with these switchboards will also be described.

A convenient circuit for charging A and B batteries is shown in Figure 1. When it is desired to charge A batteries the S.-P. D. T. switch is thrown to the left. This connects the resistance (R) in series with the battery.

Assuming that the main switch (MS) has been closed, the battery will begin to charge; its charging rate depending upon the value of the resistance (R), in this case (R) being 20 ohms; then according to Ohms' law the current through the circuit will be $\frac{110}{20}$ or 5.5 amperes. However as the battery itself has a little resistance, the actual current flowing through the circuit will be somewhat lower than 5.5 amperes.

In determining the amount of resistance to be inserted in a circuit to pass a given current, the resistance of the storage battery may be disregarded as it is small compared with the outer circuit resistance including (R) (Figure 4). Referring to Figure 1 again, when it is required to charge a B battery, the single-pole double-throw switch is thrown to the right, thereby bringing the lamp (L) in series with the source of current and the battery.

Assuming that the line voltage is 110, if a 32-candlepower carbon lamp is used, sufficient current will be passed, to charge the average B storage battery. If carbon lamps cannot be obtained, a 60-watt tungsten lamp can be used, although the charging rate will not be as high. In all cases the charging current will be shown by the ammeter. The ammeter is not absolutely necessary and may be omitted if desired. The entire apparatus is protected by a fuse block (C) fitted with six-ampere fuses.

A front view of the switchboard is shown in Figure 2. The resistance (R) mentioned above may be made up of German silver wire. In order that it may have a resistance of 20 ohms, 280 feet of 18 per cent German silver wire (B. and S. gauge 16), is required. If 30 per cent wire is obtained only 177 feet will be needed as the resistance of this wire is approximately 1.5 as much as that of 18 per cent wire.

However with 30 per cent wire, a greater amount of heat will be developed, thus making it necessary to mount the resistance units on an iron frame.

Gauge sixteen was selected as this size will pass a current of five amperes without undue heating. If 18 per cent wire is to be used it can be wound on mica strips 10 inches long by 3⅜ inches wide. Allowing half an inch at the ends, and placing seven turns of wire to the inch, eight of these strips will be required.

The strips (A) Figure 3, or rather resistance units, are spaced by wooden blocks and bolted to a suitable base as shown.

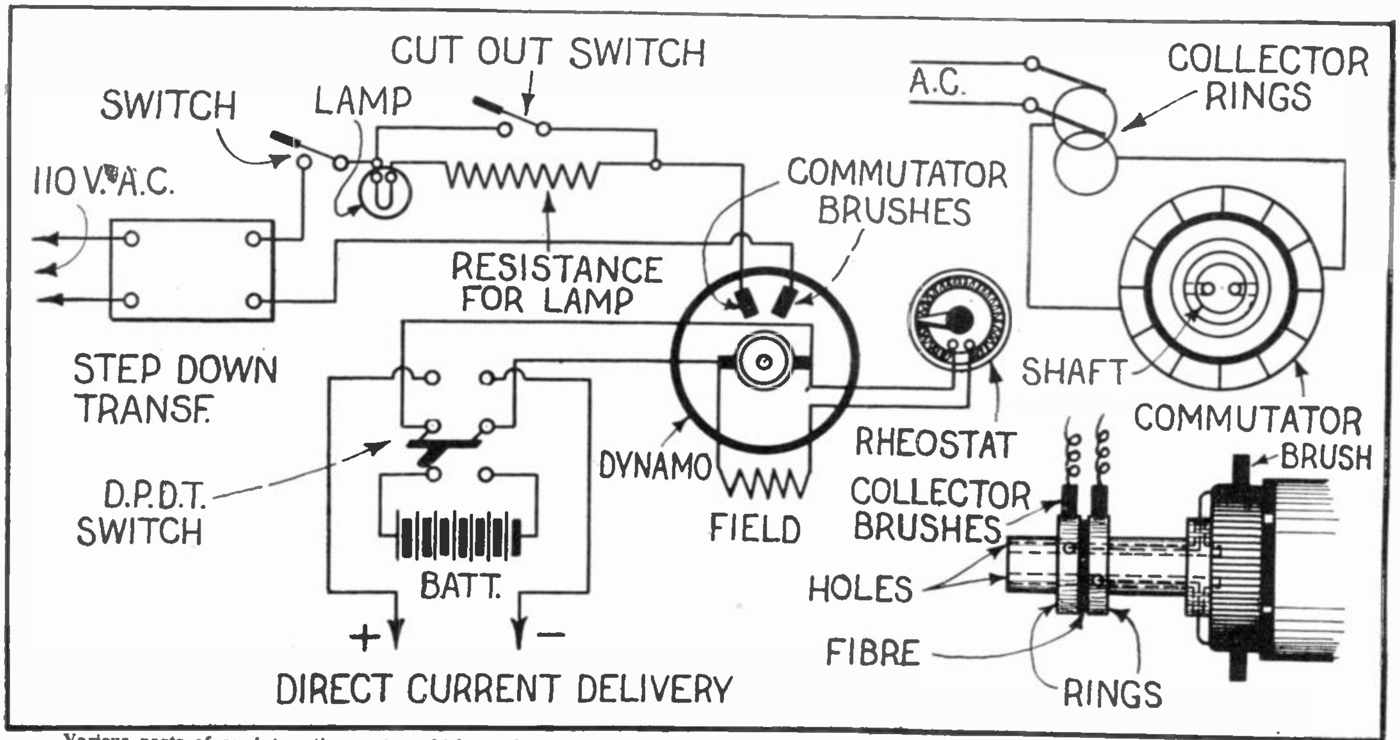
The resistance units after winding should be covered with asbestos paper. This covering is not introduced in the diagram in order to show the winding. All of the resistance units are connected in series, and the two resulting leads are connected to the two binding-posts mounted as shown. Figure 4 is a top view of the complete resistance. This resistance can also be used in connection with chemical rectifiers for charging storage batteries on alternating current.

Figure 5 shows a hook-up for charging storage batteries on A. C. with a vibrating rectifier. As all the vibrating rectifiers contain a small transformer, it will be seen that with the switching arrangement shown, it will be possible to use this transformer for different purposes, when the rectifier is not being used for charging batteries. As shown, two extra leads are brought out from the rectifier, through an insulating bushing (D). These two leads connect directly to the secondary terminals of the transformer, the other ends being connected to the lower clips of the double pole, double-throw switch. A single-throw double-pole switch is provided for switching the primary of the transformer on or off.

The time required to charge a storage battery will depend upon the charging rate and the ampere-hour capacity of the battery. If these are known the time required can be roughly determined as follows: For example let us say, that the ampere-hour capacity of the battery is 60, and its charging rate five, then the time will be $\frac{60}{5}$ or twelve hours. Assuming

(Continued on page 406)

Rotary Converter and Synchronous Motor



Various parts of an interesting motor which can be used as a rotary converter. The article and elaborate diagram explain the construction very fully.

As many electrical experimenters have difficulty in obtaining at small cost a low voltage direct current supply to charge storage batteries, operate spark coils, motors and other apparatus, they will find the following apparatus very useful.

The shunt-wound direct-current dynamo of the 8 volt, 10 ampere type, used in conjunction with a step-down A. C. transformer, and an adjustable rheostat, will be found very available for this purpose.

The alternating current voltage should be a little lower than that given by the dynamo at 3600 revolutions per minute. Higher frequencies than 60 cycles cannot very well be used. Lower frequencies require less speed.

Two insulated collector rings of brass or copper are required on the shaft. A good place for these is between the commutator and the windings. They are connected to two opposite segments of the commutator (see drawing). Two brushes of springy copper or copper gauze, the holders of which are insulated from the frame with mica or fiber, are used in connection with the rings.

The dynamo should be brought to a speed of 3,600 revolutions per minute before connecting with the transformer. This may be done with dry batteries and varied with the rheostat in series with the field. When the desired speed is attained, the switch which cuts in the synchronizing device may be thrown in. This device is a lamp of low candlepower, equal to the voltage of both transformer and dynamo. If the candlepower is high the batteries may not be able to bring the motor to the desired speed, in which case a tungsten flashlight lamp with resistance in series is the best to use.

Care must be taken to have sufficient resistance for the combined voltage of the transformer and dynamo to limit the current. The lamp should light brightly and go out, alternately, and while the light is out the switch which short-circuits the synchronizing device (see drawing) may be thrown in and the batteries taken off. Direct current may then be taken from the commutator brushes.

If batteries are not available a hand drive may be used. In some cases the lamp may burn dimly and continue so when the batteries are not strong enough to overcome synchronous speed. Then the short-circuit switch may be thrown in at any time and the batteries taken off.

This dynamo may be used to convert direct current to alternating current, the frequency varying with the speed, the direct-current supply being connected to the commutator brushes and the alternating current taken from the collector brushes and rings. This converter can also be used as an alternating current motor of invariable speed, known as a synchronous motor, which is very desirable for driving rotary spark gaps in wireless stations, and for many purposes.

Making a Commutator

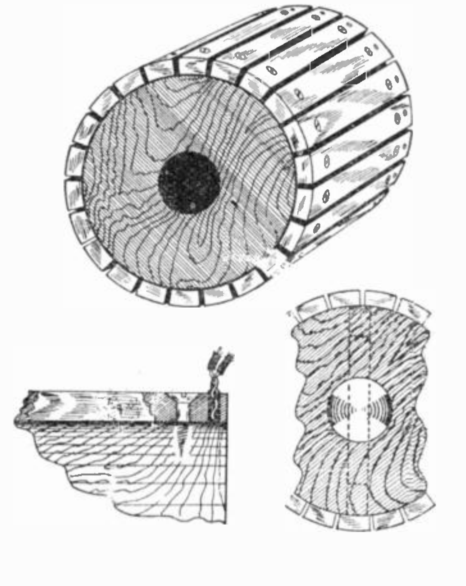
By Harold Jackson

The amateur constructing a small motor or dynamo will find the commutator the most difficult part of the work, if he attempts to imitate the commutator used on regular machines. However, this difficulty can be overcome by constructing the commutator shown in the illustration, which is easy to make and will give good results.

The core is made of hard wood of any desired dimensions. The core is turned down on a lathe or on the armature shaft until it is perfectly smooth and round. The commutator segments are then secured to the face of the core.

The segments are short pieces of copper bar one-half inch wide, one-quarter inch thick and as long as the core. These bars are screwed down in place by flat-headed brass wood screws, one being placed near each end of the bar as shown. The holes are countersunk. A space of not less than one-sixteenth inch is left between the bars. Allowance should be made for this spacing when figuring the diameter of the core necessary for a certain number of bars. The armature windings are connected to the bars as shown by placing the ends of the coil in third holes drilled at the back end of each bar and soldering the joint.

The commutator is secured to the shaft by drilling a one-quarter inch hole through both and inserting a pin as shown by the dotted lines; the pin should fit tightly and be short enough to prevent short-circuiting the bars. The surface is again turned down so that the brushes will sit properly. This is done, in case no lathe is available, by holding a fine file or whetstone against the commutator while rotating. The surface is finished with sandpaper.



Very simple construction of a commutator of special interest in connection with the preceding article, as a commutator and slip rings have both to be used upon the rotary converter described above.

Odd Telephones

By Clyde J. Fitch

(Continued from April Issue)

Another form, patented in 1885, by Alabaster, Gatehouse, and Kempe, consists of two diaphragms of wood or other sonorous material having an iron or steel wire

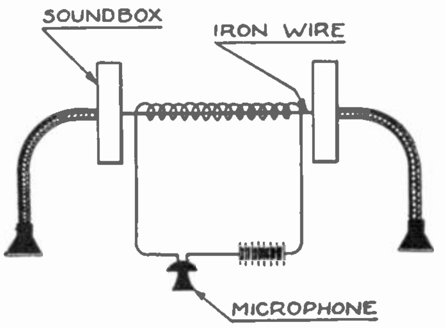


FIG 15

An iron wire wound with a coil of copper wire is stretched between two diaphragms of sonorous material; the speaking current affects the wire and thus the diaphragm.

stretched between their centers, as depicted in Figure 15. Around this iron wire is wound a coil of coarse wire connected to a local polarizing battery. Over this is wound a coil of fine wire connected to the line, through which the telephonic currents pass. Molecular vibrations in the

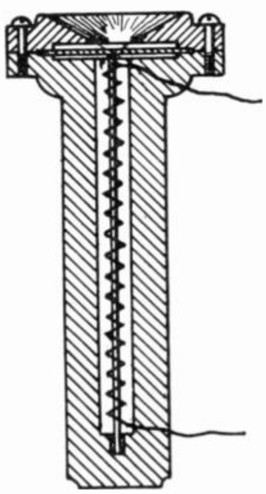


FIG 16

A simple modification of the above telephone; the axial wire is iron or steel, as in the preceding instrument.

iron wire are communicated to the diaphragms and the surrounding air. The two diaphragms may be the ends of sound boxes having flexible tubes leading to funnels which may be held to the ears.

Figures 16 and 17 show two modifications of this receiver patented by the same

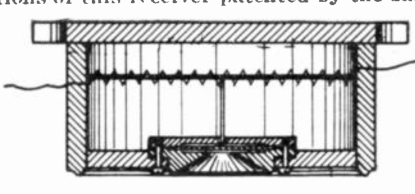


FIG 17

Another modification of the same instrument; this time the iron wire parallel to the diaphragm is connected thereto by a bar at right angles to its center.

inventors. In Figure 16 the iron wire is attached directly to the diaphragm, while in Figure 17 the motion of the iron wire is magnified by stretching it across the shell of the receiver and attaching the center of the wire to the center of the diaphragm with a silk thread.

A telephone receiver patented in 1886, by Eickemeyer involves a novel application of the well known principle illustrated by the fact that the electro-magnetization of a flexible bar twisted and maintained under torsional tension results more or less in the untwisting of the bar, and that a succeeding partial or complete demagnetization of the bar permits it to resume a normal condition.

The illustration, Figure 18, shows one form of this telephone. It comprises a U-shaped permanent magnet having annular shaped pole pieces slotted at the top. A flanged disc of non-magnetic material fits in each pole piece, and between the two discs is stretched a flat strip of soft iron, which strip may be twisted by turning one of the discs. The tension of the strip is adjusted by turning the screw which also clamps the wire wound bobbin in place. Telephonic currents passing through the electro-magnet cause an untwisting and twisting of the strip, which motions are transmitted to the diaphragm by the connecting link.

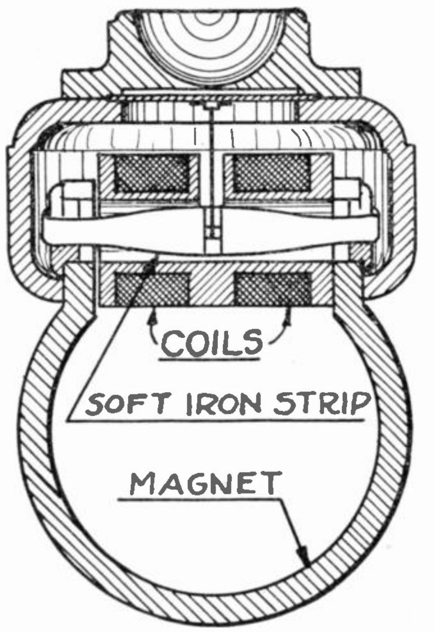


FIG 18

Telephone currents in this telephone change the twist in a flat strip of soft iron attached to the diaphragm, producing changes in magnetization thereof and giving the speaking effect.

It is not necessary to employ a flat strip; an iron wire has been successfully used, and in some cases several iron wires all twisted together give good results. Sometimes the strip may be rigidly fixed at only one end, the other end being maintained under torsional strain and attached to the diaphragm.

The curious receivers shown in Figures 19 and 20 were patented in 1887, by Watkins and are based upon the expansion and contraction of a permanent bar magnet, the movements of which are magnified by including a helical iron spring in the magnetic circuit. This type of receiver is said to be an improvement over the ones shown in Figure 13.

Two forms of this receiver are shown. In one the bar magnet is attached to the helical iron spring and the spring terminates in a polished ball pressing against the diaphragm. The pressure is adjusted by means of the screw. The speaking current passes through the bar, spring, and diaphragm, setting up vibrations in the whole system that possess the original speech characteristics.

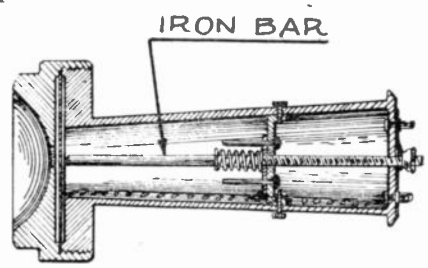


FIG. 19

The permanent bar magnet running through the center of this case changes in length under the effect of the telephone current, and a spring magnifies its motion so as to give the effect.

In the other the end of the bar magnet is polished and presses against the diaphragm. A helical iron spring is also included in the magnetic circuit as shown. The action is similar to that described above.

The receivers shown in Figures 21 and 22 were patented by Hale in 1882, and depend for their action on the expansion and contraction of an iron wire in a variable magnetic field. In Figure 21 the wire is attached directly to a circular diaphragm. It will be noted that the solenoid is placed at one end of the wire and not distributed

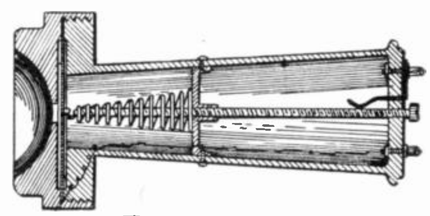


FIG 20

Another version of the above; in both of these the speaking current passes through bar, spring and diaphragm.

along its entire length as in the other cases. The one shown in Figure 22 acts upon the same principle but has a conical shaped diaphragm. This is to improve the mechanical-acoustical efficiency of the instrument.

Figures 23 and 24 show interesting receivers patented in 1890, by Wiegand. These are modifications of the ones shown in Figure 13. Figure 23 has a helical coil of iron wire in contact with the diaphragm and placed inside of the solenoid through which the speech currents pass. In Figure 24 a zig-zag iron strip is used instead of

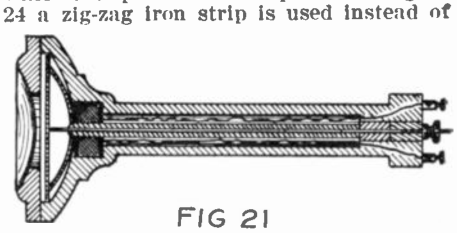


FIG 21

Similar telephone to the above, with a solenoid coil to effect changes of length in the wire running through center of the case.

the helical coil. Many other shapes give varying results.

In 1889, Bonta patented the receiver shown in Figure 25. This receiver comprises a disc shaped permanent magnet that also serves as a bobbin on which the magnet coil is wound. This core is grooved as shown in the illustration at (B) and also slotted at the outside rim and center as shown at (A) so as to have the effect of a multi-polar magnet, with north and

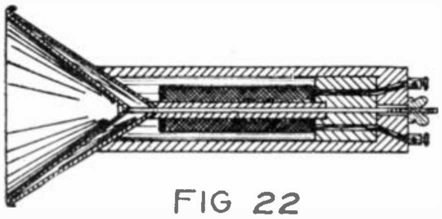


FIG 22

A version of the preceding, in which a conical diaphragm is used. Here the solenoid coil is longer.

south poles marked (N) and (S) as indicated. The iron diaphragm rests on the center projection as well as on the rim of the core, and vibrates due to molecular agitation. The diaphragm may be either in the front or in the rear or two diaphragms may be used.

Before describing the various types of telephone transmitters in detail we will conclude our descriptions of telephone receivers with the one shown in Figure 26, which is a molecular receiver of recent date and acts upon an entirely different principle from any of the others. This receiver was patented in 1916, by Rummler, who claims that it depends for its action upon the molecular stresses in a dielectric material when under the influence of a magnetic field. It should be noted that no iron is used in the construction.

The illustration shows this receiver in section. It comprises two disc-shaped coils, one on each side of a diaphragm of dielectric material of high inductive capacity, such as a thin sheet of glass. Although two coils are shown, one will give good results. The glass diaphragm is free to vibrate between the two coils as shown, and being acted upon directly by the magnetic field around the coils, molecular stresses are set up in the glass diaphragm which cause the whole diaphragm to vibrate. To intensify the action the coils have their convolutions cemented together by dielectrics of high inductive capacity. The diaphragm, vibrating in harmony with

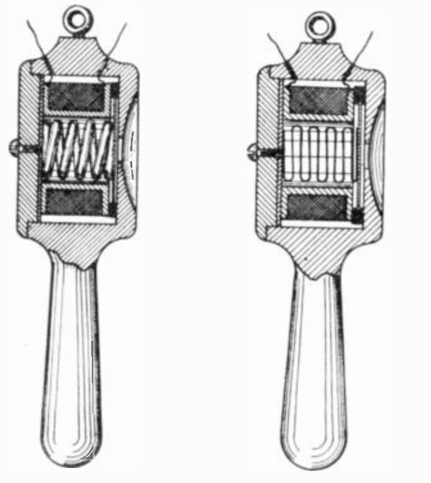


FIG 23 FIG 24

A helical coil of iron wire is placed inside of a solenoid coil through which the talking currents pass.
Next is a version of the preceding one, except that a zigzag conductor is used instead of the coil. In both cases a speaking current starts the coil into a species of vibration, affecting the diaphragm.

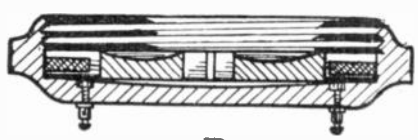
the current pulsations passing through the coils, reproduces the speech.

Telephone Transmitters

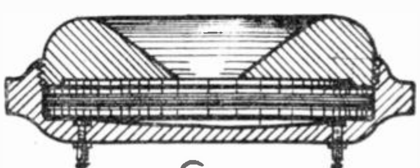
The telephone transmitter is the apparatus used for sending speech, or for changing the sound vibrations into electrical impulses. Usually all telephone receivers may be used as transmitters, the action being reversed, but the most common type of transmitter, called a microphone, comprises a cup of carbon granules placed behind a diaphragm. Sound waves striking the diaphragm cause it to vibrate and vary the pressure between the granules, which changes the electrical resistance of the microphone and hence the amount of current flowing through it..

This type of microphone is based on changes of resistance in the circuit. There are other types of transmitters that act as generators of current. The ordinary Bell telephone receiver may be used in this way. Sound waves striking the iron diaphragm cause it to vibrate in front of the permanent magnet and hence varies the flux passing through the coils. This generates current in the coils corresponding to the speech vibrations. This is the original type of transmitter used by Bell in

A



B



C

FIG 25

These are three views of a receiver containing a disc-shaped permanent magnet, with a peripheral groove in which the magnet coil is wound. In the upper view (N) and (S) represent north and south poles of the magnet produced by this winding.

his early experiments and is seldom used now except where batteries would be cumbersome, as in linemen's outfits.

There are electrostatic transmitters based on changes of electromotive force which take the form of a condenser, whose capacity is varied by sound waves. This type was mentioned before in connection with electrostatic receivers. Some radio broadcasting stations employ this type of transmitter owing to its almost perfect action.

Forbes used a transmitter, based on heating effects, that had a fine platinum wire in a narrow slit through which the sound waves pass after being concentrated by a funnel. This cooled the wire, which was heated by electricity, and modified the current passing through it. Blythe used minute electric arcs whose length and area were affected by sound waves. Dolbear used an arc as a transmitter in his experimental work. In 1860, Yeates made a liquid transmitter by placing a drop of water between the points of a Reis transmitter. Gray and Bell used a wire dipping into a liquid, the pulsations of the

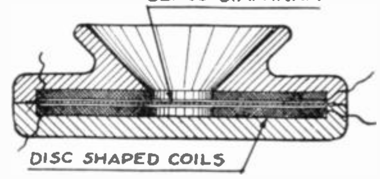


FIG 26

This is a molecular receiver, claimed to depend for its action upon molecular stresses in a glass dielectric.

diaphragm causing the wire to dip more or less deeply into the liquid and vary the resistance. Majorana varied the resistance of a water jet with sound waves. Chambers proposed to vary the diameter and length of a liquid jet emerging from a nozzle against a diaphragm. In 1878, Dolbear found that the moistened finger tip pressing against a diaphragm would act as a transmitter. The variations in pressure probably changed the length of the path of current through the high resistance human skin. He also caused the sound vibrations to vary the internal resistance of a battery.

Garrett and Lucas succeeded in making an operative transmitter based on the variation of magnetic permeability resulting from change of pressure upon nickel. This will be described later. Beetz discovered that the resistance of a platinum sponge varied with pressure. Hughes in 1878, discovered the great sensitiveness of a microphone employing light contacts between conductors, but the first commercially successful carbon transmitter was that of Blake in which a pellet of platinum attached to a light spring was pressed against a flat button of carbon by the diaphragm. The carbon granule microphone in almost universal use today was largely due to White of the American Bell Telephone Co.

Among the somewhat curious transmitters developed from time to time is the one shown in Figure 27, patented in 1886,

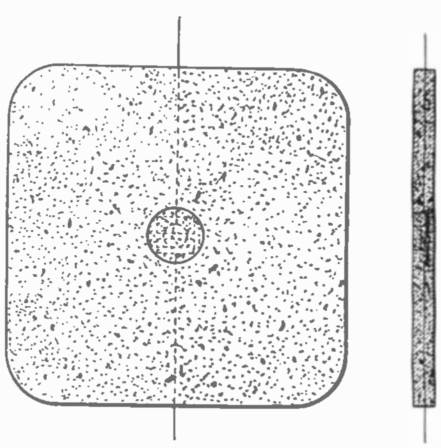


FIG 27

A curious invention for a telephone receiver. Its essence is cork in plate or diaphragm form, with granulated carbon or platinum between successive plates.

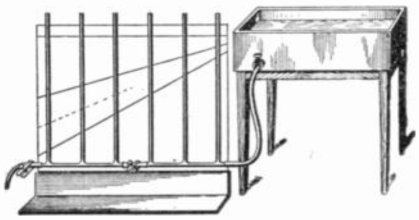
by Rose. This consisted of a plate of cork in the center of which was a compartment containing two electrodes and finely divided particles of platinum or carbon grains. Several of these microphone chambers were also used on the one diaphragm, which was mounted in a case having an opening or mouthpiece similar to that of the ordinary transmitter.

(Concluded in June Issue)

Analogies and Others

By T. O'Conor Sloane, Ph.D.

IF a current flows through a wire of uniform resistance per unit of length, the fall in potential will vary exactly as the length of the wire within which it takes place. Thus, if the wire is 5,000 feet long and there is a fall of five volts from one end to the other, there will be a fall of one volt for each thousand feet of wire, or a tenth of a volt for each hundred feet of wire, and so on.

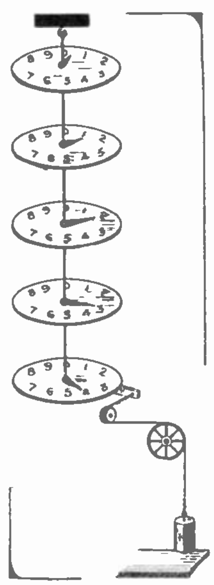


Hydraulic illustration of fall of potential; the water in the different tubes stands at varying heights in proportion to the pressure in the tube through which water is flowing.

A very usual analogy for such fall is that of water running through a straight pipe set at an angle with the horizontal. If the pipe is ten feet higher at one end than at the other, we may take it as representing a fall of potential of ten volts. If the wire is 100 feet long then every ten feet would represent a fall of one volt.

If water passed through a horizontal pipe at a considerable pressure and vertical pipes were connected thereto, the water in each pipe would stand at a different height, that nearest to the source of supply would stand at the highest point, the next a little lower, and the next still lower, thus again representing for us the fall of potential in the circuit.

But there is another very nice mechanical analogy. If we have a wire, which is shown as suspended vertically, and if we twist one end of it through a given number of degrees, each point of the wire will be twisted to a less number of degrees,



Torsion illustration of fall of potential; a wire is twisted and the twist is distributed over its length exactly as is the fall of potential over a conductor.

always in the proportion to the length affected. Thus, if on a given length of wire we had equally distributed five dials as shown in the drawing, and an index for each dial attached to the wire, the index on the upper dial would be unmoved, that on the next dial would be moved to one-fourth the angle of the index on the lower dial, the index on the third dial which is in the middle of the wire would be moved one-half as much as the lower, and so on.

