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December 1921

EDITED BY H. GERNSBACK

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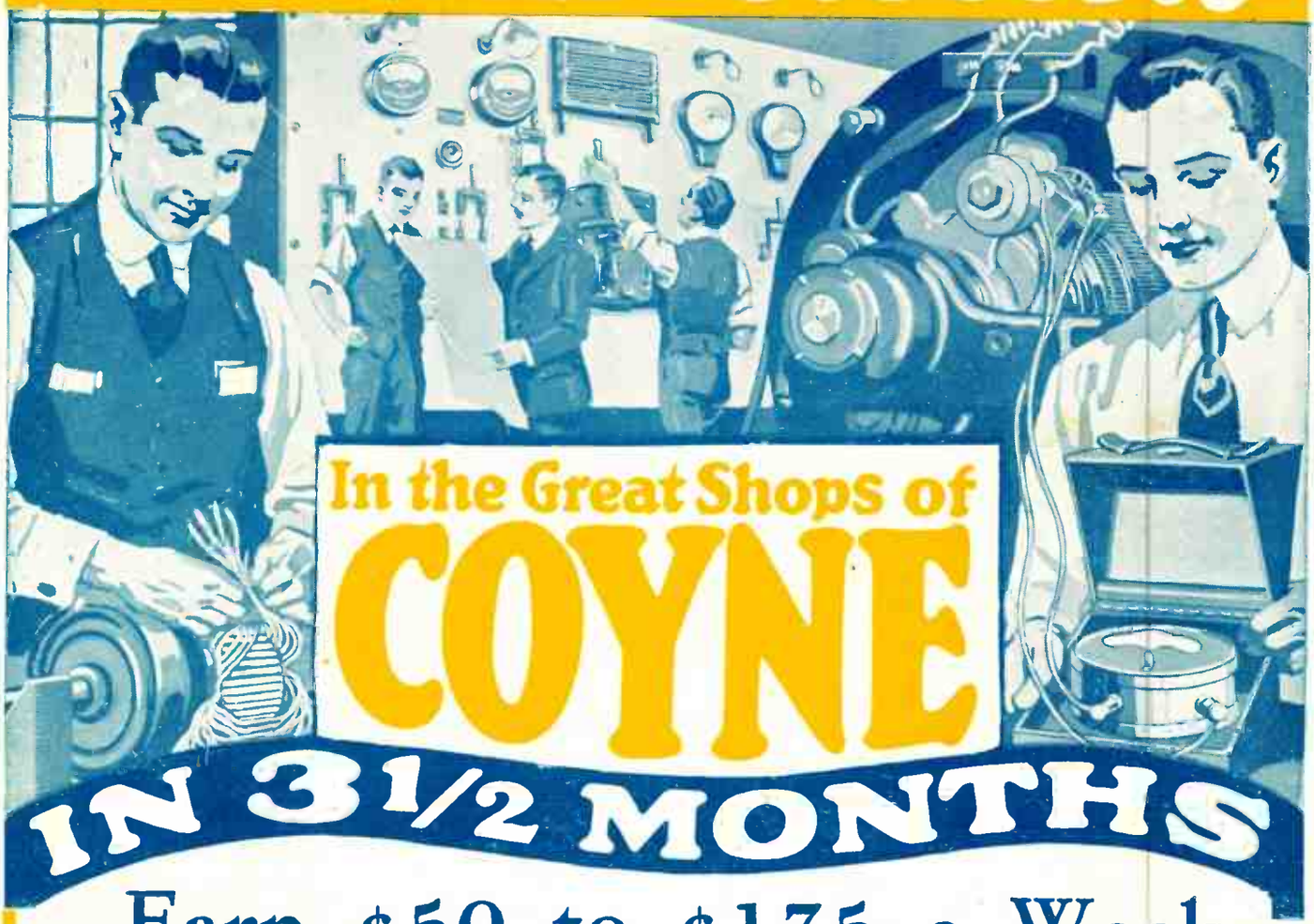

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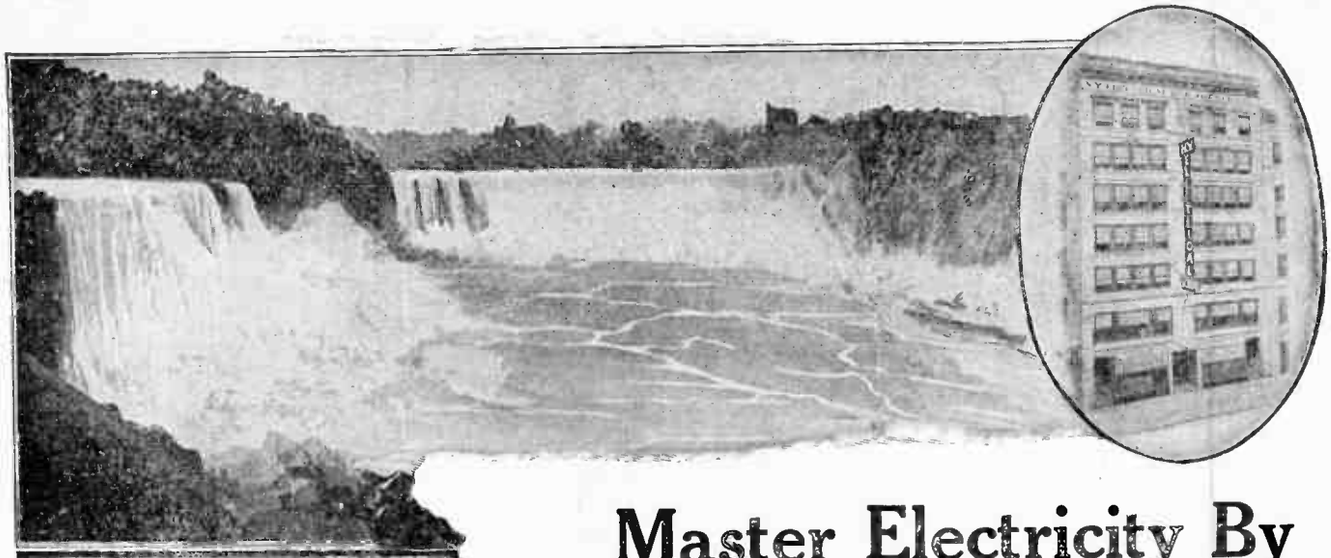

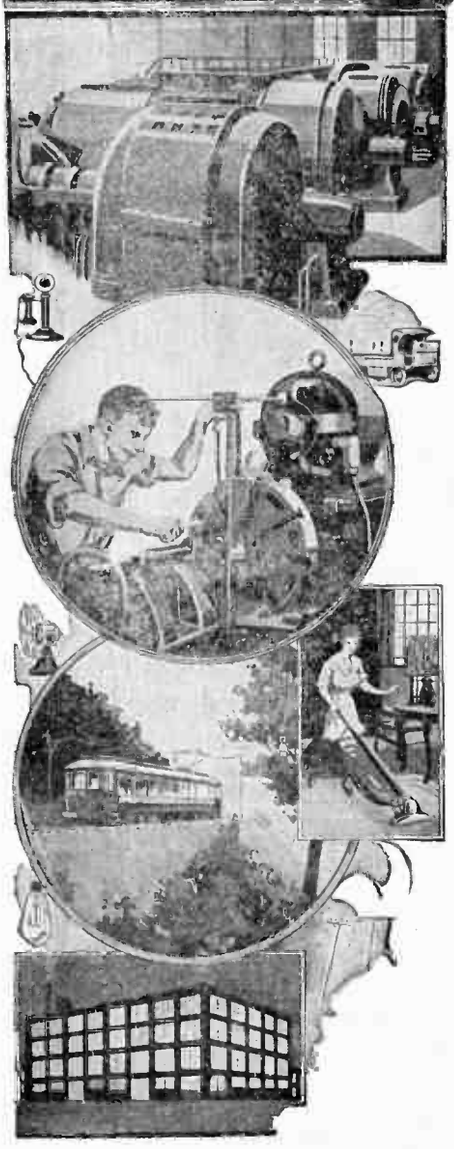

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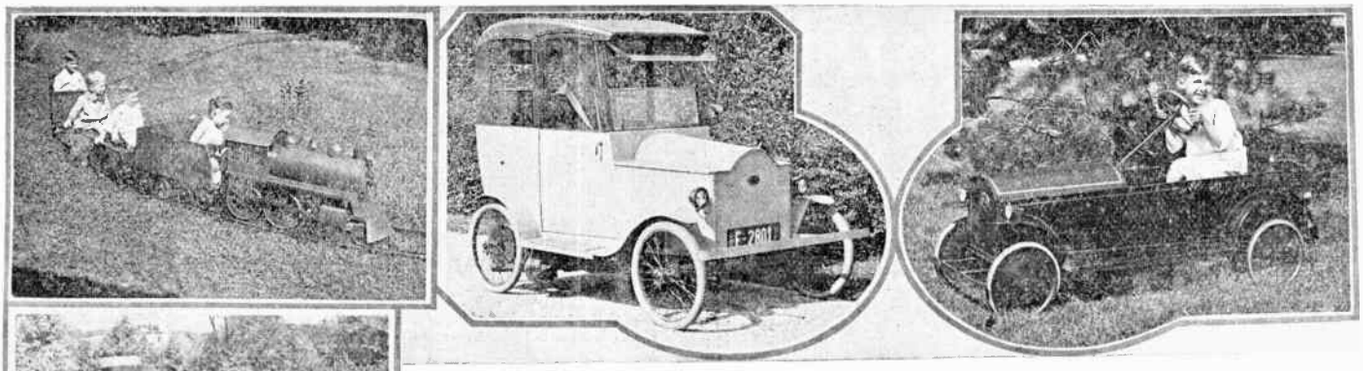
Volume 1
No. 2

Practical Electrics

December
1921

H. GERNSBACK,-EDITOR T. O'CONOR SLOANE, Ph. D.:-ASSOCIATE EDITOR

Electrical Vehicles of Low Power and Light Weight



Miniature electric motors, from the children's railroad and children's automobile to the invalid's chair and practical car for shopping purposes. These are operated by storage battery and are thoroughly practical when applied to adult use, and will certainly be a delight to young people.

WE illustrate four little electrically propelled vehicles, which bear the poetic names of a Cootie, and a Cabbie, and the prosaic ones of a Chair and a Coupé. The idea is to provide very light cars for short distance work. They are propelled by electric motors, usually taking their power from storage batteries, and the batteries can be charged overnight by simple connection to a lamp socket. This is the essential point;—that you do your own charging. They simply figure as an adjunct to the electrical house, just as much as the electrical washing machine and sewing machine do.

The Cootie is a very attractive little proposition, with bright red disc-wheels, especially for children. It will go at 7 miles an hour and has a range of 10 miles. This seems rather small, of course, but it is plenty for the purpose of amusing a child. At a high price per kilowatt hour it only costs 20c. to charge the battery. Its wheel base is 48" and tread 20", somewhat more restricted than the full size automobile. Its weight, including the battery, is 200 pounds. It will climb quite steep grades; it can be made to pull a child's wagon and can actually be used sometimes for practical purposes, and by invalids as a roller chair.

Next comes the Cabbie. This is a delightful little railroad, with engine, tender, and cars. Its high speed is 7 miles an hour; it will cover a radius of 15 miles. The track is not full standard gauge; in other words, it is but 15 inches, and the engine has 10 inch driving wheels. Cross-overs, the track, and switches are supplied ad libitum, so that it can be made a most attractive toy for children on a country place. So much for the toy constructions.

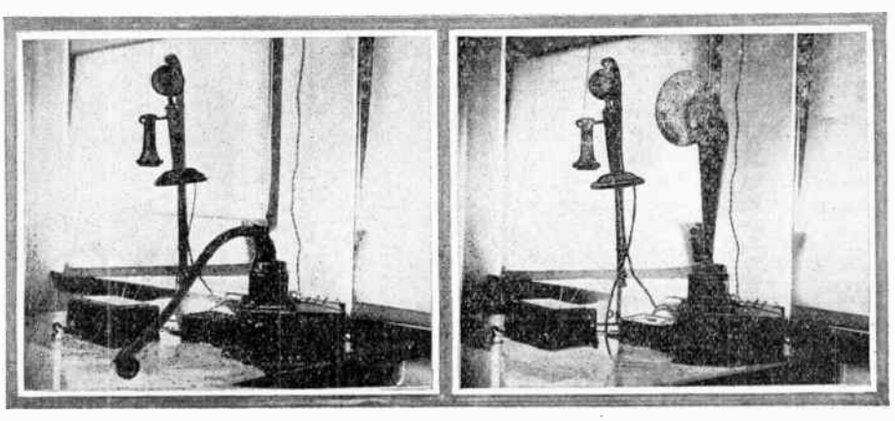
Now we come to the more serious ones. One is a rolling chair for an invalid. The chair weighs about 245 pounds with its battery, and can do 15 miles on a charge. At places like Atlantic City or Long Beach with their extensive board-walks, a chair like this would seem to be a panacea for the ills of the invalid.

Finally we come to a little Coupé. It is simply a little city car for very short runs about town. It has 42 inches tread, which is only 6½ inches less than the regular, and has a wheel base of 57 inches. It is given a radius of action of 20 miles, with a speed of 8 miles an hour. Its total weight is only 550 pounds.

It would certainly seem as if these little cars would find a place in the economy of our present day, and that electricity is here given a chance to do work, it has not hitherto been called upon to execute.

Novel Use of Radio Amplifier

THE accompanying illustrations show a remarkably simple sound intensifier recently installed in the office of a man who has been troubled with deafness for a great many years. He has been unable to use the telephone, but the use of this apparatus renders it as easy for him to talk over the wire as it is for the person with normal hearing.

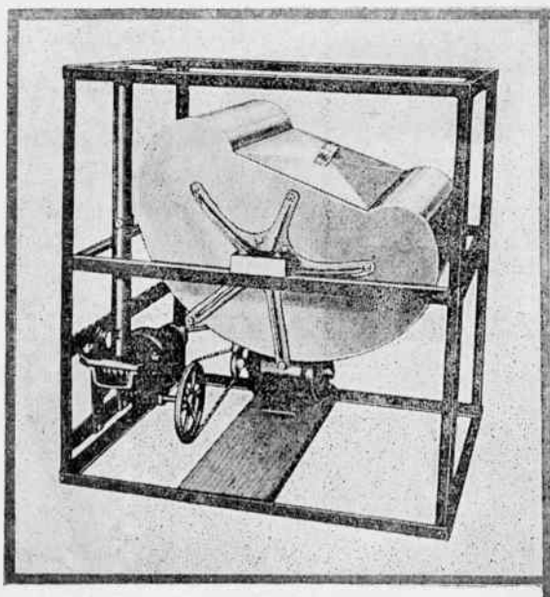


A loud speaking telephone receiver designed for use by the partially deaf. It can also be used for ordinary loud speaking purposes.

The apparatus consists of a vacuum tube two-step amplifier, such as is used in wireless communication, having a B battery of 110 volts, a storage battery to light the bulbs, and the Magnavox or loud speaking horn.

Concluded on page 55

A New Washing Machine



A washing machine is shown on the left. It operates by rocking back and forth so that solid plungers do not come in contact with the clothes. The electric motor operating it is seen below. It can be closed in so as to be a sort of table.

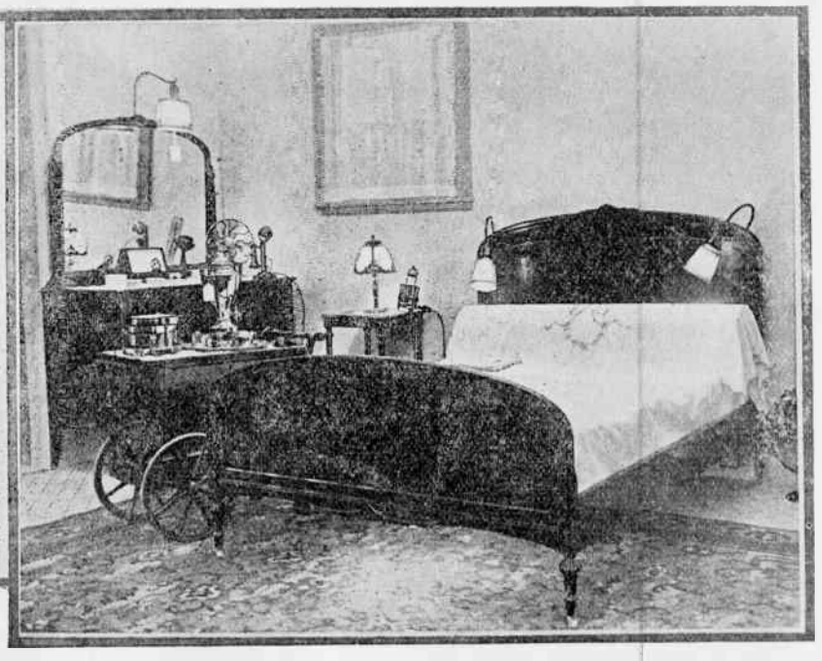
WHEN we consider the older methods of washing clothes, from the pounding between stones, which we read of in some semi-civilized countries, to the scarcely less severe treatment of rubbing on a corrugated metallic washboard, and contrast with these the modern electric treatment, it seems as if the duration of textiles subjected to weekly washing should be greatly prolonged.

We have had occasion to illustrate more than one washing machine. The one, we show here, depends entirely on agitation for its operation. Its peculiar shape suggests the efficiency of its work. It is connected to a crank by a pitman, which by belt gear is operated by the electric motor. This oscillates the peculiarly shaped receptacle back and forth, clothes and liquid being driven from one end to the other. Its contour and shape is suggestive of rather good balancing, and of effective action in the way of dashing the clothes and water about. An electrically operated clothes wringer is finally installed on top, and after the washing is done, the clothes are passed thru the wringer and are ready for drying.

The machine is fully enclosed in a rectangular cabinet, and when the top of the cabinet is put in place, it is a sort of table resembling a small refrigerator. It is said that it is perfectly noiseless in operation, and the operation is altogether done by the dashing about of the clothes in soap and water solution, there being no plungers or agitators to touch the goods. The whole mechanism can be removed for examination by pulling out four bolts. At the bottom is the faucet, by which the water is withdrawn. A ¼ horse power motor suffices to drive it.

IT has been our good fortune to tell of many things electrical, and now we show the last word in twentieth century luxury, the electrical bed. Everything is here, every want is provided for, by the exercise of the really scientific imagination.

An Electric Bed Room



A suggestion for the lights in the sleeping room. We hope that the reader will try his imagination, to see if he can find a place where an electric light is needed, which is not provided for by the arranger of this attractive chamber.

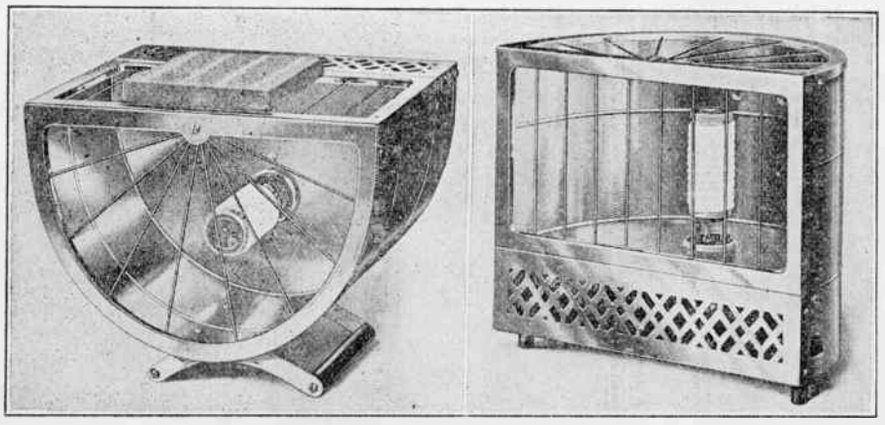
There are reading lamps for the insomniacs, a standard lamp on the little table, when reading is taboo or not desired; baby's milk can be heated, for the new arrival must have all the comforts of the electrical home. There is an attractively spread table, full of electrical apparatus. These include the breakfast accessories, coffee percolator, (electricity does not seem to favor drip coffee); there is the electric grill, and the bread-toaster will be a sine qua non. All you have to do is use your imagination, you cannot go too far. For nocturnal peregrinations a light under the bedstead is supplied; this is now quite the proper thing, as we have had occasion to state already.

The telephone is seen in a distance. Here we take issue with the person arranging this display, for we think that, to really enjoy the morning hours, the telephone should be exiled out of sight and out of mind.

Sockets properly placed will supply current for heating pads, which may be called the electrician's hot water bags.

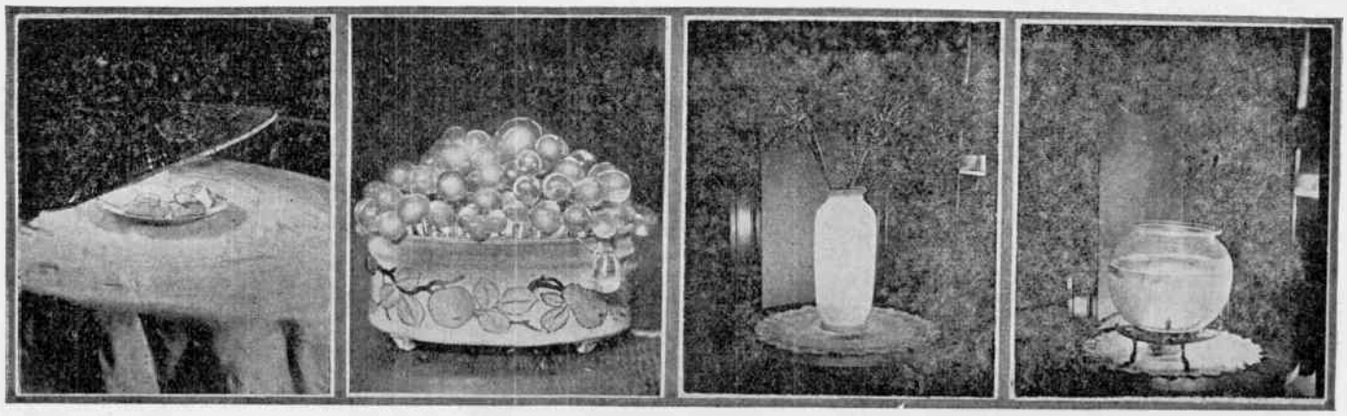
A Heater and Toaster in One

THIS heater comprises a resistance coil of cylindrical contour mounted within a semi-circular reflector, but set well back from the center of its semi-circular contour, so that heat radiated from the coil will be reflected with wide divergence, covering, as it is placed, an angle of 100 degrees. It gets rid of what is aptly termed the "spot-light effect" of some heaters. When set with the axis vertical it becomes a heater for anyone sitting near it; when turned on its back an additional function appears, for then it is prepared to make your toast. It weighs less than two and one-half pounds and, of course, works from any lamp socket. The heating coils can take 600 watts. The combination will be appreciated by some homeless bachelors or even members of the other sex.



A room heater arranged with a reflector so as to disseminate the heat, When the heater is turned upon its back—for which purpose supports are provided—it makes admirable toast.

Unusual Electric Lights About the Home



A biscuit warmer made from a Japanese fisherman's hat. A very nice suggestion for an outdoor supper.
A basket of fruit somewhat of the Barmecide order. It feasts the eye but not the body.
A vase of artificial flowers illuminated by an incandescent lamp in their vase.
An illuminated goldfish globe producing a very pretty effect, the colors of the fish being brought out by the reflected rays.

THIS electric light is not as beautiful as some which might be made at home, but it has its special purpose just the same. It contains a nitrogen lamp which gives off sufficient heat to keep a plate of biscuits pleasantly warm at the table. It is made of a Japanese fishing hat which can be lined or unlined as desired, through which a cord for a lamp is run.

Next comes the electric grape basket which can be made at home and used as table center-piece to give a soft and decidedly novel lighting effect. A tin oval box is first painted with grapes or with fruit of some kind, and wired through one end for an electric lamp. Large glass beads of different grape shades, varying from lavender to red and pale yellow, can be strung so as to give the effect of bunches of grapes, over a wire frame covered with cretonne. When the light shines through the cretonne a great variety of softly blended colors is secured.

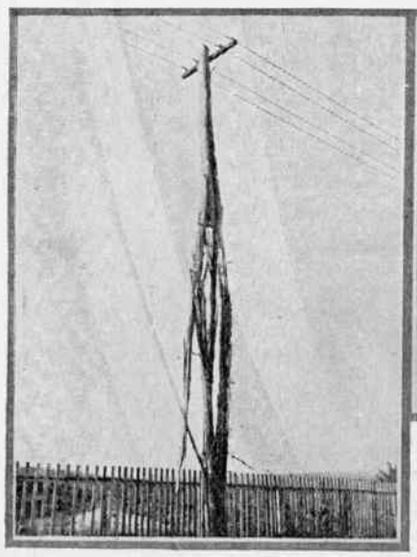
In these days of artificial flowers one needn't fear to put electricity in the vases which hold them. Many fantastic lighting effects can thus be secured. A semi-transparent vase will hold an electric light bulb, and throw enough rays of light upon the flowers above so that they can be seen in an otherwise uninteresting and dark hall.

Next we show a practical as well as beautiful way of lighting a dark hall. A home made illuminated gold fish bowl makes the hall more cheerful and attractive. This is accomplished by placing a tray on a stand and cutting away the center of the tray, so as to permit a lighted electric light bulb to press up closely against the bottom of the bowl. The bulb is wrapped with tin foil, so that the rays are not dissipated but shoot upward to illuminate the water, and the fishes. The effect is really magical and the finny pets appear to be swimming about in fairyland.

In place of a tray an ordinary pie tin—suitably painted or otherwise decorated—may be used.

Contributed by Edna Purdy.

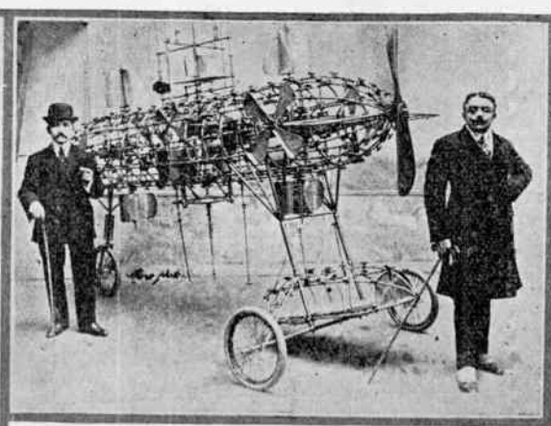
A Curious Lightning Stroke



A curiously lightning-struck telegraph pole, where, in spite of the splintering of its middle portions, it still carried the wires until replaced.

OUR illustration shows the results of one of the freaks of electricity. The telegraph pole which stood on Long Isand near Mineola, was struck by lightning. The illustration speaks for itself. The pole is shattered for a number of feet in the center the top and part of the lower sections being left intact. The wood is left in a condition still to carry wires. It is interesting to see the climbing spikes yet sticking in the wood.

Annihilating Gravitation.—Maybe!



A machine supposed to fly by the annihilation of gravity. On its right we see the inventor. There is no record that he ever got it off the ground.

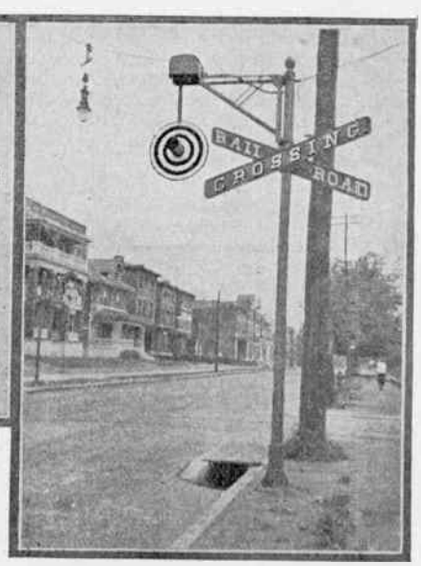
PROFESSOR L. G. V. Rota claims that by the use of Telluric or earth currents which he has discovered, it is possible to overcome the laws of gravity and so revolutionize the science of flight.

A very obvious suggestion is that these currents should be called, in honor of the inventor and discoverer. "Rotary" currents.

We illustrate his "flying" machine, which he claims to have provided with electro-magnetic means of counteracting the attractive force of the earth, for overcoming the resistance of the air when the machine is in motion, and doing other curious things. It is said that his claim for speed only ranges from 200 to 400 miles per hour. He does not hesitate, apparently, to say that he can fly to a height of nine miles and remain in the air several days and carry a load of one ton.

Professor Rota is seen on the right, and the machine appears to be an elaborate structure. As far as we can see, the only objection to it is that it will never be able to rise one inch from the ground, except at the end of a rope.

An Electric Grade Crossing Watchman

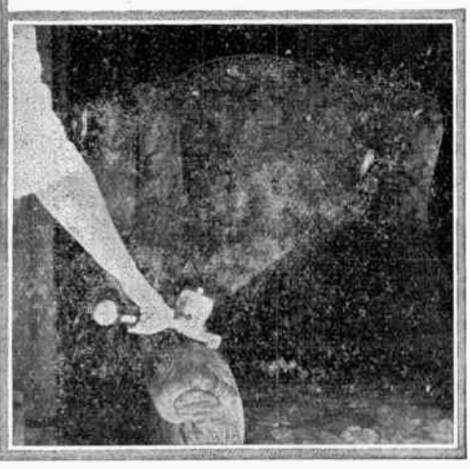


The electric flagman. This semaphore moves back and forth when a train is approaching, so as to give an unmistakable indication of the approach of a train on a crossroad.

THIS is the electrical watchman; he never sleeps. When the car is approaching the street on which this is located, the semaphore signal, a species of target, begins to swing back and forth. No one can miss the curious motion, and it at once tells the story that a car is coming. To make it effectual at night, it is fitted with a red light in the center, so that the brilliance of the red lantern in the darkness, indicates the coming of a train. It is said to be weather-proof. It is carried on an iron pole, and in every way represents a first-class fixture, if anything pertaining to a grade crossing can be considered to be first-class.

Edison's Latest.

On the left is one of Mr. Edison's latest productions in the way of a dictating machine controlled by keys alongside the key board.



A miniature vacuum cleaner which we are sure will meet the approval of our lady readers is shown below.

WHEN the business phonograph was, perfected and put upon the market it seemed as if it was the last word in the practical use of the Edison invention. But now, Mr. Edison having analyzed the motions incident to the operation of the dictaphone and studied the operations incident to reaching the different levers and foot-switch, has reached the conclusion that 85% of these motions is to be saved. This 85% probably does not represent everything, because the motion of the foot-switch may be considered especially annoying and out of place for the typewriter who has to type from the cylinder.

So the great inventor has evolved a new dictating machine which he calls the Ediphone. It looks like a little bit of an affair and works from the regular electric service in the building. All that is necessary to do is to plug in on any lamp socket, and all is ready. The mouth-piece into which the dictator speaks is provided with a hand control; not a push-button, but a good, big piece, that the fingers naturally and easily find. Thus when dictating, and wishing to stop, a pressure of the fingers, without any searching for the button, stops the machine. When you want to start the machine, you start it in similar way.

Then when we come to the repeating for the typist, again the simplest and most natural control is provided for. At each side of the keyboard of the typewriter, about the level of and at the ends of the spacing-bar, there are two keys similar to the keys of a typewriter; the one on the left starts and stops the machine; the one on the right makes it repeat as desired. Thus there is no foot motion, and no reaching around for different switches. Turning the machine on and off and making it repeat is not a particle different from spacing with the spacing-bar.

A Miniature Vacuum Cleaner

THIS little implement is neither more nor less than a minute vacuum cleaner. It contains a motor wound for 110 volts, so as to be operated directly from a lighting circuit, and the whole affair is compact and weighs less than three pounds, much less than the flat-iron used in laundries.

It has within it a brush driven by the motor, and suction is also maintained, so as to suck out all dirt and grit which may be released by the action of the brush. There is a switch on the motor case which is operated by a touch of the thumb, so that it can be stopped or started instantly. In the handle there is a dust receptacle. When this is to be cleaned, the cap on the rear of the handle is removed and the motor is started, and this blows out all the dust. Of course, care must be taken that it be blown out into the proper place. For heavier work, however, a good-sized dust bag is provided, which attaches to the end of the handle and is suspended from the arm of the operator by a short strap. The cleaner is supposed to be particularly good for dusting the upholstery of automobiles. The tendency now is to use cloth a great deal on these vehicles and it gives a large area to be gone over. This little vacuum cleaner will do it in very short order. Another special application is for billiard table work. It gets under the cushions so as to draw out dust which otherwise would remain perhaps for weeks at a time. It is claimed that it will lay the nap properly also.

Electricity As It Soaks In

FOLLOWING are a few gems, technically called "howlers," selected from the papers received by a correspondence school from its students in electricity and and magnetism:

The unit of quantity is Columbus per second.

A dry cell contains blotting paper soaked in an electrotype.

Because of the huge magnetic field of the earth, the south magnetic pole of the earth is the north geographical pole.

One horsepower equals 33,000 footpower.

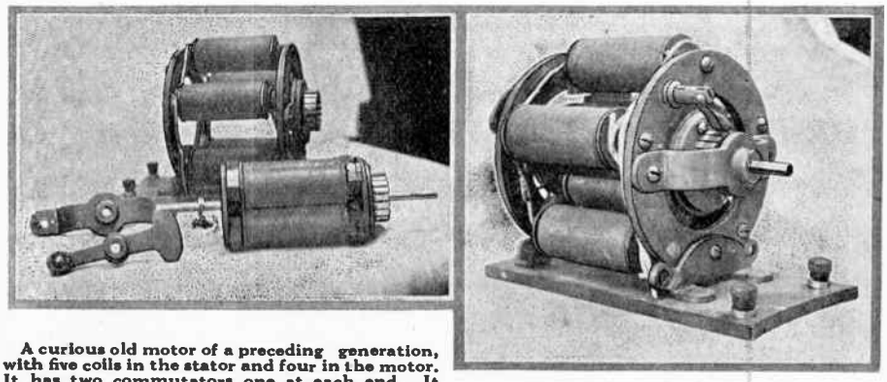
An electro dynamo is an amateur rotating in a field.

An Old Time Electric Motor

OUR illustrations show an interesting old motor which we came across in our investigations, and which ran very nicely in the good year of 1885.

The frame carries a rotor, on which there are four coils with cores parallel to the shaft. These four are surrounded by a field which contains five coils on cores also parallel to the shaft. On one end is a 16 leaf commutator with single brush. The brush bearing on this commutator conveys the current to the four coils at proper intervals. On the other end of the machine is a fixed commutator, this time with 25 leaves. A brush is carried around by the shaft, which brush bears against the fixed commutator. There being one brush for field and one for armature, a circuit for each is completed through the frame of the machine. It will be observed that there are four divisions on the one commutator for each of the coils of the armature, and five divisions for each of the coils of the field. In this way the current is commutated, so that the four coils of the armature are successively attracted and repelled by the five cores of the field. The motor is a compact little affair, quite attractive in appearance. We are afraid that its efficiency is very questionable, on account of the exorbitantly great air gaps—but no one cared in 1885. But as far as neatness of construction is concerned the little motor is worthy of all praise. It has a compact solid frame with adequate mountings for all parts and good brush riggings.

The disparity of stator coils and motor coils is its distinguishing feature.



A curious old motor of a preceding generation, with five coils in the stator and four in the motor. It has two commutators one at each end. It has operated very nicely in our laboratory.

USING ATMOSPHERIC ELECTRICITY

A GERMAN book has been published lately on the collection and utilization of atmospheric electricity. The author describes his experiments in sending up a captive balloon with a metallic cover, provided with a large number of points. This is allowed to rise to a height of 1000 or 1600 feet above the ground. The electricity which is collected is transmitted to the ground by means of a wire rope.

It is claimed that from one balloon sent up to a height of 1000 feet he obtained over 17 Kilowatts, and for some reason not fully explained he claims that battery of ten balloons would give 200,000 Kilowatts.

A BURGLAR ALARM BANK SATCHEL

ONE of our contemporaries tells of a bank satchel provided with a dry battery and alarm bell. It is so constructed that if a highwayman gets hold of it, it will start ringing the alarm, then if he goes through the street with his plunder, the ringing bell will be heard by all passers-by.

The idea is that the switch is to be hidden in the grip handle, and to be so arranged that the bank messenger when he is being robbed, can push a button and start the bell to ringing before parting with the satchel.

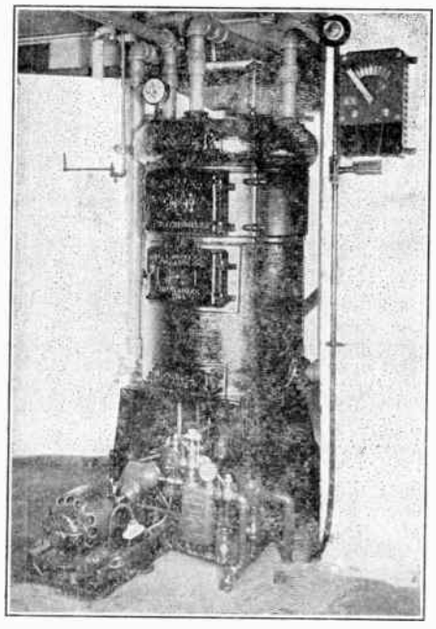
This would put a robber in the position of the commuter carrying an alarm clock home on the train. If it goes it is supposed to make the innocent commuter the object of much attention.

Furnace Heating with Fuel Oil

TWO things have to be carried out in successful burning of fuel oil. No smoke must be produced, and if there is any toleration of smoke, there is apt to be a very disagreeable pollution of air, even worse than in the case of soft coal. To give a clear delivery from the chimney, there is always danger that an excess of air will be added, which is uneconomical. One method of doing it effectively includes the injection of the oil in an atomized condition, mixing with the minimum of air which will secure perfect combustion and avoid smoke.

Super-heating of the burning gases, by the high temperature of the surrounding envelope of the fire chamber, is also of importance. Electricity, with its elastic adaptation to large and small uses, comes in here for delivering the fuel and air in proper mixture.

By the plan illustrated, the house furnace not much bigger than a barrel, or the great steam boiler, may be supplied with a fuel oil fire by identical mechanism, varying only in size. A storage tank to contain oil, perhaps enough for several month's supply, is supposed to be installed out-doors under ground; indoors and near the furnace is a service tank of smaller capacity. The oil is periodically pumped from the large into the small tank. From the small tank it is pumped into the oil burner; it passes through a needle valve, whose needle is kept constantly rotating, so as to provide a perfectly clear passage for the oil, and a cup-shaped member concentric with the needle is whirled around also, so that dirt and water inevitably mixed with the oil, are thrown to the outside, leaving a pure cylinder or tube of oil in the interior of the stream to enter as clean fuel. Arrangements are provided for withdrawing the dirt and water and cleaning the surface of the rotating member so as to insure its prompt action. The latter is done by simply inserting a rod or poker-like affair into the cup while it is rotating, thus scouring the sides of the rotator. Such, in a few words, is the general distribution of the machine, which, however, when followed out in all details is rather complicated.

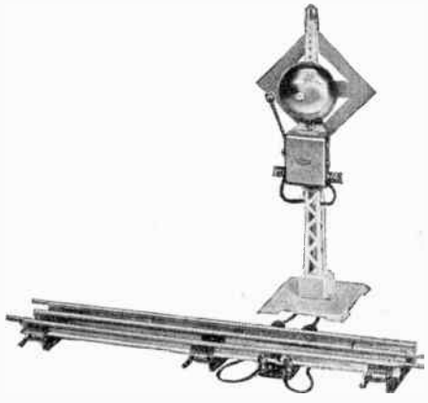


Electricity applied to a house heatingapparatus for the consumption of liquid fuel. The apparatus is quite elaborate in some of its details, zand is supposed to give very fine results

The burner is an interesting feature. An atomizer rotating at high speed occupies the central position in a circular combustion chamber. Here, the oil is delivered. From below the atomizer, air is drawn in. This is beneath the level of the atomized oil, so that an atmosphere charged with minute oil vesicles floats on top of the air all over the floor of the combustion chamber. The air-level is about half-way up the circle of fire-bricks. Combustion takes place, filling the chamber with a smokeless flame, heating the fire-bricks, and heated by them and then rising up into the boiler flues or boiler tubes, according to the construction employed. The supply of air is controlled by what is known as an air supply ring. This can be so placed as to admit more or less air, to insure a perfect combustion.

In the burning of fuels, which are liable to produce a smoky flame, the annoyance of such a flame is avoidable by fine division of the fuel, by intense super-heating of fuel and air, and by sufficient air. But there is one curious point which comes in. When one sees smoke escaping from a chimney, the remark is apt to be made that there is a great waste of power going on, for that carbon ought to be burned. But where no smoke whatever is perceptible, so that the fuel is perfectly burned, there is always a possibility that this is done by a large excess of air;—so that more heat may be wasted in the perfect combustion producing no smoke, than in a slightly imperfect combustion, producing a little smoke. But in the installation such as we describe, the vigorous atomizing of the oil and the disposition of parts in the fire chamber, with its regenerating heat effect, will go farther to produce a smokeless flame than will a simple chimney exhaust, and this without the use of uneconomical excesses of air. It is a case of what may be termed direct regeneration, the accumulated heat of the fire chamber assisting the combustion.

Bell Signal For Toy Electric Train



At left
A nice little toy signal for a boy's electric railroad, ringing an alarm bell as the miniature train approaches. Modern electric toys are a great advance on the old time locomotives of former days.

At right
Teaching the young idea how to wash. Here we see a nice little girl with a toy washing machine operated by a real electric motor, washing her doll's clothes. She may have to run a real electric washing machine when she grows up.

The progressive young American wants electric toys, which in the early years of the last century would have been veritable triumphs of natural science. One of the most attractive instrumentalities for his amusement is the miniature electric railroad, and this can now be procured in the most elaborate style as far as details are concerned.

As an example of what it presents, we illustrate a bell signal. This is one of the warning signals used to protect great crossings, which they may be presumed to protect after a fashion. But that has nothing to do with the toy. The little signal, which we illustrate, is connected so, that, when the train reaches a special section of the track, the bell will ring; the arrangement being a perfect reproduction of the real thing. This is but one of the many details of the miniature railroad with which the boy of the day occupies himself.

EXPERIMENTERS and amateurs, we want your ideas. Tell us about that new electrical stunt you have meant to write up right along, but never got to. Perhaps you have a new idea, perhaps you have seen some new electrically arranged "do-funny," —we want these ideas, all of them. For all such contributed articles that are accepted, we will pay one cent a word upon publication. The shorter the article, and the better the illustration—whether it is a sketch or photograph—the better we like it. Why not get busy at once?

EDITOR.

A Toy Electric Washer

THE child of the present generation has to be brought up in the way it should go, and the way it should go in this century, is for the woman of the house to know how to do her own work. Electricity makes this very easy for the present generation, and the modern house is plentifully supplied with all appliances. So here we illustrate a toy washer for a child to amuse itself with, for washing its doll's clothes, and for learning what it may have to do in the future, of which so much is hoped. The doll at the foot of the machine evidently has only one set of clothes, and when they are in the wash, it has to go without.

The machine is quite complete, a little alternating current toy motor drives it, and of course when the motor is present in the house, it will be used by the progressive children, perhaps under the auspices of the brothers of our little girl, for many other interesting things.

Ball Lightning

By Professor STEPHANE LEDUC

THE standard works describe three forms of luminous electric discharge in air at atmospheric pressure;

1- Disruptive line discharge more or less sinuous.

2- Branch discharge, sometime called the aigrette or forked lightning.

3- The silent discharge.

Three forms of lightning correspond to these classes of discharge.

1- Zigzag lightning in a sinuous line.

2- Forked lightning.

3- Sheet lightning.

There is also a fourth form, for lightning with ball discharge has been observed. Arago was the first to call the attention of the world of science to ball lightning. On July 3, 1725, a man and five sheep were killed by lightning in Northamptonshire. The Reverend Joseph Vass saw a ball of fire, as large as a moon during the same storm, and another person saw a ball of fire as big as a man's head, which burst into four pieces.

M. Babinet has told of a ball of fire which came down a chimney into the room of a tailor; the tailor described it as looking like a cat crawling without legs. The ball seemed luminous and dazzling, rather than hot. It traveled around his feet, climbed up the mantel piece, forced its way through a hole covered with paper leading into the chimney and exploded in the chimney, destroying it, to show that the globular form or ball lightning is the ordinary form of electric discharge in gas of atmospheric pressure.

Experiments also prove that the globular form of lighting and ball lighting are the ordinary forms of electric discharge in gas at atmospheric pressure, and that it is very frequent. The luminous line of the discriptive discharge, and the line of light so characteristic of lightning are simply the result of persistence of vision, and of the luminous impression on the retina due to the motions of the brilliant ball. It would recall the effect produced in the dark by whirling a burning stick before the observer.

HOW TO PRODUCE BALL LIGHTNING

A static electric machine with a Leyden jar connected to each electrode is set up in the dark. The coating of the positive Leyden jar is connected with a horizontal metallic plate, on which there is a photographic plate (gelatine-bromide). The negative armature of the other jar is connected with a second metallic plate parallel to the first, and from a tenth to a quarter of an inch distant from the photographic film. When the discharge between the poles of the machine is produced, the photographic plate should be protected from the light. An electric discharge in both directions is produced between the sensitized film and the metal plate above it. On developing, the impressions 1,2,3, 4 and 5 were obtained. They correspond to that which luminous balls would give, striking the surface perpendicularly. The balls exist in a uniform electric field and are attracted perpendicularly to the sensitized film; on this their impressions are developed and fixed, so as to tell the story of the impact.

If the distance between the metallic plate and sensitized film is somewhat greater, from one-sixth to half an inch, and if the potential of the discharge is increased, the luminous sphere strikes regularly, giving Figure 2.

The spheres are not rigid and are subject to deformation, as several observers of ball lighting have noted. Figure 3 shows a luminous ball, modified by the neighboring globules repelling it, conformable to the general laws of electricity.

The positive discharge from the sensitive surface to the negative, or metallic plate, always gives its image; it is a ramified discharge, whose branches, conforming to the laws of electricity, tend towards the negative globule, to seize and surround it.

When the discharge takes place in both directions, following the same line, the photographic image shows the negative ball, surrounded by the ramification of the positive discharge, Figure 6.

Figure 8, shows a ramified positive discharge without any negative influence; Figure 9 shows the image of a disruptive discharge in the form of a band of lightning, produced by the rapid passage of a negative globule, flying towards the positive pole.

If by any means the speed of the negative globule can be diminished, then instead of appearing like a streak of fire, the motion of the luminous ball will appear slow, exactly according to the description of ball lightning in storms.

It is an easy experiment to diminish the speed of the negative globular light, so that in the words of our tailor it may be seen moving as slowly as a cat.

In the dark room on a horizontal metallic plate, the photographic plate is placed film upwards. Two metallic pointed conductors rest perpendicularly on this plate, an inch and a quarter to two inches apart. Each is in connection with its own pole of the static electric machine. As soon as the machine is turned, globules of light appear at the negative pointed wire, which move slowly by more or less crooked lines towards a positive pole. These globules come to rest, start again and often burst into two or more globules, which continue their independent courses. The luminous globules act exactly in accordance with the descriptions of ball lightning.

Figures 9 and 10 are the developments of images given by the globule of traveling light. In the case of Figure 10 the experiment was stopped before the luminous globule reached the other pole.

It is easy to see that the negative globule by reducing the silver salt imparts conductivity to its path, as it moves along. For one can see on the plate before development the trace of the luminous globule, shown by a thin black line of reduced silver. If the photographic plate is fixed before development, one gets such effects as Figures 11-12. On Figure 11 one can see the effects of the bursting of the globule where the line divides. Figure 12 shows the traces of numerous globules succeeding one another.

Electric Fan for Treating Hair

An electric hair dryer. The lady using this can dry her hair herself without the penance of sitting over a gas stove or other source of heat.

THE editorial staff of PRACTICAL ELECTRICS, mindful of the Biblical statement that a woman's glory is in her hair, illustrate an electric fan which produces a blast of air and incidentally heats it. A long spout, adjustable up and down, enables the blast to be directed in any direction. A handle by which the apparatus can be held in the hand, is adapted to enter a socket in a base, so that it will become a standard instead of a hand apparatus and will support itself.

Its function is to dry the hair after washing it. It may be held in the hand and the air spout pressed into the hair, or it can be set in the base and allowed to act upon the hair, long or short range as desired, leaving both hands free for sewing or other commendable work.