Therefore, starting at the bottom, we might say that we twisted the wire through 100 degrees. Then the dial next to the bottom would show three quarters of this amount or 75 degrees; the next would show 50 degrees, the next 25 degrees, and the top none. If for degrees we substitute the word volts, we have the exact analogy of the fall of potential in a wire.

Direction is imputed to a current just as polarity is imputed to a magnet. We can always think of the galvanic battery as being historically the original source of current, and the primary battery consists of two plates of metal or other conductor, for one may be carbon. For the action of the battery it is essential that one of them be dissolved or attacked chemically by the electrolyte or solution in the battery, and that the others will be unattacked thereby.

It is perfectly natural to term the plate which is unattacked, and which never changes, the negative plate; while the one which is attacked and in a sense does all the work has every justification for being called the positive plate. This refers to the plates as immersed. Now we come to the direction of the current. There is no current until the plates are connected by a

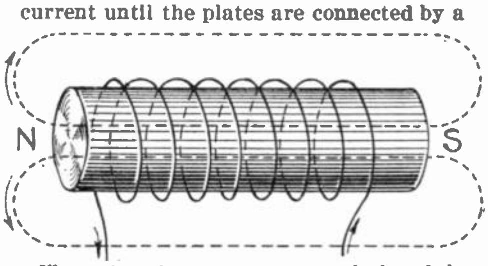


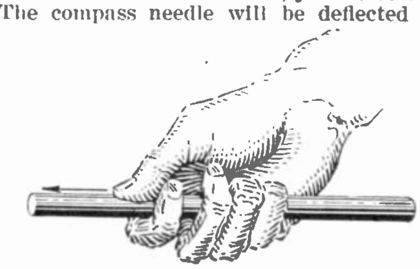
Illustration of ampere currents and also of the relations of the winding of a magnet to polarity.

conductor. If a wire is connected to the zinc plate where it comes out of the electrolyte, and the other end of the wire is connected to the carbon plate, the direction of the current is taken as going through this wire, from the negative plate, which may be of copper, carbon or platinum, through the wire to the zinc plate.

In other words, the current as it flows through a wire connecting the plates outside the liquid is taken as starting with the plate whose initial comes earlier in the alphabet, such as C for copper or carbon or P for platinum, to the plate whose initial comes at the end of the alphabet, namely, Z, for zinc. The current of course as far as it can be treated as such takes the opposite course in the electrolyte, but the current through an electrolyte is not a plain conducted current, but what may be termed electrolytic current, or one carried by an electrolytic conductor. The alphabetical order is sure to be right, because whatever may be the initial of the negative element, the positive element cannot go further down the alphabet than the letter Z, the initial of zinc.

In the storage battery the plates are oppositely named for some unknown reason. One of the plates is of a grayish color and the other almost purple. The "purple" plate begins with the letter P, and is termed the positive plate. So here again we have a case of *memoria technica* as it is called, for fixing in our minds which plate is the positive one.

If the right hand is held over the wire through which a current is passing, away from the body towards the finger tips, the north pole of the magnet will be deflected towards the thumb of the hand. One of the old *memoria technica* methods was to think of a man swimming along with the current when the wire would always be deflected to his left. The man is supposed to swim always with his face towards the wire, so that if he is underneath the wire he will face upwards, and the needle will be deflected toward his left, just as before. The compass needle will be deflected in

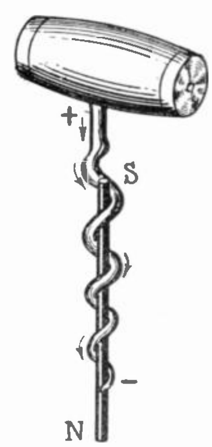


The fingers of the hand represent direction of current, and the thumb points toward the North Pole, carrying out the idea of the preceding illustration.

opposite directions above and below the conductor of a current.

Another way of carrying in the mind this deflection of the polarized needle, is to imagine a wire running across one's front. If the current is going from right to left, one may think of waving the right hand along the line of and following the direction of the current until it points in the direction the current takes, which in this case we will assume to be to the left. Thus, as before, the thumb if outstretched will point in the direction to which the needle will be deflected. If the current is going in the other direction, the hand must be waved to the left, and again the thumb will give the proper direction. The palm of the hand must be kept down. The compass is assumed to be above the wire carrying the current.

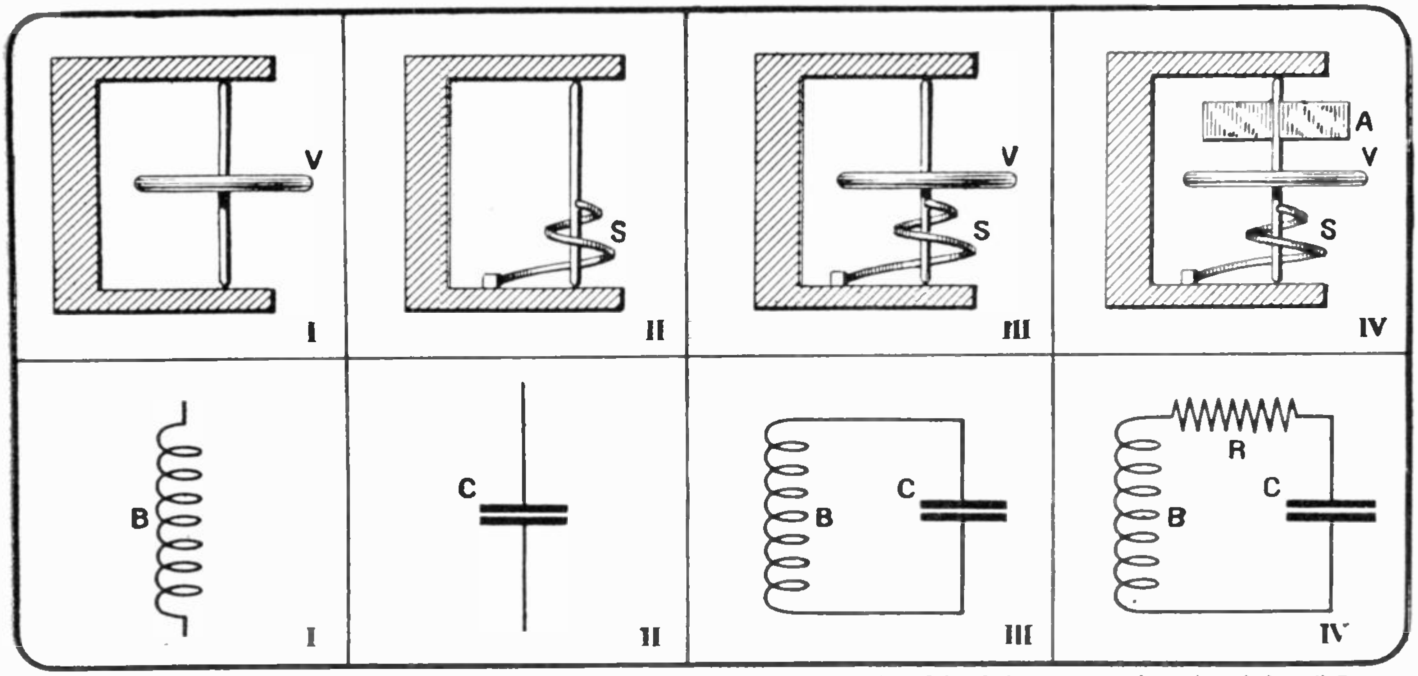
We know that conductors each carrying current in the same direction attract each other, therefore if such conductors cross each other at an angle, their tendency is to come into parallelism with each other. We all know that if a bar of iron is surrounded by a coil of wire, a magnet is



The corkscrew illustration of the relation of windings to polarity in an electro-magnet.

produced, therefore our easiest conception of a permanent magnet is that of a piece of steel within and about which currents are circulating in uniform direction at right angles to its length. These currents are theoretical and are called ampere currents.

In the illustration there is represented an electro-magnet. The direction of the current in the coils surrounding it is indicated by the arrows and the resulting north and south poles are shown. If for the coils of wire surrounding it and carry-



I. An analogy for self-induction. The flywheel V resisting any sudden change of motion of the shaft, represents the action of the coil B.
II. The spiral spring (S) in its action on the shaft is analogous to the condenser (C), which becomes charged with electricity and then discharges it through the circuit in the reverse direction in which it was received, exactly as a spring when turned in one direction will uncoil in the reverse one.
III. The combined action of the condenser (C) and self-induction coil (B) is represented by the combination of the flywheel (V) and the spiral spring (S), each modifying the action of the other.
IV. Here the combination of resistance, self-inductance and capacity is represented by the balance wheel (V) and spiral spring (S) and the air damper (A).

ing current in the direction shown we imagine the steel to be full of little circular currents in the same direction, we then have a conception of a permanent magnet. We are all familiar with magnetic curves made up of so-called lines of force, and direction is attributed to these. The same illustration shows the relation of these lines of force to the magnet. They emerge from the north pole and return to the south through the air, and they are due to the circular currents in the magnet, if it is a permanent one, or to the currents in the wire, or to the induction from the coils of wire if it is an electro-magnet.

The hand grasping the wire shown before gives the idea of the ampere currents represented by the fingers and the polarity indicated by the thumb pointing to the north pole.

If we imagine a screw being turned through a nut or into a block of wood, as we turn it in the direction of the hands of a watch it will go forward. If an electric current passes around a piece of iron in the direction of the hands of a watch, the direction of the lines of force will be that in which the screw is advancing. If we withdraw the screw from the nut or block of wood, our turning will represent current in the other direction, the polarity will be reversed, and so will the lines of force. The classic illustration of this is a corkscrew, perhaps not so familiar an instrument as formerly.

Direction is imputed to the lines of force produced by a magnet. They are taken as issuing from the north pole, going through the air or surrounding space and entering at the south pole. Again we have a *memoria technica*, similar to that used for the battery current, for in the outer air they leave the north pole and return to the south, and the letter N comes before the letter S in the alphabet. If the south pole of the magnet faces us, the lines of force are going away from us; and the lines of force in the magnet are due to a current of electricity circulating around it. If we look at our watch while we are looking at the south pole of a magnet, it gives us the direction of the currents producing these lines of force. As the lines of force are going away from us through the magnet, so is time doing, indicated by the watch.

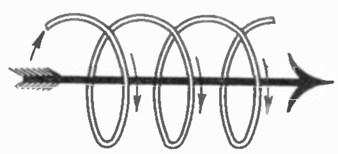


Diagram of a coil surrounding an arrow, to illustrate as before, relations of current and polarity.

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EDITOR.

This is made still clearer by the arrow surrounded by a helix. The current through the spiral produces lines of force within itself, having the direction indicated by the arrow, such lines of force being contained within the core of a magnet. The pointed end of the arrow then is the north pole. The corkscrew may be taken as representing the path of current, and the north and south pole which would be produced in a bar within the corkscrew are indicated in the illustration, and will be seen to carry out exactly the watch idea expressed above.

Suppose we have a broken circuit whose ends or terminals approach each other closely enough for what seems to be a spark to jump across. This is what we see in the induction coil discharge or in the spark of the Leyden jar. The first is what may be termed an inductance discharge and the second a capacity discharge. The first thing to be brought out is the fact that what, owing to persistence of vision, presents to us the appearance of a white spark jumping through the air, is really an enormous number of sparks and these sparks jump back and forth. If we picture to ourselves a helical spring squeezed up, this in a rough way will represent to us a charge of electricity, as if it were a lot of coulombs squeezed into a receptacle. If now the spring is released it will fly out, return a little and execute several vibrations before it comes to rest. The period of an electric discharge is extremely small, but every spark as it appears to us and what we would call a simple spark, is made up of a whole number of sparks going back and forth.

A simple straight spring or vibrating rod held in a vise or a tightly stretched spring pulled to one side to represent a charge and released to represent a discharge gives the same to and fro effect exactly comparable to the discharge of the condenser, or induction coil. The principal motion of the spring is in one direction; in the same way the principal amount of electricity discharged by the spark is under some conditions in one direction or is of one polarity, as it is called.

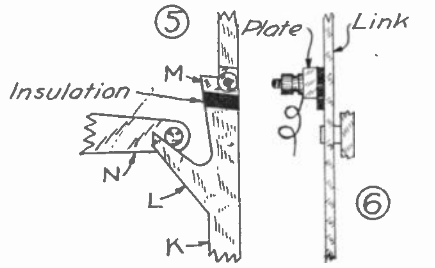
It is not so easy to find an analogy for induction. If currents go through wires in the same direction, these wires attract each other, but it is very hard to find an analogy for this. One of the earliest discoveries in the way of induction was that a compass needle as it may be termed, poised above a wire, was deflected and tended to stand at right angles thereto, although it would never quite reach the 90 degree position as far as the wire itself is concerned.

In the illustrations above we give analogies for inductance, capacity and resistance in a circuit. These react one upon the other and the above illustrations, for which the writer is indebted to a French contemporary, are certainly most interesting, and are one of the most ingenious sets of analogies that the writer has yet encountered.

Electric Oil Feed For House Furnace

By George G. McVicker

WHERE oil burners are installed to take the place of the coal grate in a household furnace or heater of any kind a delicate regulation has to be maintained to keep the rooms at an even temperature without wasting oil. The illustrations explain how an electric regulator may be constructed and connected with any clock so that an even temperature will be maintained throughout the day and if desired another even and lower temperature throughout the night, which regulator will automatically turn on more heat at any set time, as in the early morning.



Details of a double catch for thermostat furnace regulator arranged so that the same thermostat will give different regulation by day or by night.

The device includes a clock to make the necessary electric contacts at the proper times, a thermostat to act with the room heat and connect the circuit to conduct the current to the proper coils, a set of coils for operating the feeding valve of the oil burner, and a battery to furnish the current.

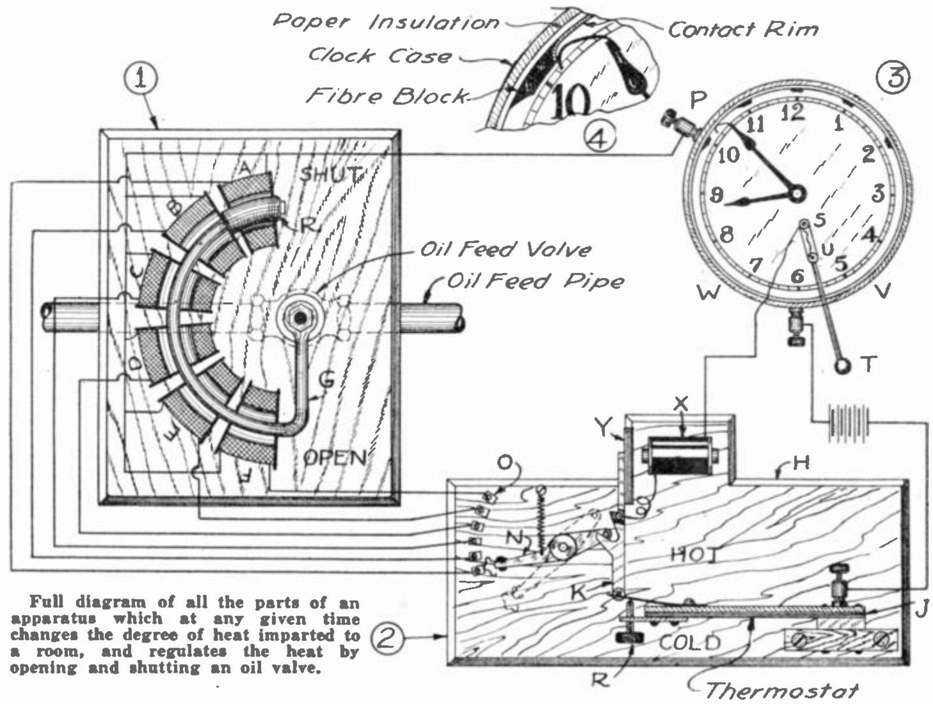
A set of six coils are arranged in a semicircle. Each coil is 1¼ inches long and set one-fourth of an inch apart. Each has a one-inch core opening. These coils are arranged concentric with the center of the regular oil feed valve stem which controls the flow of oil to the flame, and all are securely attached to a panel which in turn is attached rigidly to the oil valve. It may be strapped to the oil pipe with iron strips.

A brass rod three-eighths inch in diameter (G) has an eye at one end which can be clamped to any position on the head of the feed valve hand wheel. This rod is bent to a semicircle of five inches radius and to the outer end of this is attached a soft iron core, which will pass through the centers of the six coils, and without touching them, is of a length that will over-lap each coil in its travel.

In the room to be heated is placed the panel (H) on which is mounted the thermostat compound bar (J). The outer end of this bar is attached to the link (K) and in conjunction with this latter is the multiplying lever (N). Six brass contact plates (D) are mounted concentric with the pivot on which the latter lever (N) moves, and a spring contact is riveted to the end of this lever so that contact will be formed between the lever and one segment at a time as the device operates. Each of the segments is connected to one of the coils (A to F) by means of insulated wire. An ordinary metal case alarm clock is provided; the glass face is removed and a rim three-sixteenths inch wide made of the same thickness of metal as the clock case, is provided with fiber blocks riveted at each five minute intervals about its inner side. The "hand-approaching" end of these blocks, the lower end in the black, Figure 4, is beveled considerably while the other end is slightly beveled; on the latter end is attached a piece of sheet brass which is soldered to the false rim provided. To the end of the minute hand of the clock is soldered or welded a contact spring so shaped that it will not make contact with the false rim of the clock but so that when the hand draws it over one of the fiber blocks it will be compressed and as it springs back to its place on passing the end of the block will make contact with the piece of brass for two or three seconds, allowing a current to pass for this length of time. The false rim is insulated from the case and body frame of the clock by means of shellacked paper and is attached to the binding post (P) with the proper fiber bushing and gaskets.

For night control when the temperature is to be maintained at a lower degree, the pin in the lever (N) instead of being left in the lower notch shown (L), is hooked up to the notch (M), better shown in Figure 5. This causes the coils nearer the closed end of the series to be placed in contact with the normal positions of the thermostat, thus keeping the temperature uniform but at a lower degree than for day time heat.

The average individual does not enjoy crawling out to turn on more heat so this device again takes up its duty and opens up the oil feed a half hour or more before the owner desires the day temperature to be reached.



Full diagram of all the parts of an apparatus which at any given time changes the degree of heat imparted to a room, and regulates the heat by opening and shutting an oil valve.

The operation of the device is as follows: The feed valve is opened just sufficient to feed the oil necessary to avoid danger of the fire going out or enough to maintain what is called the pilot light. With the soft-iron core (R) then set at the end of the series of coils, the eye end is clamped to the feed valve stem or hand wheel. The thermostat and clock are placed in the room to be heated; with the temperature at the desired living degree for day-heat, the adjusting screw (R), Figure 2, at the end of the thermostat is set so that the lever (N) will touch the plate which corresponds with the coil (A), Figure 1. Then as the temperature decreases the thermostat will bend toward the side marked (cold) and gradually move the contact at (O) until it corresponds with another coil further along the semi-circular series, as at (B).

When the minute hand of the clock makes contact at the end of one of the blocks the coil (B) will then be energized and the soft iron core be pulled to the position of this coil and in doing so the feed valve is opened that much. At the end of another five minutes if the temperature in the room is still too low the same operation moves the soft iron core further around and the valve is opened still further; so on until the added fuel oil brings the temperature in the room to the desired degree. If at the end of the next five minutes the thermostat does not change the contact, then the valve remains at the same position, but if the room becomes too warm the operation is reversed and the valve is closed one point. Thus at each five minutes the difference is corrected and the heat thus retained.

Pivoted on the face of the clock as at (S), Figure 3, is the arm (T) made of thin fiber. A narrow slot is cut in the shell of the clock from (V) to (W), through which this lever may be moved. On the lever at the point (U) is a contact button just high enough so that the hour hand will make contact with it. A small insulated wire attached to this button connects with the coil mounted on the thermostat panel board. The other side of this coil is connected to an insulated plate which forms the bearing surface of the hook (M) on the link (K), Figures 5 and 6.

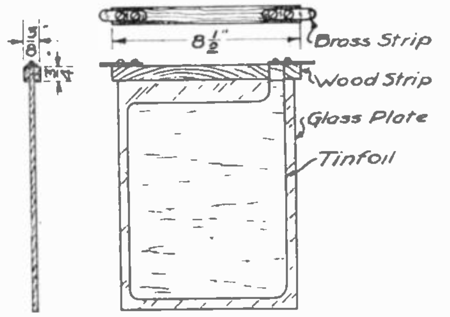
Thus when the lever (N) is hooked up for night temperature the circuit through the coil (X) is closed with the exception of the contact to be made by the small clock hand on the button (U), Figure 3. When this contact is made at the time at which the button (U) is set, the coil is energized and the link (K) carrying the armature (Y) is pulled by the magnet and the arm (N) is released and allowed to fall on the lower projection; the operations for day heat are at once begun. As the contact at (M) on the link is broken the current is shut off and the armature and the link are released. To prevent the coil from interfering with the action of the link (K) the pin in the right end of the lever (N) comes in contact with the lower projection at an angle and in finding its lowest position draws the link slightly away from the coil.

Four dry cells will operate the appliance.

High Tension Condensers

By Curtis Kissel

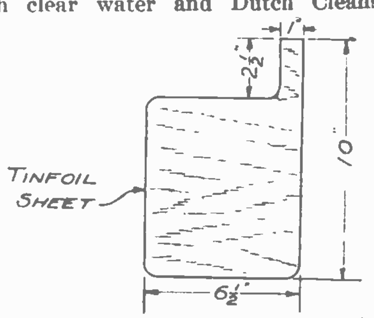
MANY Tesla and Oudin coils which are mechanically and electrically correct will not always develop the efficiency or rating expected of them by the constructor.



Construction of one of the plates of the glass condenser, showing its mounting and coating of tin foil.

The writer found that the difficulty was rather with the spark gap and condenser than with the coil proper. The spark gap was fitted with double silver sparking points, delicately adjustable, and, with the condenser described below, discarded coils taken out of storage operated splendidly, giving a flaming ten-inch spark.

The condenser is made of 8 × 10 inch photographic plates. Twelve plates are used and the gelatine coating or film is removed with hot water. After every trace is taken off the plates are further cleaned with clear water and Dutch Cleanser,

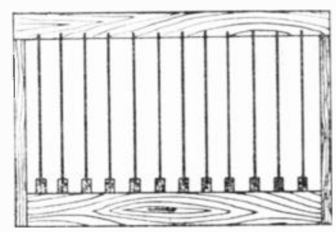


Tin foil sheet for coating the glass, with lug to complete the connection.

wiped with a clean rag and held near the fire to complete the drying.

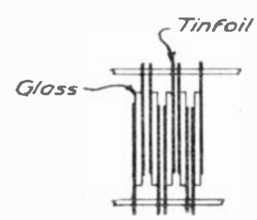
Wooden sticks 8½ inches long, ¾ inch wide and ⅜ inch thick come next. They may be made of straight grained pine or poplar. The sticks are placed in a vise and a groove cut lengthwise on the ⅜th edge with a rip saw to a depth of about a quarter of an inch. The groove may be widened a little if necessary by running a thin piece of broken glass through it so as to scrape off the sides. The glass plates must fit freely in these grooves or they may be strained and break.

Twelve sticks are thus prepared and are boiled in paraffin, and when the sticks after removal from the melted paraffin have become cool, the plates are to be fastened into them. A temporary fitting rack is shown in Fig. 2, which is self-explanatory. The grooves in the upper bar are spaced about 1½ inches apart. The groove in one of the sticks is now filled with rather thick shellac varnish and one of the plates is pressed into it, the 8 inch wide side being used. The plate is worked back and forth a little so as to



Mounting glass plates in their supporting strips. The strips are at the bottom while the cement is setting.

get it well seated; the wood should project one quarter inch from each side. The surplus shellac is wiped away while it is still liquid. The other plates are also

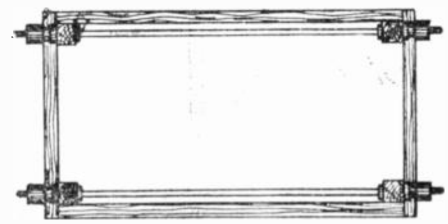


Cross-sectional view of condenser and plates.

shellacked into their respective sticks and are left standing in the frame for forty-eight hours. Any surplus shellac which is now dry is scraped off and the stick is sandpapered smooth.

The tin foil for the coating should run about 1600 square inches to the pound and be of the best quality. One pound will cover both sides of the twelve plates. The writer has tried shellac, banana oil, varnish, and glue for attaching the tin foil, and found that LePage's glue is about the best. The tin foil is cut into sheets 10 x 6½ inches, two for each plate. There is a lug on each of them and the corners are rounded.

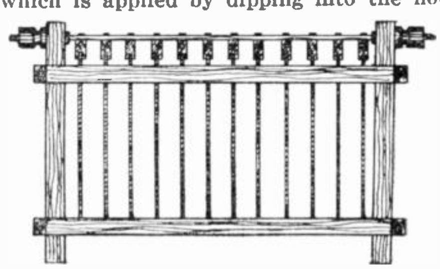
A plate is placed on a level board, the glue is spread over its surface with the addition of water, and is worked all over the surface with the fingers. One of the tin foil sheets is placed on this, allowing a three-quarter inch margin on three sides; at the top there is a 1½ inch margin. Keeping the fingers wet, smooth down the foil. It is now rolled with a wet photographer's print roller squeezing out surplus glue and water and air bubbles. The rolling should be done from the center of the foil towards the edges. The connecting tin foil lug is also glued nicely to the glass and its end is carried around the stick on top of the



Top of the case with supporting rods for carrying the coated plates.

pane. The plate is wiped up with a wet sponge and put aside to dry. It will be understood that in coating the two sides the lugs are set one to the left and one to the right.

Brass strips are screwed down to each end of the sticks, the inner end covering the tin foil lugs. They are secured with wood screws; the screws are covered with glue before being screwed down. The wood strips are now shellacked and when dry are painted with black enamel paint, only, however, for appearances' sake. The corners of the tin foil being rounded, tends to prevent brush discharge from the corners. Now the plates are coated with a thin coat of resin or resin and beeswax mixed, two parts of resin and one wax, which is applied by dipping into the hot

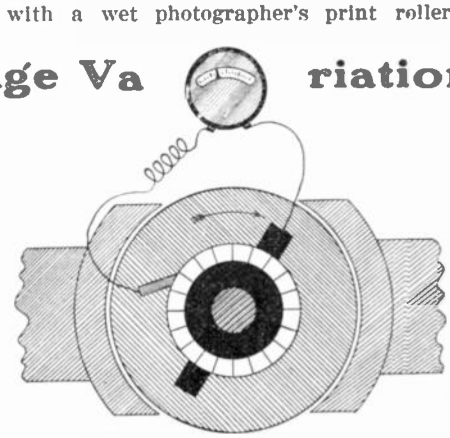


Complete mounting of condenser shown in its final frame.

mixture. The plates are first heated, then lowered into the tank with an even motion, and then quickly withdrawn with the same uniform motion and with the same speed. There must be no stop and no jerky motion.

Figure 4 shows the rack for holding the plates of the finished condenser. It will be observed that the rods on which the brass strips on the tops and ends of the sticks rest, take care, one of one set of plates and the other of another. The rods should be one-quarter inch round brass and threaded for the nuts. Porcelain bushings should be used in the uprights for the rods to go through, and the plates are to be spaced one inch apart.

Measuring Voltage Variations in Armatures



THERE are several ways of measuring the variation of voltage around the commutator, the simplest of which employs a voltmeter and single exploring brush, flexible stranded cable being used to make the connections.

The proper terminal of the voltmeter is connected to one brush of the dynamo under test. The other terminal of the voltmeter is connected to the exploring brush. With the machine running at its rated speed the exploring brush is held against the surface of the commutator at any desired point around the circumference.

At each point the voltmeter reading, as well as the angular position of the exploring brush, is noted. It will be found that variation of voltage between successive pairs of commutator segments is not constant.

The method is so simple that any possessor of a generator or motor will be interested in using it.