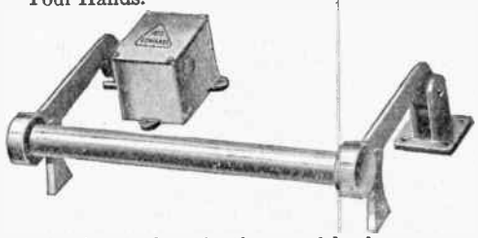
We Pay a Cent a Word

WE want your 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 photagraphs are particularly desirable.

EDITOR.

A Protection for Bank Clerks

IN future, if the appliance shown in our illustrations is extensively introduced into banks, the robbers' order to the custodian of funds will be: "Keep Your Feet on the Ground," rather than: "Hold Up Your Hands."

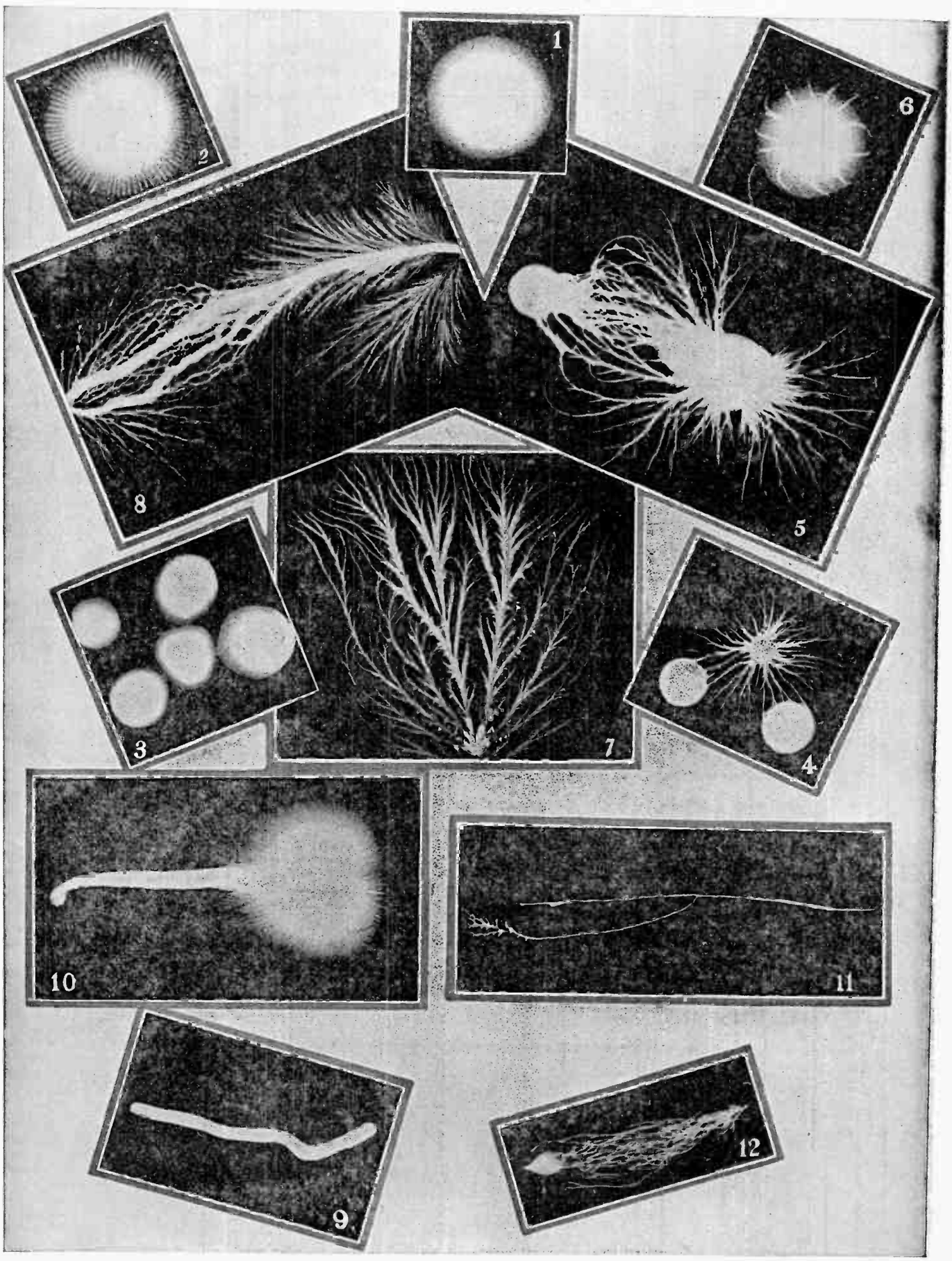


An electric alarm for the use of bank employees. By raising the toe of the foot, so as to lift the switch bar a trifle, a loud alarm is given or the police are signalled for, as may be desired. The bar may extend the whole length of a long counter, so as to take care of any number of clerks.

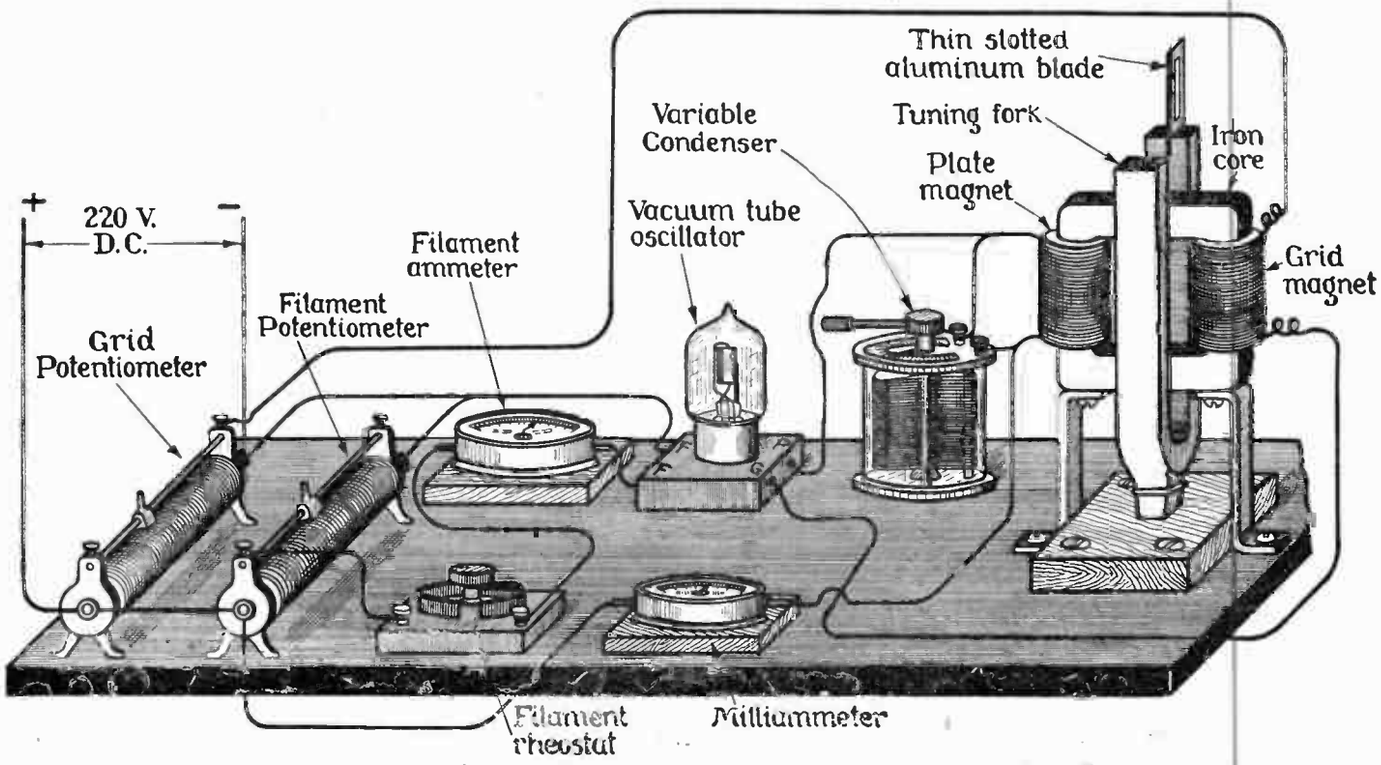
In this appliance a foot-bar, running along just in front of the bank clerk, is arranged so that when raised by a slight touch of the toe, an electric bell will sound an alarm. Bells, of course, can be placed wherever desired, or connection can be made with the police station.

The bar may extend the length of the long counter so that while one clerk is engaged in protecting himself from the robbers, his neighbor can lift the bar and start the alarm. The movement of the toe, of course, is so slight, that presumably it cannot be seen by the robber.

Ball Lightning



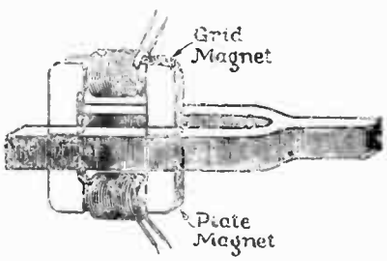
The Velocity of Projectiles.



The general layout of the tuning-fork timing apparatus for determining the velocity of projectiles as carried out in Dr. Hull's most interesting and valuable experiments, which are still in progress.

THE most accurate measurer of small intervals of time seems to be the tuning fork. To get absolute accuracy just enough force should be applied to keep it in vibration, and its amplitude of vibration must be uniform.

The most obvious way of maintaining the vibration is to have a make-and-break contact on the fork. But this partly mechanical method is not effective, as it changes the natural period of vibration of the tuning fork.



One arrangement for maintaining the vibration of a magnet, employed in Dr. Hull's experiments, from his sketches.

Dr. Gordon F. Hull of the Technical Staff, Office of the Chief of Ordnance, War Department, Washington, D. C., and of Dartmouth College, has applied the audion relay to measuring small intervals of time. We are indebted to him for some notes on his method, which notes are given further on.

The diagrams show how a tuning fork can be kept in such vibration without any make or break. It is placed so as to be acted on by two electro-magnets. One electro-magnet is in the grid circuit of an audion and placed so as to be with in the inductive range of one or both of the legs of the vibrating tuning fork, when potential acts upon it.

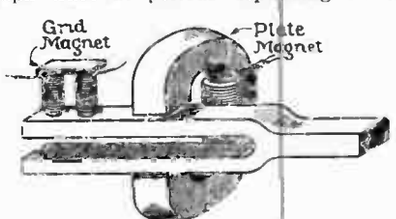
If the tuning fork vibrates it will change the inductance of the electro-magnet, and thereby affect the action of the grid in the audion; this reacting on the ions, changes the current passing through the plate circuit.

In the plate circuit is a second magnet which directly acts upon the tuning fork. When the current is turned on, the variations in the grid circuit induced by the natural vibrations of the tuning fork, are repeated with absolute synchronism in the plate circuit. The total changes effected by the vibrating tuning fork in the potential of the grid circuit are very slight, but by means of the audion the changes relay an exactly corresponding current of sufficient strength, through the plate coil, to keep the tuning fork in vibration. This vibration will continue for hours at a time with uniform amplitude. The fork never touches anything; the entire action is inductive.

The tuning fork kept in vibration gives an accurate measure of time to a minute fraction of a second. One vertical line is produced upon the chart every one-thousandth of a second. The spaces between the lines can be divided into tenths or less by measurement. The timing apparatus is applied to determining the velocity of projectiles.

The projectile is fired through two coils placed at any desired distance from each other. Sometimes the projectile has been magnetized, so as to give it polar relations, but it has been found that in some cases the change in the earth's flux through the opening of the coil as the shell passed it, was sufficient to give an inductive effect.

The coils are connected to an oscillograph or a reflecting galvanometer, the light from which is received upon a rotating drum. On the same drum is received the light passing through a slotted blade mounted on both of the legs of the tuning fork, which latter produces a line crossing the oscillograph trace at periods depending on the natural note of the tuning fork. The drum is coated with sensitized paper. The inductive effect of the projectile passing through the coils is indicated by variation in the oscillograph trace on the paper.

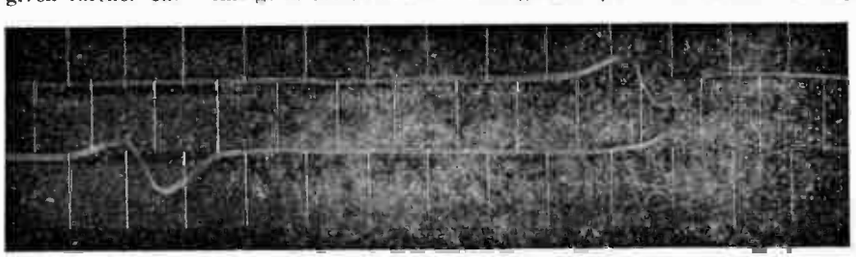


Another arrangement of grid and plate magnets for maintaining the vibration of the tuning-fork.

These traces and the time lines of the tuning fork apparatus are brought out by regular photographic development.

Dr. Hull thus describes in a letter to us the action of the electric timing apparatus:

"The only function of the tuning fork is to flash on the rapidly moving film (moving about 60 feet per second) a strip of light a thousand times per second. These flashed signals are seen on the film as fine lines, the long dimension of the line being at right angles to the film's motion. This is brought about by attaching to the ends of the fork's prongs thin aluminum strips, each of the two strips having a fine slit cut through it.



A reproduction of the curves produced by the projectile in passing through the coils. Each sharp bend in the horizontal line indicates the time when the projectile passed through the coil. The space between the upper lines indicates the one-thousandth part of a second. This can be divided by the eye easily into tenths, or by measurement into hundredths, so as to give a wonderfully close reading.

When the fork is at rest, these slots allow a thin strip (about 0.0015 inch wide) of light to pass through. So with a fork having a frequency of 500 cycles per second, the light passes through 1000 times per second. The time during which the light falls on the film is of course small compared with 0.0001 second. It is of the order of 0.00002 second.

The light from the string galvanometer or oscillograph gives a continuous line at right angles to the timing lines—as long as there is no current in the element. When the projectile passes through the coil there is a sudden sinus as you call it. The figure shows the curve given by the passage of the projectile through three coils, the upper two being between 9 and 10 thousands of a second apart. The drum made a complete turn before the lower record was made. In the diagram the plate coil represents the driving electro-magnet, the grid coil the electro-magnet, which interrupts or controls the magnet driving the fork.

Perhaps I ought to add a note to the effect that the most effective arrangement of the electro-magnets is as follows: The two magnets are placed facing each other between the prongs of the fork, the dimensions roughly as shown. There are about 5000 turns of No. 38 or No. 36 wire in the plate magnet coils, and about 5000 to 7000 of No. 38 or 40 in the grid magnet coils."

In this way it is believed that the most accurate results in determining the velocity of projectiles have been attained. The tuning fork vibrates in perfect freedom, there being no make or break of a mechanical contact, as is usual.

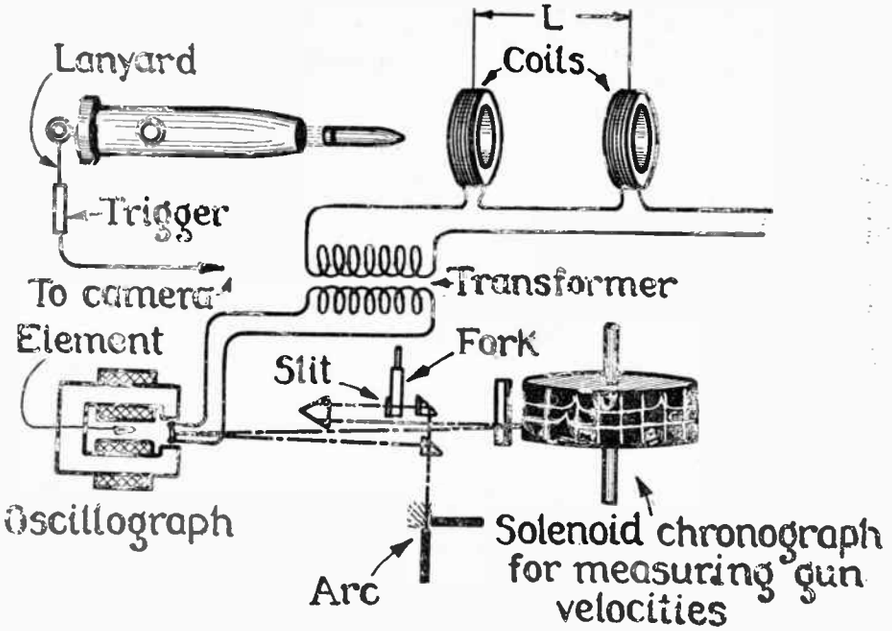


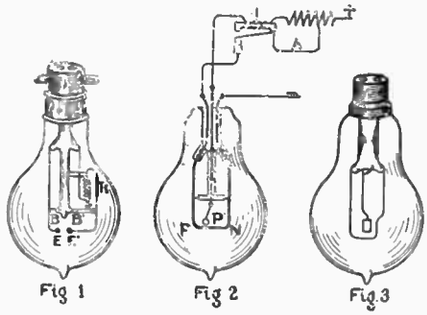
Diagram of the complete arrangements for determining the velocity of projectiles, as the experiments were conducted by Dr. Gordon F. Hull. To be studied in connection with the other illustrations.

The Pointolite Lamp

THE Pointolite Lamp has excited considerable attention in England, and experiments in that direction are now being conducted in the United States. German authorities attribute its origin indirectly to the famous Nernst of Nernst lamp fame.

We show three illustrations of different constructions of the lamp. The first figure shows the earliest form. The principle that it is founded on is the producing of an arc in a bulb which is charged with dry nitrogen at two-thirds atmospheric pressure. The arc is produced between two terminals of tungsten. The arc must be a D. C. arc. One of the terminals carries a little bead of tungsten and one of the early difficulties in constructing the lamp was in the production of this bead. Once the arc is produced, its heating effect is concentrated on the bead, and several thousand candle power, it is said, can be produced from this minute sphere, not much bigger than a pin-head.

In some cases the lamp was built for alternating current, in which case, of course, there would be two beads to be lighted. But for the direct current the cathode is given a sort of pointed form. The current goes through a heating coil S and through a thermostatic bar. The heat from the coil bends the bar so as to draw the two electrodes E and E1 apart, they having hitherto been in contact. All this occurs when the switch is closed and current turned into the lamp. An arc at once springs across from electrode to electrode, and the lamp begins to work. A duration of 100 hours is assigned to the earlier forms.



Three constructions of the Pointolite Lamp, in which an electric arc brings a tungston bead to incandensence.

A peculiar trouble that exists is that the two electrodes coming together when the lamp is extinguished and has not cooled off, are liable to weld, and to separate them some force is required, which interferes with the regularity of its operation. This trouble induced the effort shown in the second figure. Here the ionizing of the contents of the bulb is used, based on the experiences with metal filament lamps.

Three wires are fixed into the neck of the bulb. The negative wire terminates at N and N is connected by a tungsten filament wire loaded with oxides, with the terminal P. This is the ionizer. The positive wire forms the winding of an electro-magnet I in circuit with the resistance, and parallel with the short, circuit A. This forms the third wire of the lamp and ends within the lamp at terminals P' with tungsten bead. When the circuit is closed the current first flows from P to N, ionizing the gas in the bulb. Current starts from P to N, constantly increasing in strength and exciting the electro magnet. As the current acquires strength, it attracts its armature, bringing the short-circuit A into the circuit so as to cut out the resistance. The arc now rises to full strength and the P' is heated to brilliancy.

The third modification shown in the illustrations substitutes a flat electrode for the head. This is where a very strong light in one direction is needed, such direction being at right angles to the plane of the flat surface. The lamp gives what has long been desired, a concentrated area of light, the one thing desired by the projectors of moving pictures and the like.

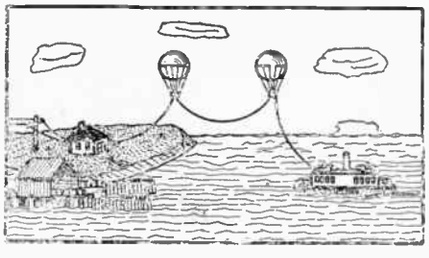
It is claimed that the newer lamps have been brought up to 500 hours duration and that their illuminating power only went down 10% in that period. The illuminating power is ten times that of tungsten lamps and it only requires ½ watt to the candle power.

A Balloon Supported Power Line

WE illustrate an interesting suspension apparatus, the invention of N. F. Rutherford, for carrying power lines without the necessity of setting up poles. The invention applies to the supporting of a flexible cable; it is maintained above the surface of the earth by one or more balloons. There may be a whole string of balloons for long lines, or a single one, where the line is only a short one. In any case, it is perfectly evident that it will save a great deal of expense, which enters into the construction of pole lines, by thus supporting power cables. He also suggests that the ground be used for the return circuit, thereby giving the balloons only one line to carry, although of course, if desired, as shown in one of the drawings in the patent, he may have two lines, one line out and one line in. The invention is also applicable to a boat, as shown in one of the drawings, in which the power is conveyed to it from the supported line. As the boat crosses the shore the balloons rise in the air and thus automatically take care of the extra length of cable.

It is evident that there are many other situations in which this system would apply, saving the time and expense of permanent structures.

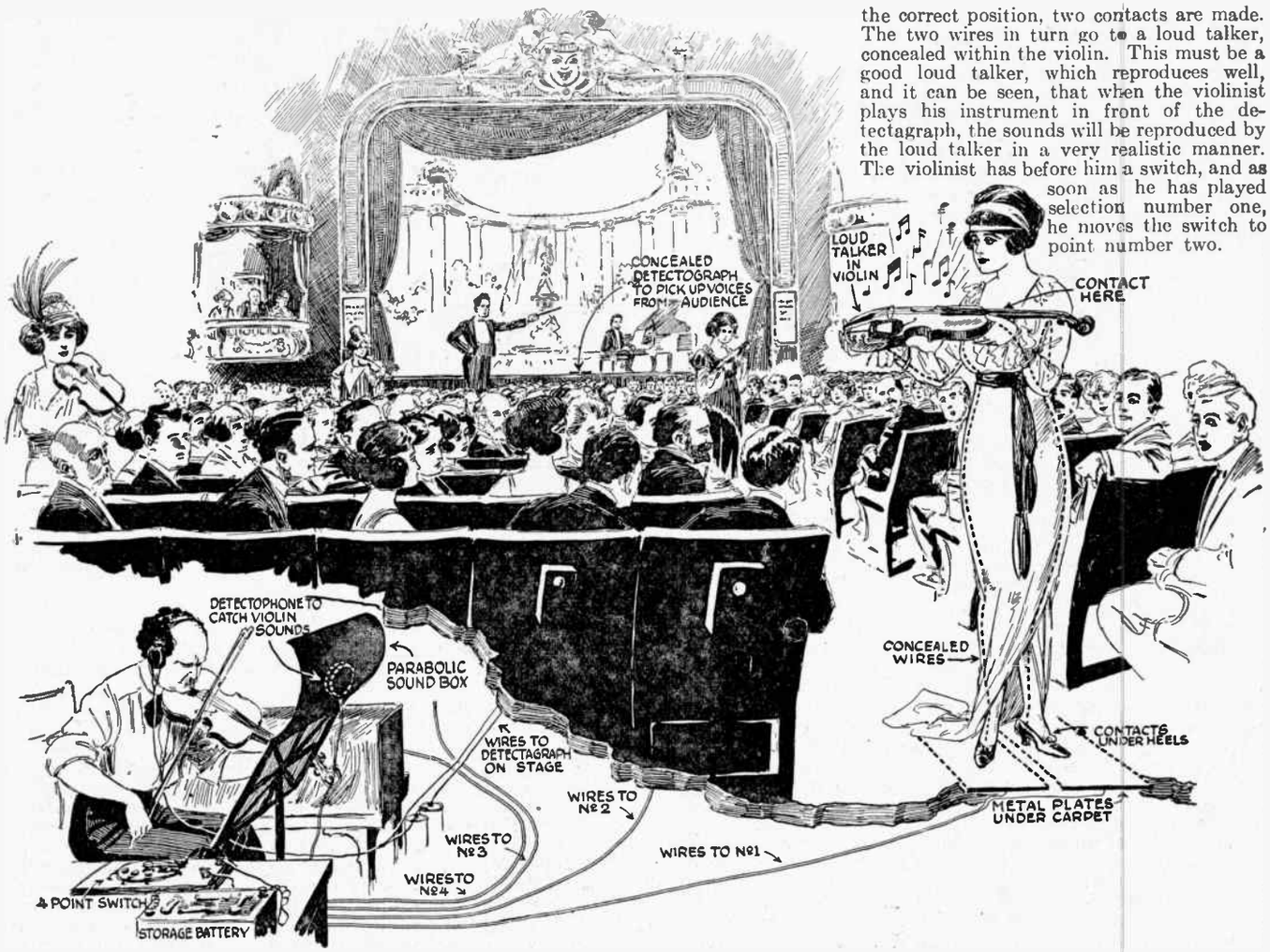
Of course the actual first cost on inflated balloons might be as high as that of a line of poles or even more, but there is a suggestion for emergency work of great saving of time, especially for difficult places.