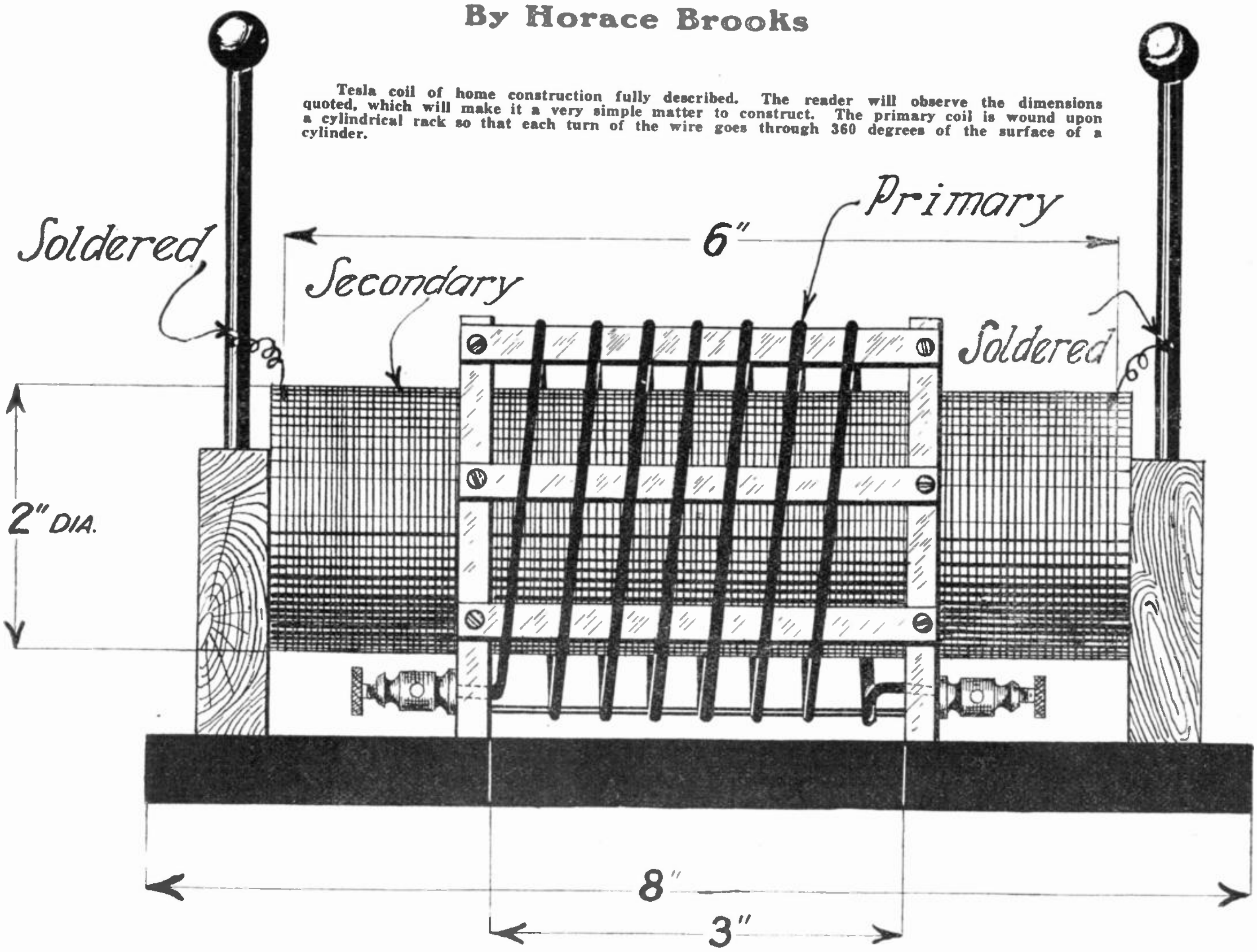
Contributed by HAROLD JACKSON.

Simple method of testing voltage variation in an armature with comparatively little apparatus. It will be found that the action of an ordinary commutator, which, of course, depends on the action of the armature, is far from regular.

Tesla Coil

By Horace Brooks

Tesla coil of home construction fully described. The reader will observe the dimensions quoted, which will make it a very simple matter to construct. The primary coil is wound upon a cylindrical rack so that each turn of the wire goes through 360 degrees of the surface of a cylinder.



A TESLA coil is an interesting piece of apparatus, and with its aid many wonderful experiments can be performed. The apparatus shown here is a rather small one, but will give good results with a one-inch spark coil.

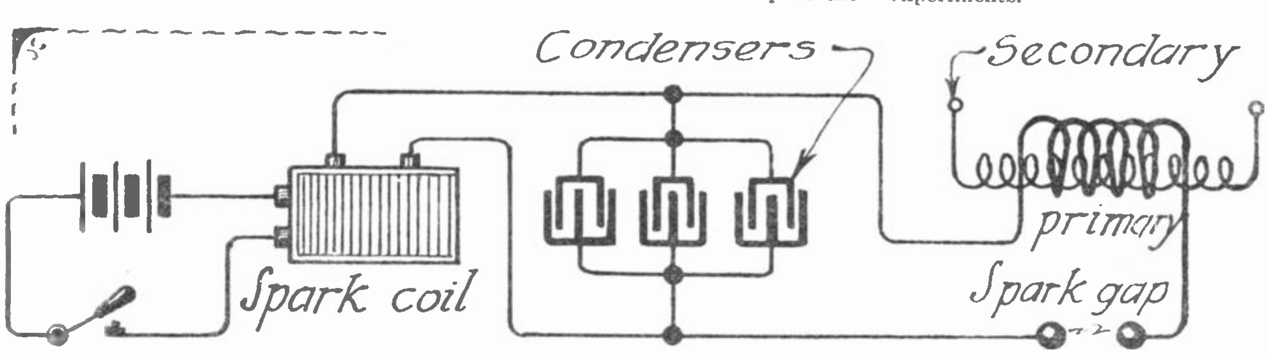
First cut a half-inch board about 8 by 3 inches. Give this a good coat or two of shellac or varnish.

The primary is composed of seven turns of No. 14 copper wire wound around two wooden drums that have an inside diameter of three inches. The drums are held together by eight strips of wood 3½ inches long and are one-quarter of an inch wide. With small brass screws, screw these eight strips of wood at equal distances along the outside edges of the drums, allowing one-quarter inch on each end for screwing. Wind on the seven turns of No. 14 wire in a sort of slant, as shown in the illustration. Grooves may be cut in the strips for the wire. Fasten the ends of the wire to binding posts. Then screw the whole primary to the base.

The secondary is wound on a tube six inches long and two inches in diameter. Start a fraction of an inch from the end of the tube and wind on a smooth, even layer of No. 24 copper insulated wire. Leave a few inches of wire on each end for connections. Then saw out two round pieces of wood just large enough to fit snugly in the tube. These are screwed with brass screws, to two hard rubber uprights or supports. If hard rubber is not obtainable, wood boiled for a few minutes in paraffin will answer the purpose fairly well.

Then bore two holes in the top of the supports to hold two brass rods that are fitted with brass balls at the top. Fit one of the round boards into one end of the secondary and then place the secondary inside the primary. Arrange the primary and secondary so that they will be concentric; that is, have a common center. Then fit the other round board into the other end of the secondary and fasten the uprights to the base. Solder the ends of the secondary to the brass rods and the coil is finished.

Use the hook-up shown in the illustration. If the coil is worked in the dark the effects are better. If one secondary terminal is grounded forked sparks will jump off the other terminal. Preceding numbers of PRACTICAL ELECTRICS on high-frequency may be consulted for other experiments.



The hook-up of the Tesla coil. Here are seen the spark coil whose spark discharge, really a cataract of almost infinitely short duration, gives the high frequency characteristic of the coil. The condensers in parallel with the primary prevent disastrous sparking and arcing and the secondary acted on by the enormous frequency gives the spectacular effects.

Building a Thermogalvanometer

By Dr. Russell G. Harris

IN the April issue of PRACTICAL ELECTRICS were given directions for building a radiomicrometer, a very sensitive and easily constructed instrument for measuring radiant energy. This device may readily be adapted to the measurement of small electric currents, either direct or oscillating at any frequency, and thus is exceedingly useful in testing radio circuits and making electrical measurements in general. As the radiomicrometer measures small amounts of heat, and as any current, whether alternating or direct, produces heat, the instrument can be calibrated directly in terms of current.

When the radiomicrometer is adjusted to its greatest sensitivity it can be made to detect differences in temperature of as little as a few millionths of a degree. It is thus an extremely sensitive electrical magazine, or has these directions available. The two instruments are practically identical, so only the few additional parts required to change the radiomicrometer into a thermogalvanometer will be described here.

The complete list of materials for building either instrument is as follows:

Brass, cardboard, or glass tube, 1 × 10 inches to 16 inches.

Wooden base, with levelling screws.

Wooden or metal plug for torsion head.

Thin glass, celluloid, or mica, for windows.

Ordinary permanent horseshoe magnet.

Pieces of quartz glass, from old quartz beaker, etc.

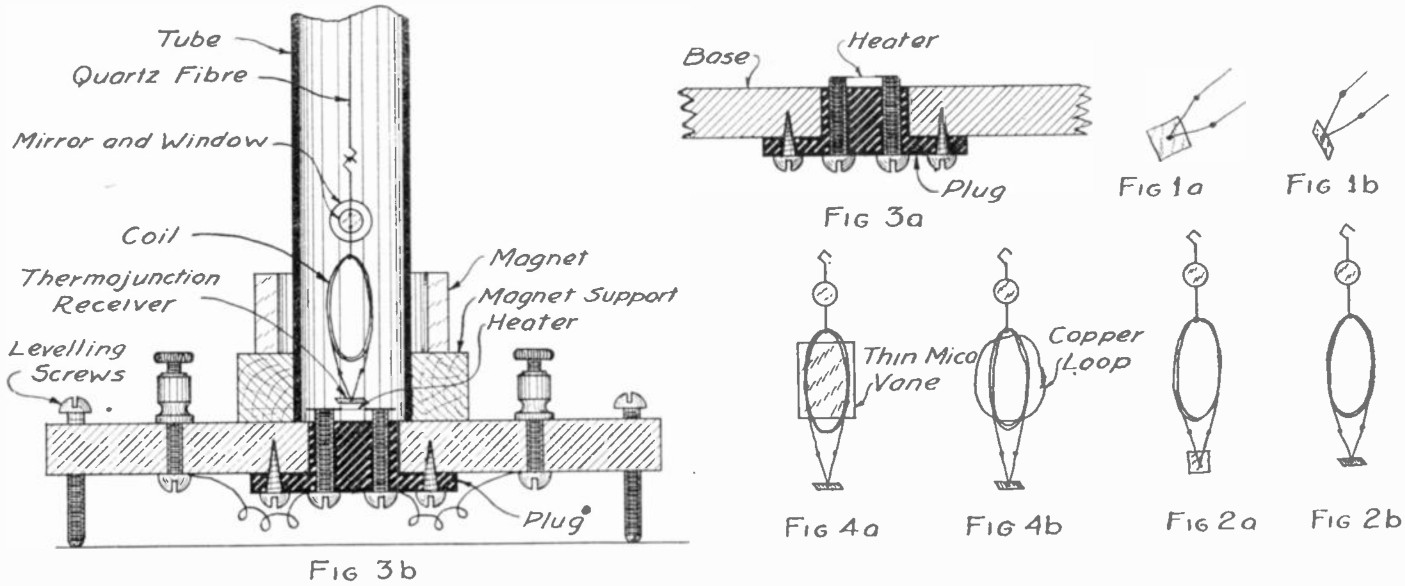
Simple carbon arc.

Three feet of copper wire, any insulation, No. 28 to No. 40.

Small pieces of bismuth and silver, or pending upon what is to be measured. It is most convenient to make up several heaters in detachable form, so that any one can be inserted in the instrument.

In Figure 3a is shown a convenient way of doing this, and 3b shows the appearance of the lower part of the complete instrument when the heater is inserted. A hole somewhat smaller in diameter than the upper tube is bored in the base, and a wooden or fiber plug is made to fit this tightly, yet so that it can be unfastened and pulled out. The heater unit is fastened to two machine screws passing through this, which are in turn connected by detachable leads to two binding posts, into which passes the current to be measured.

The amount of heat generated in the heater is proportional to its resistance, and to the square of the current passing



Various parts of thermogalvanometer illustrating this extremely sensitive instrument, employing a thermo-junction behind a horizontal blackened glass plate, all on the minutest scale.

thermometer. Duddell utilized this fact by arranging a radiomicrometer so that its receiving junction was warmed by the current passing through a resistance placed near it, and so invented the thermogalvanometer.

Any radio amateur who has had much to do with sending-sets of any type is familiar with the ordinary high frequency ammeter for measuring antenna radiation, etc. He knows that the common type, the so-called hot-wire instrument, depends on the expansion of a fine wire when heated by the current passing through it. He also knows that the more expensive instruments work on a different principle, being known as thermoelectric ammeters, and depend upon measuring the direct current generated in a thermocouple when it is heated by an alternating current. The thermogalvanometer here described is an instrument working on this principle, but it has the important advantage that it can be made extremely sensitive, since it will detect currents of a few millionths of an ampere, and it acts as its own galvanometer, so that no extra instrument is needed as in the thermocouple-galvanometer combination.

In the first place it will be assumed that the reader who wishes to construct a thermogalvanometer, either for measurements in a radio receiving or sending set, or because of the numerous electrical experiments that can be performed with it, has already built a radiomicrometer according to the directions given in this copper and constantin, or several other thermo electric combinations.

Light galvanometer mirror, or silver plating solution.

Small piece of tinfoil.

Tracing cloth, ground glass, or waxed paper for scale.

Weak spectacle lens. Incandescent lamp.

Welding tool. Shellac and lampblack. Sealing wax.

Odd machine screws, binding posts, and simple tools.

Inasmuch as one generally builds half a dozen or more suspended systems for the radiomicrometer in order to find the conditions for greatest sensitivity, it is a simple matter to alter one of them for use in the thermogalvanometer. Instead of fastening the blackened tinfoil receiver parallel to the coil, as in Figures 1a and 2a, it should be put on so that it will hang horizontally when suspended, as in 2b. This receiver should be blackened on the under side, as the source of radiation will be immediately below it. The peephole and collecting tube of the radiomicrometer may be plugged up.

Directly under the receiver, and as close to it as possible, is to be placed the tiny heater which is to convert some of the energy of the electric current into heat for the radiomicrometer to measure. This heater should be very fine, to have small heat capacity; be of bare wire, short, and straight. It should have a resistance between four and four thousand ohms, de- through it. Therefore this instrument, like practically all thermoelectric measuring devices, gives deflections proportional to the square of the current; that is, if the current in the circuit being measured is doubled, the spot of light on the scale will be deflected four times as much, and so on. It is evident that the heater should have as high a resistance as possible up to a certain limit, so as to generate as much heat as possible, yet not to hold down the current in the circuit too much. Since circuit conditions vary, we should have heaters of various resistances to measure currents in different circuits, just as 2000 ohm telephones are best in some circuits, while in others, 100 ohm instruments are more efficient.

As to the material for the heater itself, this can best be solved by each experimenter through trial, as all will not have access to the same materials. In commercial instruments the low resistance heaters are fine platinum or iron wires, while those above several hundred ohms have a very thin deposit of platinum on fine quartz fibers, such as are used to swing the suspension from in the present case. A good thing to begin with would be a bit of tungsten or carbon from an old 25 or 15 watt lamp; the longer it has burned, the better. Take a piece of this about half an inch long, and clamp it between two pieces of metal soldered to each of the machine screws going through the plug, leaving about a quarter of an

(Continued on page 406)

Coin Replicas

By Robert Rollins

EXPERIMENTAL electricity easily and frequently can be mingled with other interests, but this is the first time that I have mixed it with my interest in numismatics. A companion of mine, also interested in coin collecting, possessed an old and rare Swedish copper coin, dated 1764 and covered with those mysterious and unreadable legends that are the delight of the amateur collector. After many long and heated discussions concerning a trade or sale of the piece, I was convinced that my friend would rather part with an eye than with that coin.

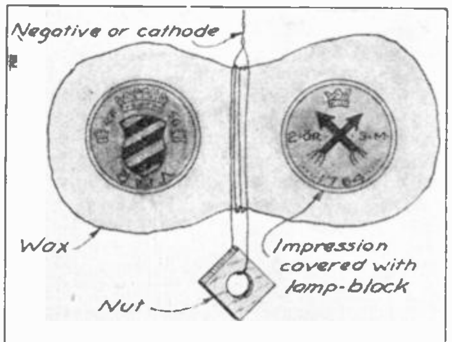


Fig 1

Electro-plating coins and medals. The wax impression is ready for the tank, and a weight to keep it immersed is attached by a thread.

Often before this, similar cases of dispute had arisen, which we had repeatedly solved by giving the other a "rub" of the coin. This was a picture of the coin produced by holding a thin sheet of paper on the coin and rubbing over it with a soft pencil. Fairly presentable pictures of both sides could be made this way, but a "rub" of this particular coin did not satisfy me. I wanted the original or something very much like it. Borrowing the coin, I made a counterfeit one as follows:

From the drug store, I bought a ten-cent cake of beeswax, and, from a raid on the pantry, I got a piece of Parowax. This is the ordinary sealing wax of fruit jars. I melted pieces of equal size in a can cover, and let the mixture solidify. While it was still warm and plastic, I rolled out a small sheet of it and pressed the coin deeply in, both face and reverse of the coin. With a small brush, I dusted the impressions with lamp-black. Binding the wax with a bit of wire, I immersed it in a solution of copper sulphate or blue stone. The small nut dangling below as shown prevented the light wax from bobbing out of the solution. I plated the impressions with copper, using one dry cell with a small resistance for the current. A strong current deposits the copper in large granules, which is to be avoided. The anode was a piece of large gauge copper wire, and was renewed as it dissolved.

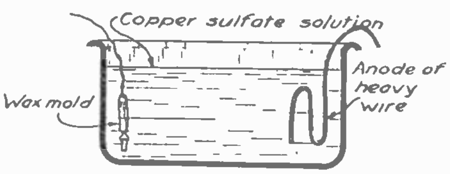


Fig 2

Fig 3

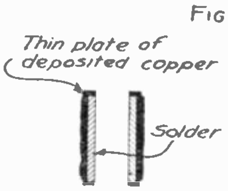


Fig 4

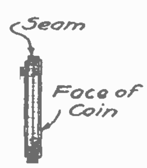


Fig 5

Further details of the electro-plating. Figure 2 is the tank and anode, Figure 3 the section of the copper deposition, Figures 4 and 5 show how to put the two halves together.

After a short time in the plating bath, thin wavy strands of copper could be seen in a network over the face of the wax. Later, the whole face of the mould was covered with bright red copper. By gently heating the deposited sheet of copper, it was pulled free of the wax. Two images of the coin stood out from the side of the sheet that had been against the wax. I carefully cut each face out with a knife as the sheet was thin and soft. Now I had two dish-shaped bits of copper whose bottoms were exactly like the faces of the coin. I filled both dishes with melted solder to strengthen them. By placing these two circles back to back, I had an imitation piece. The thickness, however, was much greater than that of the original. I ground the two backs on a grindstone until, when placed together, they compared with the original. Holding the two pieces together with a pair of pliers, I heated them. When they were cool, and the edge or collar of the coin was scraped clean of solder that had oozed out, the job was nearly perfect. It was noticeably heavier than the original, but that was not a drawback. The color was different than that of the old coin. I rubbed a little sulphur on the bright piece and heated it. Now when it was rubbed with a soft cloth, it presented the same tarnished hue of the original; and, but for the weight and a narrow seam around the collar, I had an old Swedish coin.

No, fellow experimenter, Practical Electrics will not be arrested for printing this and the money world will go on as usual. The process is not a new one, and is much too expensive to interest counterfeiters.

Efficient Electrophorus and Electroscope

By R. G. Morgan

A FEW years ago the writer had occasion to use an electrophorus, also an electroscope, during the course of some experiments in electrostatics. After considerable work and a number of disappointments the necessary apparatus was evolved along the lines shown in the enclosed illustrations.

Figure 1 represents a sectional view of an ordinary cake tray, 12 inches in diameter, and about one-half inch in depth. A three-sixteenths inch hole is drilled through the rim, and a small stove bolt is used to fasten a short piece of No. 12 copper wire to the tray. A mixture consisting of one pound dry shellac, four ounces of marine glue, two ounces of Venus turpentine is melted together in a pot. The pot should be absolutely leakproof, and great care taken not to spill the mixture, as it is highly inflammable.

Stir the mixture while melting, and when it runs freely pour into the cake tray, to a depth of three-eighth inch. Before it hardens a three-inch length of wooden rod, one-half inch in diameter, is set up in the liquid one-half inch from the rim of the tray. As the mixture hardens the rod becomes firmly fixed in it, and serves as a handle later on. After cooling and hardening for three hours, turn the tray over bottom up, and rap on it a few times until the electrophorus drops out of the tray. The electrophorus is now ready for use and should be put back in the tray.

Figure 2 represents a sectional view of a small glass table, an insulating stand which is essential to the proper and satisfactory operation of the electrophorus. This table consists of an eight-inch headlight glass, plain glass, about three-sixteenths inch thick, and has three insulators, ball type. The insulators are dipped into melted marine glue, about one-eighth of an inch, and squeezed down on the glass. After the glue has set, the table and insulators are given two or three coats of orange shellac all over, and set aside to dry.

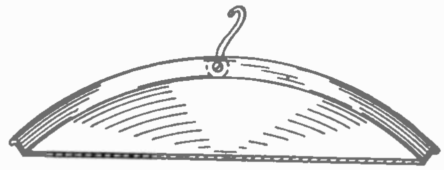


Fig 1

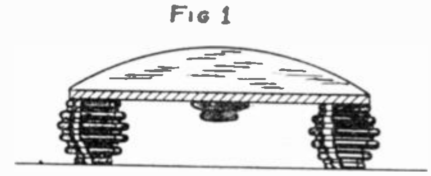


Fig 2

Insulated or glass-legged screw for experiments with static electricity.

The electroscope (of the induction type) is a far more satisfactory piece of apparatus for the amateur experimenter, than the direct contact type. The construction is shown in the next figure.

Figure 3. An old Leyden jar is stripped of its tin foil, both inside and out, and a few turns of No. 6 annealed bare wire is wound around the outside of the jar. The jar is now set up in another glass slightly larger in diameter, and melted Parawax is poured around it to a depth of about one inch, care being taken to cover the bare copper wire with a film of wax, especially its ends. The melted wax is simply brushed on. When set it becomes firm enough to handle. Aluminum foil is used for the sensitive element, a strip three inches in length and one-quarter inch in width.

Figure 4. (A) represents a one-inch brass ball. (B) represents a six-inch length of one-eighth inch brass rod, and (C) represents the aluminum strip. A drop of glue on the rod holds the strip in place, the strip being hung on the stirrup, and a drop of glue is applied at the edge of the strip. *No glue must get between strip and stirrup.* The brass ball screws on the end of the rod. After assembling and mounting on cover, the cover is placed in position on the jar and all exposed surfaces on jar and rod are given

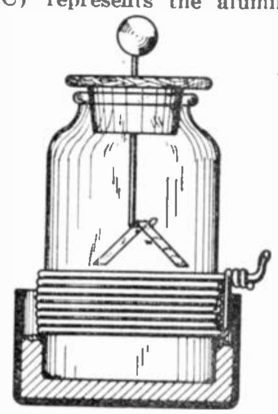


Fig 3

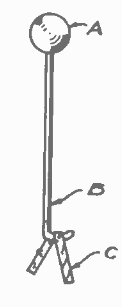


Fig 4

A Leyden jar is the basis of the galvanometer. The high quality glass used in these jars makes them particularly available.

(Continued on page 406)

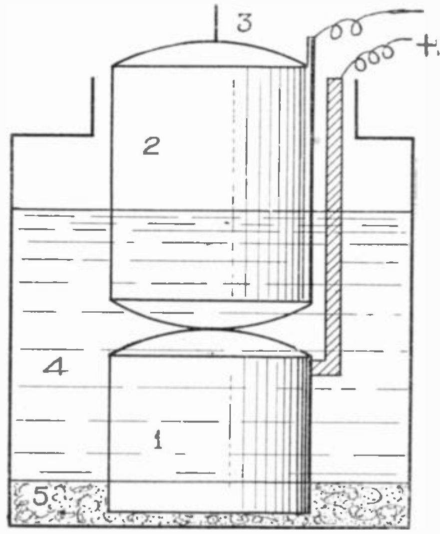
Some Primary Batteries

OUR esteemed contemporary *La Nature* of Paris has recently published an article on primary batteries for radio work. Batteries are an interesting subject for all of us, and we give an excerpt from the paper in question.

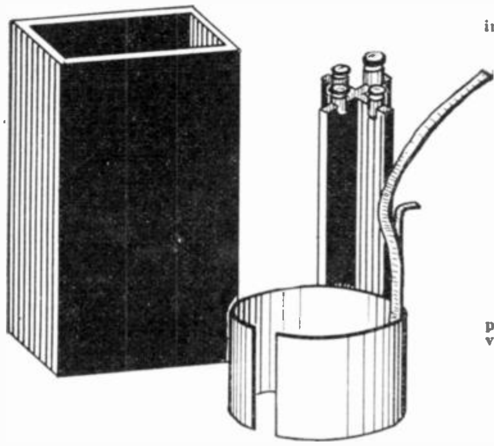
The French have never lost their love for the copper sulphate battery, and our first illustration shows the Aubert battery, named from the inventor. A glass cell such as is used in the LeClanché battery may be used as the container.

In the bottom is a spiral-wound plate of copper, not much more than a hundredth of an inch thick, about three inches high and a foot long when opened up. A gutta percha insulated wire is attached to it without soldering in order to avoid local action. A spiral of zinc somewhat similar in dimensions but wider, is supported above the copper which it must not touch, but to which it can be very close.

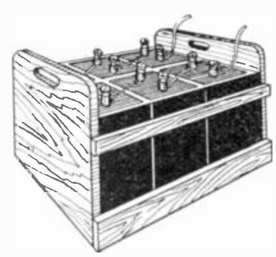
When both plates are in position and the supporting of the zinc is left to the constructor's ideas, the cell is filled with a solution of zinc sulphate of about ten degrees Baumé or 1.074 specific gravity, and a few crystals of copper sulphate are then thrown into the bottom. After a few minutes the battery is ready to work, and all that has to be done is to renew from time to time the copper sulphate, and as the zinc sulphate solution becomes denser, to withdraw it from time to time and replace by water.

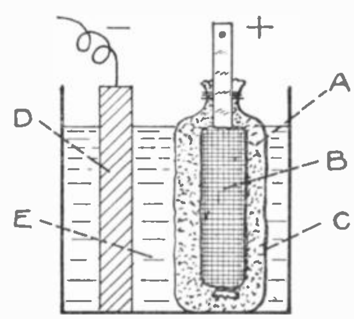


French copper sulphate battery; it is contained in a LaClanche jar; the upper cylinder is zinc.


The Hydra battery; it employs a salt solution for the zinc and a potassium bichromate solution with sulphuric acid to surround the carbon.

The elements of the Hydra battery are next shown. This battery will take care of two audion tubes if there are three elements put in series, and the same three elements in series will charge a four-volt storage battery. The container is of bakelite or is a bakelized cell, within which there is placed a cylinder of zinc. This is surrounded by water saturated with common salt. Within the zinc cylinder is a porous vessel filled with special depolarizing liquid and which contains a more or less compound or laminated carbon.

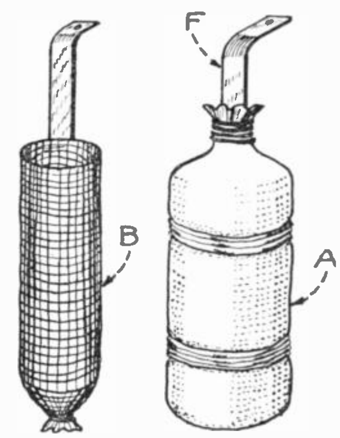

Six cells of the Hydra battery mounted in its portable case, their square shape making them very compact.



Potassium hydroxide battery; an amalgamated zinc rod (D) is the positive; (B) is a copper wire gauze cylinder contained in a cloth bag (A); packed with copper oxide (C).

The depolarizing liquid is of the following formula: Water, 7 parts; sulphuric acid, 1¾ parts; hydrochloric acid, 1 part; or, potassium bichlorate, 1 part, all by weight. Sulphuric acid is first mixed with the water little by little and then the bichromate is added, and when completely dissolved, the hydrochloric acid is introduced. The salt water surrounding the zinc contains 300 parts of salt to a thousand of water. The battery will run six hours, giving one ampere. The solution then has to be replaced, but the zinc will last through several discharges.

It has a semi-solid electrolyte and is made in two styles, one with the contents exposed to view if the cover is lifted and the other covered with cement or wax. The exposed type is supposed to permit the replacement of single elements as just stated. The cemented batteries are supposed to run longer.