A suggestion for supporting aerial electric power lines. As the boat nears the shore the balloons lift the line higher in the air.

The Haunted Violin

By H. Gernsback



Above is shown graphically how the now famous haunted violin trick that mystified so many thousands of people is performed. The answer is electricity plus concealed wires. The illustration better than words explains how the violin music issues from the instrument held in the girls' hands, without a bow being used.

RECENTLY there was produced in the Greenwich Village Follies at the Shubert Theatre, New York City, a novelty that no doubt is of interest to our readers. The stunt is as follows:

Four ladies of the chorus step out into the aisles, assuming positions in different parts of the house. The conductor asks persons in the audience to call out the name of a song they would like to hear. Upon the title of the piece being given, he points to one of the young ladies. She holds up the violin, as shown on our front cover, when the instrument starts to play at once in the usual manner, with the exception that there is no bow and no one playing it. Someone else calls out a different song, and the conductor points to another young lady, and the correct musical selection immediately issues from the haunted violin. So in turn one after the other of the violins starts playing whatever song is called for by the audience.

Naturally the audience is very much mystified, and wonders how this unusual trick is performed. It should be noted right here, that the strains that come from the violin, are violin music, and good music at that. There is no grating, mechanical sound about it, but the strains come out well-nigh perfect.

The explanation lies of course, in the one word "Electricity." Our illustration shows how this trick can be performed by anyone. To begin with, it is necessary to prepare the spots or places underneath the carpet runner, on which the girls are to stand. There are usually two metal plates or sheets of fair dimensions, and each girl will know where the plates are by their location in the house. For instance, the first girl will know that her place is opposite the row of seats marked B; the second one will know that her place is opposite seats P, and so on. These metal sheets which may be of zinc. or any other clean metal, usually are about two feet by one foot, in area, and are placed as shown in our illustration.

A wire connection goes from these metal plates to a concealed room, in which is located the grand secret in the form of a violinist, who plays in front of a good detectagraph. This detectagraph is connected in series with a battery, and the wires lead to the two metallic plates. Each girl should wear, preferably, long skirts, to hide the necessary wiring, which of course, is all important. The wiring on the girls is as follows: One flexible wire starts from the shoe, where it ends in a sharp point. This point is necessary so that the minute she steps upon the concealed plates, the point will go through the carpet runner, penetrating the layer, and making connection with the metallic spot. Both shoes are thus equipped. The wires then run up the legs, under the dress, and thence down the inside of the arms. Long sleeves, are of course necessary for this trick. The only exposed part of the wire is from the wrist down on both hands. Connections are made between the bare wire, and a small metallic contact plate beneath the violin, as shown in our illustration.

Therefore, the minute the violin is placed in the correct position, two contacts are made. The two wires in turn go to a loud talker, concealed within the violin. This must be a good loud talker, which reproduces well, and it can be seen, that when the violinist plays his instrument in front of the detectagraph, the sounds will be reproduced by the loud talker in a very realistic manner. The violinist has before him a switch, and as soon as he has played selection number one, he moves the switch to point number two. Immediately the haunted violin number two will start to play. It is the same with violin number three and four, all the girls, of course, being wired in the same way, and standing upon similar plates.

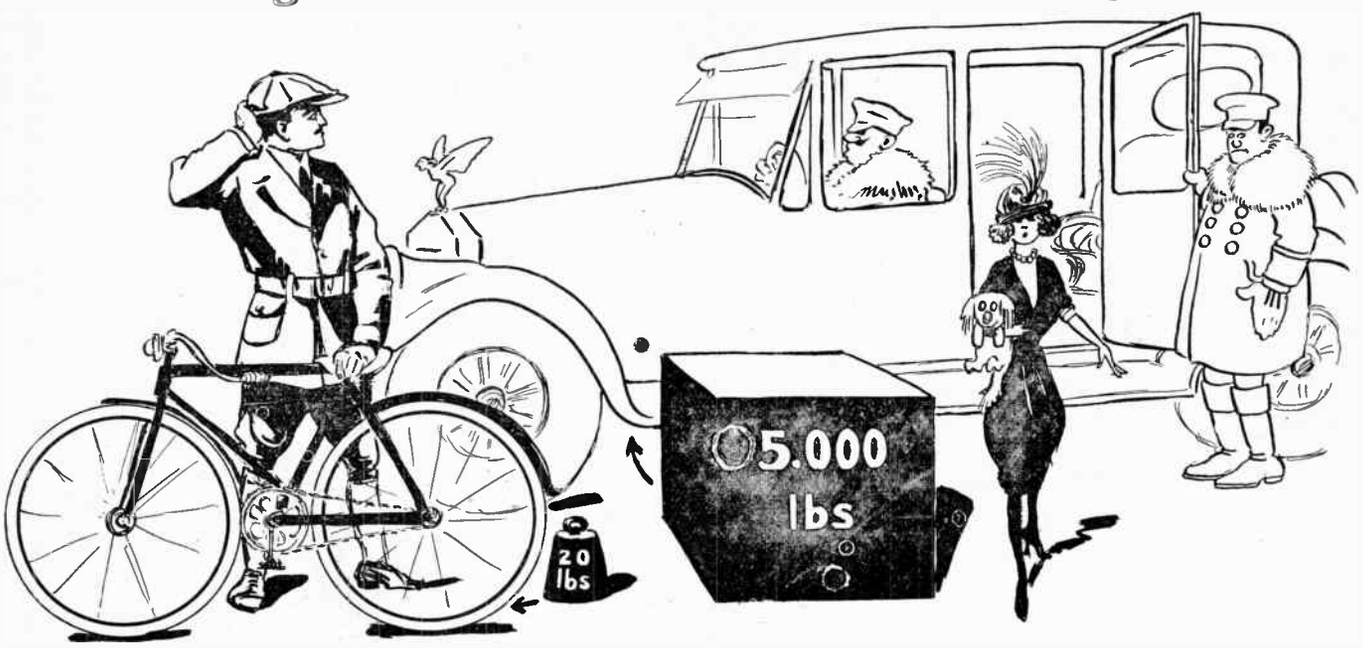
How does the concealed violin player know what to play? Very simple. Down in front, near the orchestra, there is a concealed detectagraph, or for that matter several of these may be scattered throughout the audience. These detectagraphs pick up the voices from the audience, and convey them to the concealed violinist, who immediately starts playing the desired selection.

If this method is not desired, another one can be substituted by having an attendant concealed behind the curtain, who, having a microphone before him can talk to the violinist, thus giving him the selection desired.

This is, of course, not the only way in which the trick can be performed. It can be done by radio, but this necessitates an elaborate equipment, because the girls would have to carry around with them the amplifiers, audion tubes, batteries, etc., so that for all purposes the one described here is probably the best in the long run.

Another method of reproducing violin music which is very good also, is as follows: instead of using the detectagraph in front of the violinist, an ordinary microphone of the Skinderviken-button type may be attached right to the violin itself. This in some cases makes an even better reproduction. But this method does not lend itself equally well to all violins.

Lightness In Electrical Machinery



Above we see a heavy man with his 20 pound bicycle, and alongside of it is a weight of 20 pounds. In the background is the 5000 pound limousine, and this is operated for the benefit of the rather thin lady, and is a contrast to the 20 pounds of the bicycle. The 5000 pound weight is seen standing there. One is good engineering and the other is bad.

WHEN the electrical transmission of power was first proposed. it was said that it was impossible of realization on account of the size of the conducting wires which it called for. By the use of high voltage generation and step-up transformers, high potential is developed on the line and the long miles of wire are reduced greatly in size, so as to save copper;-and as the potential on these lines is too high for practical utilization, step-down transformers are used to reduce the potential on the short service lines, which directly convey the power to motors for mechanical use.

The recent million volt potential-difference experiments are in the direction of getting a large power through a small wire or conductor. A wire, 25 mils, a little over 1/50 inch, in diameter, or No. 22 gage, will carry an ampere. If it were possible to get such a wire to carry an ampere of current, without corona or other loss, and deliver it with a potential difference of one million volts at the motor, 1000 horse power might be taken through a wire of the diameter of a steel knitting needle. This, at

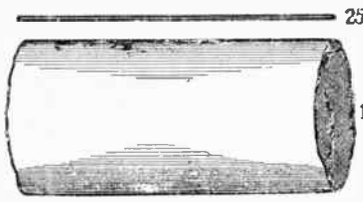


FIG. 1

The upper wire at 250,000 volts will transmit the same power that the lower one will at 100 volts.

present, is impracticable, but it does show the direction to which these high voltages tend, namely to the further saving of copper in the line conductors. This is an instance of economy in stationary appliances due to high voltage. The pity is that as great an economy on the same principles cannot be applied to motors. It is not safe to say that anything is impossible, but the idea of handling a million-volt potential difference for operating an electric motor is certainly rather appalling.

But to think of the power which the million volts, leaving out all considerations of corona and special difficulties, could carry through a small wire, requires on the face of things a little effort. Considering the weight of copper in the conductor, that our every-day potential difference of 110 volts requires for a given amperage, and remembering that 220,000 volts is practically in use to-day, it seems a pity that there is no way of applying these high voltages to motors. Now the transmission lines get all the benefit of the high potential.

On the trolley car, which certainly is a very heavy etructure, and one in which there seems to be no effort made to avoid weight, the motors form a considerable percentage of its avoirdupois, for the electric motor with iron cores for its field, and for its armature—both of them masses of inert weight, which in turn are wound with heavy coils of copper, is a very heavy mechanism. It operates at some 600 volts. If the motors were built for 110 volts their weight would be much greater. The principal element which keeps the weight of motors within limits is their high rate of rotation.

Not long after the work of the early investigators, Thomas Davenport in 1837, produced one of the first electric motors, and then thirty years or more had to elapse, before the self-exciting convertible generator and motor were devised. Since then, everything has been, as far as motors are concerned, in the direction of increasing their power, for curiously enough, they started in at quite a high efficiency once they were fairly introduced and going. Little or nothing radical has since been done to reduce weight.

Imagine a motor wound with No. 22 or No. 23 wire, and in some mysterious way operating with a potential difference of one or two hundred thousand volts; the weights of its cores and windings would be very slight and its velocity would be very great. Thus it might operate with one ampere and be exceedingly light, not any larger than a sewing machine motor, though of many horse power.

In the cases of transportation of persons or of material, lightness of the vehicle and propelling mechanism reads economy and efficiency. A man of 150 pounds and upwards may do his mile on a 20-pound bicycle in three minutes. This is an enormous advance over what nature has done for him, and here man is a better engineer than nature has proved to be. At the other extreme, a lady, weighing perhaps 100 or 125 pounds, uses a 5000-pound Rolls-Royce automobile to go about in. The man represents almost the perfection of mechanics as regards weight of appliances; the woman with her Rolls-Royce represents one of the most ineffective ratios that exists. It is a pity that the electric motor cannot be brought down from its present weight to a much less one. We would not say that the advance would even approximate the ratio of weights between the bicycle and automobile just cited, but something might be done.

When it was first seriously proposed to send electric power over long lines, it was "demonstrated" to be impossible, on account of the size of conductor required. By raising the voltage this "demonstration" was disposed of in short order.

Imagine an electric driven ocean liner with 100,000 or 200,000 volt motors to transmit the power of a high speed internal combustion motor to the propeller shafts. The combination would save tons of weight. If the motors of trolley cars could be operated at such voltages a great reduction in the unsprung weight would be effected. And

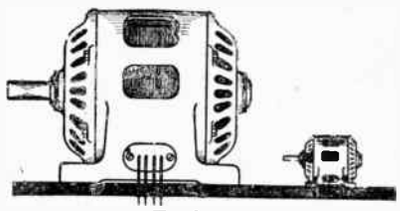


FIG. 2

If the small wire can transmit as much power as the large one, why cannot the little motor be made to develop the same power that the large one does?

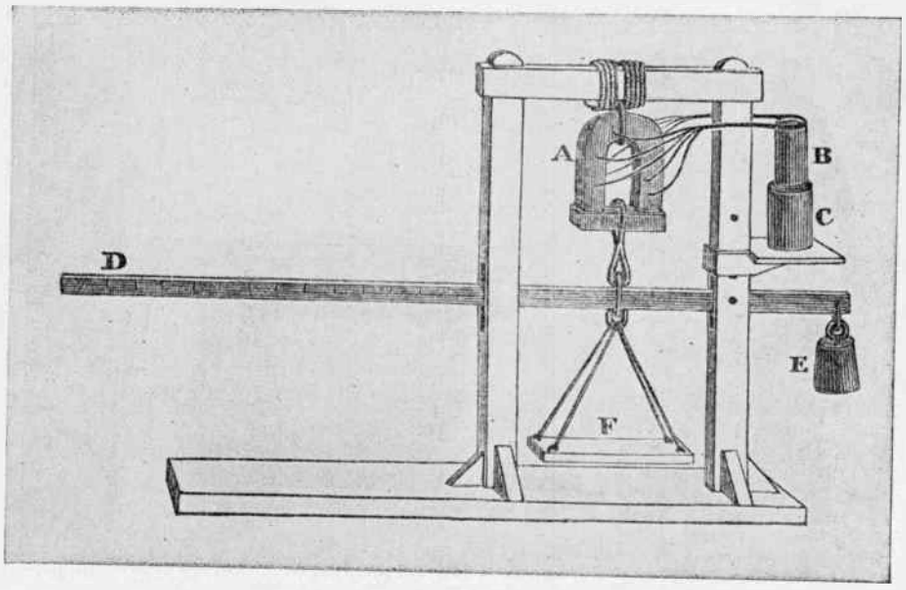
finally, if someone would invent a light storage battery, another great advance would be made.

Engineers have pushed efficiency to the upper limits in electric generators and motors, but little has been done to reduce weight. It is an almost untilled field.

The remorseless way in which moving vehicles are constructed from the standpoint of weight is certainly one of the blemishes of modern engineering practice. The Pullman cars weighs far too much for the load it carries, and it exacts a heavier toll than would be necessary with lighter vehicles—and so it goes, all the way down the line. There seems never to be a thought of saving weight.

The Discovery of the Electro Magnet and of the Electro Magnetic Field

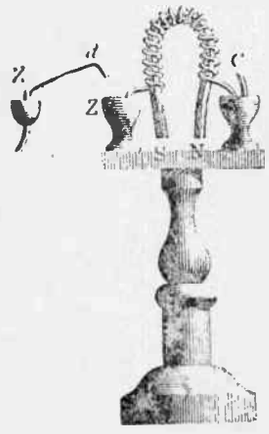
By Prof. T. O'CONOR SLOANE, Ph. D.



This very interesting illustration is an exact reproduction of a wood engraving nearly 100 years old, which was used to illustrate Professor Henry's first article on the electro-magnet. The magnet was wound with four parallel coils of wire and Professor Henry states the different effects to be produced by soldering the ends of the wires together. In other words, he provided for series or parallel circuits.

B represents the battery plates and C the battery jar. The magnet is thrown in and out of action by immersing the plates and withdrawing them from the solution.

It will be observed that the artist drawing the magnet apparently had no conception of the fact that it was wound with wire coils. The use of the lever, D, and its counterpoise, E, shows that Prof. Henry was ahead of his time.



William Sturgeon's electro-magnet. This magnet was supported by the wire winding, the ends of which were secured to the stand. It shows how little conception Sturgeon had of the possibilities of the electro-magnet, which were only developed by Professor Joseph Henry at the Albany Academy and in Princeton University.

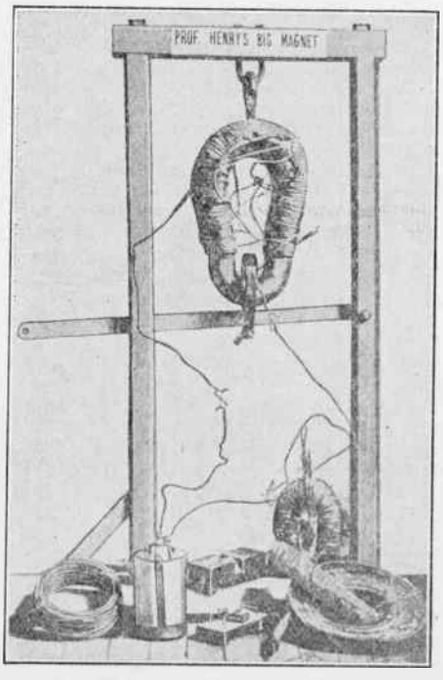
ONE of the earliest references to the mariner's compass in literature occurs in Dante's "DIVINA COMEDIA," where he speaks of the "needle pointing to the star." This was before the conception of magnetic poles, and takes us back well over 600 years. What construction of compass was then used, we do not know, but at any rate here was a recognition of the directive action of the magnet. Any connection of the earth with its direction presumably did not exist; it points to the star, the poet says.

In our last issue we gave some interesting reproductions of the work of Volta. He, in inventing the voltaic battery, failed, naturally, to grasp the resistance element involved. To get more effect, he kept on adding couples, thereby, of course, cutting down his current, whenever he worked with low resistance external circuits.

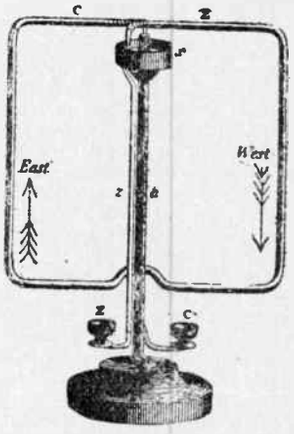
Feeble as his currents were, the greatest interest attached to his researches, and in the early part of the last century we find the Danish Professor, Oersted, investigating the action of a wire conducting a current upon a pivoted compass needle. He found that a wire conveying the current to a battery, which he called a "conjunctive wire", acted upon a pivoted magnetic needle in its vicinity, so that it deflected the needle to one side or the other, according to the direction of the current, and position of the wire with relation to the poles of the magnetic needle. He issued a short paper in Latin describing his experiments. His work was so small and so limited, that today it seems almost trivial, yet it was absolutely the beginning of our knowledge of electro-magnetism. He was born in 1777 and died in 1851. So little did he realize the relation of magnetism and electricity, that he experimented with a brass needle and needles of glass and of gum-lac, which he states remained quite quiescent. This was twenty years after the Galvani and Volta discoveries and controversies.

There is a hint that in 1802 Romagnasi of Trent in the Tyrol, observed an effect produced on a compass needle in the neighborhood of a voltaic pile, but this tells nothing as details are lacking.

Oersted's experiment excited great interest. The famous Arago brought the the news of Oersted's discovery to Paris



Professor Henry's great Princeton magnet, photographed at Princeton before its removal therefrom. It is now in the Smithsonian Institute, Washington. This magnet supported 3600 pounds.

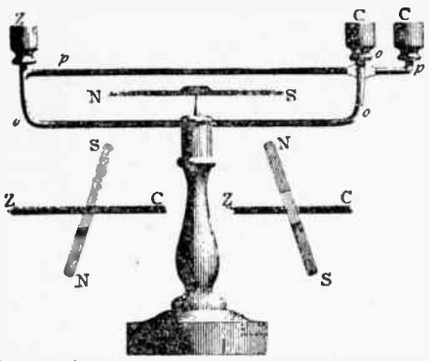


A pivoted conductor placing itself in the magnetic meridian when current is passed through it. Mercury cups are used to make connections. This dates back to the days of William Sturgeon, in 1825.

on September 11, 1820, and only a week later Ampére presented a paper to the Paris Academy of Sciences. He had spent the week in doing work which Elihu Thompson aptly characterizes as "the production of a mind of the first order working at high pressure."

The next development was to try the effect of passing a current through coiled wires, and in doing this the coils were found to possess within themselves a directive force. Ampére's theory of terrestrial magnetism and of the permanent magnet was formulated. This theory was that currents of electricity circulated around the earth, while currents also circulated around the elements of a permanent steel magnet; it was by the reaction of earth currents on the magnet currents that the directive action was produced.

During this same period, Arago was working on the subject, and he is supposed to have been the first to find that a wire, carrying a current, attracted iron filings. Then we hear of Arago magnetizing steel needles by placing them within a helix, through which a current was passed. As late as 1858 the above experiments were described in Silliman's "PRINCIPLES OF PHYSICS", and the book states that if a tube of copper or other metal were employed to magnetize the needles the action of the current on the enclosed bar would be destroyed. This, of course, is absolutely false, but it seems



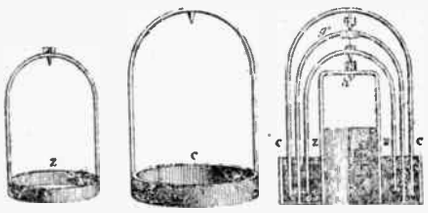
Sturgeon's apparatus for illustrating the action of the electric current on the magnetic needle, carrying out Oersted's experiments.

strange that within the lifetime of so many of us, the above error was put in print in the leading American text-book on physics.

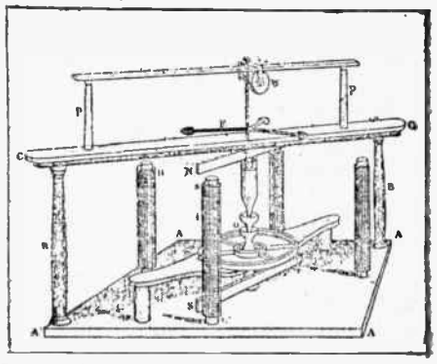
America has had the good fortune in science to do physically big things. Prof. Hare of Philadelphia cut loose from the high resistance voltaic battery which long persisted in use, and increasing the size of the plates, reduced the resistance and obtained greatly increased currents.

In England William Sturgeon of Woolwich had produced an electro-magnet, shown in one of the illustrations, which sustained an armature. The picture reproduced was published in the Transactions of the Society of Arts of London in 1825. A great quantity of other apparatus was exhibited by him and a silver medal and a large cash prize was awarded him.

When Professor Joseph Henry of Princeton took up his investigations a little later, he did what no one seems to have done before. He began to produce electro-magnets of great power. He developed the electro magnet in size and did not stop until he had produced for Princeton a magnet which would support 3600 pounds, and one for Yale which supported over 2000 pounds. The writer has been told by people of a somewhat earlier generation than his, of



Zinc and copper cylinders placed concentrically were caused to rotate in opposite directions by the insertion of a magnet pole in their axis. These were constructed by William Sturgeon and exhibited by him in 1825 with the rest of his apparatus.



Sturgeon's motor. One of the very first electric motors ever produced. This dates back to 1825 also.

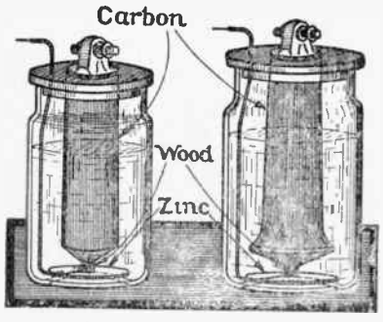
lectures given in the old days, at which electro-magnets, carrying out Professor Henry's ideas, were shown, which lifted a number of people standing on a platform. They may have been somewhat in the line of solenoids. So here the fundamental organism for the creation of a strong magnetic field, the electro-magnet, was invented and constructed, ready to carry out Faraday's discoveries, and to provide a mechanism for converting mechanical energy into electrical energy, and for carrying out the reverse action.

The Fery Battery

THE Fery battery has excited a great deal of attention in France and has been extensively introduced there for open circuit work. The illustrations show several models and the general principle of its action is the following:

On the bottom of the jar is a plate of zinc; to this a copper wire is attached, the wire being soldered to the zinc electrode on its surface. The plate of zinc lies in a horizontal position under, near the bottom of the jar. Upon the zinc plate there is a non-conducting block which may be wood. Then on top of the wood there rests a cylinder of carbon. This is made by special formula for the purpose of their battery. The excitant of the cell is purified sal ammoniac dissolved in water. The proportion is 15 parts of the sal ammoniac to 100 parts of water by weight. To put the cell in operation, it is first filled up to about two-thirds its height with water, and the sal ammoniac is then introduced, and the mixture agitated, until it dissolves completely. Pure water is then carefully added so as to lie above the sal ammoniac solution. This is poured in until it comes to within about 3 inches of the top of the jar, which is of course the top of the carbon.

The action of the battery is quite peculiar and characteristic. The sal ammoniac solution attacks the zinc. Polarization at once begins. A very slight collection of hydrogen bubbles appears on the carbon, concentrated in locality near to the zinc. As the hydrogen accumulates it polarizes the lower part of the carbon, cutting it off from the electrolyte. Now, if there were no depolarizing action, the entire surface of the carbon would become coated with hydrogen and the current would cease. But on account of the vertical position of the carbon rising up from the zinc, the upper layer of the liquid absorbs a certain amount of oxygen from the air. This establishes a sort of gas battery between the upper and lower areas of the carbon, so as to put the carbon, as it were, on short circuit within itself, and depolarization begins to act at once. The lower part of the carbon gives nascent oxygen, which combines with the polarizing hydrogen, forming water, and putting the surface of the carbon in perfect condition. Special experiments have been made to test this theory out fully and it has proved to be quite justified.



An open circuit battery of great duration, running for many months with little or no attention.

The electromotive force is 1.25 volt. The resistance is simply stated to be slight, as there is less than one-half inch between zinc and carbon, and the solution of zinc chloride gives good conductivity to the electrolyte. There is no action on open circuit. Without adding anything to it, unless possibly water, it can continue to work until the zinc is dissolved. The zinc never needs cleaning, and the depolarizing agent, the oxygen of the air, is naively said to cost nothing. It consumes about 20 grains of zinc to the ampere hour. It will be noticed that as long as the sal ammoniac stays in the lower areas, creeping of salts over the edge of the jar will be avoided. This battery is said to operate for several years without being touched.

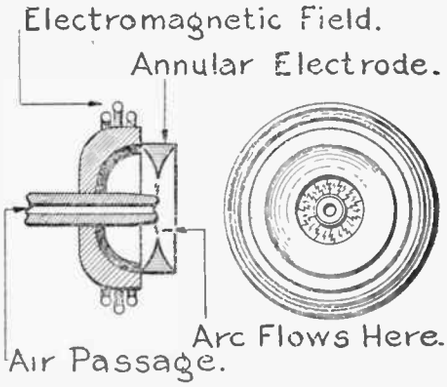
Warning is given that no oil should be poured into it, a frequent practice with gravity cells. Such oil cuts off access of air, and the depolarization ceases.

Of course in the gravity batteries in which oil is used to prevent evaporation and creeping of the zinc salts, there is no question of exclusion of air. Zinc sulphate, which is produced in the gravity battery, has a most annoying disposition to creep up the glass jar and even to creep over the top. It is also vital that the zinc plate should be under the water, and evaporation would throw out the battery, and act as if a switch was opened. In the Fery Battery evaporation does no harm, within limits, of course.

Electric Arc Lamp With Rotary Arc

AN electric arc lamp, especially one for projection purposes, should, if possible, provide a crater in the positive carbon. This crater is then the source of light. It is limited as to size and should be practically fixed in position. In the present invention a horizontal positive carbon is surrounded by an annular negative electrode, so that the arc will spring between them and form a crater directly in the end of the positive carbon. If this was done always from one side, the crater would rapidly burn away and be impaired or destroyed. Accordingly, an electric field is introduced which produces a rotary arc, the arc moving around like a hand of a watch or clock so as to spring from different parts of the negative annular electrode to the crater of the positive one. This preserves the rim of the crater intact.

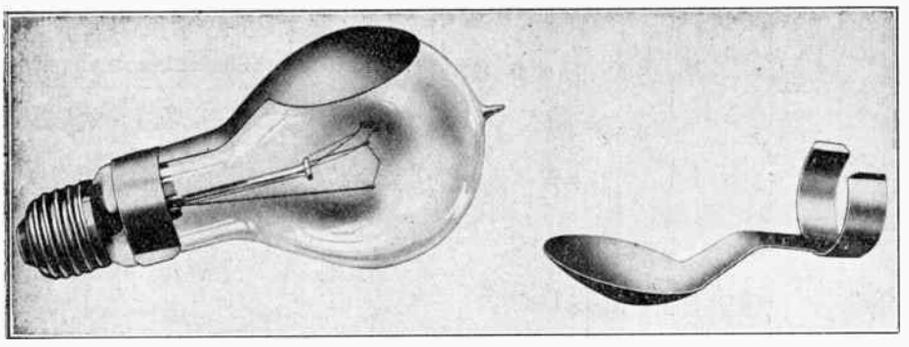
The positive carbon gets very hot and of course begins to burn away. This trouble is minimized by placing a concave insulator, a structure like a reflector, a little way back of the end of the positive carbon. This forms a chamber directly back of the annular electrode, which gets filled with the carbon dioxide gas and prevents the positive carbon electrode from burning rapidly. An axial hole may be made following the center of the positive carbon, through which air is passed.



An arc lamp especially adopted for projection of pictures on the screen.

New Things Electric

A Protector for Gas Filled Lamps for Out Door Use



A simple protector for the incandescent lamp, when used out of doors exposed to the rain. This protects it from cracking, reducing the expense of electric signs.

THE comparatively recent practice of putting gas in incandescent lamps, made possible by the use of tungsten filaments, has brought about remarkable results in efficiency. The old ratio of 3½ or 4 watts to the candle power has been changed to a watt or less, a very wonderful advance. These lamps have their troubles. The gas within them, owing to convection, arises in a constant stream, impinging upon the glass directly above the filament. In this way it develops a definitely located hot spot upon the glass. For outdoor uses, as in electric signs, if rain falls upon the hot spot on the glass of the lamp, it is pretty sure to crack it, which, of course, is the end of it. We illustrate a protection, now on the market, designed to prevent this source of loss. It is a little, spoon-shaped affair, which fastens by a spring or clip, so as to cover the glass above the filament, when the lamp is in a horizontal position. Then the rain cannot strike the hot glass, so that fracture is prevented. When the clip is used the spoon-shaped protection can be attached while the lamp is in the socket. If the spring, which completely surrounds the neck of the bulb, is used, the bulb has to be taken out of the socket to put the spring in place.

New Alternating Current Rectifier

THE illustration shows an apparatus for charging strorage batteries, which is of the utmost simplicity of application. All that is requisite is to connect it to any 60-cycle, 110-volt circuit. These are the figures in general use in this part of the world; in England the commercial frequency is much lower. It is a polarized contact make-and-break machine, the vibrating element operating in exact synchronism with the frequency of the current, so as to give sixty charging pulses of current each second.

Referring to the diagram, the vertical vibrator with horizontal polarized armature on its top, is seen extending down between two screws B and G. The screw B is a contact screw, the screw G is simply an adjusting screw to limit the length of the arc of vibration.

As the apparatus is shown in the diagram, the alternating current is passing by the connection, A, through the magnet coils H, H, to the condenser, I, to the connection F. At F the negative pole of the battery to be charged, is connected; the positive pole is connected at E. The battery is now short-circuited and receives no charging current. When the positive part of the cycle acts upon the polarized armature above the magnets H, H, the circuit we have just traced is opened, being short-circuited through the contact B and through the battery, between E and F. This short-circuits the magnets H, H, and the current goes through the lamp D, and flows between E and F, charging the battery connected between them.

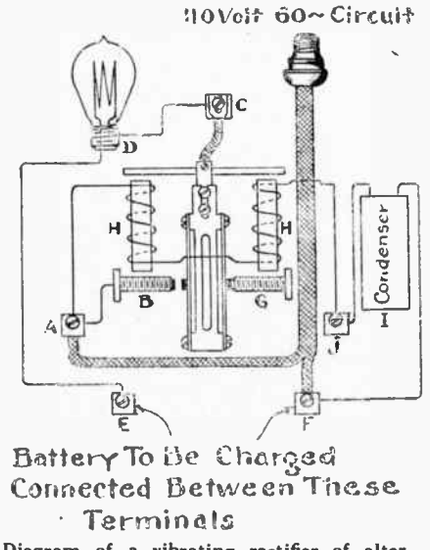


Diagram of a vibrating rectifier of alternating current of considerable capacity, with lamp used as resistants.

The current flows through the spring, with its contact point touching the contact point on B, to the terminal C, and then through a lamp D, which lamp must be of proper size for the requirements of the battery. The current then goes to E, which indicates the positive pole of the battery. Passing through the battery the current leaves it at F and returns to the lighting circuit. As the armature is polarized the two coils work in unison to close the circuit at B on one part of each cycle. The lamp D is to be selected of such size as to pass the amperage required for the special battery and in accordance with the voltage of the battery. This restricts the current to the proper amount for charging purposes. A lamp so large as to rate at 115 volts, 75 watts, can be used. Beyond that there is danger of burning out the contact. All that is necessary to put the rectifier to work is to screw the plug into any lamp socket.

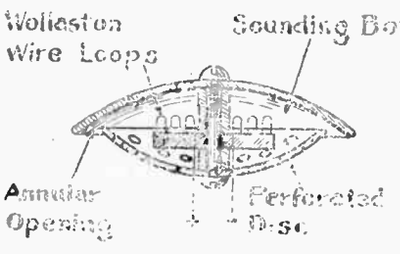
One essential thing is that it must be on a 60-cycle 110-120 volt circuit. The condenser advances the current in the coils H, so as to break the circuit at the point of the cycle when no current is passing; this point is at the zero potential of the alternating current.

A Thermic Telephone Transmitter

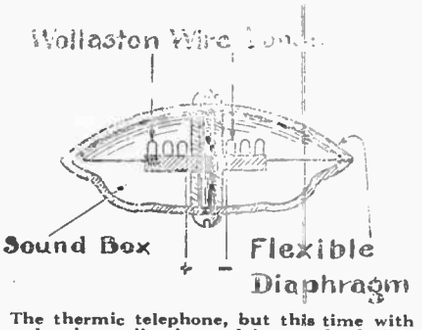
THE telephone, invented by Robert Aernont, Baron van Lynden, which we illustrate, is founded upon a basic action which the patentee does not undertake to fully explain. It amounts to this: that an excessively thin Wollaston wire, which is the thinnest wire made, is arranged in multiple for the speaking current to pass through. The wires are enclosed in a case and constitute the microphonic element of a telephone system. When the sound waves act upon the wires, either the compression or the expansion of the almost invisible thin wire, or the changes of temperature produced by the successive compression and rarefaction of air within the transmitter, will produce variations in resistance. It is thought possible that the changes of density due to the succession of sound waves may cause such variations, or that changes of temperature may. In any case, the wires do vary in resistance with the sound waves, and a speaking current is thus produced.

Two forms of diaphragm chamber are shown in the patent. One comprises two concave diaphragms, the hollow sides facing; and is open to the air by apertures, and the second, a concave diaphragm, is of different size, so as to give an annular opening between them. In another construction the

(*Continued on Page 91*)



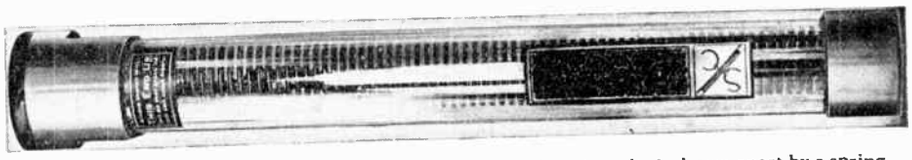
A telephone utilizing the heating effect of the current upon minute parts of Wollaston wire. Open sounding box construction.



The thermic telephone, but this time with a closed sounding box, relying on the flexible diaphragm for its operations.

A New Electric Overload Fuse.

WE illustrate a very interesting fuse, which is so arranged that, when the conductor within it melts, the gap is at once increased ensuring a definite break. The glass tube contains a fusible element, through which the current passes. This conductor element is kept in tension by a spiral spring; the minute it melts the ends will be drawn apart, because the spring will contract, clearing the circuit absolutely. It is said that less than the time of one cycle of alternating current is required for the break. The tube is filled with a non-inflammable liquid of a high diclectric strength which in popular language means "of high resistance". The freezing point of the liquid is lower than 65 degrees below zero Fahrenheit. The fuse is so rapid in its action that if on a branch circuit and a short circuit occurs thereon, the line will be cleared before the heavy main line fuse, or oil circuit-breaker, as the case may be, can open. One of the minor features—and a very good one—of this fuse is that by looking at it from quite a distance it can be determined whether it is open or not, because the contracted spring will indicate that the rupture has occurred. The tube must be placed in a vertical position with the proper end upward. There is a vent in the cap to permit the escape of the vapor, which is evolved when the fuse parts.

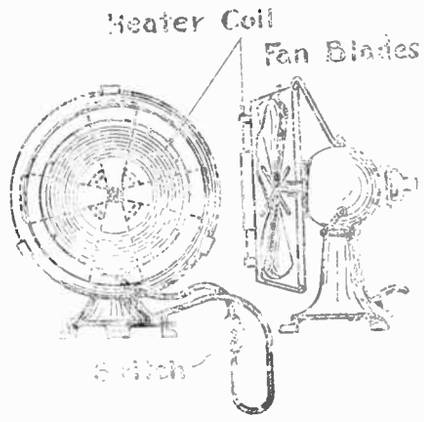


A fuse operating by the melting of a wire, which when it melts is drawn apart by a spring. The whole is contained in a glass tube, so that it can be told whether the spring has contracted or not. If the spring has contracted, the fuse has melted.

Fan Electric Heater

THIS electric heater is an arrangement for use with an electric fan. It provides a heating coil, which can be used in cooperation with the fan, in order that the draft produced thereby will pass through it, and the air will become heated. A double electric connection is arranged so that the wires may branch, part of the current going to the fan, and part to the heating coil. This is done by a sort of two-way socket, one element of which connects with the heating coil, and the other with the fan.

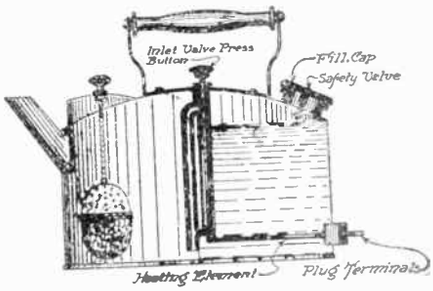
The patentee, J. D. Zieley, states that his conductors may be in two sets, one of large and one of small wires, and that current may pass through one or both sets of coils, according to the requirements of the case. The coil is provided with a snap attachment, so that it can be snapped on in front of the fan or removed, according to the season of the year. It often happens that an artificial draft in connection with the heating apparatus gives much better results than where the natural draft of the air is relied on to distribute the heat.



A heater coil to be attached to a fan for winter work. Like the man in Aesop's fable this fan blows hot and cold with the same mouth.

New Electric Tea Kettle

THE illustration shows an English innovation, a novel electric tea kettle. The kettle is divided into two parts by a cross diaphragm. On one side of the diaphragm in a steam tight compartment is the water; on the other side is the tea, contained in a tea-ball. There is an electric heating element on the bottom of the side containing the water, and there is a safety valve for this compartment out of which steam blows when due pressure is reached. When steam shows, a button on the center of the top of the kettle is pushed down. This opens communication by means of a siphon tube between the two compartments of the kettle, and the pressure of the steam forces the boiling water through the siphon tube into the compartment in which the tea-ball is hanging. In this way the tea is made with boiling water, as the water will not enter until it has actually exceeded the ordinary boiling temperature. The steam generated in the right hand compartment operates to keep the water in which the tea ball is immersed, very hot. It will be noticed that the end of the siphon in the right hand compartment, does not reach the bottom, so there will always be water there to supply the steam. It will not boil away for some time.

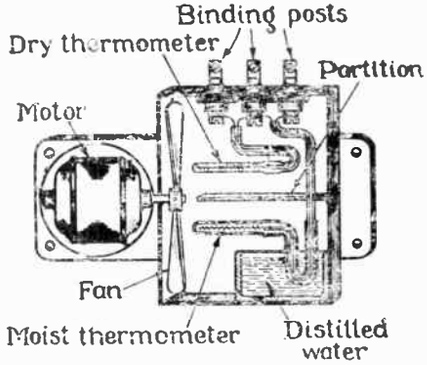


An electrically heated tea kettle. If it does nothing else, this will give you your tea good and hot and will maintain the temperature of the tea as long as desired by the pure steam heat generated by electricity.

Distant Reading Hygrometer

DISTANT-READING hygrometers are used where humidity has to be watched, as in refrigerating chambers, slaughter-houses, granaries, malt houses, workrooms where spinning is done, green-houses and the like; also in schoolrooms, banks and offices, in which ozone-apparatus and ventilation apparatus is in use. These distant-reading hygrometers are very useful. The system illustrated is on the principle of the aspiration psychrometer.

To enable distance readings to be taken in place of the former usual mercury thermometer, quartz glass resistance thermometers have been employed with good results for some years. There are two of these resistance thermometers in a tubular holder, one a "dry bulb" thermometer, and the other a "wet bulb" thermometer. The illustrations show the arrangement. The dry bulb thermometer is indicated above and by a partition, is separated from the wet bulb thermometer, below. The wet bulb thermometer is covered with a porous envelope, that dips into a vessel, of distilled water. If the air whose humidity is to be measured passes over both thermometers, the evaporation of the dampness acting on the wet bulb thermometer establishes a difference of temperature between the two. The relation between the dampness on one hand and between the actual temperature and the difference of temperatures on the other hand, is definitely established and is printed in Jelinek's psychrometer tables. The figures given in these tables apply only for an air current of about one meter per second or more. In cases in which this velocity of current does not obtain, it has to be produced artificially by a fan, as otherwise the readings will be incorrect.



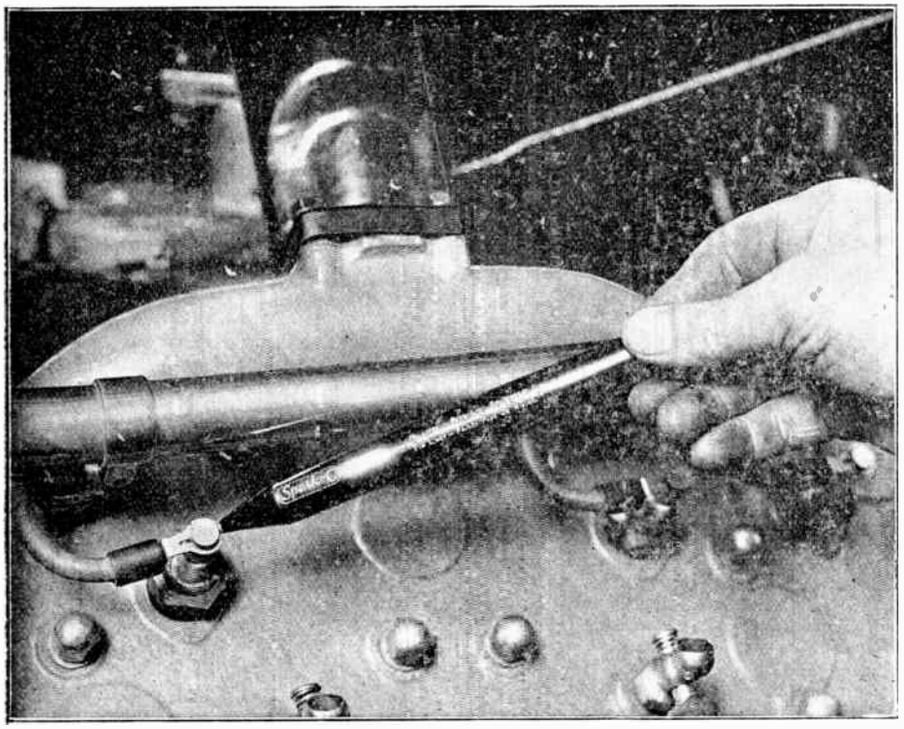
A distant reading Hygrometer

The temperature of the two thermometers is measured by a distant temperature measure of similar construction of Siemens and Halske. Over each push-button provided, by any given fan is switched in this way, superfluous excurrent by connections of long wires avoided. For reading the temthe wet bulb thermometer, it is

Continued on Page 91

Motor Electrics

A Spark Plug Tester



A plug testing apparatus containing the rare element, neon, whose action tells whether the plug is operating properly, and if not, discloses what its trouble is.

THIS new ignition gauge not merely shows whether or not the current reaches the spark-plug, but it tells exactly whether the current is doing its work faithfully or only partially. The action of the new spark tester is founded on the fact that when a glass tube filled with neon (a gaseous element found in the atmosphere, of which it forms about 1-1000 of one per cent by volume) is brought into the proximity of a high tension circuit it becomes luminous, similarly to a Geissler tube. The glass tube containing the neon gas is enclosed in a hard rubber tube, shaped like a fountain pen, in which a small window has been made through which the action of the electrified gas may be observed.

If an orange colored light appears at regular intervals, when the device is held against a spark plug or ignition cable, all is well in that particular cylinder. But if the light is of a bright color it means that particular spark gap is set too wide. If only a dim light appears the spark gap is set too close. Dim light also may indicate a cracked porcelain. If no light at all appears there is either a dead line or a plug shorted by carbon or oil.

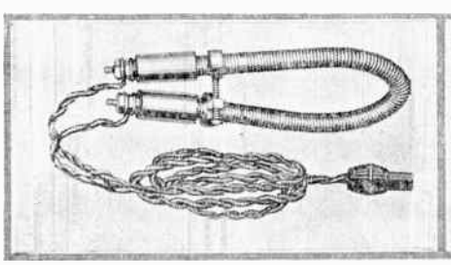
An Electric Intake Heater for Starting the Car

EVERY automobilist has had trouble in starting his car in the cold weather. Frequently gasoline will be seen to drop from the intake of the carburetor before the engine starts. This drip is due to the condensation of the vapor of the gasoline on the interior of the cold intake pipe of the manifold. It is on record that cars have been started by the aid of a hot water bag, and a thermos bottle of hot water has been carried on the trip by some enterprising drivers in order to start the motor for the home voyage. All this seems rather absurd, when there is electricity on the car. It is used at home to make our toast and heat our coffee, and the illustration shows an apparatus for using the electricity always at hand on the car, for heating the intake. It is a resistance coil heater with a flexible cord and plug to attach to a convenient socket on the car. The heating coil is clamped on so as to surround the manifold close above the carburetor. Before the self-starter is put to work, current may be turned on for a few minutes to get the intake pipe warmed up. Then when the spray from the carburetor jet rises into the intake it will volatilize and be converted into gas, so as to reach the cylinders and give them a rich mixture to start on. The amount of electricity used is trivial, because the heater is supposed to be kept in action, except for the starting few minutes before and during the starting.

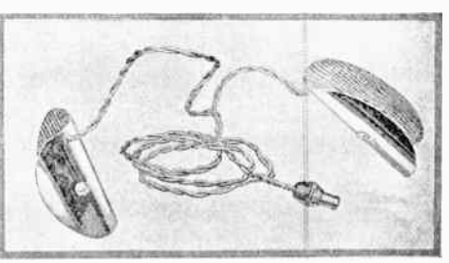
While the average automobilist wants to save his battery, this appliance will not [illegible] made on it by the starting motor, [illegible] ing, when the oil in the cylinders [illegible] frozen, and the rings are clogged [illegible] almost solid lubricant.

Hand Warmers for the Automobile Steering Wheel

THE Chinese have little stoves using a carbon pencil, mixed presumably with saltpeter, for fuel, to keep the hands warm, one for each hand. On the automobile electricity can be used for this purpose. The illustration shows a pair of hand-warmers, which are secured to the wooden rim of the steering wheel. They are connected by flexible cord to a plug, which is inserted into the dash board socket. They contain heating coils and are constructed for the usual six volt storage battery; they use a current of three amperes. When the car is running the generator does far more than take care of this consumption of current. They seem to be a very great comfort for cold weather work, and when it is considered that there is literally electricity to burn on all of our cars, this seems a very rational use for some of it.



A heating coil to encircle the intake of an automobile engine's manifold, to warm it up and facilitate starting the engine. It is plugged in as needed and the plug is pulled out once the engine starts.



A pair of hand warmers to be clamped upon the rim of the steering wheel of an automobile, making driving in cold weather perfectly comfortable.