Negative element of the potassium hydroxide battery and its wrapping. (B) is the wire gauze, (A) is the bag and (F) the terminal.

An interesting copper oxide battery is illustrated; with its electro-motive force of .8 volt, it can give 1½ amperes of current. An amalgamated zinc rod is one electrode and the other one is a cylinder of copper wire gauze of very fine mesh, and contained in a cloth bag. The bag is packed with copper oxide. The two electrodes are placed in a glass or porcelain cell and an aqueous solution of potassium hydrate, 25 parts to the thousand by weight, is the excitant. These oxide of copper batteries are very easily constructed by the amateur and are very much to be recommended.

$100 Old Telephone Receiver Contest

Our readers' attention is called to the Old Telephone Receiver Contest. The particulars will be found in the April issue on page 313. We give full particulars of the prizes and conditions of this most interesting contest.

Everyone undoubtedly has an old telephone receiver of either the Bell or watch case type, which perhaps at the present moment is not in service. It is the purpose of this contest to have our readers compete for the best application of these old telephone receivers and to adapt them to something useful and interesting. We have shown and illustrated in our April issue four different ideas as to uses for old telephone receivers. We are making no restrictions as to how they can be employed. No contestant will be barred from the contest if he suggests ideas for using telephone receivers, even if they embody no electrical use at all. As long as the new arrangement is useful—that is what is wanted. Remember, USEFULNESS will go a long way toward winning a prize.

PRIZES	
1st Prize..........	$50.00 in gold
2nd "	20.00 " "
3rd "	15.00 " "
4th "	10.00 " "
5th "	5.00 " "

1.—The telephone receiver must be converted into something useful, and new if possible.

2.—As many receivers as required can be used in the new appliance or instrument.

3.—Receivers can be rewound to any ohmage or resistance required by the builder.

4.—When models are sent with entry, they must be completely assembled. The judges cannot take it upon themselves to assemble models.

5.—Only complete telephone receivers can be used in this contest. (Cap may be left off.) Parts of receivers such as magnets or windings cannot be entered, but if a complete receiver is used in the new device, then it would be allowable to use other parts from another receiver.

6.—This contest closes at noon, May 15, 1924, at which time all entries will have to be received by us in order to qualify. Should two contestants submit the same idea, the same prize will be awarded to both.

7.—Address Editor, *Old Telephone Receiver Contest*, Practical Electrics, 53 Park Place, New York City.

Awards in the $50 Special Prize Contest
For Junior Electricians and Electrical Experimenters

First Prize, $25.	Second Prize, $15.	Third Prize, $10.
Eliner Leck,	Herman E. Schielke,	J. Barma,
929 Minor Ave., Hamilton, Ohio.	P. O. Box 121, Vacaville, Calif.	47 Churchill St., Buffalo, N. Y.

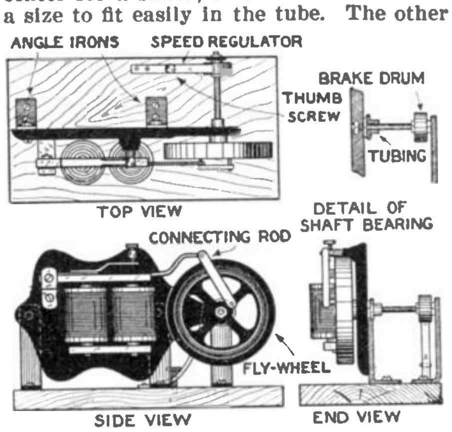
First Honorable Mention—Constantine Troy, 665 Sullivan St., Elmira, N. Y.
Second Honorable Mention—Kenneth Haniflan, Waterville, Ohio.
Third Honorable Mention—Lester J. Ballard, 277 Putnam Ave., Cambridge, Mass.

First Prize
Motor from Electric Bell
By Eliner Leck

AN interesting electric motor can be made from an ordinary electric door-bell. If possible, procure a bell with a wooden back, as such is easier to attach to the base. Set the bell on the base, edgewise, with the hammer, or tapper, up, and secure with screws.

If a wooden backed bell is unobtainable, a bell with an iron frame may be attached to the base by using angle irons, as shown in the illustration. Remove the bell post, and substitute a small piece of metal tubing where the post pierces the back board; in the case of the iron frame bell, a hole will first have to be drilled through the casting.

Then cut out a wooden flywheel of about the same diameter as the bell, and run a piece of stiff steel wire through the center for a shaft; this wire should be of a size to fit easily in the tube. The other



An every-day electric bell is made to supply the principal parts of the very nice little toy motor. Its construction can be warmly recommended to our younger readers.

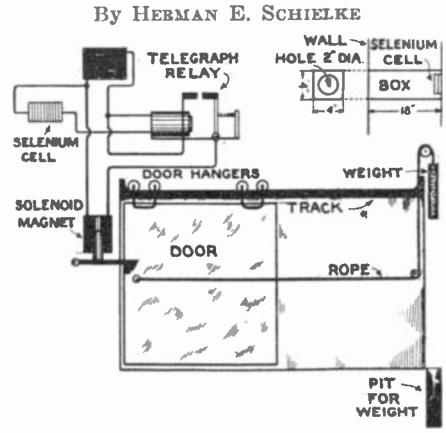
end of the shaft is supported by a sheet-metal bearing, fastened at the rear of the base and drilled with a hole, near the top, to accommodate the shaft. Rivet the end of the shaft slightly to prevent it from pulling out, or drill a hole through it and insert a cotter pin, or piece of wire.

Before setting the shaft in place, a brake drum made from a small spool, or disk of wood, is driven on the shaft in the position shown. Then arrange a strip of spring brass to the base, so that it will not quite press against the brake drum; a thumbscrew may be added for holding the spring against the drum, if desired.

The hammer stem is next flattened on both sides at its outer end, and a small hole is drilled through its center; this is then connected to a screw by means of a sheet-metal connecting rod, which screw is placed near the center of the flywheel.

Determine how far the hammer will move when attracted by the magnets, and then put the screw just half this distance from the center of the wheel; it may be possible, by adjusting the tension of the spring, to obtain greater freedom of armature movement. Such a motor will operate on one or two dry cells, and will provide sufficient power to operate small mechanical toys.

Second Prize
Garage Door Opener
By Herman E. Schielke



This garage door is opened by letting the light from the automobilist's spotlight shine upon a selenium cell. The door is opened by a weight when the current releases the latch.

THE illustration shows a garage door opener, using a selenium cell.

I purchased a selenium cell, and enclosed it in a deep box, nailing the box close to the roof, thereby shutting off all light possible. I then obtained an old telegraph relay, (from a kind hearted Western Union man) and a 6 volt storage battery, hooking it up in the manner shown.

My car is equipped with a spot light, and any time, either night or day, regardless of the weather, all that is necessary to open the door is to turn the spot light on the selenium cell. The door opens automatically. It can be applied to either sliding or swinging doors; a weight of some kind, a couple of small clothesline pulleys and some small rope is all that is required. It is necessary to see that the door works easily; the easier it works the lighter the weight needed.

$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.

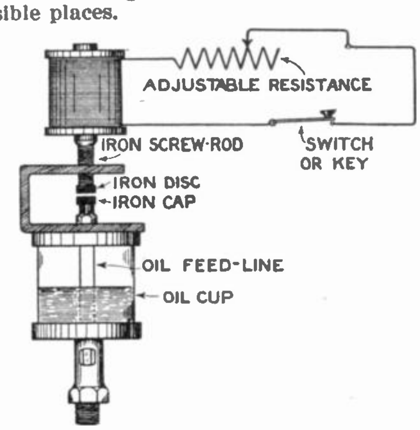
If in any way possible, a clear photograph, should be sent with the idea; but if that is not possible, a good sketch will do.

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 *Editor, Electrical Wrinkle Contest,* in care of this publication. Contest closes on the 15th of each month of issue.

Third Prize
Electrical Oil Cup
By J. Barma

THE electrically operated oil cup illustrated will be found convenient means of controlling oil feed in difficultly accessible places.



Electrical oil cup; a touch of the button or closing of the switch opens the oil valve and admits oil to the bearing.

An electromagnet is used in this scheme, as shown. To open the oil cup, energize the magnet by the control switch or push-button. The iron disc adjacent to the electromagnet becomes magnetized and draws up the iron cap on the top of the oil-feed pipe, and the oil will commence to drip.

Upon breaking the circuit, the disc is demagnetized and the cap of the oil-feed pipe being no longer attracted, again falls and closes the feed hole.

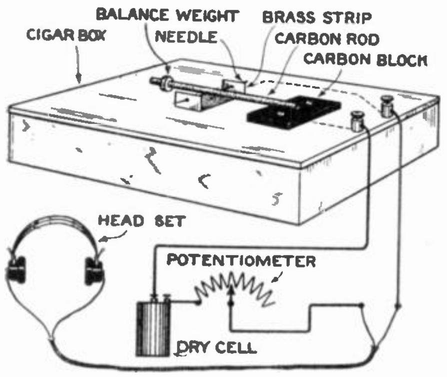
Regulation of the flow can be accomplished by adjustment of the iron disc, which is connected to a screw rod, as shown. A small electromagnet and a rheostat in series in the circuit will render the control of the oil cup quite precise.

1st Hon. Mention
A Sensitive Microphone
By Constantine Troy

A SENSITIVE microphone, constructed as shown here, forms a welcome addition to any "bug's" laboratory. For sensitivity, this apparatus "takes the cake." One stunt performed with it was to listen to a fly's footsteps!

Remove the cover from a cigar box and

soak and scrape off the paper and let it dry. With a hacksaw, cut a small, square, carbon block from a battery carbon and bore a hole in it. Fasten this on the



Interesting example of an exceedingly sensitive microphone. One end of a delicately poised rod rests upon a block of carbon for the contact.

bottom of the box with a small bolt, as shown.

From a strip of brass, bend a U-shaped piece and punch a hole in each side for a needle to rest in. This needle supports the carbon rod as shown. The rod should be from one-eighth inch to one-quarter inch in diameter. A small hole is drilled through it, off center, and the needle passed through.

The heavier end of the rod rests on the carbon block. To obtain a very light contact, a balance weight made of wire in the form of a ring is placed on the lighter and free end of the rod.

Connections are made as shown by wires running to the brass support and carbon block.

To obtain the best results, a radio headset, with one dry cell and a potentiometer, should be connected as shown.

2d Hon. Mention

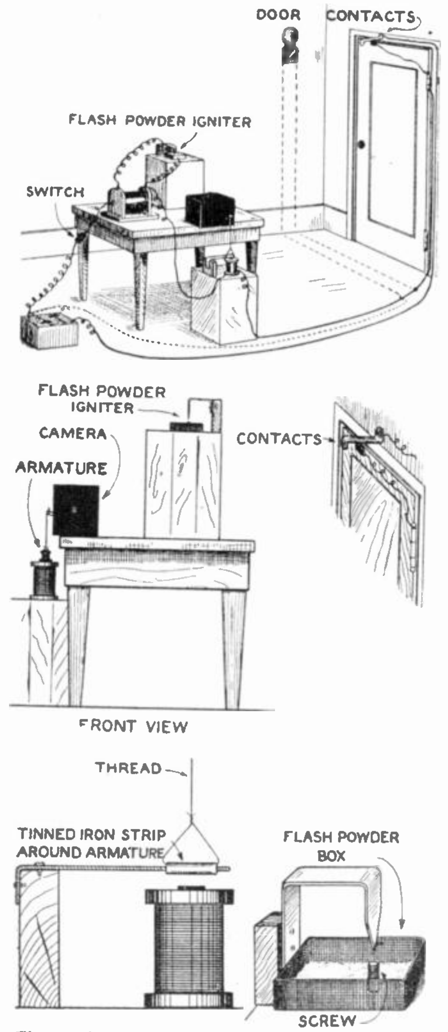
Snap the Burglar

By Kenneth Haniflan

WHEN a burglar hears a burglar alarm he generally gets away. So why not get his picture before he disappears, to aid in capturing him?

This is how it's done.

A camera is set upon the table in front of the door; it is best to have the camera

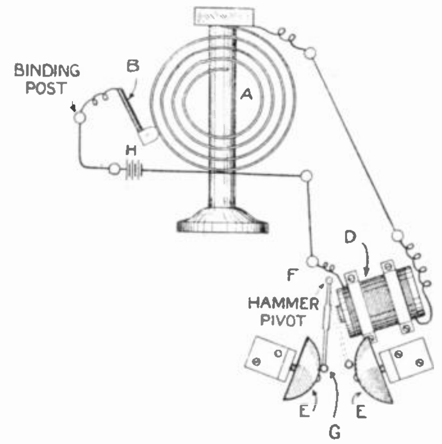


Three views of a photographic apparatus arranged to photograph a burglar as he enters a house. Opening the door deflagrates the flashlight powder, so as to take the photograph of the intruder; this is supposed to be an improvement on fingerprints. Presumably it will not be one of the popular smiling photographs.

camouflaged so that nobody will know what it is. Then solder a lever to the camera lever as shown in the diagram, arrange a flash-light igniter as shown in Fig. 5; connect this to the secondary leads of a Ford coil; place a contact on the door and another over the door as shown in Fig. 4; connect the apparatus as shown in Fig. 1.

A bell can be inserted in the circuit if desired. If lights are to be left burning all night, the flash-light igniter can be omitted.

When the door is opened the circuit is closed, the current passes through the coil and pulls the lever on the camera, and passes through the spark coil; then it goes through the bell. By this time we have the burglar's picture taken.



A chime which in the act of striking closes a circuit and rings bells in as many places as desired.

3d Hon. Mention

Bell Ringing Chime

By Lester J. Ballard

THE illustration shows a master chime to be used for ringing bells in one or more distant rooms.

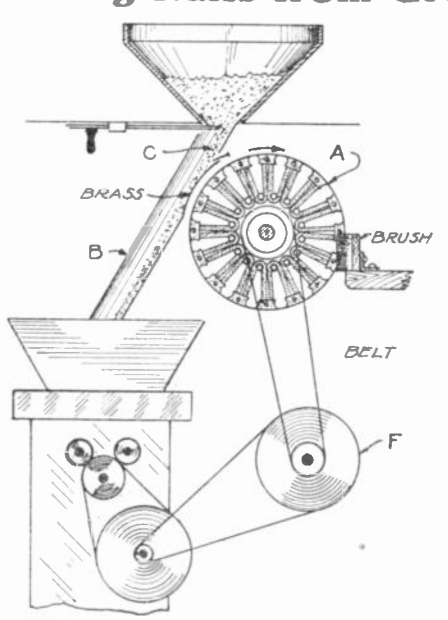
(A) On the diagram is a chime or gong on the master clock; (B) is the hammer which striking the gong completes the circuit. The hammer on my clock had a felt buffer on it, so I soldered a small piece of wire on the arm to make electric contact when it struck. (C) are binding posts; (D) electromagnets and (E) distant bells, different in tone to give a chime effect if within hearing distance of the master clock. (F) is the hammer journal. (G) is the hammer and (H) the battery. All can be made from a few old bells.

Removing Nails from Grain

FOR small grinders which are not provided with a safety nail detainer, there is always a worry lest the grain carry with it some iron or steel which will damage the burrs of the mill. A very effective attachment may be made from an old Ford magneto which will catch and remove such pieces from the grain as it comes down the chute to the mill.

The flywheel of the motor with the magnets attached is mounted on a bearing and a belt pulley is attached to its side. This bearing is attached to a stand in such a position that the magnets sit close to a curved sheet of brass forming the bottom side of the feeding chute to the mill. An opening an inch wide is left between the upper end of the brass sheet and the upper part of the bottom on which the grain slides down. By means of a reducing belting system the flywheel is then connected so as to be slowly driven from the slow speed pulley on one of the shafts. About 25 revolutions per minute is as fast as the magnets should travel.

At the rearmost side of the magnet wheel two stiff bristle brushes are attached to a stationary frame work in such a manner that they will brush from the magnets any nails or pieces of steel which



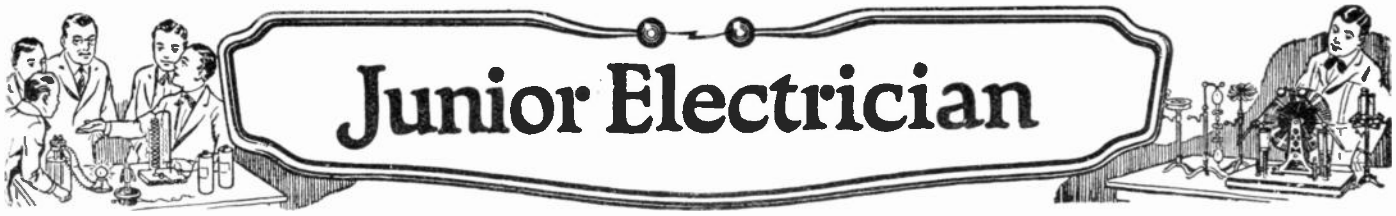
Apparatus for removing nails and bits of iron from grain before it goes to the mill, applicable to many other places where iron is to be separated, as for instance from brass turnings.

might be carried back into the grain again.

The magnetic separation of iron from lathe turnings and from drillings of brass is an important operation, in order to prevent iron and brass all going into the crucible together, when the scrap is melted at the brass foundry. A very important ore of iron is the magnetic oxide which is attracted by a magnet. A similar apparatus to this one is employed in its separation, and the ore of the famous Cornwall mine of Lebanon County, Pennsylvania, one of the world's famous deposits, is thus treated at one of the furnace plants.

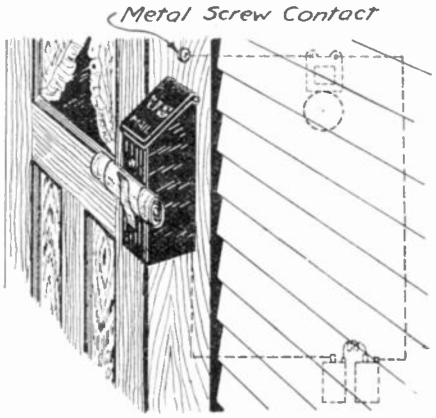
There are other examples of this concentration of magnetic iron ore which could be cited. For these operations on a very large scale, however, it is generally electro-magnets that are used. For this smaller operation permanent magnets are employed.

An arrangement like this has even been proposed for picking up nails from a road to protect pneumatic tires from puncture. Iron pyrites are sometimes magnetic and such an apparatus as this could be utilized to separate them from iron ore for if once sulphur gets into iron, it is practically impossible to remove it except perhaps by the basic process.



Electric Letter Box

RECENTLY I was unemployed and devised this simple means of "getting" the signal every time the mail man brought a "prospective reply" to one of



In this letter-box, newspapers, circulars and the like being placed in the outside clip, do not ring the alarm bell, thereby avoiding the annoyance of getting uninteresting mail.

my advertisements. Of course when he placed a circular in the spring holder I was not bothered by being called down the steps and being disappointed not finding a letter.

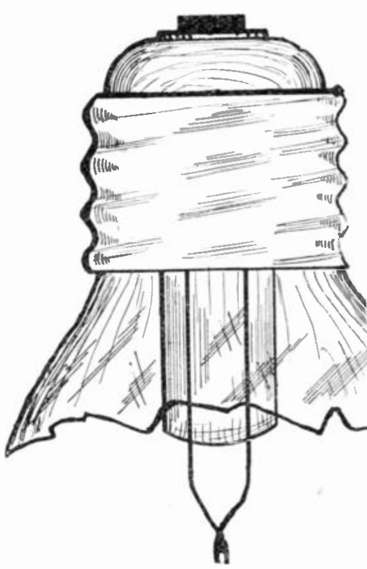
Contributed by MILLARD R. FERRELL.

When the Lights Go Out

IT is not very bad for big sister and her beau, but when you are experimenting or doing something or other very interesting, it is exceedingly displeasing.

If caused by a blown fuse, it may be very easily remedied. Take an old electric light bulb and break the glass off down to the base, then take the filament out, leaving the two stiff wires. Twist these together and place it as a fuse in the fuse box; it will act as a temporary fuse until another one can be obtained. Caution: Do not use any powerful electrical apparatus as it might blow the meter.

Contributed by JOHN ODENBACH.



Broken electric light bulb made to operate as an extemporized plug fuse.

Revolving Armature Motor

AN electric motor which is very simple to construct consists of a horseshoe magnet, some wire, two iron bolts, several strips of copper and some pine sticks one-half inch thick.

The base (X) in the cut is 5 inches long and 3 inches wide. The upright post (Y) is 7 inches long and 3 inches wide. The magnet is supported by a bracket (Z) which is 3½ inches long and 1 inch wide. It will be necessary to cut two slots in (Z) to hold the magnet in a vertical position. The same bracket holds the upper end of the vertical shaft (S) of the armature in place. This shaft is a small rod 6 inches long. Its lower end rests on a glass plate and carries the armature and commutator.

Interesting Articles to Appear in June Issue

Historic Incandescent Lamps (Concluded)
By T. O'Conor Sloane, Ph.D.

Electricity Detects Counterfeit Paintings.
By M. Bayle, Director of Bureau of Identification, Paris.

Experimental Microphone.
By Frank W. Godsey, Jr.

Electric Boilers.

Utilizing Solar Heat.

Dry Cells from Wet Batteries.
By C. A. Oldroyd, Barrow-in-Furness, England.

Electro-Magnetic Induction.
By Harold Jackson.

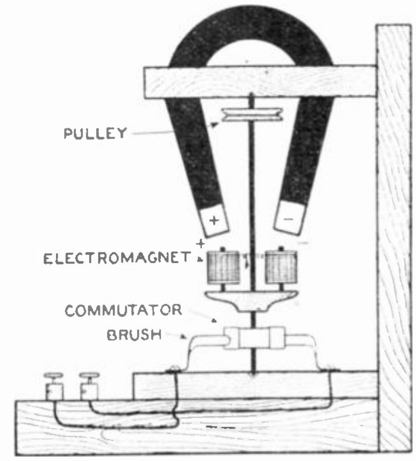
Hudson River Vehicular Tunnel.

Stunts with Static.
By Harry R. Lubcke.

The armature (A-A) is made of two stove bolts two inches long set into a wooden base. This base is a disk 2 inches in diameter and ½ inch thick. The upper end of each bolt is wound with eight feet of magnet wire. Tight fitting washers hold the wire from slipping off the bolts. The armatures should be secured to the shaft so that the upper end of each bolt is held ⅛ inch below the poles of the horseshoe magnet.

A quarter of an inch below the armature the commutator is fastened on the shaft. The commutator consists of a wooden center (a disk about 1 inch in diameter is about right) upon which strips of copper one-half inch wide are tacked. The ends of the copper strips must not touch, so they are insulated from each other by a strip of dry wood. Thin rubber or silk cloth placed around the core before the copper is fastened on makes a more reliable insulator but it is unnecessary provided the wood is never allowed to become damp. Posts an inch high on each side of the commutator hold the brushes (B-B). Each brush rests on one copper plate of the commutator at a time and both change from one plate to another at the same time.

Now you are ready for the simple wiring. A copper wire connects the battery with the brushes. From each brush a similar wire connects with the lower end of the bolts of the armature, which transmits the current to the magnet wire as



Very nice version of the old rotating armature, really a high speed motor; it is constructed of the simplest parts.

wound around it. The upper ends of the armature bolts are connected with a copper wire. When the connections are all made, the armature will revolve very rapidly.

Contributed by HARRY L. ELDER.

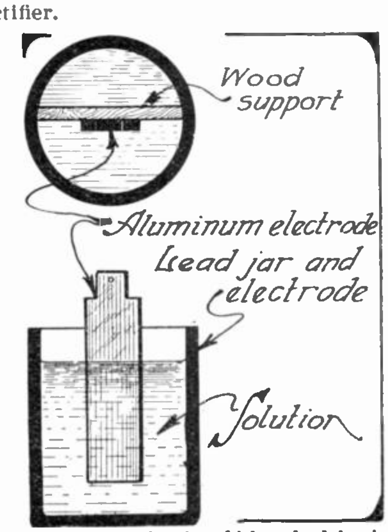
Chemical Rectifier Jars

THE requirements for rectifier jars are as follows: They must withstand heat, be unbreakable and simple to construct. The following described jar made of lead fulfills these requirements.

One advantage of lead jars is that they can be used as one plate, and thus simplify the construction of the rectifier.

Cut out a sheet of one-eighth inch lead size 4 by 7 inches and bend in shape of a pipe. Burn or solder the edges together. Cut a circular piece to fit the bottom and fasten in the same way. The result is a lead jar. The size can be changed and any size jar made.

Set a strip of aluminum in the center, supported by a strip of wood; mix the solution and connect up like any chemical rectifier.



Electrolytic rectifier in which a lead jar is not only a container but is one of the elements.

Multiple Push-Button Connections

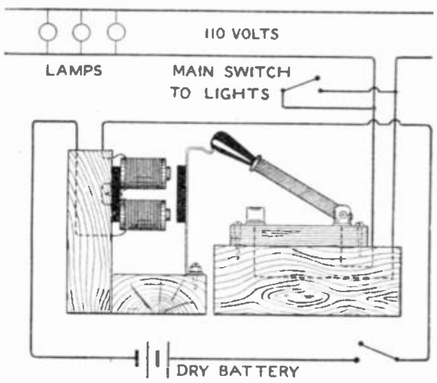
THIS is a cheap and simple method of placing several push buttons in convenient places about the room to operate a knife switch.

Secure a single pole, single throw knife switch, two dry cells, although one will answer, two pieces of soft iron for magnet cores, two soft iron bolts will do, and wind six or seven layers of No. 30 cotton insulated wire on them; place them as shown in the illustration.

The single pole knife switch is arranged in such a manner, as is clearly shown, that the armature of the magnet will hold the blade away from the contact. When the battery circuit is closed, the armature will be attracted to the magnet releasing a catch, and letting the blade of the switch fall, from force of gravity, to the contact.

A button is placed near the bed, others wherever it may be desirable; the switch is set before retiring, and all is in readiness for flashing the light on in the morning very conveniently.

Contributed by GLENN J. WHITE.



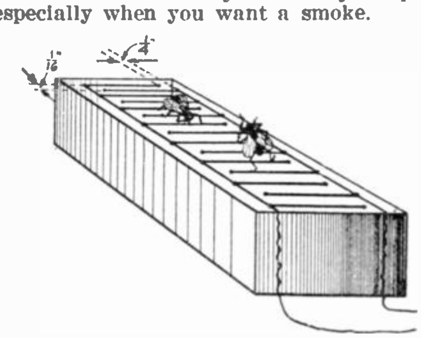
Knife-switch held open by a catch and released so as to fall between the blades by the touch of a distant push button.

Electrocuting Flies

By FRANK F. BRUCE

DID you ever make an electric fly trap with the idea of catching and electrocuting flies? You never did? Well try it and if your experiment and experience are the same as mine I'll say that you are in for some surprise.

Well, Bugs, here's how it was. While employed as Refrigerating Engineer in a large packing house in my home town the idea hit me one day that I could rig up a little scheme for electrocuting flies that would make the ordinary fly swatter look like a two cent piece half spent, and incidentally win the undying gratitude of a fly-infested community. Did I? Well, I got an empty cigar box—empty, yes; it was no trouble as they are always empty, especially when you want a smoke.



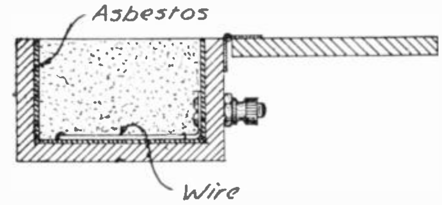
Attempting to electrocute flies, but the said flies, as the story tells us, perversely refused to succumb to the current, whether A. C. or D. C.

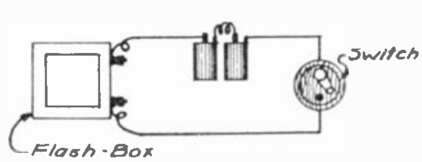
I took the cigar box as before mentioned and drilled two rows of holes down each side ¼ inch apart; I next cut some short lengths of bare copper wire, and strung them across the top of the box with each end through a hole and bent over downwards; next I took two lengths of wire a little longer than the box and soldered one down each side and on every other wire (reference to sketch will show how I staggered the holes at drilling to accomplish this), this spaced the wires about 1/32 inch apart and made it almost impossible for a fly to climb it without making himself an automatic fly switch.