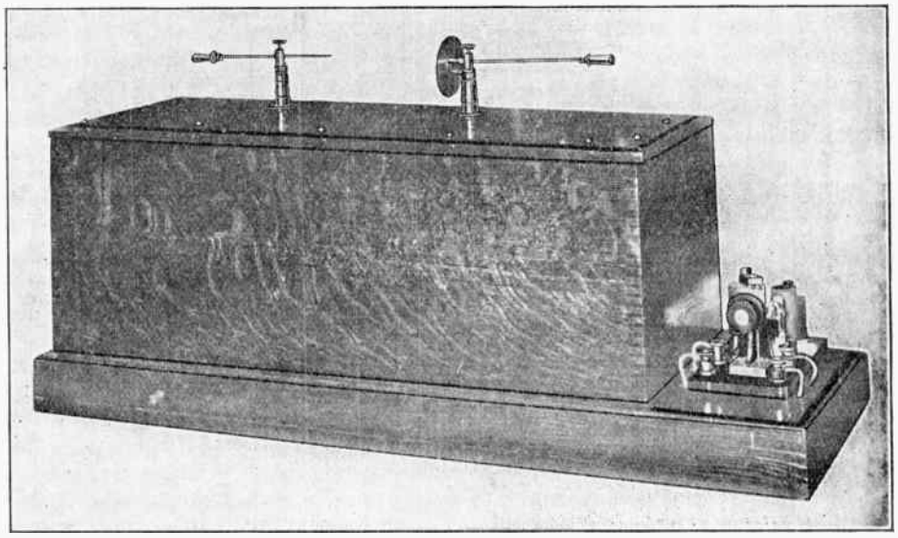
Replacing Brushes in Small Magnetos

FROM a French contemporary, we glean the following: It seems that the motor-cyclists sometimes lose the brushes of the ignition magneto, although this we hardly can feel is a common accident. The loss is repaired generally, our authority states, by making a brush out of wires, to be hammered flat if necessary, and easily made to form an excellent collecting brush. Now, says our friend, suppose there is [illegible] His recommendation, in that case, is to use the lead of a lead pencil. This gives a good brush. The only problem is to get a good connection between the wire and the lead inside the wood. This can be done by cutting into the wood, leaving part of it intact, in order to reach the lead, and combine the conducting power of the graphite of the black lead with the strength of the wood enveloping it. The suggestion is a good one and may serve on occasions to get you home.

Building An 8 Inch Spark Coil

By H. WINFIELD SECOR
Associate Member, American Institute of Electrical Engineers.

SPARK coils are not used so extensively in radio and other electrical work as they once were, but dozens of experimenters often desire to build a large spark coil for operating X-ray tubes and carrying on many other interesting experiments and researches. The present article contains data for building an induction coil giving a spark 8 inches long when it is operated on battery current at 18 volts potential; the current taken by it at this voltage is about 4 amperes, or the coil consumes approximately 80 watts. On lower voltages, the length of spark produced by the coil will of course be proportionately less. Several of these coils were built exactly as here described for commercial purposes some years ago, from the author's original design; the only difference in the coils built and the one here described is that a separate or independent magnetic interrupter was utilized, as the photograph of the finished coil shows, but the writer has built coils fitted with a double spring interrupter of the type shown in the drawings, with excellent success.



Perspective view of the finished induction coil, with one disc electrode and one pointed one. The very compact lay-out of the coil is well brought out, and it is inclosed from dust.

Primary Winding of 8 inch Spark Coil.

Before the primary winding can be put on the annealed iron wire core will have to be either made or purchased. This core is composed of as fine iron wire as possible, and a compact bundle 23 inches long by 1½ inches in diameter should be used. This core should be annealed to the highest degree possible, and this point can be ascertained by means of a small pocket compass. First, the core is magnetized by placing it inside of a coil, through which battery current is passed, or else the core may be placed in contact with a powerful magnet. What we want to measure is the retentivity of the iron for magnetism. When the current is shut off or the core separated from the magnet, the compass needle is brought near the ends and it should be barely attracted, thus showing that very little magnetism is retained by the core. If the core is not thought to be annealed sufficiently

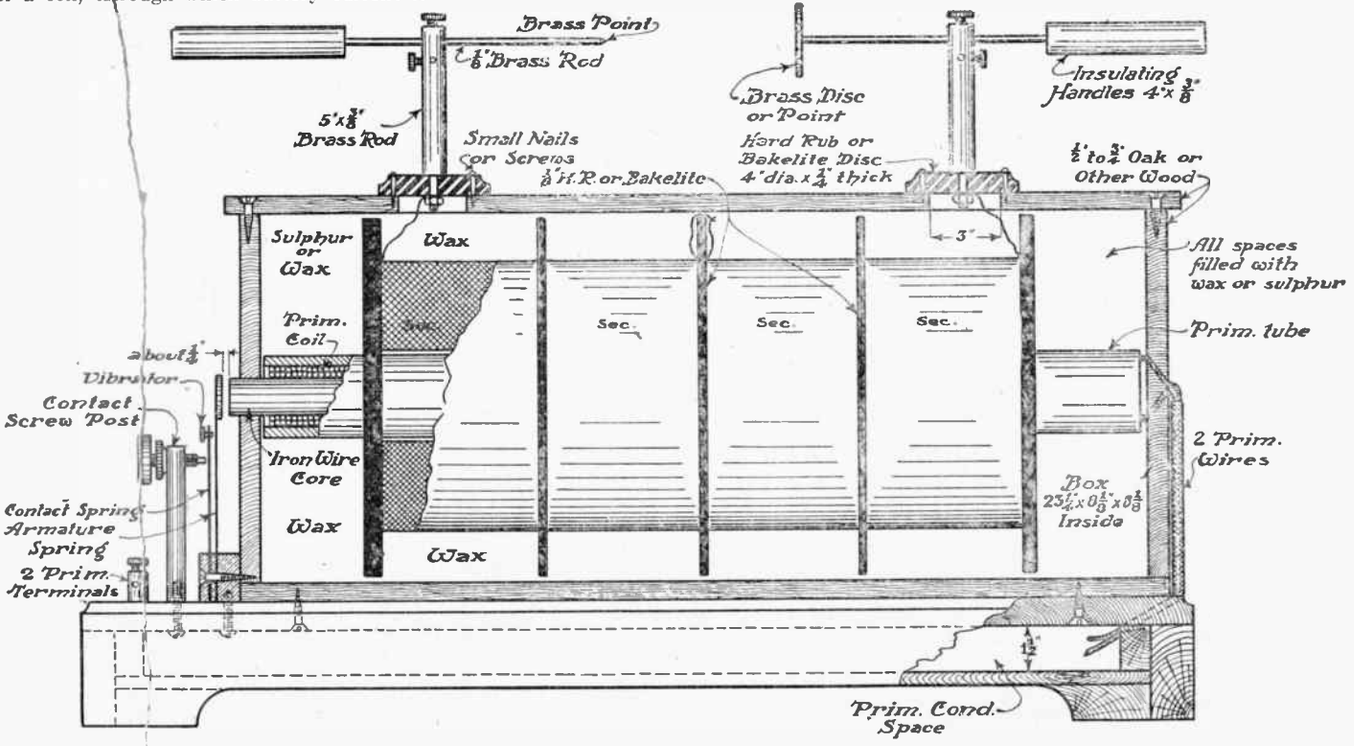


Fig. 1

Fig. 1. Full diagram of the layout of the induction coil, showing the double vibrator, the winding of the coil in four sections, distribution of insulating material, and all details.

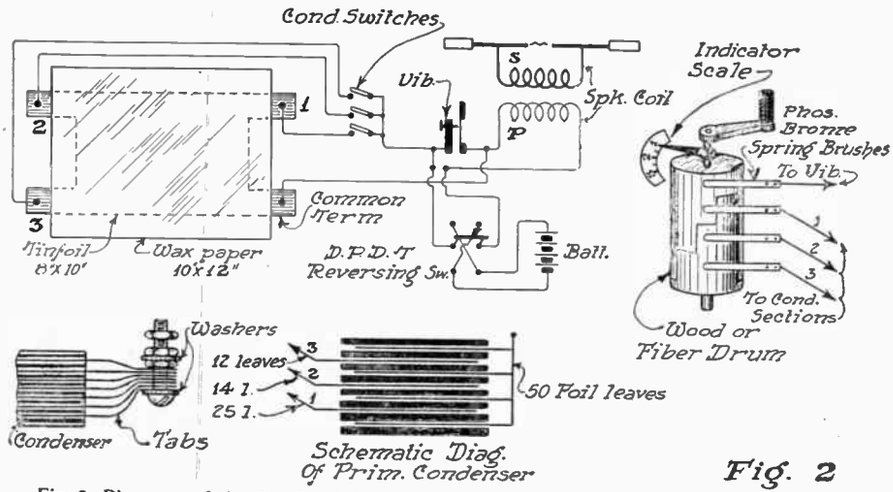


Fig. 2. Diagrams of the details of the induction coil, explaining fully all minor features of its construction.

it can be further softened in one of several ways. One method is to place it on top of a coal fire in a stove or furnace until it becomes a light cherry red or nearly so; it is then removed with pincers or tongs and buried in the ashes under the grate and left to cool very slowly for several hours. Some spark coil builders anneal cores in a gas or electric stove, reducing the heat after the initial light red point has been reached about every half hour, when finally very little heat is applied to the core. This gives the same results as the first method.

After the iron wire core is sufficiently annealed it should be insulated by wrapping five layers of oiled linen or Empire cloth around it; either a wide strip or else tape may be used. Over this insulation the primary winding is wound, which consists of two layers of No. 12 B. & S. gage D.C.C. magnet wire. The primary winding when completed may be given a good coating of orange shellac or else it may be soaked in hot paraffin wax or dipped in melted sulphur. The primary core and winding is slipped into an insulating tube, as shown in the drawings.

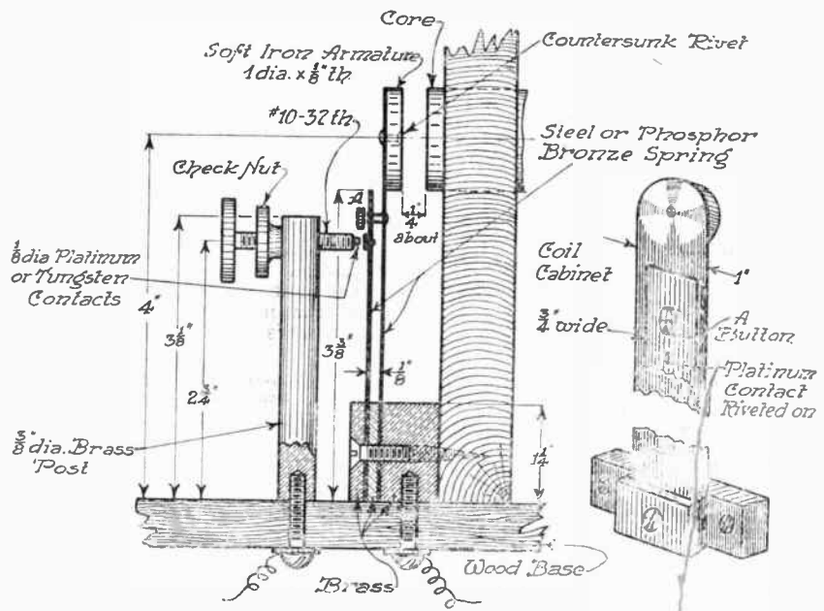
The insulating tube, separating the primary and secondary windings, must be very substantial and is to be composed of hard rubber, glass, bakelite, fibre, or micanite. Bakelite and micanite are probably the two best choices. This insulating tube measures 23 inches long and has a 5/16 inch wall. The inside diameter of the tube is 2 inches and the outside diameter 2⅝ inches. If the primary and core are a little small for the tube, they may be wrapped with a layer or two of oiled linen or waxed paper, so as to fit in the tube snugly, and also to be centrally located within it.

The Primary Condenser and Interrupter.

The tinfoil and waxed paper primary condenser for the 8 inch spark coil may be made up in several ways. In the first place many experimenters will probably not want to bother to make the large condenser which is necessary, and will endeavor to purchase one of the proper size, or several small ones which can be connected in parallel to give the necessary capacity of 2.32 microfarads.

The condenser of this coil will require 8,500 square inches of paraffin paper measuring .003 inch thick, coated on both sides with charging foil; or we may use 106 sheets of paraffin paper measuring 10 inches x 12 inches, with 107 tinfoil leaves measuring 8 inches x 10 inches each. The drawing Fig. 2 shows how the condenser is built up and also the manner in which connection tabs may be brought out from different sections of leaves at the successive corners of the condenser. It is not particularly necessary to arrange the condenser with switches or drum controller, as shown in Fig. 2, but where the coil is to be operated at different voltages this feature is often desirable, as the amount of capacity shunted across the vibrator is greater as the primary voltage is increased; likewise it becomes smaller the faster the interrupter operates, so that when we have an electrolytic interrupter the speed of interruption is so rapid that no capacity at all is necessary or desirable.

The paper used in building the condenser may be ordinary white writing paper or typewriter paper which can be purchased at any stationery shop. The thickness should be checked before waxing with a micrometer, and it should be within a thousandth of an inch or less to the specifications. The paper sheets are paraffined by using a large drip pan in which several pounds of paraffin wax is melted. Care should be taken not to overheat the paraffin as this destroys some of the insulating qualities. The paper is waxed one sheet at a time. Thin copper or aluminum foil may also be used instead of tinfoil without lowering the efficiency. The tinfoil tabs forming a terminal may be tightly connected together by means of two large washers and a machine screw with nuts. In assembling the condenser, every other tinfoil sheet is connected to the common terminal, as the diagram shows.



The make and break of the coil with its dou contact, double springs, so as to give the best possible results.

Terminal 1 if the condenser is made adjustable, comprises all the tabs from the first 25 alternate foil sheets which are not connected to the common terminal. Terminal 2 comprises the next 14 alternate foil leaves, while terminal 3 includes the final 12 alternate foil leaves. Note that condenser switches in any case have to retain their first connections as additional capacities are switched in. The author has generally preferred the drum type controller illustrated in Fig. 2 for switching and retaining in circuit the successive condenser units.

The double spring vibrator which has been used by the writer on spark coils of all sizes up to 12 inches, is shown in Fig. 3. The contact spring may be made about half the thickness of the armature spring which carries the soft iron button at its upper end. This interrupter gives the highly desirable long make and quick break action, which results, as actual tests have proven, in giving about twice the spark length for a given coil, in comparison to the old single spring vibrator

(Continued on page 91)

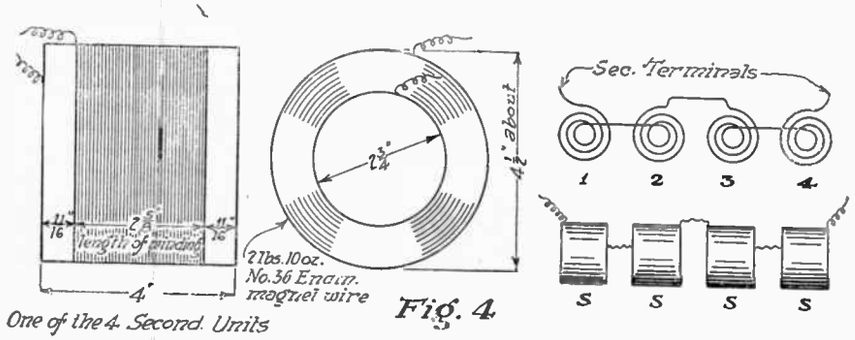
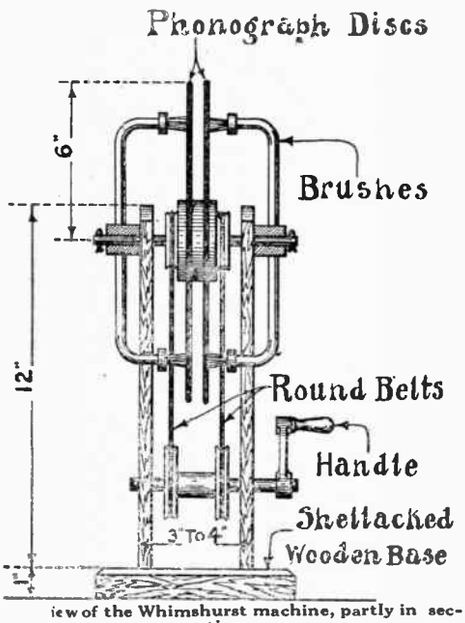
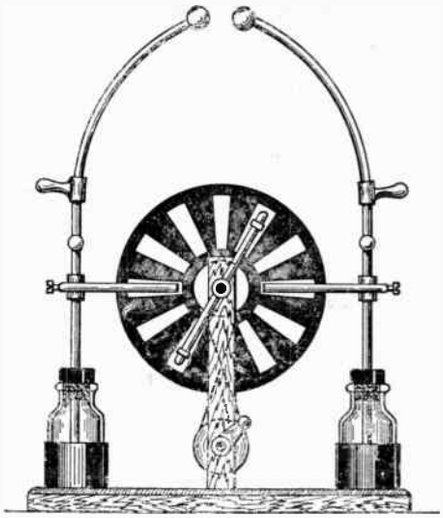


Fig. 4 Winding and reversing connections of the secondary wi

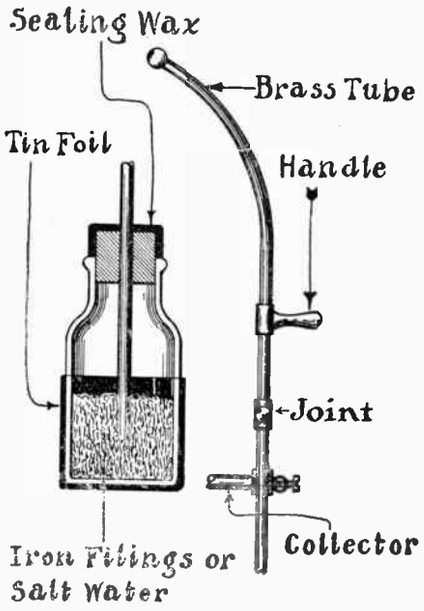
Construction of a Whimshurst Machine



iew of the Whimshurst machine, partly in section.



General view of the Whimshurst machine set up, showing the arrangement of prime conductors, Leyden jars and phonograph disc.



Section of the Leyden jar and construction of the prime conductor.

WITH the static machine it is possible to perform interesting and amusing experiments in a physical course. But these machines are often high priced and it is interesting to make your own apparatus, with such materials as are often at hand.

Thus it is easy to construct in a very rudimentary work-shop a Whimhurst machine with ordinary phonograph discs. It is advisable to get discs with one face smooth. The two discs are assembled so as to rotate on a fixed shaft, and are fastened to wooden washers with grooves turned on extensions of smaller diameters on the outside of each to act as driving pulleys. They have a hole through the center, of the same size as that of the discs. The axle is held motionless in the frame, the pulleys turning on it. Dimensions are given in the transverse view of the frame. The shaft must project on each side of the frame sufficiently to receive short tubes, one on the center of each of the brush holders. The driving pulleys with the handle for turning are journaled at the lower part of the frame; round leather belting is used, (or stout rubber bands.) It is easy to replace the handle by a pulley and to drive the machine by an electric motor. In this case the lower pulleys will have to be of a reduced diameter, to prevent the speed of rotation of the discs from being too high. The brushes are carried by copper tubes, one eighth to one fifth of an inch in diameter, bent as shown and soldered to the central tube, where they go on the extensions of the shaft. They must fit snugly so as to hold any position given them. The ends carrying the brushes are re-inforced by sockets soldered on them. The brushes are made of thin flexible copper wires. These brushes must be very flexible so as not to injure the tin foil. Figure 1 shows the arrangement of the segments of tin-foil attached with shellac to the smooth surfaces of the discs. The conductors or collectors are made of heavy copper wire, at least a quarter of an inch in diameter, bent and soldered to a copper ring and provided with a set-screw as shown in the figure. Brass points are attached to the interior of the collectors, holes being drilled for each one, and are soldered in place. The points are inclined a little bit in the direction of the rotation of the discs. The prime conductors are also made of copper wire and are slightly curved and each has a ball at its end. It is well to have them arranged, so that the balls at the ends can be brought together or separated. For this purpose there may be a stiff joint in one of the wires. The lower end of each prime conductor is held in a preserve or pickle jar. They are held firmly in place by a cork and this should be coated with sealing wax or else should be shellacked. It is to be remarked that common bottles give much trouble by leakage of electricity; vulcanite tubes or bakelite tubes about a thirty-second of an inch thick with about one quarter of an inch sulphur poured in while melted, for the bottom, make excellent jars. Coat the outside of the Leyden jars with tinfoil—about half way up. Coat the bottom too. Tinfoil is best attached with shellac. The inside filling even with the foil, is iron filings or salt water. The jars or tubes must be securely fastened to the base of the machine. Above is show the side view of the mounting. It is well to shellac everything. The brush arms should be at right angles to each other and the discs should be spaced apart about a quarter of an inch. The best position to give the brushes can be found by trial. The copper brushes should touch very lightly on the tinfoil segments without any pressure. An excellent material for the brushes is what is called "lametta", a species of tinsel, used on Christmas trees. The collecting points should be placed about a quarter of an inch from the discs. The discs must run perfectly true at right angles to the axle.

This machine should give a good 2 inch spark.

Electrical Articles in December Science and Invention

A New Color Music Instrument
By Edwin Haynes

Oddities of 1,000,000 Volt Transmission
By H. Winfield Secor

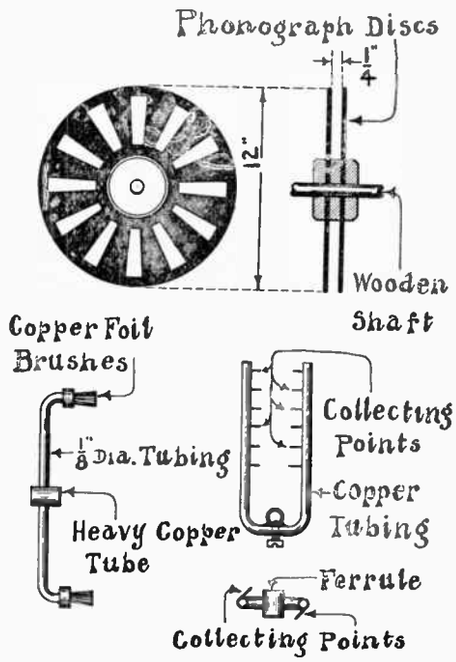
Perfectly Synchronized Talking Pictures
By Joseph H. Kraus

Learn and Work While You Sleep
By H. Gernsback

Electric Powder From the Earth's Heat
By C. S. Corrigan, C. E.

Invisible Ray Signalling
"Home Electrics"-Locating" Short-Circuits" in Grounds By G. L. Hoadley, M. E.

Electrical "Pitcher" For Baseball
How Phonograph Records Are Made
By Alex H. Kolbe

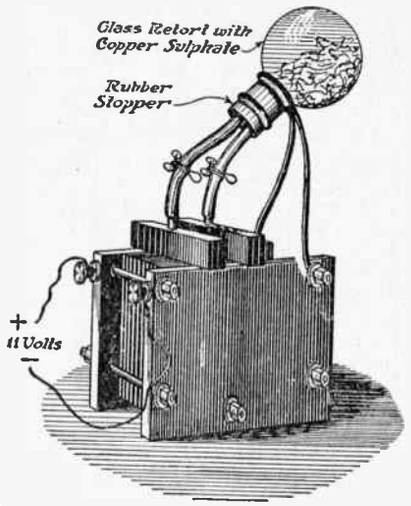


Further details of the parts of the Whimshurst machine

THE LIGHTNING FLASH AND ITS VOLTAGE

DR. Charles Proteus Steinmetz has recently given his views on lightning. It is obvious that the voltage of the flash is very great. Dr. Steinmetz notes the fact that we are now able to reproduce lightning experimentally in the laboratory. Corroborative evidence goes to show that the the voltage of a lightning flash is usually between twenty million and one hundred million volts, averaging probably fifty million volts. The power exerted during the flash is enormous, but owing to its short duration the energy is not very great. Dr. Steinmetz says that it is hard to conceive what 1,000,000 volts means. Five hundred volts will kill a man.

A Remarkable Power Battery-Full Details How To Make It



A copper sulphate battery of remarkable power and constancy. It plates are so close as to ensure low resistance and full particulars of its action as follow.

AN adequate galvanic battery must have the highest possible potential difference, so that the number of cells shall be small when a higher potential difference is needed. The internal resistance must be small, so that the elements will take but little space. During the period of inaction they must consume nothing and the constants must be as good as those of the Daniel element.