When it was all finished I hooked it up to a lamp socket, sprinkled some sugar over it to draw them on and sat down to await results. Now in our engine room we had an 85 KW. 220 V.D.C. generator. Now you would naturally think this would be instant death to any fly. Anyway I thought so. But no! Oh, no! The first victim that straddled those wires gave me the surprise of my life, because instead of being shrivelled up and half burned to a cinder as I expected, he gave a very graceful exhibition of a fly caught in new Tanglefoot. Yes, the juice held him all right, he didn't fly away, neither did he die, but his wings beat a tattoo at a mile-a-minute pace for about five minutes, after which no amount of poking would make him move. Thinking that by this time the fly was dead I turned off the current to examine the victim, when low and behold . . . the dead came to life and walked right off the trap. Was I stung? I was, for after a whole day of this performance there was nary a funeral in flydom.

Not satisfied with this however I took my trap over to my boarding house where we also had a very nice collection of flies (it is necessary to have boarding house experience to appreciate this), and connected it to 110 V.A.C. I thought this might make a difference. It did—but very little, for at the end of a week I probably had not killed more than a dozen flies. At this stage of the game disgust was the ruling passion and I wrecked the trap having no more desire to assassinate flies.

Electric Ignition of Flashlight Powder





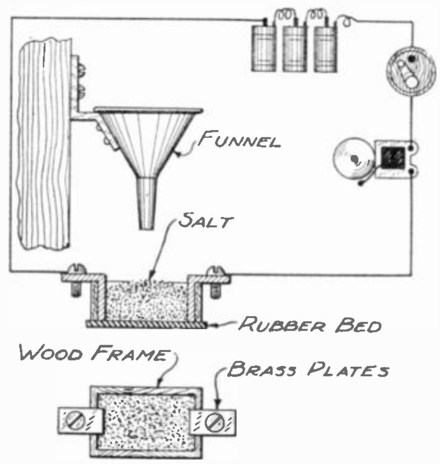
Very neat arrangement for deflagrating flash powder for photographers; it is done by an incandescent wire, not by the spark.

FOR taking pictures of groups when one wants to be in the picture, or for taking one's own picture by flashlight, the apparatus described works well and is very simple. Another advantage of setting off the flash by this means is that the photographer can ignite the powder without letting the poser know, as would be the case when doing it by means of a match.

The box is made of wood taken from the ever handy cigar box. It is 1¼ inches square and three-quarters inch deep inside. If desired it can be lined with asbestos, but this is not necessary. The binding posts are taken from an old dry cell. The cover is hinged to the box by a small hinge of whatever kind is handy and small enough. When down, the cover protects the wires, and when opened protects the binding posts from the flash. For setting off the flash a short piece of wire such as used on toasters is procured. The amount and size of wire depends upon the strength of current used, and this can be very readily determined by a little experimenting. A washer is placed on the binding-post between the heating wire and the box. The wire should be fastened to the bottom of the box with small brads.

Contributed by JOSEPH A. BIEKE.

Rain Alarm

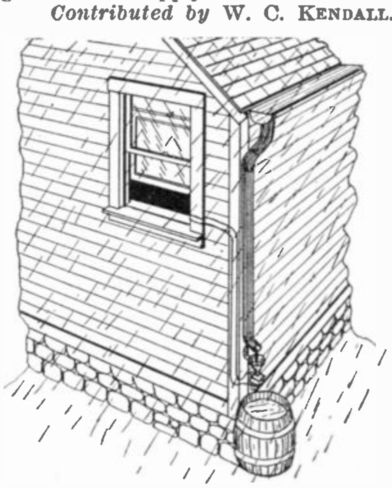


Rain gauge. It is made very sensitive by catching the rain in a funnel.

WE present our readers with another version of a rain gauge. Here a funnel is mounted on a bracket to catch the rain and concentrate its flow. Below the stem of the funnel there is a box filled with salt with a couple of contacts. The least amount of rain falling into the funnel streams out of the end of the stem upon the salt, moistening it and making it a conductor. The circuit arranged as shown is thus closed and the alarm bell rings.

A further refinement is to place the funnel under a leader pipe coming from the roof of the house, thus getting a still larger area to supply the water.

Contributed by W. C. KENDALL.

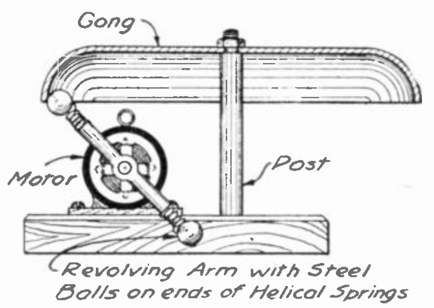


The rain gauge established at the base of a roof leader so as to give it a greater supply of water than the funnel alone would yield.

Motor Driven Bell

THE bell illustrated here is so clearly shown that description seems hardly needed.

A substantial gong is mounted on a rather high standard, a miniature motor is attached to the base, and to the shaft of the motor a transverse arm is attached, to whose ends steel balls are attached by helical springs.



A gong, the clappers of which are whirled around by an electric motor, so as to produce under proper conditions a deafening sound.

When the bell is to be rung, current is turned into the motor by a push-button or key, and the motor armature at once commences to turn and whirl the bar around, striking the gong twice for every revolution and producing a noise, presumably far in excess of that due to the ordinary make-and-break circuit instrument.

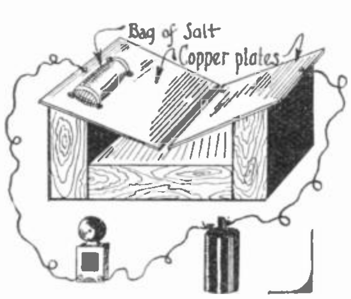
It must be strongly constructed and care must especially be taken about the springs and balls, so that they shall not be detached by centrifugal force.

Contributed by IRVIN E. PIPPIN.

Electric Rain Signal

TAKE two copper plates, 6 by 2 inches, and mount them on wooden supports so that their edges are held about a sixteenth of an inch apart, and the plates are in a slanting position something like a trough.

Each plate has an insulated wire connection. Wired in series with the plates are a bell and a battery. A very small elongated sack of salt lies upon one of the plates. When a drop of rain falls on one of the plates, it rolls down the inclined surface, and before it reaches the bottom of the trough comes in contact with the other plate and dissolves some of the salt. This completes the circuit and causes the bell to ring. The latter is an ordinary bell and an ordinary dry-cell is used to supply the current.



Rain alarm. The rain streaming down the copper plates and dissolving the salts, closes the circuit and rings the bell.

Contributed by HARRY L. ELDER.

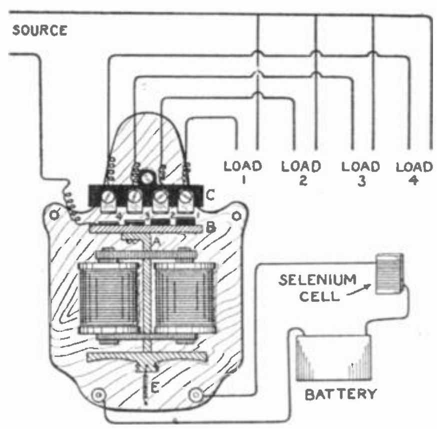
Multiple Contact Relay

THIS apparatus is intended to act as a relay, and to control the current to several different loads at different times.

It was made from a direct stroke door bell. The make and break contact points were bent so as to form a closed circuit. The striker arm was bent at (A), so that a crossbar (B) could be mounted as shown. This crossbar has on it four contacts, 1, 2, 3, 4. Each contact is of a slightly different length than the other, growing shorter from 1 to 4.

For light work the difference in size is scarcely noticeable. For heavy work they may be made with much more difference in size, but their corresponding contacts must be mounted in a different way. For the corresponding contact, a base (C) is mounted as shown; this must be made of insulating material, such as bakelite. For the contact points which correspond to 1, 2, 3, and 4, spring brass is mounted as shown at (D). Silver is a good metal for the contact points. The brass supports (D) must be very springy and flexible. The contact points are hooked to the source and loads as shown.

Successful operation of this device depends upon finely adjusted contacts, and a very slow increase of electricity in the coils. The latter may be carried out in more than one way. The relay may be hooked up as shown with a selenium cell. With the approach of daylight, more and more current is passed to the coils due to the selenium cell. As the current increases the magnets start drawing in the armature, overcoming a very weak spring (E). As the armature is drawn in, it closes the contact 1, 2, 3, 4 in succession. The time between the closing of each contact may be regulated by setting them. At night the contacts are opened one by one due to the decrease in the primary current, or vice versa, using a sulphur cell.



Multiple switch, in this case controlling four loads, whose operations are determined by daylight acting on a selenium cell. More and more circuits are turned on as the light grows brighter.

The instrument may also be regulated by a clock. On the face of the clock are mounted strips of brass with insulated space between, commutator fashion, as diagrammed in (H). The end of the hour hand is bent down to make contact on the brass as it goes around. The segments of brass are connected to taps from a resistance (F), as the hand goes round it cuts out more resistance with each segment, thus sending more current through the coils and turning on another switch, 1, 2, 3, or 4.

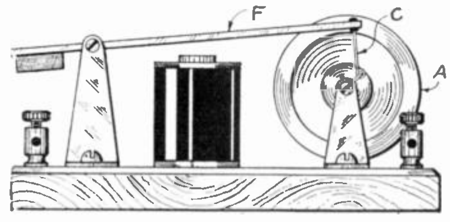
Contributed by LEROY COX.

Simple Electric Motor

TWO magnets from an old bell are mounted on a base as shown in the illustration. The bearings for the beam and armature (F) are placed about one inch from the magnet.

The beam is made of a piece of soft iron strip, and a small weight is placed on one end of the rod so that it will run more smoothly. The bearings for the crankshaft and flywheel are made of sheet brass drilled and fastened to the base. The connecting rod (C) is made of stiff wire looped at one end to take the crank pin.

The make and break arrangement consists of a small brass disc, and a copper spring. The disc has the hole for the shaft drilled in it near the edge, so as to give it an eccentric motion. It is placed on the shaft in such a position that every time the shaft makes a revolution it will make contact with the copper strip when the beam is at its highest.



Very simple walking beam electric motor, made out of old parts, forming an attractive machine.

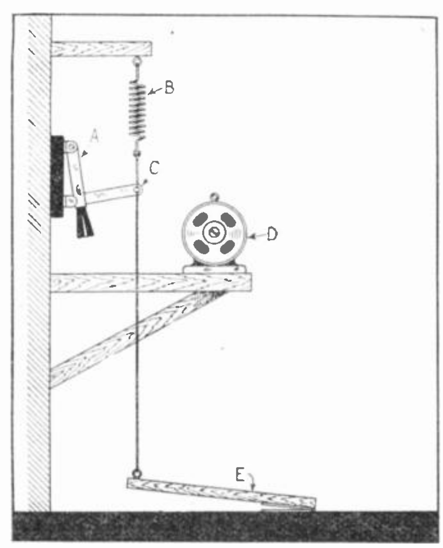
Connect up as follows: A wire is run from one binding post to the magnet; the other wire of the magnet is run to the copper strip. One of the crank-shaft bearings is connected to the remaining binding posts.

Contributed by WILLIAM MEAGHER.

Switch Pedal

THE illustration shows a very convenient method of operating a knife switch with the foot. There are many occasions, such as on lathe work and the like, when it would be quite desirable to shut the current on and off, and while this is shown as applied to a knife switch, the same arrangement can be made to operate a starting box.

A short bar of metal is attached at right angles to the switch bar near the handle. Above the switch there is a bracket carrying a helical spring; the lower end of the helical spring is attached to the end of the arm of the switch just mentioned by a wire, and another wire from the same point goes down to a pedal on the floor.



Simple yet most convenient addition to a knife switch so that it can be opened and closed by a foot pedal, leaving both hands free.

It will be seen that the depression of the pedal will draw the switch bar between the blades, while if the pedal is released the spring will pull the bar up and open the switch.

Motor Made With Buzzer

A SPOOL and an ordinary electric buzzer can be combined to make a unique and practical motor for running toys and moving show window attractions. A side view of the buzzer motor is given in Figure 1.

The spool is used as the rotor and is supported directly above the vibrating armature of the buzzer with a thick stiff wire bent into a "U" shape and fastened in an inverted position on the wood base. This is plainly shown in Figure 2.

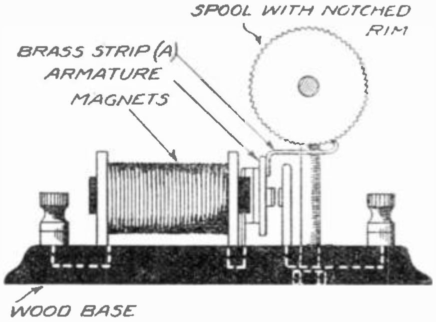


FIG. 1

Construction of a ratchet-and-pawl driven motor from a buzzer, with a spool as the rotor.

A strip of thin springy brass or a piece of a watch spring one inch in length and about one-eighth of an inch wide is soldered to the top end of the vibrating armature directly under the rim of one end of the spool. The spring is bent down at right angles to the armature and the end of the strip is formed into a small half hook which engages the rim of the spool. (A) in Figure 1 illustrates how this is done. This is the most important detail and it must be accurately done for the best results. The rim of the spool is finely notched by filing out notches all the way around.

The motor is operated by connecting it to a source of current which can be either direct or alternating. The alternating current from a transformer should be connected directly to the magnets without allowing it to pass through the make-and-break contact points.

The operation of the motor is interesting. When the vibrating armature is drawn towards the magnets, the small spring strip pulls the rim of the spool

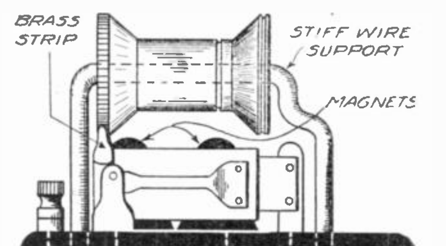


FIG. 2

End view of the above motor, showing the ratchet and pawl on the left hand of the spool.

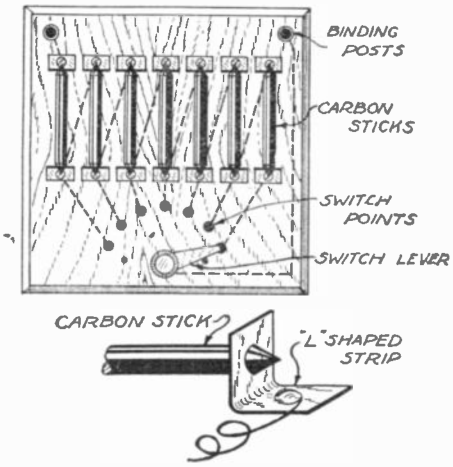
around slightly. As the armature moves back from the magnets the spring strip does not have an appreciable effect on the motion of the spool, consequently the spool rotates continually in one direction.

Contributed by H. P. CLAY.

Carbon Bar Rheostat

THE illustration shows a rheostat composed of carbon sticks. Thin strips of brass about an inch and a half long and an inch wide, after being punched with holes on each end, are bent into the shape of an L.

They are then placed directly under each other at a distance a little less than the length of the carbon stick. The rest of Fig. 2 is self-explanatory. Fig. 3 shows



Very compact and efficient carbon bar rheostat made from carbons out of flashlight cells.

the appearance of the individual L-shaped brass strip with the carbon run through the upper hole.

Contributed by JACOB SCHMIDT.

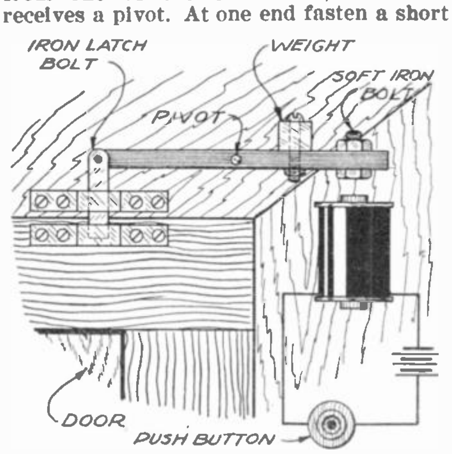
We Pay One Cent a Word

WE want good electrical articles on various subjects, and here is your chance to make some easy money. We will pay one cent a word upon publication for all accepted articles. If you have performed any novel experiments, if you see anything new electrical, if you know of some new electrical stunt be sure to let us hear from you. Articles with good photographs are particularly desirable. Write legibly, in ink, and on one side of the paper only. EDITOR.

Simple Electric Locks

I.

PROCURE a brass bar one-quarter inch square and four inches long and through this drill three holes, one at each end and another one and one-half inches from one of the end holes; this hole receives a pivot. At one end fasten a short



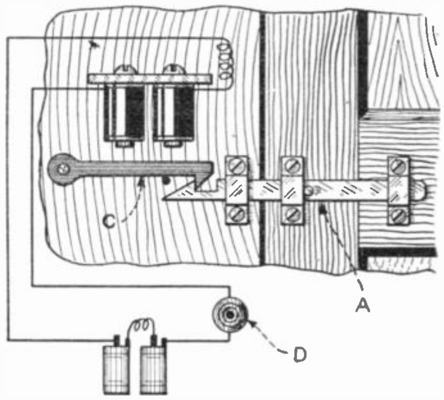
A simple lock which is opened and closed electrically by touching a button.

soft iron bolt. At the other end a longer iron bolt is attached in such a way that it would have some slight freedom or play.

The apparatus is to be assembled as shown in the illustration; the magnet is made fast with a thin strip of tin. After assembling the lock it may be necessary to add a small weight to the short end of the lever to compensate for the weight of the iron latch-bolt.

II.

THIS lock can be used very well for a sliding garage door. The details of the construction are shown in the illustration.



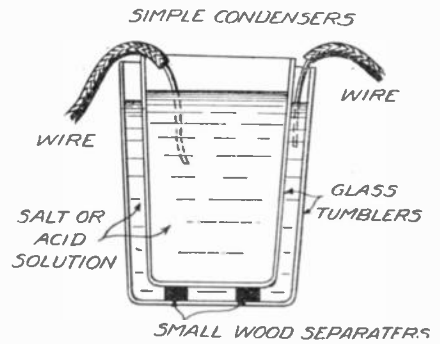
Similar lock, this time designed especially for a self-latching sliding door.

When the door is closed and the bolt (A) is pushed into position, it automatically locks. To unlock, push the button (D), which act will cause the electromagnet to raise the latch (C), when the bolt may be drawn and the door opened.

Contributed by
(I) G. C. LUDWIG.
(II) EDWARD WIDDIS.

Simple Condensers

CONDENSERS for spark coil experiments and the like can be made easily and of varying capacities in the following manner: All that is required are two glass tumblers, one somewhat smaller than the other. Set the smaller container within the larger concentric with it and not touching at the bottom. Use separators to keep them in place. Fill both of them with a concentrated solution of salt. Insert the ends of two wires into the liquid and the condenser is complete.



Condenser made of two tumblers and some salt water, a very simple method of getting efficient results.

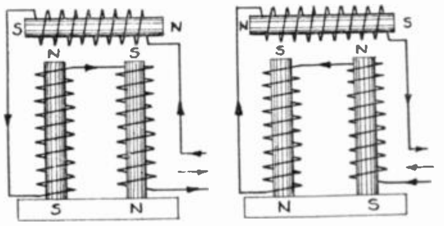
Diluted acids can be used in place of the salt solution, if the connecting wires are of a metal not easily corroded, and will give results approximately equal to a condenser with metal plates of the same capacity. The bottom of the smaller glass should be raised slightly above the other with two pieces of wood. After the desired capacity has been found, paraffine should be poured on the liquid to prevent it from evaporating and lessen the danger of accidentally spilling any of it. It is well to coat the upper parts of the tumblers inside and outside with melted paraffin wax.

Contributed by H. P. CLAY.

A. C. Current on Telegraph Sounders

I TURNED my direct current sounder into an alternating current sounder by the following changes.

I removed the magnets and tested them to see that the upper end of one was south and the other north, as is shown in Fig. 1.



Interesting suggestion for operating telegraph sounders by alternating current. The point is that the armature is wound so as to establish polarity, which will cause it to be attracted by the actuating magnet at both phases.

I then wound some magnet wire around the armature as shown in the accompanying illustrations, so that unlike poles were over each other.

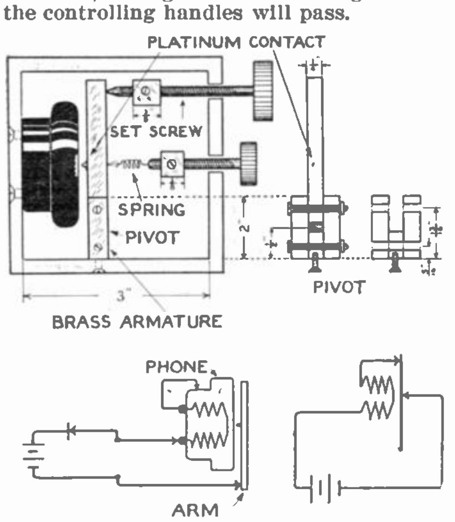
On sending a direct current through it acts the same as before, and when an alternating current flows through it you will understand that it changes polarities both of armature and magnets as shown in the two figures. But the armature will always be attracted as the poles are always unlike.

Contributed by ROBERT S. FULLER.

High Frequency Buzzer

By H. A. CARDER

A VERY neat high frequency buzzer suitable for use on 110 D. C. or twenty-five volt battery current can be easily constructed from which almost any frequency can be obtained and which will also retain its adjustment. The materials required are an old metal case receiver, with its windings in good condition, either seventy-five ohms resistance for twenty-five volts or 1000 to 1500 ohms resistance for 110-volt D. C. circuit as desired, one platinum contact and a wooden box three inches square or slightly larger than the phone, put together with screws, also some threaded brass rod about 8/32 inch thick. In the rear of the box the phone is mounted, facing the front through which the controlling handles will pass.



Very ingenious high frequency buzzer, utilizing the action of a telephone diaphragm for producing the requisite frequency of makes and breaks.

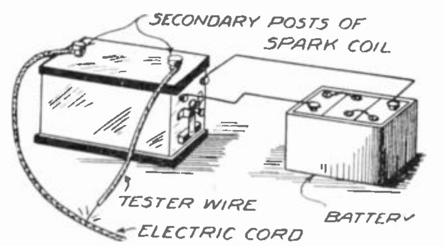
An upright brass arm (A), Fig. 1 and 2, made from ¼-inch square brass rod is set in pivots (B), Fig. 1, 2 and 3, and mounted in front of the phone so that it passes the center of the diaphragm, which must not be enameled. On this rod where the center of the diaphragm will come, drill and tap a hole for the platinum contact (E), Fig. 1 and 2. The supporting pivots for the arm are made as shown from the ¼ inch brass rod (B) Fig. 2 and 3. Running across the top of the box, to form a cross-arm in front of the top of the phone and in front of the upright arm, mount a ⅜ inch square brass strut (C), fastened on each side by a screw. Opposite to where the upright arm will pass, drill and tap a hole for the threaded brass rod (D), and in front of the box, opposite, drill another hole for the rod to pass through, on the end of which rod will be mounted a hard rubber handle. In the illustration is shown an adjustable spring attached to the upright arm controlled from the front of the box (F).

In practice when the adjusting screw (D), which controls the upright arm, is turned in, it brings the arm (A) with the contact against the diaphragm in varying tension, according to the pitch of the note desired. If the maximum of sound is wanted, a hole can be made in the top of the box and a horn set in.

On the outside of the box attach two binding posts to which the inside connections will attach. The connections are shown, one binding post of the phone to be connected to its case. Care should be observed to make connections correctly in regard to polarity of the phone, that is if a good note cannot first be obtained, reverse the current polarity.

I find that an old flexible phone cord makes an excellent connection for the buzzer, in fact for any buzzer set, no changes being necessary in the cord.

Testing Electric Cord



Simple system of testing a flexible cord for weak points, only utilizing a common spark coil and battery.

ELECTRIC cord that is used daily should be tested frequently to determine the condition of the insulation. This precaution will help to prevent bad shocks. The best method is to attach the cord to be tested to one of the secondary posts of a small induction coil. To the other secondary post connect an insulated wire of about the same length as the cord. Start the spark coil going and move the bared end of the testing wire along the cord.

Wherever there is a break in the insulation larger than a pin point a spark will appear; the size and brightness of the spark indicates almost exactly the degree or importance of the break. If the wires in a cord are broken and it is difficult to locate the break by bending or twisting the cord, it can sometimes be detected by the method described above, since it is to be expected that the insulation at the break is also damaged enough to allow sparks to pass at that point.

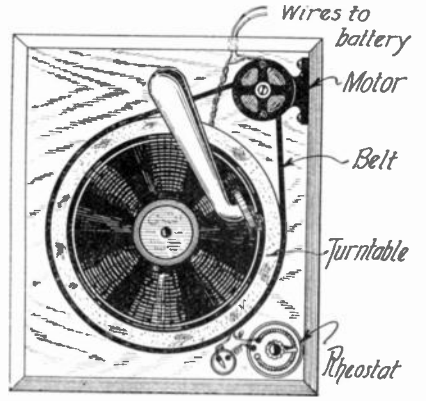
Contributed by H. P. CLAY.

Electric Phonograph

THE illustration shows how an ordinary phonograph may be converted into an electric machine which does away with winding up for every record or two.

A small electric motor is located at the back of the cabinet as shown, the pulley of which is in line with the rim of the turntable. A round leather belt is used to belt the two together, as indicated by the heavy line in the illustration, the belt being passed around the pulley of the motor and the rim of the turntable.

A rheostat is placed as shown in the



How to drive a phonograph by electricity so as to avoid the necessity of repeated winding.

front corner of the cabinet and so connected into the circuit as to regulate the speed of the motor. A switch is also placed in the circuit to start and stop the motor. The current can be supplied by primary cells or the motor may be connected to the house lighting circuit by the use of suitable resistance or transformer in the case of alternating current.

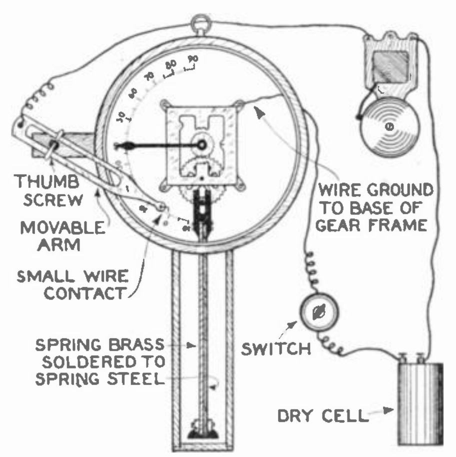
Contributed by HAROLD JACKSON.

Cold Weather Alarm

SOMETIME ago I had charge of three steam heating boilers. In winter when the weather was very cold my hours on heating were uncertain. If the thermometer began to drop down to the zero mark I had to be on my job, and it made no difference at what time of night.

I found myself breaking up my nights' rest by getting up every hour or two to see what the thermometer read; so I constructed an alarm. If I wanted to rise when the thermometer was at zero I would move the connecting point to the zero mark. So when the hand came around to zero it would ring a bell until I turned off the switch.

There are two pieces of spring metal, one of brass and one of steel sweated together with solder, making a compound



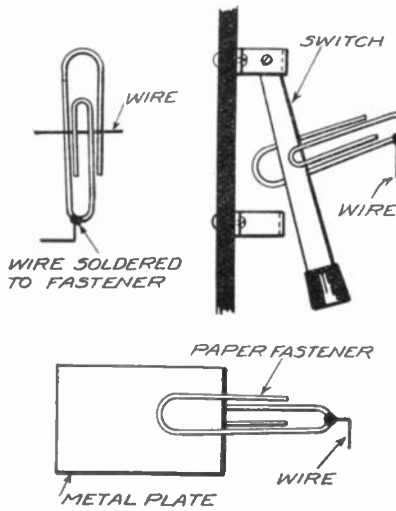
A temperature alarm. Although called a cold weather alarm, this operates in two directions, having a compound bar, and may be made to give a signal for too high or too low temperature.

thermostat bar. The brass and the steel expand unequally and in doing so operate the contacts. The strips of metal are about 1/16 x ½ inches and 10 inches long. The gears were taken from a small alarm clock.

Contributed by FRANK W. NIGHTINGALE.