These requirements are obtained by the union of ten batteries into one with only two binding posts as described below. The use of changeable parchment cells and the bringing of the electrode plates close together, with only 4/10 inch between them, along with the arrangement for circulation which ensures a saturated copper sulphate solution, but which prevents the formation of a saturated high resistance zinc sulphate solution, produce an extraordinary diminution of resistance and make the element a very constant one.

Looked at close at hand, this battery has some analogy with the old time voltaic pile, and its building-up is similar to that of the above.

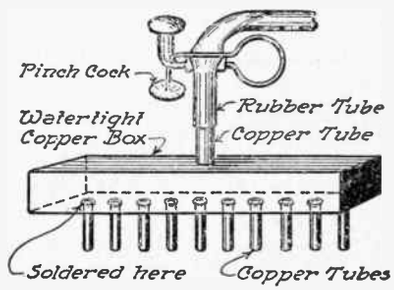
On a perfectly horizontal board a zinc plate is laid down, to which a terminal wire is soldered. On top of the zinc place a sheet of heavy parchment paper with the rough side inwards. After this comes a U-shaped frame of 3/8 inch thick pasteboard which acts as an insulator and to retain the liquid; it also forms the walls of a cell. This U-piece may be formed out of heavy cardboard, which should be paraffined before using, otherwise the acid contained in the copper sulphate will destroy it in time. It is also possible to use soft wood, preferably paraffined, but the cardboard, being flexible, is better. Notice particularly that each of these frames has a small groove as shown in the illustration, about one quarter of an inch from the right end top. This may be V-shaped, cut with a pen knife. This groove is for the following purpose. It is necessary that the liquid in all the cells is of equal height. Therefore, as soon as the tube rack is placed in the cells as described hereinafter, the liquid in all the cells will be of even height.

Next comes a plate of zinc, but this zinc plate is faced with a thin piece sheet of lead on the side turned towards the parchment, which on the upper edge, where the U-formed frame is open, is bent over on the zinc. Next on the zinc side comes again a piece of parchment, a U-frame, a plate of lead, a zinc electrode, etc., until the tenth frame and the eleventh zinc plate (covered with lead,)—this constituting really the tenth lead plate,—is put into position.

After this comes the covering board. Through the edges of both boards threaded bolts are passed and are drawn up so tightly that the V-frames form a water-tight joint between the parchments and the metal plates. The whole is then set up so that the open sides of the U-formed frames stand upward. This gives one a vessel with ten divisions, which on the left has zinc covered with parchment and on the right has a plate of lead.

The last zinc plate with its lead plate has also a copper wire soldered to it, which is connected to the binding post screwed to the covering board, and at the other board there is a second binding post, which receives the terminal wire of the first zinc plate.

An important constituent of the battery are the racks of tubes, which take care of the supply of copper sulphate and the removal of zinc sulphate. These two appliances consist of rubber tubes on which pinch-cocks are placed, connected to the supply bulb which is connected to them and is placed above the battery. To put this into action the cells are filled with water



The Tube Rack

The tube rack with its connections leading to the supply bulb for supplying the battery with electrolyte.

until it begins to run over the grooves. As we mentioned before, the grooves in the frames serve the purpose of keeping the liquid level of the batteries of the separate cells at an even height. Inasmuch as some liquid will always run over, this also makes it necessary to place the battery when completed in such a position that the overrunning liquid does not do any damage. The writer used a shallow sand box on which he placed the battery; the dropping liquid then fell on the sand, where it was absorbed. Then the india rubber tubes going from the supply bulb are cut off by the pinch-cocks. The supply bulb is filled with crystals of copper sulphate (for Battery No. 1, 1½ pounds, for Battery No. 2, 4½ pounds), and with water, and closed air-tight with the india rubber stopper. Then both the sets of tubes are connected to the battery so that there is a little tube dipping into the liquid in each individual cell of the battery.

The action of the circulating battery may be simply explained as follows. As soon as the glass balloon is filled to the brim no air remains within it. This is highly important. The copper sulphate solution being heavy, then sinks down through one of the tube racks. In doing so an empty space is created in the inside of the glass globe, which cannot be filled with air because no air can enter it, the cork sealing the glass hermetically. So the only thing that remains is for a lighter liquid to be sucked up through the second tube rack.

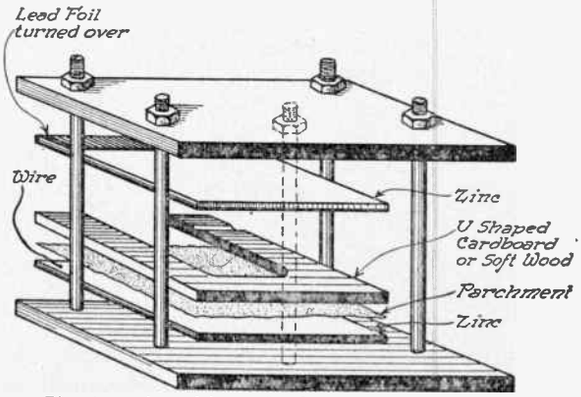
Inasmuch as plain water, or zinc sulphate has a considerable less specific gravity than the copper sulphate, it follows that as copper sulphate sinks down the one tube rack, water or zinc sulphate is sucked up through the other. Thus the principle of this battery is made plain, which indeed is founded upon the circulatory effect of the liquid. This is the great secret. In other words, as long as the liquid keeps on circulating, the cells always have a uniform density of the copper sulphate solution, which gives rise to a heavy current production, not attained in any other battery.

If the supply bulb empties itself, (an accident which can only happen by incorrect handling,) the first thing is to see if all the cells are full of water, and if the bulb and all the tube-racks are closed air-tight, and if all the little tubes of the racks dip into the solution.

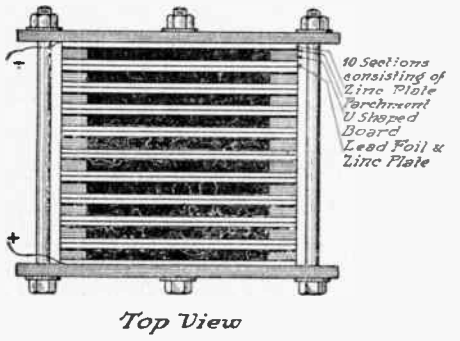
Sometimes the tubes of the racks have to be looked after to see if they are not stopped up, which is most easily attended to, by letting water run through them. After this precaution has been taken, the pinch-cocks are opened leading to the divisions, upon which the solution at once begins to circulate, and the battery in about 20 minutes acquires its full strength, which lasts as long as the copper sulphate is kept in the bulb. To get the battery to full strength in a shorter time, it is filled with water at 25 degrees centigrade, and rain water is especially adapted for it. If the battery is to be put out of action, the pinch-cocks are closed, and the lamps are allowed to burn until the copper sulphate solution in the battery is completely expended, which causes the residue of copper sulphate in the battery to be precipitated as copper.

As the battery works for an hour after the pinch-cocks have been closed, it is recommended to shut them an hour before the lights are to be put out. The battery then can be emptied, rinsed out well with water and filled with pure water until the time comes to use it again. With the first employment of the battery, it must be filled five to six hours before use with water, and care must be taken that in doing this some of the fluid gets between the parchment and the zinc. The replacement of plates and parchment for proper handling of the battery and for expenditure of about 20 watts for Battery No. 2, and 7 watts for Battery No. 1, would take place every 80 to 100 hours. The changing of plates is done with very little trouble.

The great advantage of the construction of this battery is now clear. It admits of the use of plates of large area with their opposite faces in close proximity. The effect of large area and short distance between the plates conduces to low resistance and operates to overcome what may be called the handicap of low voltage. The phantom cut given below is not a presentation of the battery in any sense, it is merely designed to show the order of the plates. In building or laying up the battery the plates are laid one by one on top of each other.



Phantom view of how the battery is put together.



A view of the battery, looking down upon it, illustrating the arrangement of the plates and for the electrolyte supply and circulation for the battery.

If the batteries stand longer than a week without being used, it is highly advisable, a day before they are put into use, to set them to work for an hour with a single lamp or resistance in circuit and to let them work until the next day. Then the battery is ready for action as prescribed above.

The advantages of this arrangement are: The small space, which the battery requires; for an arc lamp eight No. 2 batteries 30 x 30 inches; the getting rid of the troublesome amalgamating; the avoidance of the use of an acid; the absence of disagreeable vapors; perfect security from breakage; no soldering; no riveting; a small number of binding posts; the recovery of the copper in plates; constant yield for eight hours, after which time nothing is necessary but the addition of water and copper sulphate to make it work for another eight hours. In this way it can be kept in use until the zincs are used up, which can be carried out until they are practically thin foil.

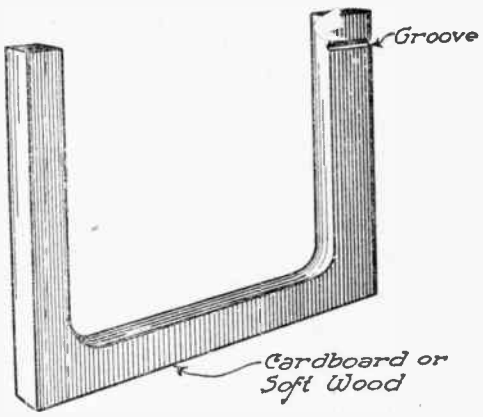
Battery No. 1- (size 8 x 5½ x 6½ inches) is capable of supplying 7 to 10 watts, enough for running a three-candle-power incandescent lamp. The glass reservoir in this size can be got rid of by replacing it with a water-tight wooden box, which gives a portable battery, which has its uses in powder magazines or in spaces exposed to danger from fire. This makes the handling a little more difficult and makes it less popular. The larger size, 14 x 10 x 5½ inches, has found great use in small lamp installations, as well as for occasional illumination with the arc light. The arrangement of the battery for this purpose is based on voltage. Electro-platers use the battery a great deal, as it gives out no disagreeable fumes and there is no amalgamating to be done.

The handling of it is exceedingly simple; one hour before the predetermined shutting off of the current, the pinch-cocks are closed, so that the copper sulphate on open circuit will not act upon the zinc and so injure the battery. It is highly recommended, so as to avoid this, to use the batteries in connection with accumulators. Then when the pinch-cocks have been left open, there is always a current, and when the lamps are put out any current still produced will go into the accumulators.

For driving sewing-machines two large batteries are quite sufficient. One is enough to drive a White sewing-machine. The handling is, as already stated, simple. It is enough to remove the exhausted solution and rinse the battery out with pure water so that any sediment which settles in the bottom will be taken off; and if necessary a wooden spatula can be used to help get rid of it. Filled with pure water the battery will remain ready for the next period of use.

One advantage in this is, that the battery, when it is a long time out of use, loses the faculty of at once giving its full power. As already said, it is enough to add a little warm water, and a short run should overcome this difficulty.

No particular dimensions have been given in the construction of this battery, and the reader can use his own discretion as to the materials. Making the zinc and lead plates larger, the current capacity of the battery will be much larger too. Of course the voltage does not increase, which always remains at about 1.1 per cell. Ten cells, therefore, give about 11 volts. It is not advisable to build up a battery with more than ten cells, as usually not such good compression can be secured for the U-frames, and leakage might develop. Therefore, such cells are usually built up in units of ten cells.



One of the battery separators, showing the overflow grooves for regulating the depth of the solution.

The zinc plates should be about 1/16 inch to ⅛ inch thick. Naturally, the thicker they are the longer they will last. The lead foil that is used in these cells may be as thin as it comes. 1/64 inch to 1/32 inch will do nicely. The lead where it is exposed to the liquid should be clean and bright, and preferably sand-papered before using.

The choice of the lead plate is simply because it is a soft metal, and lies flat against the zinc thus making good contact. There is no necessity for using copper plates, because as soon as the cells start working electrolytic copper is deposited upon the lead. Besides, lead is cheaper than copper.

Construction of a Small Tesla Coil

TO those experimenters having only a small spark coil (mine is a ¼-inch Ford ignition coil) and wishing to produce High Frequency currents, I describe here a coil I made which proved very satisfactory. I get a H.F. spark nearly ¾-inch long. When the electrodes are wide apart the brush discharge (in the dark) is very marked and beautiful. A 6½ inch Geissler tube begins to glim when placed 3 inches away from coil, if placed between electrodes, and ½ inch away from them, the tube lights up brightly. Even a small X-ray tube lights up. The coil was constructed with use of only a few tools. The wooden parts are 3/16 inch cigar-box wood, except the base, which is ½-inch common wood. For the primary I cut out 2 rings 2½ inch outside diameter 1¼ inch inside diam. These are connected by 6 crossbars 1⅛ inch long and about ⅜ inch wide. After the drum is fastened together with wooden "nails" (pegs) (don't use metal nails or brass screws) and boiled in parafine, it is wound with 5 layers of brass picture wire (or any stranded wire baring iron) with equal distances between layers. The whole is glued between 2 blocks in the center of the baseboard. The secondary is a cardboard tube 1 inch wide 4½ inches long. The tube ends are closed with wooden discs. After boiling in wax it is wound (close and even) with No. 34 or 36 S. S. C. wire to within ¼-inch of the end. The supports for secondary are an old fountain pen holder cut in two, forced and glued into two pieces of wood. 1¼ inch from bottom a hole goes right through and brass rods hold the secondary, exactly in the center of the primary. A thick brass wire with a binding screw on top is fixed into each support and

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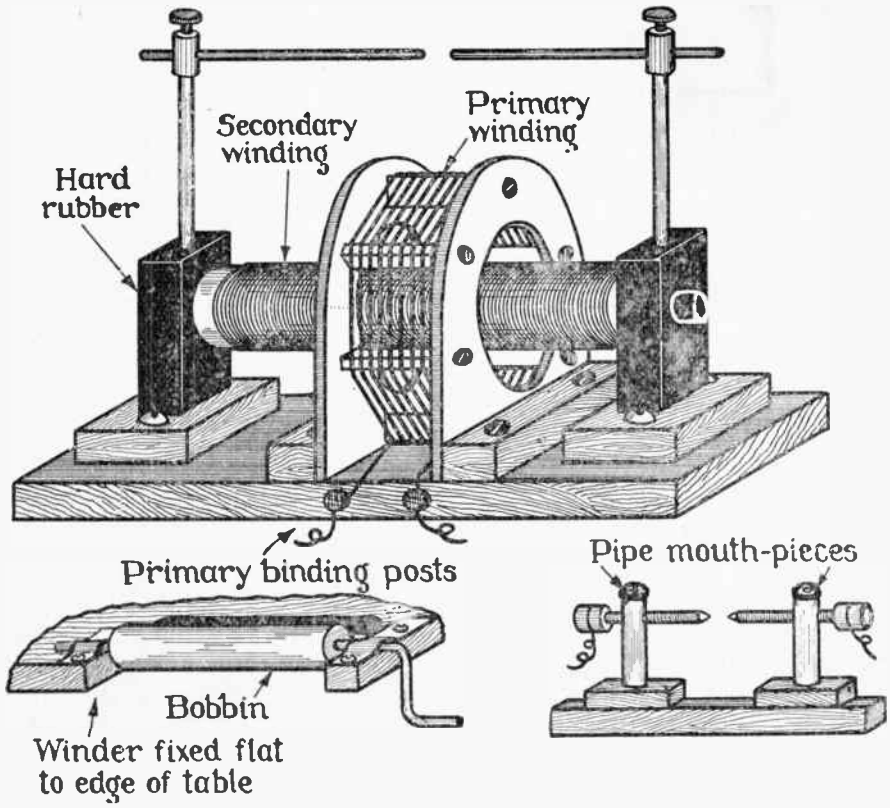
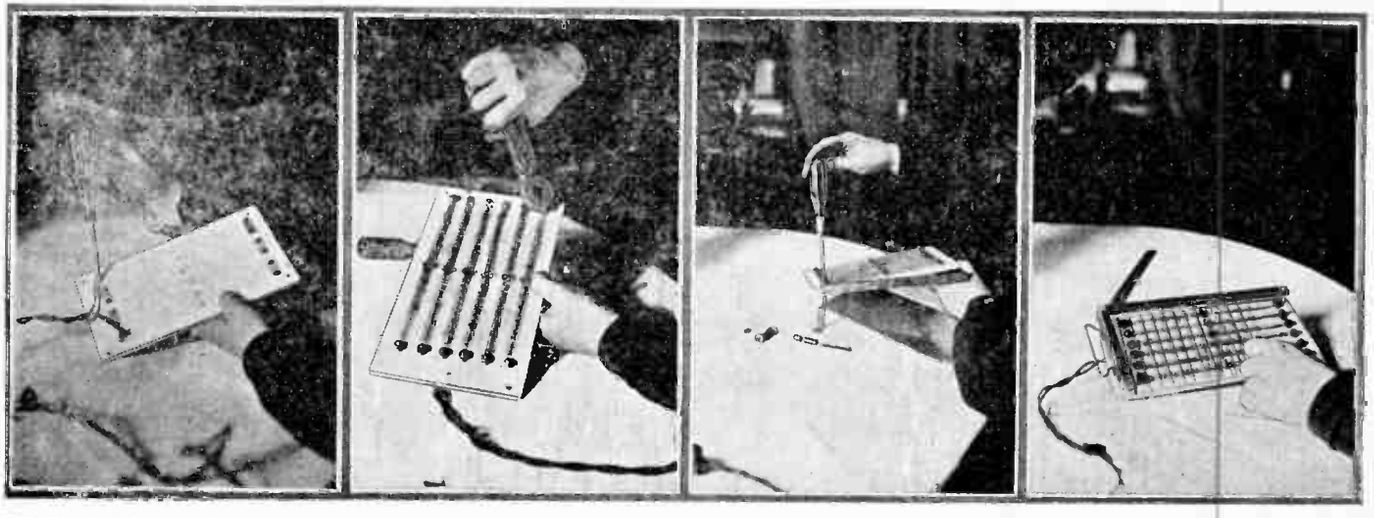


A perspective view clearly showing the construction of a simple induction coil for high frequency work. A simple bobbin winder is shown for use in making it up. Notice particularly that for insulating supports of the static make and break, mouth pieces of tobacco pipes are used.

Make Your Own Electric Toaster

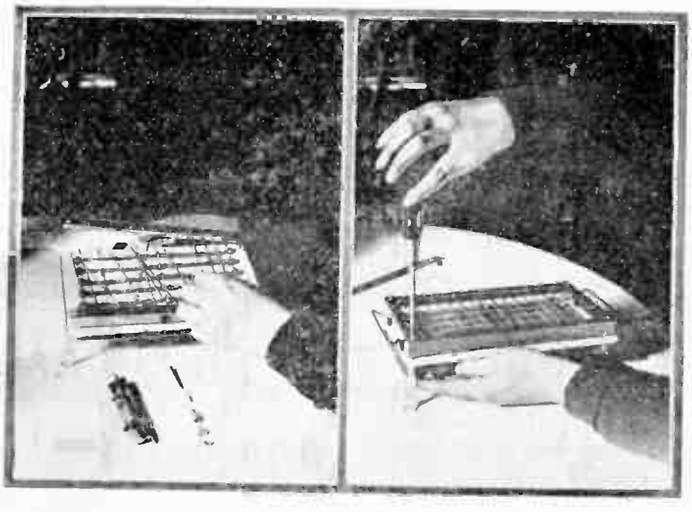


THE electric supply store will be just as glad to sell the householder the supplies for making an electric toaster at home as is the electric dealer to sell a toaster all ready-made, except that the supply store is able to sell at a much lower figure. A considerable amount can be saved if the toaster is made from these supplies and assembled at home.

First, secure a piece of asbestos board, six by ten inches in size and one-quarter inch in thickness. Then punch twelve holes in the asbestos, six at each end, as shown above. In these holes electrician's bolts are placed, which in turn hold six strands of electric heating wire stretched in the center by running them through six screw eyes as shown in the illustration.

The two electric wires are connected to the two end screws at either end of the asbestos on the under side.

Five small metal strips are placed between the ten remaining screws on the under side of the asbestos to complete the contact of the wires above



A home-made broiler. In the above illustrations all the details are given corresponding to the description of the article, producing a very nice gridiron to be heated by the electric current.
This description tells you how to construct a toaster for making your breakfast toast or a broiler for more serious operations of the culinary art.

The essential part of the heating element of the toaster is now complete. The remaining operations are mostly a matter of choice, except for the underneath finishing, where one must be particularly careful that no metal touches the two wires where they are attached to the outside screws.

A suitable stand may be made of sheet metal held one half inch below the asbestos by hollow posts, covering long screws, approximately one and three quarter inches in length and attached to the asbestos, as is also shown, by a metal border or frame secured at the four corners of the asbestos.

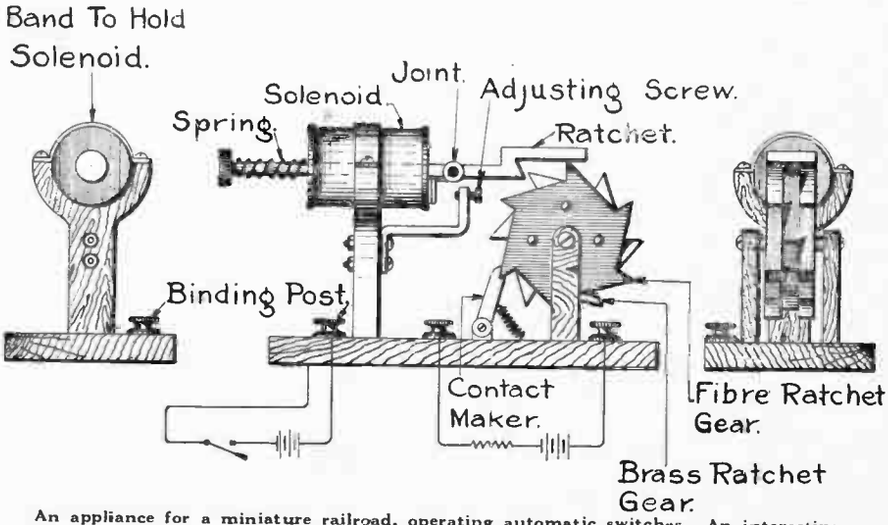
The metal frame should be punched with sixteen holes on either side through which heat-proof metal rods may be laid, and secured to the opposite side of the frame as shown in one of the figures

The complete toaster may be finished in a workmanlike manner with appropriate metal or wooden handles.

Contributed by Edna Purdy.

Remote Control Automatic Switch

IN designing a signal system for a miniature railroad, I found it necessary to open and close a circuit from different places, and at the same time not to interfere with the operation of the various points of operation. Accordingly, I designed the accompanying automatic switch. It will be seen upon a study of the drawing, that by closing a remote switch, or push button, the solenoid coil pulls in the plunger, which thus causes the ratchet arm to move forward one notch. This closes the circuit. Now, if the push button be



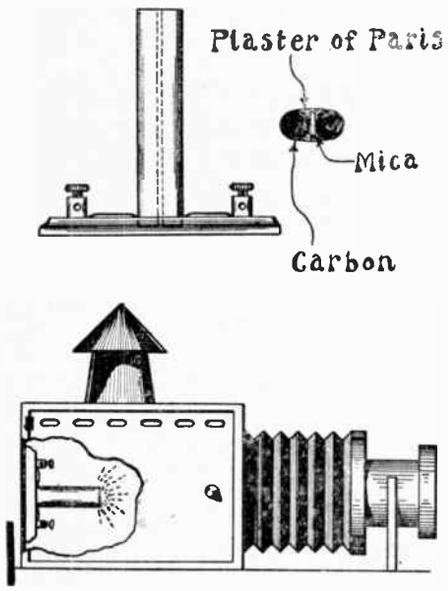
An appliance for a miniature railroad, operating automatic switches. An interesting apparatus for the young people.

again pressed, the operation is repeated, but this time the circuit is opened. Any number of stations can operate this automatic switch and yet not interfere with each other. The adjusting screw on the solenoid bracket will allow close adjustment of the movement so as to allow the ratchet to move one notch at a time only.

The construction of the switch, adapted for remote operation, is suggestive of its applicability to other uses; it certainly is a simple way of attaining the desired result.

Contributed by, Frederick W. Weis, Jr.

A Jablochkoff Candle



A simply made Jablochkoff candle and a suggestion for its use in a stereopticon.

REMOVE the carbons from two dead flashlight cells. Take a block of good, hard, neat cement mortar or an asbestos shingle and drill two holes near the center, the size of the carbons, and 1/16 inch apart.

Place the end of a piece of copper wire (about 20 B. & S.) in each hole, and connect the other end of each piece of wire to a binding post. Press one carbon into each hole. Place a thin strip of mica between the two carbons and cement them together with Plaster of Paris or a similar cement. If the job is well done the finished device will present the appearance of a candle.