Uses for Paper Fasteners

HERE are some uses for common paper fasteners. I tried this method of tapping the current from a wire, etc.,

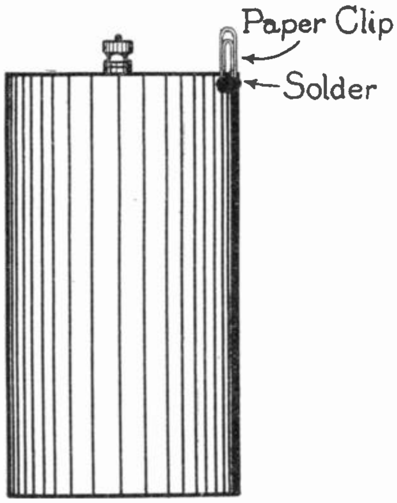


Various uses for the familiar paper clip; these are usually made of steel but are nicely plated so that they will not have much tendency to rusting.

with great success. I also use them as temporary connectors for metal plates, cylinders, etc. It is a valuable hint to the experimenter as a connector and current tap. They also make excellent page markers for PRACTICAL ELECTRICS and other books.

Contributed by PAUL LIER.

From another author we get this suggestion for the use of a paper clip as the connection to the zinc container and positive electrode of a dry battery. Care must be taken in this case that the paper clip shall not come in contact with the electrolyte.



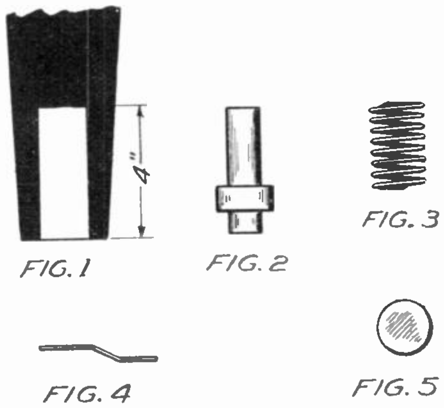
Paper clip used in place of a binding screw upon a battery zinc. It is well to solder the clip in place and not rely entirely on its elasticity.

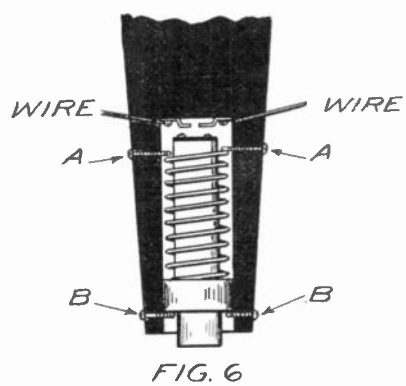
Chair Switch

MY busy time is devoted to work both at and away from the bench. At the bench the electric light is in constant use. To extinguish the light when leaving the bench and relighting it when returning a few minutes later, throughout the livelong day, becomes very monotonous. For this reason I used to let the light burn practically the whole day. Lately, however, I struck upon an idea, which has eliminated both the trouble of extinguishing and relighting and the unnecessary consumption of electricity.

A hole about 4 inches deep is drilled in one of the legs of the stool. Fig. 1 shows a cross-section of the leg in question. A piece of wood is then cut out into the form shown in Fig. 2, as a loosely fitting plug. The length of it is slightly less than the depth of the hole. A round brass plate (Fig. 5) the exact diameter of the wooden plug is then screwed to the top of the piece of wood. Around the part below the plate a spring is then placed. At the top of the hole two brass strips, the shape of which is shown in Fig. 4, are screwed and then wired. Screws are placed at the points indicated on the drawing. (A) are the screws to hold the spring and (B) are the screws to keep the whole device from falling out.

When a person seats himself on the stool the weight causes the spring to yield, thus allowing the brass top of (A) to come in contact with the brass strips and





Well concealed switch placed in a hole bored in the end of a chair leg, so as to put out the light, when the chair is not occupied.

completing the circuit. When the weight is removed (A) jumps back to its original position thus disconnecting the circuit.

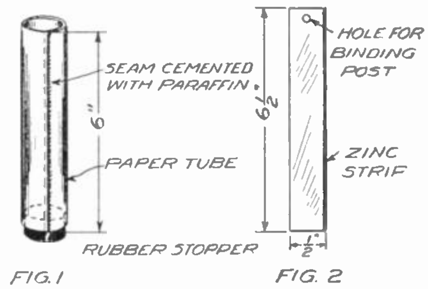
Contributed by JACOB SCHMIDT.

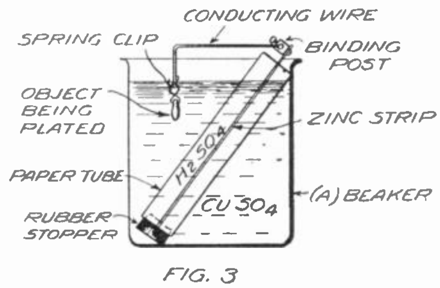
Simple Method of Copper Plating

WHILE experimenting with various types of primary cells I recently found this very simple method of copper plating. The cell used will be recognized as essentially the Daniell cell and the copper sulphate electrolyte in the cell is also used as the plating solution. A method of doing this experiment is described below.

A strip of heavy wrapping paper, three inches by six inches, (Fig. 2) is made into a tube with the edges overlapping about one-quarter inch. This seam may be held by applying a small amount of melted paraffin along the seam. One end of the tube should be closed with a rubber stopper. A sheet of zinc is cut the size shown in Fig. 2 and thoroughly cleaned. It is then amalgamated by rubbing with mercury.

The vessel (A) (Fig. 3) may be a beaker or other similar glass container. This is filled with a saturated solution of copper sulphate. The paper tube is filled with dilute sulphuric acid (10 parts water to 1 of acid) and placed as shown





Simple copper plating in which not even a porous porcelain cup is used, a process which can be carried out by anyone.

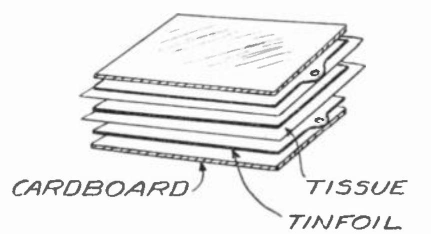
in Fig. 3. Remember, in mixing acid and water, that the acid should be slowly added to the water. The zinc strip is placed, as shown, in the tube with a copper wire conductor attached.

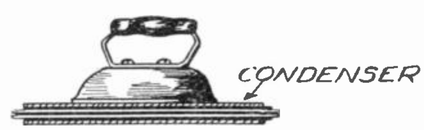
The object to be plated should be thoroughly cleaned and placed in the clip (B) (Fig. 3). Plating commences as soon as the object is placed in the solution.

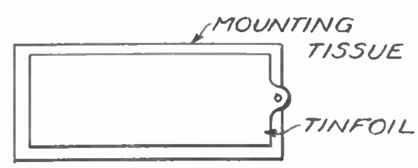
Contributed by C. LE ROY ASHLEY.

Fixed Condenser

THE illustration shows the plan used by the writer for making a fixed condenser.







New way of making a condenser, using photographers' mounting tissue as the dielectric, producing a very solid construction.

Eastman Kodak mounting tissue is the best thing for the purpose. Place sheets of tin foil and sheets of this tissue in alternation and after all is in place the sheets are secured by placing a hot flatiron on the condenser. This will cement all the sheets together in a firm pack.

One thing must be remembered—that the sheets of tissue must be a little larger and wider than the tin foil and must seal all edges.

Contributed by JAMES H. JAMES.

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.

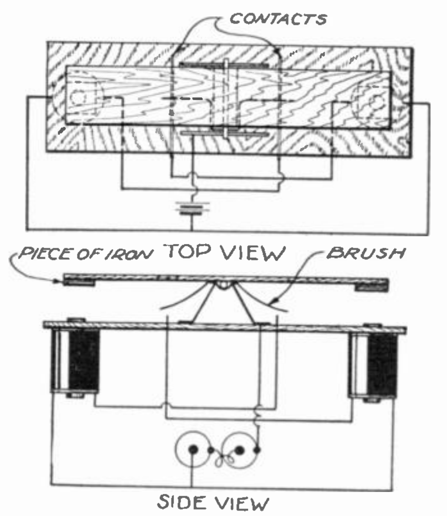
Simple See-Saw

WHILE glancing over my February issue of PRACTICAL ELECTRICS, I happened to notice that one of your readers has submitted a most interesting "see-saw."

Desiring to construct one as an experiment, I discovered that I did not possess a motor which I could use as described in the diagram, so I made the "see-saw" without the motor.

Thinking that some of your readers might be in the same circumstance that I was in regard to the motor, and might desire to construct the "see-saw," I am submitting the diagram of the one I made. This motorless "see-saw," when well balanced and the brushes set just right, will work very well.

Contributed by DUDLEY E. YOUNG.



A nice window display; very simple see-saw which will operate as long as the current is supplied.

Electric Oracle

THE prophecies of the "Ouija Board" can be outdone by this electric oracle.

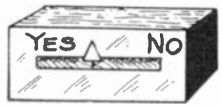
A wooden or paper box, about two inches by two inches by three inches, has a slit cut in one side. Through this slit projects a piece of No. 30 wire with a paper arrow-head or other form of pointer fastened to its end with sealing wax.

The wire is fastened to the middle of a magnetized needle suspended by a silk thread inside the box. The needle, wire and pointer must turn freely without touching the box.

The box is placed on top of the table and a pair of wires are led under the table as shown. The words "Yes" and "No" are printed on the front of the box, on each side of the slit.

Now, when the victim desires to ask a question, everyone present is seated around the table, including the operator who works the two foot contacts. By pushing the corresponding contact, he can make the pointer swing to right or left and point to either "Yes" or "No." The contacts are put under the carpet, and the wires concealed as much as possible.

The operation of the instrument depends upon the direction in which the



The intelligence box, as it may be called, of an electric oracle, which purports to answer questions as put to it. A suggestive trick for performances in so-called legerdemain.

current flows through the wires under the table. These should be placed directly beneath the box. By closing one contact, the needle is deflected one way, and closing the other, it will be deflected in the opposite direction.

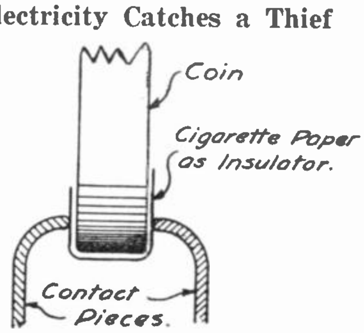
Contributed by N. DEL VECCHIO.

Tele-Vision

THE new Tele-Vision machine—the Telehor—operated by radio at a distance, invented by Mihaly, is fully described in the present issue of RADIO NEWS. This machine can be used also to see over a wire outside of radio and is of more than passing interest to readers of PRACTICAL ELECTRICS. Do not fail to read it in this month's issue of RADIO NEWS.

List of Important Articles Appearing in the May Issue of "Radio News"

Electricity Catches a Thief



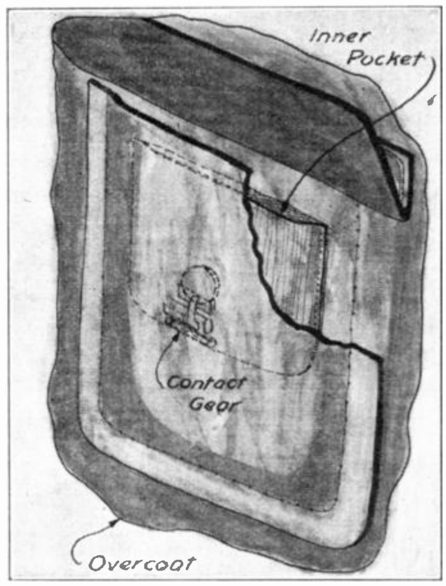
Contact pieces holding a coin but protected from electrical contact by cigarette paper. When the coin is withdrawn the contacts spring together, closing the circuit and ringing the bell. A thief was really caught by this method.

FREQUENT thefts of money from the inner pocket of an overcoat in the hall, drew suspicion to the servants of a fairly large household. It was left to an experimenter to find the thief; of course, with the aid of electricity!

Figure 1 gives an idea of the pockets; in the interior of the large outside overcoat pocket a smaller change pocket was placed. The outer flap has been omitted in the illustration.

Figure 2 shows the "trap." In addition to several coins of low value, a two shilling (50 cent) piece was held, at the extreme end, between two small brass clips; which in turn had been tied to a tiny wood strip by thread.

As soon as the coin was withdrawn, the



This shows the arrangement of the coin and contact pieces in the cash pocket of an overcoat.

contact pieces would touch each other, and an alarm bell would ring.

To insulate the sides of the coin, a strip of cigarette paper was gummed to the coin where gripped by the contact pieces; this would also serve to identify the thief, when the coin was found in his or her possession.

The whole contact gear was fixed to the lower lining of the coat pocket by a safety pin, which was also attached to the wood strip by the thread; the same winding of thread passed around contact strips and safety pin.

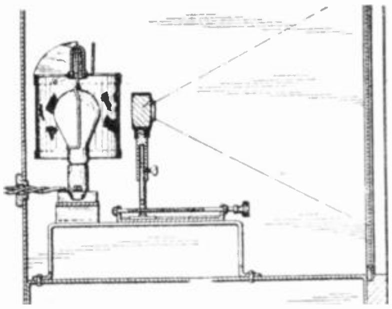
The contact gear was connected in series with a dry battery and an alarm bell; the latter was placed in a living room. As soon as the bell rang, the observer ran out into the hall, and caught the culprit in the act.

Unlike apparatus described in detective stories, where flashlight plant and photographs are generally employed, this simple apparatus was made and installed in less than forty minutes; and in less than two hours from the start, the thief had been caught.

Contributed by C. A. OLDBOYD.

Latest Electrical Patents

Electric Advertising Sign

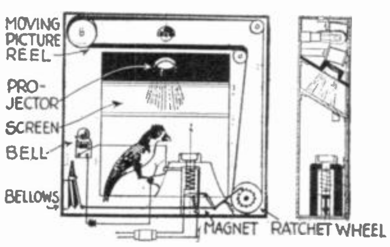


We are all familiar with the simple advertising device comprising an electric lamp having a paper cylinder balanced on the bulb tip and rotating due to a current of warm air rising through the propeller-shaped opening in the top of the cylinder. The device here illustrated is of similar construction, but in addition has a lens mounted in front of the rotating cylinder for projecting the figures of the cylinder upon a screen. The cylinder in this case is transparent with the illustrations painted thereon.
Patent 1,472,222, issued to Wilfred J. LeVie.

Mechanical Eyes

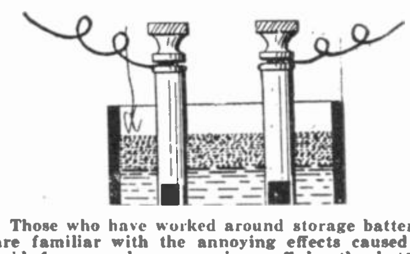
These eyes are used for optical demonstration purposes and by means of an electric motor and suitable switching arrangements are made to move in life-like fashion. The rods emanating from the pupils represent the line of vision.
Patent 1,476,621 issued to Alcuin E. Kintner.

Advertising Device



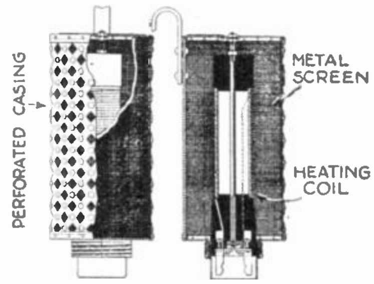
Motion, light and sound are used to attract attention to this advertising device. The animated bird appears to eat out of the dish and in doing so rings a bell and chirps. At the same time motion pictures are projected on the screen. All is accomplished electrically, even to pumping the bellows that causes the bird to chirp.
Patent 1,465,753 issued to Albert Angel.

Battery Electrolyte Covering



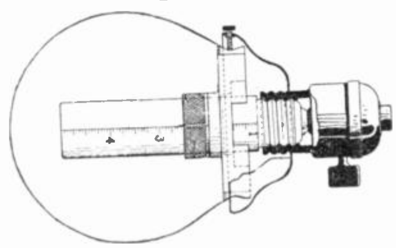
Those who have worked around storage batteries are familiar with the annoying effects caused by acid fumes and vapors given off by the battery electrolyte, which are not only injurious to health but also ruin metallic objects in the vicinity, if of metal attacked by the acid. Many forms of electrolyte coverings have been suggested for stopping the fumes, such as oil or sawdust, but the covering which is the subject of this patent is claimed by the inventor to be much superior to any other form of covering. It consists of a floating substance in the form of powder or flakes, such as comminuted gilsonite, a natural asphalt mineral.
Patent 1,475,434, issued to W. E. Kershaw and C. D. Galloway.

Electric Heater



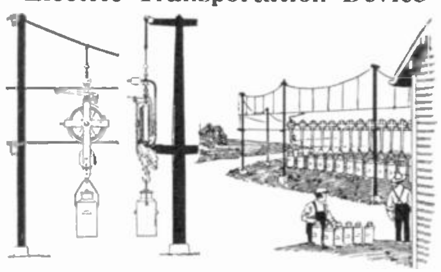
This electric heater is especially designed for use in rooms containing inflammable gas. It consists of a heating unit surrounded by a metal gauze cylinder like a miner's safety lamp, and the whole is placed in a perforated metal case.
Patent 1,472,171 issued to Julius D. Haynsworth.

Illuminating Fixture Gauge



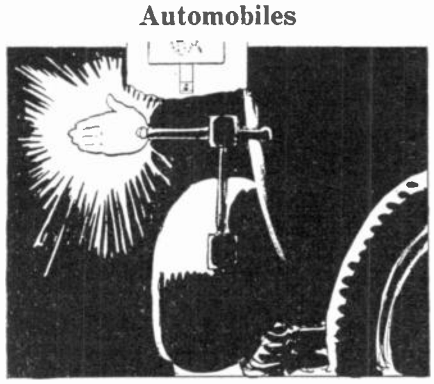
Assembling and adjusting of electric light fixtures is greatly facilitated with the use of a fixture gauge similar to the one shown in the accompanying illustration. This gauge screws into the standard lamp socket and by means of the graduated rod and sliding member, the point of engagement of the canopy with a globe or other illuminating device may be tested for accuracy of position relative to the lamp socket.
Patent 1,470,870, issued to H. D'Olier, Jr.

Electric Transportation Device



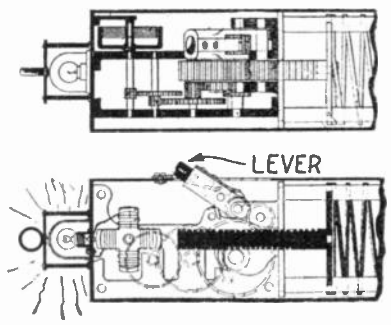
This is an automatic electrical device for transporting filled milk cans from farms to railroad stations and returning the empties. The device is suspended on a cable and takes current through a trolley system. An electric motor is used to propel each carriage with its can of milk.
Patent 1,417,062 issued to Elbert E. Hawkins.

Direction Indicator for Automobiles



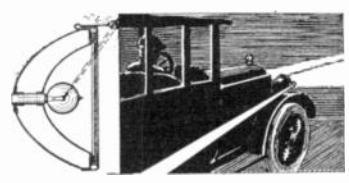
This direction indicator comprises a "hand" mounted on a rod, which rod is pivoted on a support on the car with a counterbalance on its other end. It is actuated by an electric motor by pressing switch-buttons on the steering wheel. The motor is geared to the indicator and swings the indicator upward, where it is automatically stopped by opening contacts at the right, left, or stop position, as determined by the driver of the car. At night an electric lamp in the "hand" illuminates it so that it will be plainly visible.
Patent 1,472,186, issued to Carrol E. Morris.

Magneto Flashlight



This magneto flashlight is somewhat larger and more powerful than the ordinary pocket magneto flashlight, and must be wound like a clock before it will deliver light. The one shown in the illustration is especially designed for use in mines. It has a powerful helical spring which must be compressed by hand by means of the lever, then by a suitable mechanism the spring rotates the magneto armature and generates current for lighting the lamp. It may be stopped and started at will by pressing a button.
Patent 1,472,335, issued to Antoine Luzy.

Head Light Indicator

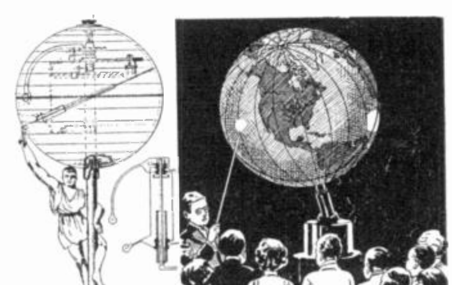


The driver of an automobile, motorcycle or other device cannot always tell at a glance whether his electric headlights are burning or not. With this indicator, which is simply a mirror mounted so as to reflect some of the light back, the lighted lamps are brought into view. The device may also serve to illuminate license tags and act as a parking light.
Patent 1,471,625 issued to Harry S. Opsahl.

Telephone Meter

To accurately time the length of a telephone call, this receiver is equipped with a clock-work mechanism that may be wound by hand from its projecting lever. The mechanism is set to open the receiving circuit automatically after the receiver is in use a predetermined length of time.
Patent 1,474,053 issued to Edward H. Martin.

Astronomical Model



An artistic device for automatically indicating the positions of the sun and moon with relation to the earth is shown in the illustration. The device consists of a translucent globe representing the earth inside of which are two lights driven through a chain of gears by an electric motor. These travel around inside and cast illuminated spots on the globe which represent the positions of the sun and moon at all times of the year.
Patent 1,484,174 issued to John J. Divo.

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. We have given monthly prizes of $3.00 for the best idea on "short-circuits." Look at the illustrations and send us your own "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!

Rests here in peace
What was Patrick Girard.
He turned on the light
While gripping the guard.
—STANLEY MORASKA.

Cold, cold, 'neath this ground
Rests dear old Doc. Toiler.
For the juice at his head
Met some from the boiler.
—HENRY AQUILINO.

Here lies the body
Of Billy Zime.
He changed both fuses
At one time.
—HENRY AHLEMAN.

In this cool grave
Lies John E. Lath.
He dried his hair
While taking a bath.
—C. E. FLYNN.

ELECTRICITY FATAL TO BOY

While playing near his home Tuesday afternoon with several other boys, Mike Graznoff, 13, of 1600 Ninth ave. S., was instantly killed when he picked up the loose end of an electric light wire which had been broken by the storm.

Mike, with Peter and Tony Vovadus, was playing in the vicinity of Atlantic ave. S., when they saw a long copper wire lying in the grass. All three of the boys ran to get it. Mike got there first, and grabbed it. A flash of blue flame followed, and the boy dropped to the ground, dead. The lad is survived by his parents and several brothers.

Owl Puts Out Electric Lights in Four Towns

Special Dispatch to THE NEW YORK HERALD.

NEW LONDON, Conn., Dec. 23.—Four communities—Central Village, Plainfield, Moosup and Jewett City—were without electric lights for four hours last night after an owl struck three high tension wires near French's Crossing at Plainfield and was killed.

Beneath this sod
Lies Sigmund Dwight.
He touched the bed
While pulling the light.
GEORGE SABOL.

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.

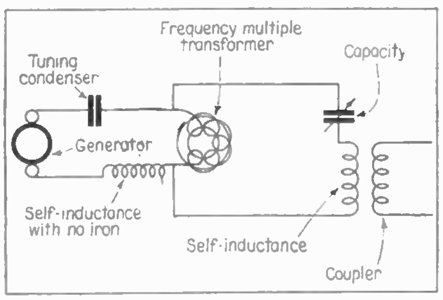
Kindly oblige us by making your letter as short as possible.

Frequency Multiplier

(410)—Arthur Dudley, Providence, R.I., asks:

Is there any form of static frequency multiplier that will multiply the frequency several times?

A. 1.—A newly developed frequency multiplier using static transformers is shown in the illustration, and it is claimed that it may be a serious competitor to the vacuum tube oscillator. The iron core is made up of extremely fine iron wires, 0.05 mm. in diameter. It was possible, with this apparatus to get as high as the forty-seventh harmonic with 50 per cent efficiency. With a 3.5 kw., 7,600 cycle generator and a multiplier of the above frequency an antenna output of 1.5 kw. and waves as short as 750 meters have been obtained easily with a very good sound, free from secondary noises. It was necessary, however, to provide the driving motor with an extremely sensitive speed regulator. Such a device has been developed which keeps the speed of the motor within 0.0001 per cent between no load and full load. This motor is based upon the Tirrill principle.

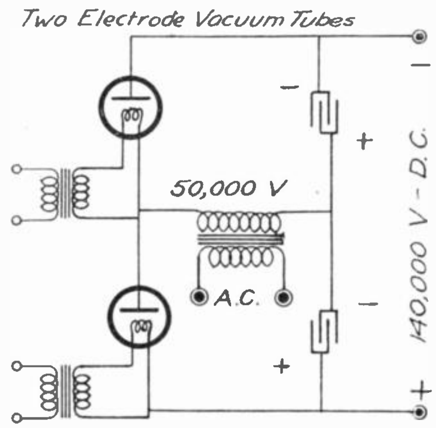


An interesting appliance for multiplying the frequency of an alternating current. The text shows extraordinary results in the way of multiplication of original frequency; if this were carried out far enough it would seem theoretically possible to produce light thereby.

High Voltage for X-Rays

(411)—Geo. L. Marion, M.D., San Francisco, Cal., asks: In the February issue there was an article by A. G. Warren of London suggesting that the best method of operating an X-ray machine would be to use a D. C. supply, obtained by charging condensers from A. C. supply rectified by thermionic valves. Please give me a detailed description of the apparatus.

A. 1.—There are several methods for obtaining a high voltage D. C. from an A. C. supply, the one shown in the illustration being probably the most convenient and simple, using two thermionic valves, or two-electrode vacuum tubes, as they are called in this country. Some types are known as Kenotrons. Two high voltage condensers are also required, capable of standing half the D. C. voltage required. A transformer to step up the A. C. voltage is also used, and the one indicated in the illustration steps it up to 50,000 volts. The filaments of the tubes are also shown lit by small transformers. Both halves of the A. C. wave are utilized, one half charging one condenser and the other half the other, so that the total D. C. voltage will be equal to double the peak voltage across each condenser, as they are connected in series. In this case the D. C. voltage is approximately 140,000 volts. It is best to purchase the equipment outright rather than to attempt to construct it.



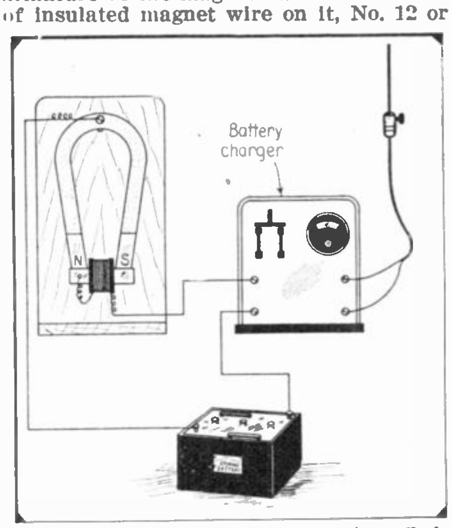
Another curious problem, this time in the production of high voltage for X-ray apparatus, the X-ray tube, of course, giving the high frequency waves.

Reverse Current Relay

(412)—Robert Phillips, Mineola, L. I., inquires:

Q. 1.—I have a storage battery charger and occasionally the A. C. line is interrupted and the battery discharges back through the charger. Will you show a method or device which will automatically open the battery circuit when the A. C. supply fails?

A. 1.—Some sort of a polarized reverse current relay should be used for this purpose. The one illustrated in the figure is very simple to construct and is absolutely reliable. It consists of a horseshoe magnet suspended on a suitable support. The armature of the magnet has several turns of insulated magnet wire on it, No. 12 or 14 gauge, and is connected to the charger and battery as shown. The charging current energizes the armature, forming an electromagnet out of it which is attracted to the permanent magnet. If the A. C. fails, the battery will discharge through the charger but in doing so the polarity of the electromagnet is reversed and it will be repelled from the horseshoe magnet. It will fall from the magnet and open the battery circuit, preventing the battery from discharging through the rectifier. The pole tips of both magnets should be clean, because the circuit is opened and closed where they make contact.



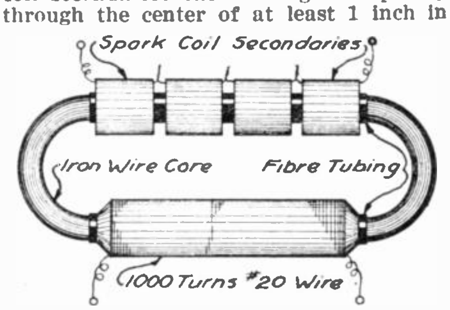
This is a simple apparatus for cutting off the current in a storage battery charging apparatus when the voltage falls, so that there is no danger of the battery discharging through the circuit.

High Voltage Transformer

(413)—Linwood Daniels, Dover, N. H., wants to know:

Q. 1.—How to make a transformer which may be operated on the 110-volt 60-cycle lighting circuit and will give a three inch spark.

A. 1.—A simple way to make this transformer is to obtain about four spark coil secondaries each having the opening through the center of at least 1 inch in diameter. These coils are all connected in series and form the secondary winding of the transformer. The primary consists of 1000 turns of number 20 D. C. C. magnet wire wound on a fiber tube which is of 1 inch internal diameter. The tube should be as long as the four spark coil secondaries are when they are placed end to end. The four coils are also placed on a fiber tube. The core consists of a coil of bare soft iron wire wound through the fiber tubes until they are filled tightly. The diagram shows the connections. The transformer may be mounted in any convenient manner.



General layout of a high voltage transformer, using four spark coil secondaries spaced apart so as to constitute a version of the "pie system" of winding a coil.

D. C. Fan on A. C.

(414)—M. F. Damon, Weymouth Heights, Mass. inquires:

Q. 1.—Please advise me how to change a direct current fan motor to make it run on A. C. I have tried it as it is now on A. C. and it will not run.

A. 1.—We do not advise you to attempt to rewind or change over the D. C. motor as it is a very difficult job and should be done by an experienced armature winder. Only certain types of motors can be changed over. Why not use a four jar electrolytic rectifier and change the current to D. C. and then run the fan?

Instantaneous Heater

(415)—S. E. Miller, Salina, Kan., inquires:

Q. 1.—In several issues of PRACTICAL ELECTRICS, electric water heaters have been described. I want an instantaneous heater, one that will heat water to the boiling point instantly. Is there any such heater?

A. 1.—We know of no heater that will heat water instantly. If a heater is made large enough to heat the water as quickly as you wish, there would be no time to stop the action after the water reached the boiling point, and the water would instantly dry up. The action would be similar to that which takes place on throwing a cup of cold water into a white hot furnace fire.

Transformer Design

(416) — Geo. Anderson, Cumberland, Md., asks:

Q. 1.—What is the rule used in determining the number of turns of wire in the primary of any transformer?

A. 1.—The complete transformer formula is as follows:

$$\text{primary turns} = \frac{\text{primary voltage} \times 10^8}{4.44 \times \text{frequency} \times \text{flux} \times \text{cross-sectional area of core in square inches}}$$

The flux, for extra fine silicon steel, is figured at 60,000 lines per square inch of core area. For a low grade it is sometimes figured as low as 30,000 lines, but for average purposes 50,000 may be used. This formula was described in detail in the October, 1923, and February, 1924, issues.

Condenser Construction

(417)—Leon Breault, Woonsocket, R. I., asks:

Q. 1.—Please tell me the size and number of lead foil plates to make a one-quarter microfarad paper condenser.

A. 1.—You will require two lead foil sheets 6 inches wide and 15 feet long and two waxed paper sheets slightly larger than the foil sheets. The four are placed together alternately and the whole tightly rolled up, taking care not to let the two foil sheets touch each other.

Q. 2.—If I double the number of plates in a one-quarter microfarad condenser will it be equal to a one-half microfarad one?

A. 2.—Yes. The same result will also be obtained by making two one-quarter microfarad condensers and connecting them in parallel.

Sauer Cell

(418)—M. H. Morse, Oakland, Cal., inquires:

Q. 1.—What is meant by the term photo-electricity?

A. 1.—Photo-electricity is the term applied to electricity generated under the influence of light. Photo-electric cells are recognized as close competitors with the selenium cell in many branches of research work, where the latter cell alone was used in the past. Those acquainted with selenium cells know that they act as a resistance that changes its value under the action of light and thus serve to control currents in proportion to the light falling on them. On the other hand the photo-electric cell accomplishes a similar result by generating a current in proportion to the light striking them and will, therefore, serve in place of selenium cells.

Q. 2.—Is the Sauer cell a photo-electric cell and if so please give its construction and action.

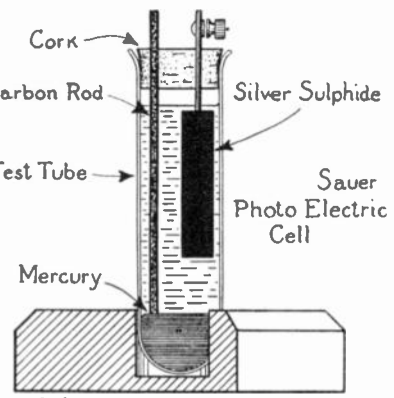
A. 2.—We give in the illustration details of the highly sensitive Sauer cell. A large test tube contains at its bottom a small quantity of mercury to which connection is made by a thin carbon rod. A platinum wire may be sealed through the bottom of the tube to make this connection, if preferred. A plate of silver sulphide is supported in the upper part of the tube in a position to be acted upon freely by the light. The solution in the cell consists of 100 parts water, 15 parts common salt and 7 parts of copper sulphate. The cell is mounted upright in a wood block.

This cell when exposed to light gives an appreciable current. The rapidity with which the variations in current strength follow variations in the intensity of the light falling upon it, make it a close second to the selenium cell and perhaps with some refinement it may work still better.

The reaction taking place in this cell is rather complicated and is supposed to be the following. The copper sulphate and salt (sodium chloride) form cupric chloride which is reduced to a cuprous chloride by the mercury. The cuprous chloride under the influence of light acts upon the silver sulphide to form a silver chloride with generation of an electric current.

Another cell has given much promise, and one or two persons have claimed they generated current on a practical scale with it. It employs two copper plates.

One copper plate is oxidized by holding in a bunsen flame until black. The other copper plate is cleaned with sand paper;



One of the most interesting of the photo-cells. It gives a fairly good current in sun-light.

the two are mounted on opposite sides of a glass strip. The water in the cell has mixed with it a few grains of copper sulphate and the tube is covered with black paper except for a narrow strip down the side nearest the oxidized copper plate.

This cell will give a fairly strong current in bright sunlight. By coloring the exposed plate with such dyes as eosin, malachite green or naphthol yellow the effect will be increased. As in the case of the silver cells the violet end of the spectrum has the greatest effect upon the cells.

The photo-electric current is produced in all these cells in one of two ways. One class of cells, such as the modified silver cell and the Sauer cell, depend for their action on a chemical effect that only takes place in the presence of light. Since the ultra-violet light and the light at the violet end of the spectrum have the greatest effect upon the cells, these rays must have a greater reducing effect than the other rays. Oxidization or reduction of any electrode in a solution will result in a current-flow.

The other class of cell employing electrodes of one substance depend for action on the fact that some subtsances throw off electrons under the influence of light which leaves behind on the plate an opposite and equal positive charge which creates a potential difference between the plates. In attempting to again reach electrical equilibrium the cell gives off a current. The tiny charged particles thrown off are in what is termed a colloidal condition and further study of metallic colloids will no doubt add much to our knowledge of photo-electric phenomena.

Static Electricity on Paper

(419)—J. C. Lacy, Richmond, Va., writes:

I have machines running paper from rolls. These rolls are put on one end of the machine and the paper runs through the machine a distance of about 12 feet where it is cut into sheet form to any length desired by a rotary cutter. When these sheets fall into the box made for this purpose, one sheet following another at about 100 sheets per minute, the static electricity that accumulates on the paper delivered from the rolls causes no little amount of trouble after the paper is cut into sheets. There are a number of appliances out claiming to give a solution of this problem, but I have never seen anything work satisfactorily. I have tried practically everything that one would think of without success. There is a great possibility in successfully mastering this trouble and no doubt the solution is very simple.

Q. 1.—Will you kindly explain how the static may be taken out?

A. 1.—This is a problem that has bothered many printers operating printing machines and no satisfactory solution has as yet been devised. In some cases a grounded metal comb was used that was placed close to the paper as it unrolled. The points of the comb were supposed to collect the static and conduct it to earth, the action of the comb being similar to the action of collectors on frictional static machines. This method was not practical and the results were poor. Another method was to moisten the air in the room with steam so as to prevent the accumulation of the static and allow any that does accumulate to leak off into the air. This method also gave poor results.

In the early days printing was done on damp paper and no trouble was experienced with static; now the paper is used dry and static troubles develop. If it were possible for you to slightly dampen the paper before it is run through the machines the static trouble would be eliminated.

Bell Transformer

(420)—Peter Martini, Greensburg, Pa., writes:

Q. 1.—I have a 110 volt bell ringing transformer that has a six volt secondary. Can I use this transformer for charging a storage battery?

A. 1.—No. The transformer is of no use for that purpose. A rectifier should be used, which may be an electrolytic rectifier, Tungar rectifier, or magnetic rectifier. Many of these have been described in back numbers of PRACTICAL ELECTRICS.

Bell Transformer

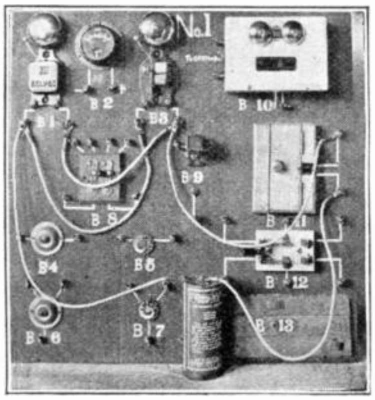
(421) — E. Alvarez, Habana, Cuba, writes:

On checking up a house wiring circuit which I supposed to be grounded because the wattmeter dial was running, the fault was found in the bell transformer which was rated to work on 110 volts and was connected across the 220-volt circuit. As soon as I disconnected the transformer, which was painfully hot, the dial of the wattmeter stopped.

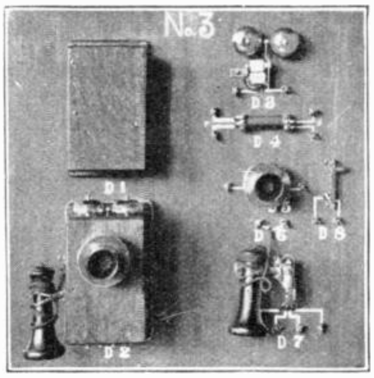
Q. 1.—Why did the transformer make the wattmeter run when connected across the 220-volt line?

A. 1.—Since the transformer was designed for use on a 110-volt circuit, it had just enough iron in the core and enough turns on the primary so that the

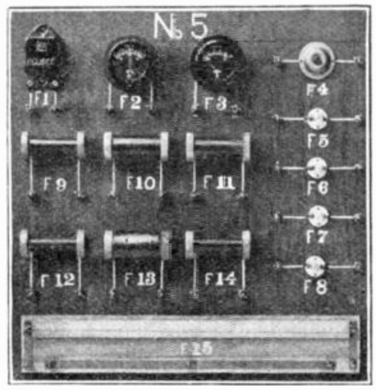
(*Continued on page* 400)



Illustrations show three of the series of electrical Home-Laboratory equipment furnished to every student. They are not just models, but



life-size, actual apparatus, the same as you meet in everyday work. Cost thousands of dollars to prepare, but sent free to students.



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E. Pittsburgh, Pa., March 9, 1924.

Mr. F. C. Raeth,
Education al Director, Extension Division,
School of Engineering of Milwaukee.

Dear Sir:

In answer to your complimentary letter of March 5, 1924, I wish to thank you very much for the high standard you have accredited to my work in the Extension Course of the School of Engineering of Milwaukee. I might add that all through the course I have had no help because I wished to get the full benefit of the work by relying on my own efforts.

Before writing you my opinion of the course I decided to wait until I had nearly, or completely finished, so that I might give my opinion of the entire course. Having completed lesson 49 which finishes all of the theory and having completed most of the laboratory work, I am safe in saying that I believe your course to be the clearest, most practical and up-to-date course of its kind published. I have compared it with a number of other courses.

The outstanding feature of the course is the attention which you have given to details. Nothing is left to the imagination. A fellow can sit down and try to wade through a lot of text books and get a hazy conception of the subject he is studying, but it takes a course like yours with faculty of expert instructors—that is another important feature—it is not the knowledge of just one man, but of many which makes the course so much broader than a good many others.

After completing the course it becomes an easy matter to read most text books intelligently, for you have the fundamental knowledge and theory of electricity and can then supply whatever detail may be lacking in the text. This makes them very useful for reference.

At present I am plotting hysteresis curves of various kinds of magnet steel in the Standard House of the Westinghouse Electric & Mfg. Co. Will have an opportunity to get practical work in meter testing, electrical measurement, etc. This is where my S. of E. training will count a great deal.

On my diploma I should like my name appear: Henry De Witt Carrington.

Thanking you for the personal interest you have taken in me throughout the course and wishing you and your excellent home-study course the best of success.

Very sincerely yours,
De Witt Carrington.

This amazing new System of Training for success in Electricity was originated and produced by America's Greatest Institution for Electrical Education. For years, nineteen of them, we had trained boys and men from the world over, here in our great residence school to enter this big field on the right footing. We realized that many boys could not leave home to get an education, and therefore, after years of experiment and at a cost of many thousands of dollars, this special Extension Course was developed.

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City.................... State..........

How and Why?

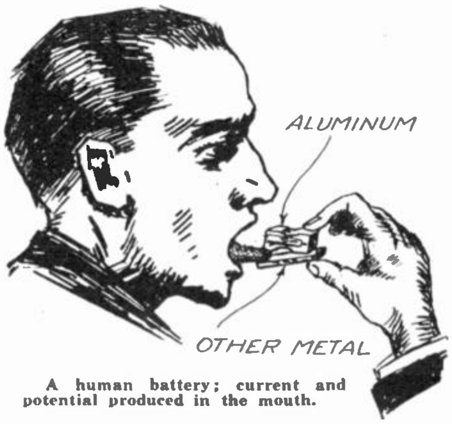
(*Continued from page 398*)

iron core would not become magnetically saturated when connected to the 110-volt line, and the self-inductance of the transformer would be so great that only a very slight amount of current would pass. When connected to a 220-volt line, the core became saturated and the transformer acted practically as though it had little iron core and the self-induction was not great enough to limit the current to a small value. Hence, a large current passed through the winding, which was not designed to carry a large current, and it became hot. This current, of course, caused the wattmeter to register.

Human Battery

(422) — Humphry Fry, Wayne, Pa., writes:

Q. 1.—I found that when I touched an aluminum pencil sharpener and some other piece of metal together and put my tongue between them, I felt what seemed like a slight shock, like that received from a dry cell. I could not feel this when anything else was substituted for the aluminum, or when both the pieces of metal were not touching each other and my tongue. Please explain this.



A human battery; current and potential produced in the mouth.

A. 1.—The two metals and your tongue formed a cell or couple from which an electric current flowed through the tongue when the circuit was completed by touching both pieces of metals together, as shown in the illustration. The current was generated due to the chemical action that took place between your moist tongue and the metals. The following table shows the contact series of metals, and since aluminum heads the list, the effect will be greatest with aluminum and the substance at the other end of the series, namely, graphite:

Aluminum
Zinc
Lead
Tin
Iron
Copper
Silver
Gold
Graphite

Motor Winding

(423)—John Vengoecher, Philadelphia, Pa., inquires:

Q. 1.—How many turns of wire should be placed on the armature and field of a 12-volt motor in order to operate it efficiently on five volts?

A. 1.—The motor should be rewound with one-half as many turns as it now has with a wire three sizes larger than the present wire. This applies to both armature and field windings.

Q. 2.—I have a Ford spark coil that fails to operate, although the armature is attracted to the core when the current is on.

A. 2.—The vibrator contacts are probably short-circuited inside somewhere. The case should be opened and the connections inspected. Perhaps the paper condenser is shorted. If so a new one should be added.

Q. 3.—Please tell me how to make an induction coil that will give a fairly good spark on five volts.

A. 3.—The core should be made up of a bundle of soft iron wires six inches long and one-half inch in diameter. The primary is wound on the core after binding it with insulating tape, and consists of two layers of No. 20 wire. Insulation is wrapped around the primary and the secondary coils are then placed on. It is advisable to purchase the secondary coils as they cannot be wound very well by hand because they require too many turns of fine wire. The interrupter may be constructed or taken from an old coil. A one-quarter microfarad paper condenser should be connected across its contacts.

The Man Who Saw Beyond

(*Continued from page 368*)

through the outskirts of the city. In about a half hour I reached Green Terrace, and following the road that cut across the grounds, finally drew up before the porch of a large rambling house. I ascended the steps and pressed the button.

The door opened and I was received by a quiet voiced gentleman of about forty years, and invited to step into the library. As I entered the room, I saw to my surprise, Doctor Emory Morton, who was sunk in a Morris chair nervously twisting his derby hat.

My soft spoken guide immediately introduced himself. "Doctor Graham, I am John Palmer, owner of this estate. I have called you and your friend," with a wave of his hand toward Morton, "to witness a wonderful experiment. It will be necessary for both of you to stay here for the next day or two, and I am prepared to make it well worth your trouble and inconvenience."

"Impossible," I exclaimed. "Do you mean to say that you have called us at such a time to watch your confounded experiments, while giving us the impression that the case was one of life or death? I find it quite impossible to leave my practice for such a time as you suggest."

Prisoners in the Interest of Science

"I quite agree with Doctor Graham," interposed Morton. "I really fear, Mr. Palmer, that you have called upon the wrong men."

"Your pardon, gentlemen, if I appear rude," said our host, "I hope to be spared any difficulty in persuading you to stay. However, I have made the choice only after careful consideration, and cannot change my plans now. The fact is, gentlemen, you must stay here, whether you care to or not. These windows all have steel shutters, the door has an automatic electric lock, of which I alone possess the secret, and we are alone in the house. Stay, Doctor Graham," he added, as I stepped forward angrily, "there is no need for violence, nor will it do you any good. I am the only one who can unlock this house. If anything happens to me, it becomes your tomb."

Impotent, I sank into a chair opposite Morton, and faced our host, or rather our jailer. "It seems, sir," I declared with some heat, "that you have led us

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The Man Who Saw Beyond

(Continued from page 400)

into a neat trap, and now I would be interested to hear you explain."

"Gladly, Doctor, and may I remark, that having heard me, you will perhaps be more willing to remain. Come remove your coats and make yourselves comfortable."

Electronic Structure of Matter

"As you are medical men and probably more or less inclined toward scientific research, you are doubtless aware that the accepted belief of the scientific world today, is that all matter is electronic in structure. That is to say, all matter is composed of minute, electrically charged particles, called electrons, which are held together only by their mutual attraction. You and I, as large chunks of matter, are no exceptions to this rule. Also, there are those who claim that the force which controls this mass called our body, is a force which cannot be destroyed; that after the body has ceased to function, and is in that state which we know as death, this governing force continues to live, perhaps on another plane of existence, but nevertheless it lives and is indestructible.

"The theory is good, gentlemen. But after all, theory is only theory, and the world at large must have proof. Heretofore the trouble has been that in order to put the theory to the test, man must die, and, having taken that step, no return was possible. If, however, this matter which imprisons the spirit, the soul, the ego; call it what you will; if, I say, this matter may be dissociated and the ego made free to go and come at will, the only difficulty which remains to balk us, is that of reassociating the particles so that they may again form a habitat for the ego; or to put it plainly, so that from the particles the body may be formed again.

"This then was my object in calling you here. As men high in your profession, I wished you to witness the dissociation of the body, the freeing of the spirit, and after a time the reuniting of the ions and the return to the form of life which you know. May I ask if you are interested?"

Morton interrupted him, "I refuse to take part in any such tomfoolery. It is utterly preposterous. None other than a madman could conceive it."

"And you, Doctor Graham; what is your opinion?" asked Palmer with a half smile.

Insanity?

I hesitated. Insanity I had coped with before, and this man with the quiet voice, soft eyes and perfect composure, showed none of the commoner traits of the mentally deranged. Then again, if he were insane, the course of least danger lay in humoring him; and I was interested, in spite of my better reason.

"Sir," I answered, "it would be rashness on the part of any man to say, 'This is, or is not impossible.' In the past century the impossible has been made possible too often. I am prepared to hear more on the subject before passing judgment."

"Doctor, I am delighted to hear you speak so," cried Palmer. "but instead of merely hearing of my work will you step into the laboratory and see the apparatus."

I followed him into the next room, Morton reluctantly keeping pace with me. There, against the wall, stood a tall glass front lead box. Opposite on the other side of the room stood two X-ray machines, or so I took them to be. Lead shields were placed around these machines, so that they might be completely enclosed. Our guide threw a switch and the noise of a motor-generator filled the room. He then carefully enclosed both machines in their lead covers, leaving only a small rectangular opening which faced the lead box across the room.

"Stand close by me," he ordered, and as we obeyed he shot home two more switches.

From the machine on our right a brilliant ray shot forth, just covering the lead box; and this ray bears description, if indeed it may be described, for it was not violet, nor green, though there still lingers in my mind an impression of these two colors. In fact it was no color that I may describe, since no man, other than Doctor Morton, has even seen the like. It was a new color.

From the other machine came a ray of black light, if I may be pardoned the term, for that is the only thing that describes it. An inky pencil of gloom, that pierced the light in the room and also came to rest on the lead box.

Within the box no effect took place. It was lit even as the rest of the room. Both rays merged together and disappeared.

An Accident with Strange Rays

"These rays—," began Palmer, when we were interrupted by a piercing shriek from Morton. The latter had been stirred to curiosity by the two strange rays, and, during his investigation, had managed to get his right hand and wrist in the path of the bright ray. Almost instantly, beneath his very eyes, his hand and forearm melted away, becoming only a translucent mass of brilliantly lighted particles bearing the shape of a hand and wrist. At the time I heard a small tinkle on the floor, but thought no more of it until later.

Like a flash, Palmer seized the luckless doctor and swinging him around, thrust the affected member's shoulder deep into the gloomy ray coming from the other machine. I rubbed my eyes, and my hair raised an inch; for Morton's arm was whole again. The brilliancy had faded, the only change noticeable being that the hand was colored a baby pink instead of the previous brown.

"Hold him," said our strange host, and hastened to pull the switches controlling the machines. Then he stopped the generator and led the way back to the library. Morton was too much dazed from his recent experience to utter a word, and I was so startled that I waited mutely for the explanation, nor was it long in coming.

"My friends," said Palmer, "you have just witnessed in rather a forcible manner the results of my research. You have seen the means that I intend to employ to dissociate the body and later to reunite it. I will admit, I had no intention of driving the lesson home so forcibly. However, now that you have seen, tell me, what is your opinion?"

"I concede," I answered hoarsely, "that you have two powerful agents under control, but explain the principle. I am dumfounded."

Dissociating the Body

"I will explain that which is necessary," he replied, "without going deeper than is absolutely necessary into the technical details. That ray, which our friend so unfortunately came in contact with, I have called the dissociation ray. Under its influence certain kinds of matter are freed from their present form and become merely little electrically charged particles of matter. The energy so suddenly released in this manner is transformed into radiant energy, and expends itself as light and heat.

"These particles are very active, and rushing here and there, some throw themselves far enough away to escape the natural attraction of the other particles.

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The Man Who Saw Beyond

(Continued from page 402)

Thus, if what was Doctor Morton's hand had been allowed to stay in normal atmosphere for any length of time, it would have gradually reduced in size as the particles escaped, and would have finally disappeared altogether. As it was I thrust it immediately into the path of the dark ray, which is the reassociation ray.

The effect of this ray is just opposite to that of the other. It forces the particles back to their normal position. As you will notice, the Doctor's hand is rather pink due to the fact that a part of the outer layer of the skin freed itself of the mass before I could get it under the influence of the other ray."

Morton, who had been gazing at his hand and wiggling the fingers, now broke in, "My ring, the gold ring that was on my finger. Was that consumed?"

I recollected the tinkle on the floor, and Palmer stepping into the laboratory, reappeared with the ring slightly pitted.

"When your hand became transformed," he said, "your ring having no material substance to uphold it, simply dropped to the floor. The ray is only slightly active on most of the metals, on lead not at all, and not on some gases. The organic matter of which our bodies are composed, is most sensitive to the ray. As you see, the ring is somewhat pitted. It will be a good memento of the occasion.

After our host had prepared an excellent breakfast, he led us again to the laboratory and there prepared for his big experiment, moving back and forth and changing over several switches. He donned a suit of heavy leather, complete even to a covering for the face. "In case," he explained with a dry smile, "the particles of my dissociated body decide to escape, the leather particles will start on the journey first. If the ray remains focused on the particles they will not wander out of the path of its attraction, but will maintain a constant position. This is merely by way of an added precaution, in case anything happens for a short time to cut off the ray. If it stops longer than that,—well," with a shrug, "the experiment will be a failure."

Experimentum Crucis

"You are actually going to expose yourself to that ray?" I demanded, horrified. "Man, I refuse to countenance such a madcap scheme."

"My dear Doctor," he replied, "you have nothing to say about it. You have merely to help me get back. I don't think you will object to that. Now you know what I meant when I said that it was a case of life or death.

"I have attached the ray machines to a storage battery of sufficient capacity to run the machines during the test. I cannot afford to take a chance on outside power service. By the way, Doctor, what time is it?"

I glanced at my watch. "Seven twenty," I replied.

The Letter of Instructions

"Good," he answered. "Here, take this envelope and open it at eight o'clock. I beg of you, follow the instructions closely if I am to live again, and now stand clear, please, away from the lead case."

As we obeyed, he stepped into the case and closed the glass door, pulled the leather hood over his face, and raising his hand, pressed a button on the wall.

Instantly that terrifying beam of light leaped forth from the machine.

The figure of Palmer became transformed, even as had Morton's hand. Where he had stood, remained only that weird, radiant mass, bearing the outlines of a human body. In the center of what would correspond to the head of the mass, glowed a little round spot of vivid blue, now bright, now dim. As we looked it moved. Straight up it went, until clear of the radiant mass below; hovered an instant within the scope of the ray, then —it was gone.

Terrified Spectators of the Change

With a groan as of mortal pain, Morton turned and stumbled from the room. Blindly I followed him. We sank into the nearest chairs and waited, for what we knew not.

A loud gong, followed by the striking of the clock aroused me. Eight o'clock. I remembered the envelope that Palmer had given me, and seizing it, ripped it open. The message enclosed read as follows:

My Friends:

It will be eight o'clock when you read this. At four A. M. tomorrow, open the switch which controls the dissociation ray and close the one next to it, which starts the reassociation ray. The switches are plainly marked on the switchboard. Between that time and the present, do you stand watch and see that the present ray continues to operate. For it to cease means death to me.

If the experiment fails, the safe in the library will open of its own accord at eight o'clock, due to a time lock which I have perfected. The safe contains the secret of opening the doors, and you are free to go. Do not hesitate, for at nine o'clock a mine will explode, which will wreck the building, and incidentally the ray machines. Also you will find in the safe an envelope addressed to you both. In that envelope is my will, leaving to you both in trust, all my estate, to be used for the building and maintenance of a hospital which you will supervise.

As you value your lives and mine, follow these instructions closely.

John Palmer.

Having read the message to Morton, I volunteered to take the first watch of the ray, and begged Morton to try to get some sleep. At noon we ate, and Morton took up the gruesome watch.

I will not detail the strain of those hours, between eight and four the next morning. Morton and I kept watch and watch, and slept not at all. At half past three the next morning, we both entered the laboratory, and fixed our eyes on the radiant figure in the lead case. Almost unwinkingly we watched as the minutes dragged on, and we sat there, watches in our hands, with our hearts pounding furiously, wondering what the hour would bring forth.

Suddenly Morton gripped my arm. "My God, Graham, look," he gasped. My gaze followed his finger, and I went hot and cold alternately. Just inside the edge of the ray was that spot of vivid blue. Even as before it seemed filled with a pulsating fire, and as we watched, it drew nearer, and finally settled into place in the head of the figure, where it continued to glow steadily.

Remembering with a start, I glanced at my watch. Two minutes of four. I sprang to the switches, and as the second hand crossed the mark, and the library clock started to strike the hour, I threw out the one and in the other, as the letter directed.

The bright ray went out and that inky pencil cut its way across the room, and covered the box like a blanket, shutting out from our view what was transpiring within.

John Palmer Returns

And then as we watched, out stepped John Palmer, and raised the leathern cowl. Stepping over to the switchboard, he cut out the dark ray and advanced toward us. Gone were our fears and doubts; only an overwhelming curiosity as to his experiences seized both Morton and myself. Grasping his hands we poured out our relief and congratulations, but he stopped us with a wave of his hand. A mingled look of exultation and sadness was on his features, as he placed a hand on our respective shoulders.

"My friends," he said, "you have performed your task well. I have watched over you and know your fears. Were it not for the fact that I must let you know it was no fault of yours, I would not have returned. Ah, you are surprised, but such is the case. I may not tell what I learned while my spirit was wandering through space, and knowing what I know I cannot stay here on earth. The world is not ready for the revelations which I sought. I found them in greater measure than I fancied in my wildest dreams. I must pay for my temerity with my life, or life as you know it.

"Do not think that I say this with regret, for there is no regret in my heart, excepting that I must leave my associates on this plane, not to return to them again.

"So my friends, I returned to tell you that as far as your efforts were concerned, the experiment was a success; and now I must prepare for my final trip to that higher plane from which I have just returned."

Swiftly he turned to the dark ray machine. Reaching into its interior, he plucked forth a vacuum tube and dashed it to the floor; thus destroying the heart of the machine. Then opening a steel cabinet set into the wall, he carefully adjusted several dials, and locked the door again. Once more he turned to us, and entering the library, opened the safe and handed me an envelope.

"Here, my friends, is the envelope which I mentioned," he said. "Also instructions which will enable you to open the door. I have so adjusted the mechanism, that the mine will explode in half an hour, destroying the house and apparatus. I charge you, when I have gone do not linger, for the mine is of terrific power. Goodby, my friends, and thank you."

"But surely," I cried, "this is madness; it is suicide. You cannot go through with it."

Goodby to Earth

"I must," he answered simply. "To live here on earth now, is impossible. It would be more than madness to remain. Be broadminded enough to recognize the fact, and believe that I know best. Once more, goodby."

He took each of us by the hand for a moment and almost before we realized what had happened, he had stepped inside the box, leaving the door open. I made a step forward but he called out sharply in warning, and fear held me back. A snap, and again that fearful light shot through the room and settled on him. Again the transformation took place, and for a time we stood there transfixed. Under our eyes, a human being had changed into a mere body of light; and this time we knew that there was no return.

A tug at my arm, and I turned to Morton—"The mine," he said, "the mine." We turned and dashed for the door. Several minutes were lost while we read the instructions and fumbled with the unfamiliar mechanism. Finally the lock yielded and the door swung open. Once outside fear lent us wings, and we ran as never before. Almost we had waited too long. Came a terrific blast and we were thrown to the ground stunned, while around us rained the debris of the explosion.

Recovering somewhat, we got to our feet, and drawn by some fascination, approached the ruin of the house. The walls were still standing, for the most part, but the roof had entirely gone. As we watched there came into view, again, that eerie figure, over the ruin of the house. Dimmer now and smaller, it seemed that I could see still that lambent blue flame, where the head of John Palmer had been. Was it imagination, or did that dimming arm raise, as in a mute gesture of farewell? Then the flame was gone, and the figure drifted away, dimming, ever growing dimmer.

Battery Charging Switchboards

(Concluded from page 374)

that the battery is completely discharged the time required will be longer than twelve hours as 60 ampere hours represents the proper output of the battery only.

There are several ways of determining when a battery is fully charged; the best way being to determine the specific gravity of the electrolyte, which should be from 1.275 to 1.300.

Another way is to measure the voltage. As an open circuit voltage is misleading, a resistance should be shunted across the voltmeter shown in Figure 6. If it is intended to be used for testing a six-volt storage battery, this resistance should have a value of about three ohms. Thus during the time that the voltage is measured the battery will be delivering a current of approximately two amperes. The voltage per cell when fully charged should be from 2.4 to 2.5. If the battery is old the voltage will be a little below these values. Although a battery may be in an entirely discharged condition it will usually register two or more volts when connected directly to a voltmeter.

Building a Thermogalvanometer

(Concluded from page 383)

inch uncovered in the center, this being placed directly under the receiver, and almost touching it. Various methods of getting still higher resistance in the heater will suggest themselves; those who silver plate their own mirrors in a silvering solution should try using a short length of quartz fiber with a very minute deposit of silver on it, to make it barely conducting.

The reason the heater must be short and straight, when a nice little coil of high resistance wire would give much more heat, is that we wish to calibrate the instrument in terms of direct current, and have this calibration hold for high frequency currents. If the wire is not straight and short it will have an appreciable inductive effect, and will have inductive reactance to high frequency currents, this being equivalent in many ways to an increase in its resistance. For the same reason, the machine screws and leads should be as far apart as possible, to avoid capacity effects at high frequencies.

If the radiomicrometer suspension used is as sensitive as that described in the previous issue of PRACTICAL ELECTRICS, with a 4 ohm heater 7 millivolts should give at least 10 inches deflation on a scale at one yard, while with a 1,000 ohm heater 110 microamperes should give the same deflection. This would mean that a microampere would give a visible deflection; the ordinary pair of head-phones requires about this current for minimum audible sound; hence incoming radio signals, under certain conditions, should produce a deflection. But do not expect too much at first. Begin by measuring a current of fairly great strength, being sure first, of course, that it will not burn out the heater. Connect a dry cell in series with a pair of 2,000 ohm phones and your thermogalvanometer; if you get a deflection, you will know that your instrument responds to less than 600 microamperes, anyway. But if you get a deflection of less than full scale, there is still room for improvement. (N. B.—Do not connect more than a single cell in series with the phones, as you might burn them out.) If you get no deflection, try connecting the cell and thermogalvanometer in series with a 40 watt tungsten light. If this draws 40 watts at 110 volts, its resistance is $(110)^2$ divided by 40, or about 300 ohms. Hence the current flowing when the cell, lamp and thermogalvanometer are in series will be the quotient of 1.3 volts (e. m. f. of cell) divided by 300 plus the internal resistance of cell and instrument. These are unknown, but the first is negligible, and we know the second has some value greater than zero, so we can be sure the current flowing is less than $1.3/300 = .00433$ amps. or $4\frac{1}{3}$ milliamps. This is the approximate amount of the constant plate current flowing through a vacuum tube as ordinarily used, with the grid bias zero.

In a subsequent article will be given directions for calibrating the instrument, measuring its resistance, and using it for various measurements. In constructing this device for use either as a radiomicrometer, or as a thermogalvanometer, the experimenter is liable to run into one or two difficulties which have not been mentioned, but which are easily overcome. It should be dead beat; that is, when the receiver is warmed, the beam of light should deflect upscale to a maximum, slowly reach this, and stay there until the source of heat is removed. In the first suspended systems constructed the experimeter is liable to find that after reaching a maximum the beam swings back and forth, over and under the maximum for some time. The instrument can usually be made dead beat by increasing the strength of the magnet, or by changing the number of turns in the coil, or by using a finer quartz fiber suspension. If the right solution cannot be readily found, fasten a thin sheet of mica to the coil with sealing wax, as in Fig. 4a. Or, a single closed loop of copper wire, while adding slightly to the weight of the suspended system, will act as an electrical damper. One generally finds, however, that after having gone to the trouble of putting on a damping vane or coil, the next suspension he makes is dead beat of its own accord.

Another precaution which cannot be overstressed is to be sure to have the instrument protected from air currents. The writer places all of his radiomicrometers in an outer wooden case with proper windows for mirrors, etc., and stuffs the region between the body of the instrument and this case with cotton batting, sealing all cracks with wax. When this is carefully done, blowing near the case should not produce any deflection of the beam of light. If it is not done, accurate measurements will not be possible, on account of the constant irregular motion of the beam due to air movements.

Efficient Electrophorous and Electroscope

(Continued from page 384)

two or three coats of orange shellac. *The brass ball should not be shellacked.* Experiments are as follows:

The glass table, the electrophorus, and its tray are warmed up sufficiently to dry the surface moisture on them. The tray is then connected by a short (two-foot) straight piece of insulated wire, to the heavy winding on the outside of the electroscope. The tray is placed on the insulating glass table, and the dry electrophorus placed in the tray. Grasping the edge of the tray firmly with the left hand (grounding it) the operator rubs a catskin vigorously over the surface of the electrophorus, withdraws his hand from the tray and lifts the electrophorus from the tray by its wooden handle. The aluminum strips of the electroscope will fly apart and become strongly charged by induction. Touching the ball on the electroscope with the bare hand will increase the charge on the strips. Touching the tray will discharge the tray and winding on the jar. Gradually the charge on the aluminum strips will leak off of the corners and edges of the strips and they will collapse.

Another master charge is produced on tray and winding by simply replacing the electrophorus on the tray, taking care to ground the tray by touching with the hand while the electrophorus is on the tray. Remove the hand—then the electrophorus, tray, winding, and aluminum strips will be strongly charged again. No rubbing with the catskin is necessary this second time. Simply raising and lowering the electrophorus on tray will cause the strips to open and close in turn with the up and down motion of the electrophorus. No grounding of the hand is necessary.

Soldering Iron Furnace

By R. M. Shelor

A very efficient and inexpensive electric furnace, for heating small soldering irons, can be made from material to be picked up around any experimenter's shop.

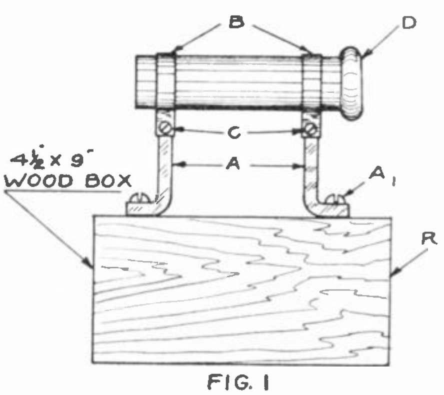


FIG. 1

First step in making a home made furnace for soldering iron.

First the base (R) is made of a small wooden box 3" x 4½" x 9", although the size is immaterial. Mount on the box, a

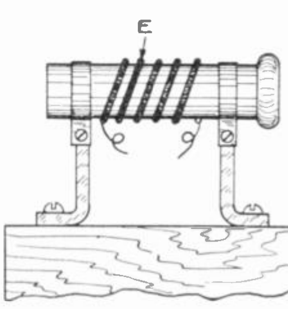


FIG. 2

Putting on the heating wire around the insulating tube.

1½" x 6" porcelain tube (D), as shown in Fig. 1, by using two pieces of iron (A) bent in an L shape at the bottom (A-1) and two pieces of sheet brass cut in small strips (B).

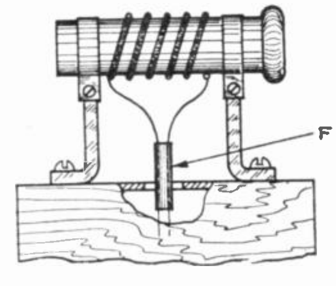


FIG. 3

Showing the connections for the heating wire through the center of the supporting base.

The tube can be procured from any electrician as such are used for running large wires through partitions. Cover the tube with a thin sheet of asbestos, clamp the brass straps around it at the ends and bolt them to the iron upright strips (C).

Now take an old coil resistance unit (E), (an old element from an electric stove eye serves very well) and wrap it around the tube, Fig. 2.

Connect this element with a piece of Duplex cable (F), as shown in Fig. 3.

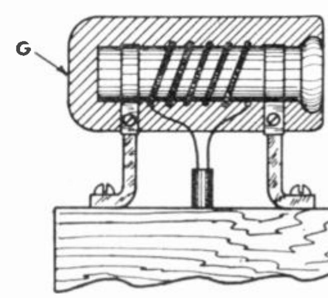


FIG. 4

Now the tube is covered with asbestos cement to retain and concentrate the heat.

Now cover the element and tube with a coat of asbestos plaster (G), about one inch thick, Fig. 4. The plaster will hold the element and connections in place and will also retain the heat.

Run the cable (F), down through a hole cut in the base, bushing the hole with a small one-half inch porcelain tube (H), Fig. 5, and connect the ends of the cable to the male part of an old electric iron connection (I).

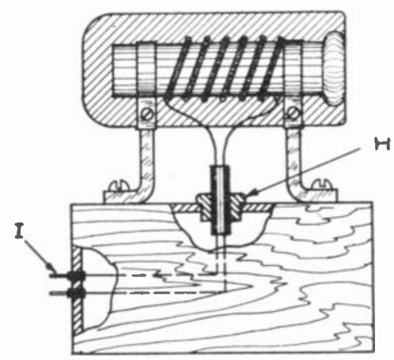


FIG. 5

The complete soldering iron furnace with its connections.

All that will be necessary to connect the furnace will be to slip a connecting plug (J), Fig. 6, on the connection (I). A flatiron cord makes a very good cord for connecting the furnace with the current supply.

To heat, connect up the furnace, turn on the current and put the iron in the tube, Fig. 6.

You will be surprised at the short time in which the iron will come to a soldering heat.

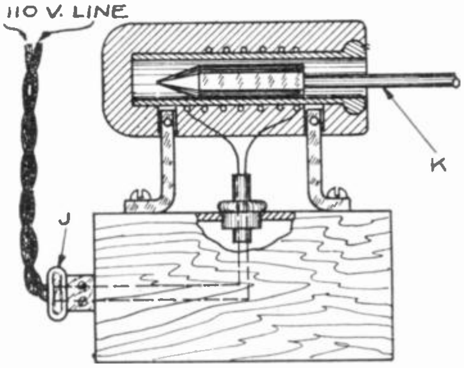


FIG. 6

The furnace at work with an iron in it.

I constructed this furnace and found that it gave very good results when I needed a hot iron at short notice.

It can be constructed for a very small amount, and it enables you to use all your old irons that are already well tinned. All irons ought to be kept in this condition.

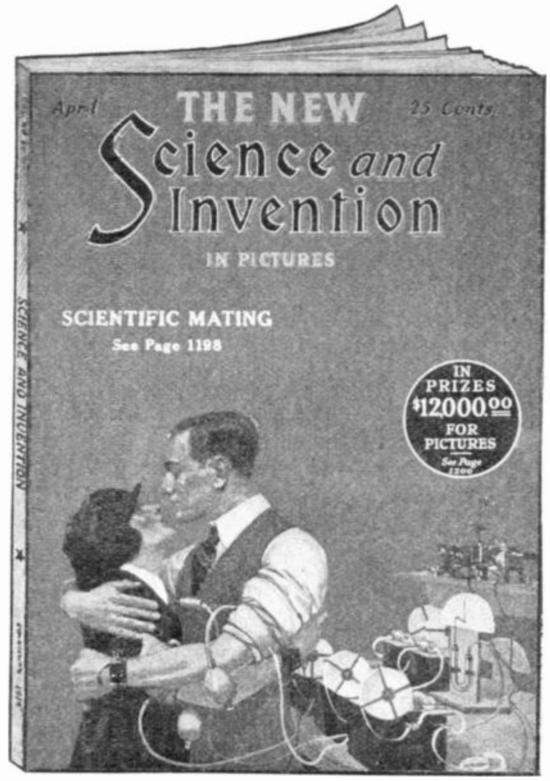
Cost of "White Way" Electric Advertising

WHAT is probably the most famous advertisement in the world is now approaching the end of its glittering career, *The Wall Street Journal* reminds us, for the electric Wrigley chewing-gum ad at 44th Street and Broadway, New York, is to be taken down, not to be replaced, and the block on which it stands is to be demolished. This bit of news leads the writer in *The Wall Street Journal* to reflect on the high cost of advertising of this kind, which forms so conspicuous a background for night life in New York's theatrical district and in lesser "white ways" on many a Main Street. The Wrigley sign is the most expensive of them all. It "cost $100,000 a year rental, and in the seven years it has existed it represented $700,000 of the $40,000,000 spent thus for advertising Wrigley products." But there are plenty of other sign-boards in Times Square which paid rental enough to make the buildings on which they stood more profitable as sign-boards than a new modern building would be on the same ground. One of these buildings, for instance, carried three signs which cost the advertisers $14,000 a month. Other interesting facts about Great White Way advertising are thus set down:

An instance of costs is that of a shoe-lace company which found it could afford $3,000 a month for a sign. One of the biggest publishers in the world paid a similar sum for a sign advertising his two New York dailies and, subsequently, his motion pictures. The Ide collar sign, 47th Street and Broadway, costs $6,000 a month, burns 4,000 lights, and measures 53 by 49 feet. On the same building Macy's 50 by 54 foot sign costs $5,000 a month. At 49th Street the Clicquot Club sign costs $6,000 a month, burns 4,957 lights, and is 57 by 75 feet. The Socony display at Columbus Circle costs over $5,000 a month, being 60 by 70 feet and using 5,600 lights; Pure Oil Co. paid $4,000 a month for a sign which it had early this year.

Building owners, in many cases, use their own signs, such as the 200 by 70 foot sign of the Rivoli Theater burning 1,800 25-watt lamps. Macy's store has four signs, two 24 by 79 feet and two 24 by

(*Concluded on page 411*)



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MAIL YOUR SUBSCRIPTION NOW

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"SCIENCE and INVENTION" has 9,899 reporters combing the world for scientific news. It is represented in every world capital, in every important laboratory—in fact at every place in the world where scientific development or achievement may occur.

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RADIO NEWS, SCIENCE and INVENTION, PRACTICAL ELECTRICS, and MOTOR CAMPER & TOURIST

Cost of "White Way" Electric Advertising

(Concluded from page 409)

67 feet, burning 4,282 lights. The letters are 18 feet high. Gotham National Bank has the distinction of having the highest sign in New York, and the only bank building with a roof-top sign. It displays two signs 347 feet above street-level, each 68 by 80 feet, with 12-foot letters spelling the bank's name. The "M" uses 61 lamps, the "I" 18, and a total of 1,456 50-watt lamps are used. Fisk Tire Co. has two 36 by 117 foot signs using 856 75-watt lamps, each letter being 25 feet high.

Outside of Times Square two of the most notable signs are that of Colgate & Company in Jersey City, with letters 42 feet high, and that of the Loose Wiles Biscuit Company in Long Island City with 32-foot letters. While there are a number of choice strategic electric-sign sights in other places in New York City, the Times Square area holds the preeminence, because, as *The Wall Street Journal* puts it, "in the parlance of outdoor advertising men" this is a 24-hour district with "circulation" of 1,200,000 every 24 hours. They point out there are 46 theaters and 27 hotels in a five-block radius, and that most of New York's 300,000 daily visitors pass there. *The Wall Street Journal* continues:

Business of finding, leasing and selling locations is handled by large agencies operating all over the country. Their service includes building, erecting and maintaining signs along with providing copy, artistical work, and other efforts. For this they have assembling plants, studios, real-estate departments, artists, carpenters draftsmen, steel-erectors, lawyers, landscapers, inspection crews, and other employes. In fact, even such big companies as Standard Oil find it more advantageous to operate through agencies and pay a net rental than doing the work themselves.

Huge amounts of labor and materials are used in sign-making. An instance is the Gotham Bank sign, with 80 tons of steel riveted by a ton of rivets and built to withstand 35 pounds wind-pressure to the square inch. The Socony sign at Columbus Circle has about nine miles of main cable, while Macy's four signs required more than eleven miles of wiring. Signs are painted three times a year, while spectacular displays in Times Square have to be inspected four times nightly to replace burned-out lamps. In few cases can more than a third of the space of roof-top signs be used for copy.

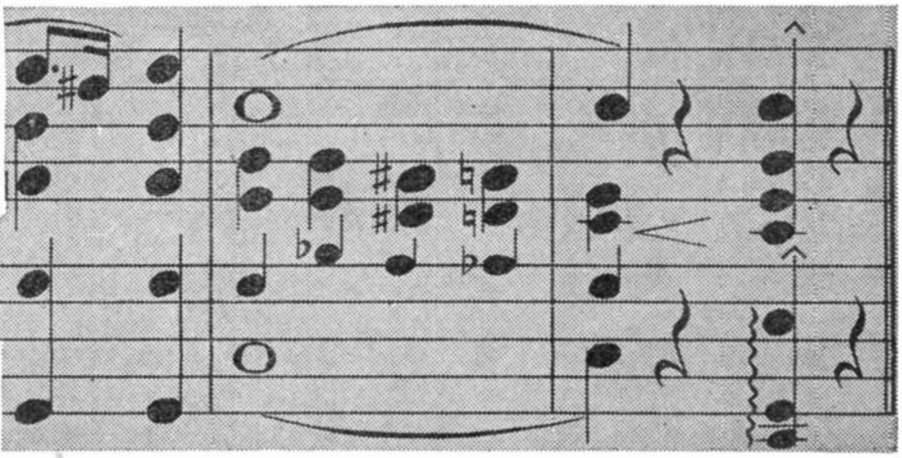
Evolution of poster and electric sign advertising started fifteen years ago to change the old method of painting any stone, barn or other space along highways. Then the biggest advertisers were whisky, beer, and cigaret makers. The latter are still among the largest users. In place of the former two agencies find new clients covering a wide range of products, from shoe-laces to banks. One of the largest signs in Chicago is of religious nature, exhorting the public to "Go to Church."

Middle West banks have long used electric signs and billboards, but first use in the East was by a Brooklyn group of savings banks last year, with a slogan "Put Your Savings in a Savings Bank."

Development of electric-sign advertising is nice business for companies selling electricity. As electric signs find their greatest use in New York City, Consolidated Gas gets a large electric business through its subsidiary, New York Edison. Between the Battery and 135th Street there are 9,500 outdoor signs using 1,000,000 lamps.

An illustrated presentation of this subject will be found in PRACTICAL ELECTRICS for September, 1922.

Noted Musical and Radio Authorities Select three Distinctly New Radio Song and Dance Hits



Now We Have *Radio* Song and Dance Hits

35c
EACH
Postpaid

In a recent nation-wide Musical Radio Contest three compositions were selected from the hundreds of Manuscripts submitted as prize winners. These numbers have now been published in the conventional form so that Radio Music Lovers and also Music Lovers everywhere can enjoy these distinctly new hits in Popular Music.

These prize Radio Hits will be a sensation in your dance folio. They offer you the opportunity of buying three fine melodies at the same time each better than the other. It were as if you had picked the choice numbers out of hundreds of songs at your dealer.

These Radio Song and Dance hits will be exclusively Radio—To and for the Radio Public. They will be Broadcast from your local Broadcasting station. Listen in for them. Your local Radio Dealer will have copies for you. Look them over the next time you visit him or write us direct for your copies.

Published and Distributed by

THE CONSRAD COMPANY, INC.
233 Fulton Street, New York City

Radio Jazz:

Irresistible foxtrot. One of the prize winners of RADIO NEWS Broadcast contest! Young feet dance—old feet tap time, to the fascinating melody of this real smashing hit.

Listen In:

Featured in RADIO NEWS Broadcast contest, has caught the fancy of all America! Its rare swing hypnotizes—and its tuneful melody makes it simply irresistible.

Radio March:

Another Prize Winner of RADIO NEWS Broadcast contest. Here, music lovers, is a wonderful number! Is there anything so appealing as the stirring strains of a military march?

Super-Power Conference

HALF a million dollars and 50,000,000 tons of coal could be saved every years by electricity-users of eleven northeastern states on an investment of $1,250,000,000, Mr. Herbert Hoover, Secretary of Commerce, told a "super-power" conference of public engineers of the eleven states on October 13, 1923.

By developing easily accessible water power, he said, and by linking into a vast network of distributing cables the existing electricity producing stations, more power could be developed, more cheaply, and with a more even and dependable flow to the users.

Mr. Hoover assured delegates to the conference, which had been called with the approval of President Coolidge, that it was intended as a preliminary discussion of steps federal and state authorities might take in promoting super-power development in New England and mid-Atlantic states. "Engineering science has brought us to the threshold of a new era in the development of electric power," he continued, "an era that promises great reductions in power cost and wide expansion of its use. We can now undertake the cheaper sources of power from water sources further afield, such as the St. Lawrence, and cheaper generation from coal by larger and more favorably placed generating plant."

States could assure themselves of more economic electricity, of a more dependable supply, and of more security from the effect of coal strikes if they would join in producing and distributing electric power, he said. Groups of states were associated in networks of inter-connecting power distributing lines, he pointed out, but lack of protective legislation, federal and state, stood in the way of rapid and complete development of the "fluidity" of power, and that was the immediate problem he asked the delegates to consider.

Electric Drive on Ferryboats

THE Golden Gate Ferry Co. of San Francisco has placed a repeat order with the General Electric Company for complete electric propulsion and control machinery for two new steel hull, double-end ferry boats. These crafts will, it is expected, be operated in the same manner as the "Golden Gate" and "Golden West," equipped with General Electric propulsion and control machinery and now running between Sausalito and San Francisco. It is expected the new boats will be run between the same points, releasing the older craft for new routes.

The two new ferryboats will be somewhat larger than the previous craft, having, instead of two main generating sets, three Werkspoor Diesel engines each direct-connected to a 270 kilowatt, 250 volt, direct current generator. A 30 kilowatt auxiliary generator is mounted on an extension of each main generator shaft.

Two 950/150 s.h.p. 180/150 r.p.m. 750 volt, intermittently rated motors will be mounted in each end of the boats and direct connected to the propeller shafts. These motors will have a constant rating of 900 s.h.p. at 180 r.p.m. Ward Leonard type of voltage control will be employed and both pilot house and engine room control will be available.

The Golden Gate Ferry Co., with the installation of the first two electrically equipped boats, the "Golden Gate" and "Golden West," inaugurated a radical departure in ferryboat construction, these being the first double-ended craft where each propeller is driven separately.

One of the obvious benefits to be derived from the installation of electric propulsion and control machinery will be the saving in space which will result from the use of the new system, and there are many other advantages to be counted upon.

I Guarantee

To Make You A Public Speaker or I Wont Take A Penny

Give Me 15 Minutes a Day

I'll Show You How to Control One Man or a Big Audience—How to Conquer Stage Fright—How to Increase Your Earnings—All by the Power of Effective Speech

THAT'S all I want, 15 minutes a day, to prove to you beyond a shadow of a doubt that I can do for you what I have done for other men—increase your income, make you a leader, make you successful.

C. F. Bourgeois, President of Robischon & Peckham, says: "The lesson on 'How to Develop Personality' is alone worth the entire cost of the course. It has been of real practical help to me." Walter O. Ford of the Ford Manufacturing Company writes, "Was always considerably flustered when called upon to speak. Now, thanks to your course, I feel perpectly at home, and confident. Every man who wants a strong personality and the power of effective speech should take your course." H. B. McNeal, President of the Telephony Publishing Company, says: "It should appeal to every man and especially to young men who are ambitious for rapid promotion."

Increase Your Salary

These men write as do hundreds of other successful men concerning this amazing new method of making you a forceful, fluent, convincing speaker. Why do salary increases and the big-pay jobs seem to just come naturally to one man when all about him are men of equal ability in other respects? I'll tell you. The successful man has the knack of making every word he says or writes count in his favor. He is never at a loss for the right word and he presents his proposition or views in clear, logical and forceful language. He gets what he goes after.

Sway Others at Will

How many men can address a dignified board of directors and have his plans and ideas instantly approved? How many men can appear at a moment's notice before an audience and create enthusiastic notice? Not many. And yet there is no reason why any man should not be able to do those things.

I don't care what line of business you are in. I don't care how embarrassed you now are when you are required to speak. I don't care what you think now. I can show you how to rise quickly above the mass in business, how to step to promotion, how to be a leader with poise and the assurance to plunge right into any subject and convince your hearers of your point of view. By this amazing new method, made possible by Professor R. E. Pattison Kline, formerly dean of the Public Speaking Department of the Columbia College of Expression, being a powerful speaker is easy and simple.

Make This Free Test

To convince you fully that you can become a powerful and convincing speaker by giving me only fifteen minutes a day right in the privacy of your own home, I will send you a remarkable FREE self-test, and then you can judge for yourself. I want you to determine whether or not you wish to have this power of speech that men envy and women applaud. Also, because I know that you will be so delighted that you will tell others of this amazing method, I am making a special offer for a short time only.

Send No Money

Fill in the coupon and mail at once. You, like thousands of others, can quickly and easily learn the secret of achievement both in position and salary and all this without leaving your present position and by devoting only a few minutes a day to the fascinating material I will send you. Just give me your name and address on the coupon.

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Address ....

City .... State ....

....
(In Box)

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- How to make after-dinner speeches.
- How to write better letters.
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- How to enlarge your vocabulary.
- How to make political speeches.
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HERE is a set of books that will take you as far as you wish to go in electricity.

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Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, current, switchboards, distribution systems—installation, operation and repair of electrical machinery—wiring for light and power—wiring of finished buildings—underwriters' and municipal requirements—how to do a complete job, from estimating it to completion—illumination in its every phase—the latest and most improved methods of lighting—lamps and lighting effects, etc.

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