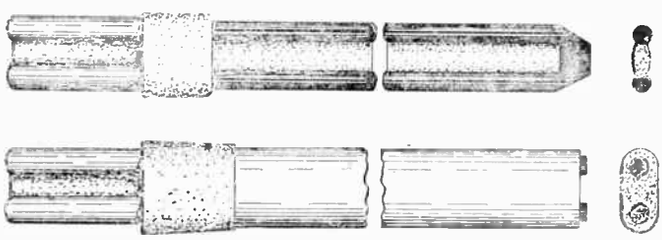
Connect the device (after the plaster has dried thoroughly) to a source of electricity, in series with a resistance of ten to twenty ohms. An electric iron will do nicely for that purpose, as will any five ampere heating device, although a resistance may be made of the proper amount of iron wire.

Start the arc by touching the two carbons simultaneously with a piece of metal or carbon, and then drawing it away as the arcing commences. If the gap has been made too large it may be found necessary to start the arc, two or three times before it takes hold. After the arc is going well, place a frosted globe such as is used with inverted gas mantles, around the candle to protect the eyes and give a more uniformly distributed light. The candle works best with A. C. but will also operate on D. C. for a limited time.

This type of light is particularly useful for stereopticon or microscopic work as the carbons do not need adjustment. For this service the block is mounted on its side so that the light will not get out of the proper elevation in the optical axis.

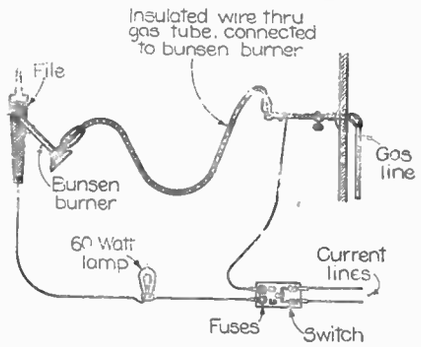
The candle was invented in 1876 by Paul Jablochkoff and was used for street lighting. At one time 4000 were in service in Paris alone.

Contributed by Myron Drachman.



The above cut shows the construction of the original Jablochkoff candles as used for lighting the streets of Paris toward the end of the last century.

Novel Lighter



A simple laboratory appliance, which will light the Bunsen burner without the use of matches.

IF most young experimenters are like I am they have considerable trouble keeping their never-idle Bunsen or other burner supplied with matches. If so, this little useful device which I have used continuously for the past year with great satisfaction will prove as useful to them as it is to me.

An insulated wire is passed through the rubber tube to the burner from one side of a knife switch (any switch of course will do). Another wire soldered to an old file or other piece of rough metal nailed to the wall or bench, passed through a 60 watt incandescent lamp, which serves as a rheostat to save the fuses (goodness knows they're always glowing anyway) and on to the other side of the switch. The switch is fed from the house current or any other convenient source large enough to make a spark when the burner is rubbed on the file. It works every time.

Every chemist will appreciate the advantage of running his laboratory without matches.

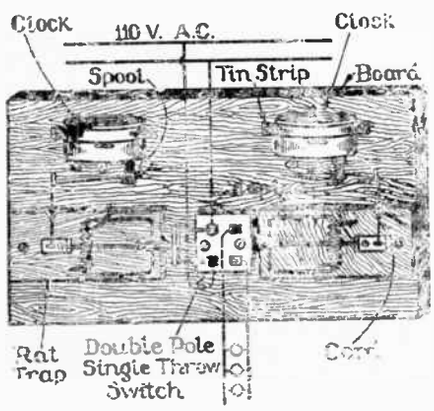
Contributed by

B. BRYANT BACHMAN

Simple Time Switch

THE following is a description of a time switch which we have been using for several years in the store and have found very satisfactory.

The figure is practically self-explanatory. Two rat traps and a D. P. S. T. switch are mounted on a board in such a manner that one trap throws the switch on and the other off; the positions of the switch handle being shown (one in phantom). Two alarm clocks are fastened to the board with tin strips and with screws on either side of the "foot". A spool is split in two, fitted to the alarm winder, then glued together and a couple of turns of wire put around to hold it solid. A cord leads from the spool through several staples and a groove in one side of the rat trap (to prevent cutting of cord) to the bait hook. If desired, a piece of rubber or a 5c. eraser may be put at the ends of the rat traps for the spring to hit on, thus reducing the noise to a thud.



This effective time signal apparatus operates to turn electric lamps on and off at any desired times. It is primarily designed for lighting service although it is admirably adapted for special signalling service. The powerful springs of the rat traps ensure perfect switch action.

Operation: The alarms are wound up (this loosens the cord) and one alarm is set for the time to turn the lights on and the other to shut them off. The traps are then set and the switch handle placed in position. When the alarms go off the result is obvious.

We used Simplex clocks as they have 8 day movements and 24 hr. alarm dials, enabling them to be set any time during the day.

Contributed by,

Robert C. Bryant

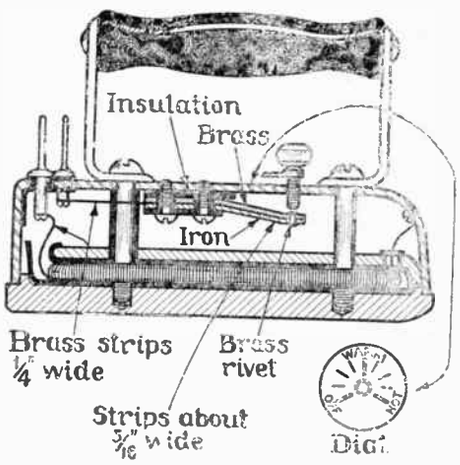
Heat Regulator for Flat-iron

THE illustration shows a heat regulator which may be attached to any electrical flat-iron. The purpose of this attachment is to keep the heat of the iron at a pre-determined degree of temperature, which would do away with the close watch which must now be kept upon the heat of the iron.

It is arranged on the order of the compound bar thermostat or sign-flasher. The expansion of the brass strip, the upper one being greater than that of the lower one an iron strip, the combined action opens the contact at (a). The screw on the top of the iron regulates the heat by regulating the point at which separation occurs.

Platinum or silver contacts reduce sparking. If neatly made, your mother, sister or wife will welcome this addition to their equipment.

Contributed by Wilfred Wetzel



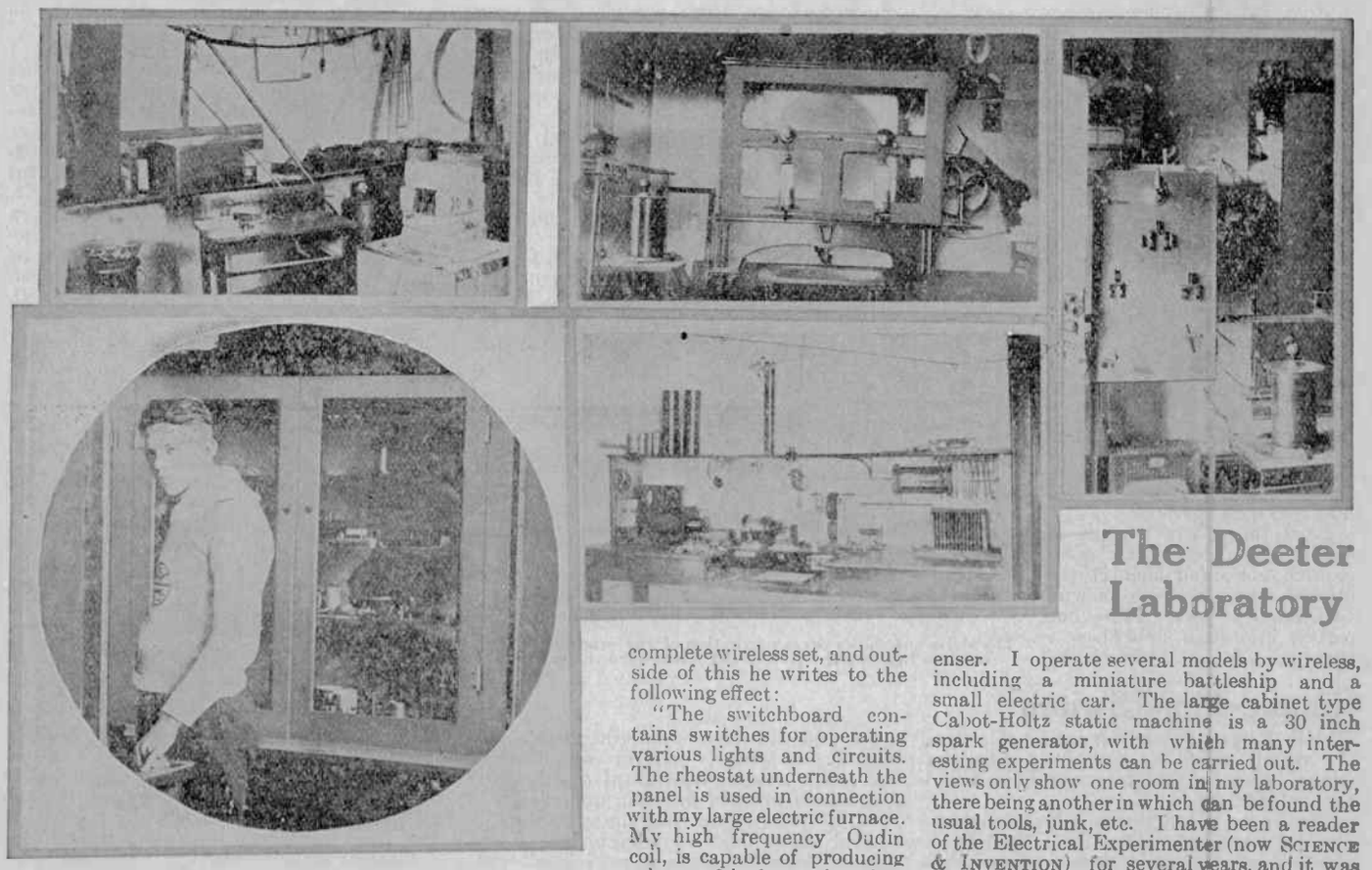
A thermostatic sad iron. This is set by an adjusting screw for any desired temperature. With it there is no danger of burning the clothes.

THIS department is open to all readers, whether subscribers or news-stand readers. We aim to show here for the benefit of others the best photographs of amateur work shops and laboratories. Nearly every experimenter has his own work shop, and we would like to receive photographs of all these. Photos are judged for best arrangement, and novelty of the apparatus, neatness of lay-out and arrangement, etc. The prize does not necessarily go to the shop containing most apparatus and instruments.

In order to increase the interest in this department, we make it a rule not to publish photographs unaccompanied by portraits of the owners.

We prefer dark photographs to light ones. Prize photographs must be on prints not smaller than 5 x 4½ inches. It is impossible to reproduce pictures smaller than 3½ x 3½ inches. All pictures must bear name and address written in ink on the back. A letter of not less than 100 words with full description of the shop must accompany the picture.

PRIZES: One first monthly prize of $3.00; all other published pictures will be paid for at the rate of $1.00 each. Pictures and photographs will be returned on request.



The Deeter Laboratory

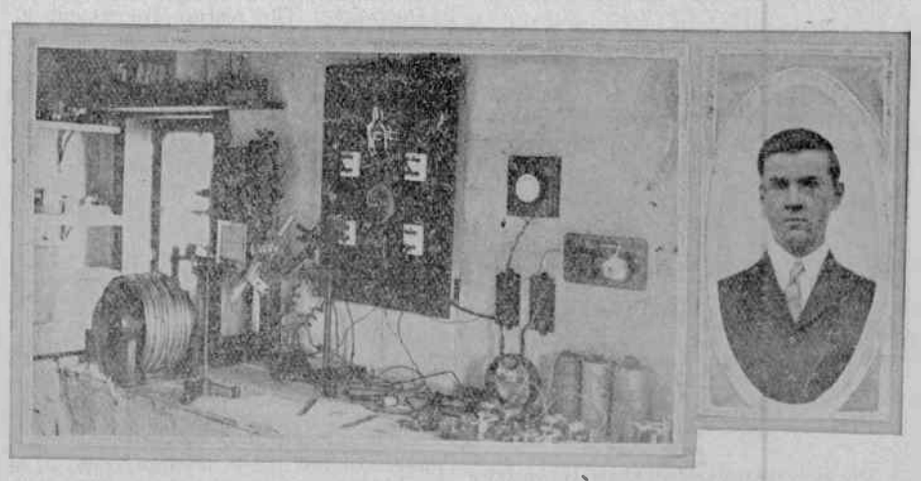
Mr. Everett Leo Deeter has given us some picturesque accounts of his electrical laboratory. It contains, naturally, a very complete wireless set, and outside of this he writes to the following effect:

"The switchboard contains switches for operating various lights and circuits. The rheostat underneath the panel is used in connection with my large electric furnace. My high frequency Oudin coil, is capable of producing a heavy 8 inch spark, when used with the ½ K. W. transformer and the condenser. I operate several models by wireless, including a miniature battleship and a small electric car. The large cabinet type Cabot-Holtz static machine is a 30 inch spark generator, with which many interesting experiments can be carried out. The views only show one room in my laboratory, there being another in which can be found the usual tools, junk, etc. I have been a reader of the Electrical Experimenter (now SCIENCE & INVENTION) for several years, and it was through this splendid magazine that I received my start in my electrical career."

Slabodnik Electrical Laboratory

Mr. Mark Slabodnik, Ely, Minn., has a true electrical laboratory. He does not touch much on chemistry, although the two sciences are coming closer together every day, so that it is a question whether the chemist will run away with the electrician, or the electrician run away with the chemist.

The view of his laboratory shows a place adapted for good work, and it is evident that his operations have taken largely the form of heavier installations. The large switchboard with its appurtenances, and the coil of large caliber wire in the background, are further suggestive of the line of work which Mr. Slabodnik carries on in his shop.

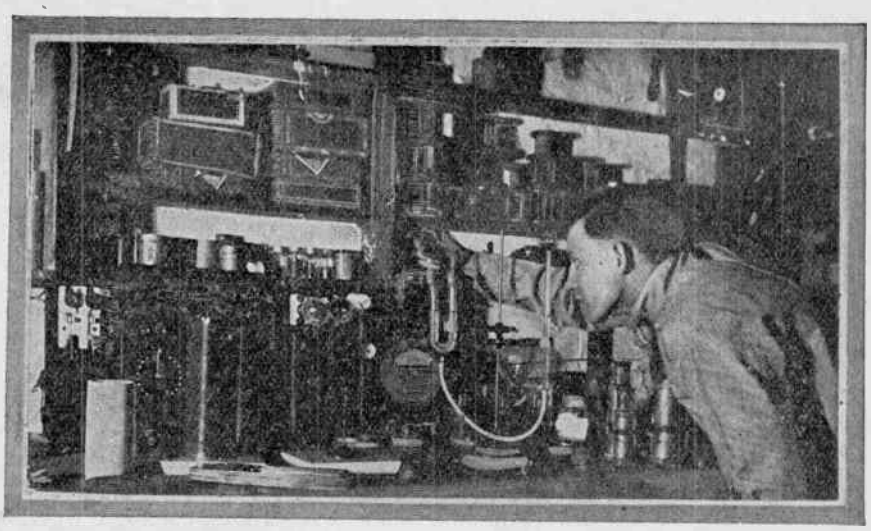


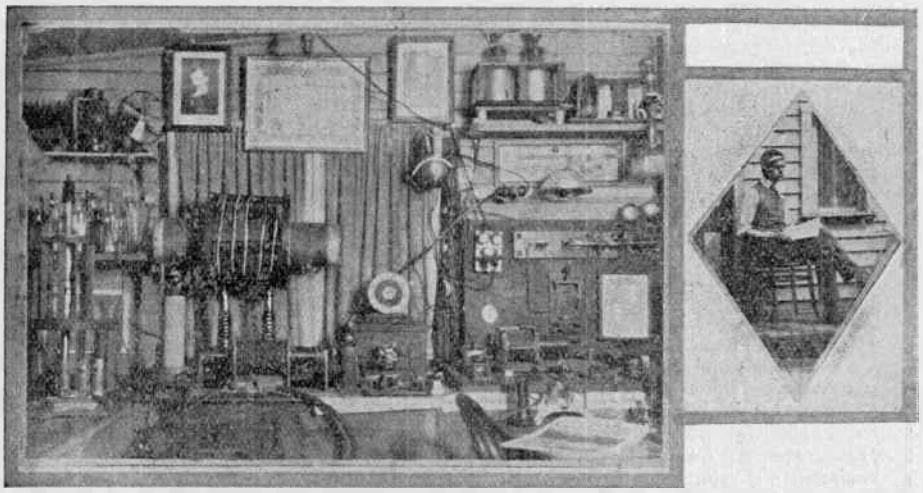
He is of the engineering type and is prepared to work with heavy currents and does not treat the subject as a plaything. This is the way with the science—it is an engineering proposition now and is no longer carried on by one or two grenet cells, as it was in the last century. Yet curiously enough coincidently with this aspect we find the radio engineers and the telephone engineers working with almost microscopic currents.

Benson Laboratory

Thomas W. Benson is shown in his laboratory in active work, taking a reading of a U-tube. He is evidently a worker, for table and shelves are crowded with his apparatus. The whole place bears such an aspect of activity and investigation that it makes one wish to be there on some of Mr. Benson's busy days.

Every shelf carries its load of apparatus, and while the first impression is that the shop is crowded, close inspection shows that everything has a meaning and plays its part in carrying out Mr. Benson's operations. It is inspiring to think of how many of our young men in this country are devoting their energies to the practical applications of electricity, and it will undoubtedly have a great effect on the future of this science.





Edwards Laboratory

In Mr. J. N. Edward's busy corner we again have a view of the practical man's workshop. It is evident that this experimenter is of the constructing order, that he makes apparatus, and in the modern way treats electricity as a branch or development of mechanical engineering.

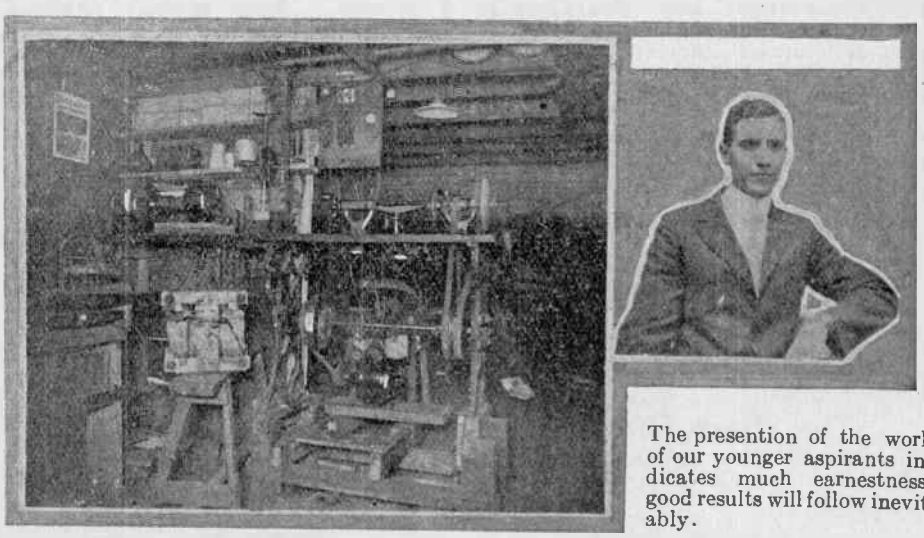
Of course, this is but a corner of a very live shop, for we are sure that Mr. Edwards would feel more complimented in having his establishment called a shop, plain and simple, than to have its title restricted to the more pretentious word, laboratory. For after all, a laboratory is a place where one labors, and the briefest inspection of this picture shows that it is the home of an active worker.

Mr. Edwards belongs to Bluefield, W. Va. and we are sure that his work in his home laboratory will bear good fruit in his after career; young men who start in practical experimental work at home, are certainly to be congratulated on the direction they have given their interests.

Birchier Laboratory

Mr. Joseph F. Birchier of St. Louis, Mo., sends us a photograph showing what we term the real thing, the working corner of a laboratory from which much useful electrical material may emanate. The young man who does his own construction, runs his own lathe, and delivers the goods, appeals to the editorial mind more than the theorist, and we are sure that Mr. Birchier will lay a foundation of practical electrical work which will make assimilation of the theory of the science comparatively easy.

It is fair to say that book and algebraic study of Ohm's law will never make the relations of electrical current voltage, and resistance, mean as much as where it is practically applied. It is work in such laboratories as this, supplemented by study, that brings about valuable and good results.



The presention of the work of our younger aspirants indicates much earnestness; good results will follow inevitably.

$100.00 Household Wrinkle Prize Contest

Nearly every house today has electric current. The question before us today is, how can we utilize this current? Your mother, sister, or wife is doing the slave-work about the house. We electrically-inclined men should use our brains to reduce this load to the irreducible minimum.

Of course, there are many devices upon the market today that will do wonderful things. It is not with these that we concern ourselves in this contest, it is rather the little wrinkle, the little new stunt, that any of us can get up with a few articles of junk in our work shop plus a little "elbow grease," and perhaps a little gray matter, which we do not use half the time.

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

We not only want practical ideas, but they must be positively useful. The idea furthermore, must make something easier to do than it has been heretofore.

All prizes will be paid upon publication.

This contest closes at noon, December 24th at New York, and all manuscripts must be in at that time in order to be qualified. Should two contestants submit the same idea then in that case the same prize will be paid to both. Address all communications to EDITOR, HOUSEHOLD WRINKLE CONTEST, care of this publication.

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 a monthly first prize of $3.00 for the best electrical trick, and the Editor invites manuscripts from contributors.

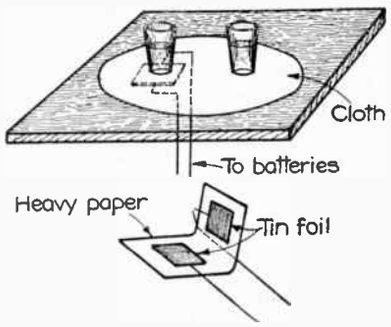
To win the first prize, the trick must necessarily be new and original. All other Elec-Tricks published are paid for at regular space rates.

An Electrical Mind Reading Trick

By EDWIN G. GETTINS

A VERY mysterious and puzzling trick may be performed with the assistance of electricity.

In other words, you may place two tumblers of water on a table upon which there is a table cloth or scarf. Step into the next room, shut the door after you, invite anyone present to take a taste of water from either glass, and upon reentering you can tell which glass he had picked up.



A very simple and effective trick in which telepathy from an adjoining room is simulated.

The explanation of the trick is very simple. Under the cloth is placed a piece of heavy paper on which are glued two pieces of tin foil. The paper is folded so that the two pieces of tin foil face each other. The stiffness of the paper acts as a spring and holds the tin foils apart. From each piece of tin foil runs a fine wire. The two wires run through the crack in the middle of the table, (which will be found on all extension tables) down under the carpet into the next room. Here the wires run to a battery and a small incandescent lamp.

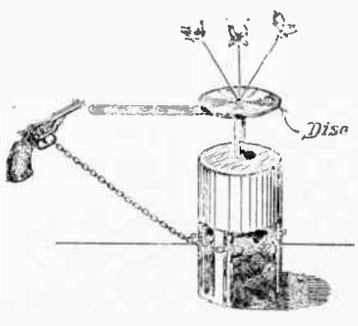
When a glass is placed over the paper the sheets of tin foil are brought together, causing the incandescent lamp to light. So in setting the glasses on the table, one is placed over the paper which is hidden by the cloth, and the other is placed beside it.

The Sharp Shooter

ALTHOUGH this is not such a mystifying affair, it provides very interesting entertainment for the younger dabblers in science, and is rather instructive for physics classes.

Three butterflies whose bodies are made of pith and whose wings may be made of gold foil are mounted on the condenser plate of a Leyden jar. They are held fast with threads which will give them a freedom of motion for a distance of about eight inches. Extending from the top of the disc, is a long rod. A metal chain passes around the body of the Leyden jar, to which is attached a small toy gun.

When the Leyden jar is charged, the butterflies will fly upward widely separated from each other. They look very pretty as they seem to flit up and down because of the changes in intensity of the charge. With the metallic gun in the performer's hand, he now brings it down in proximity to the rod extending from the top of the Leyden jar. Shortly thereafter there is a sharp crack, and the three butterflies fall "dead."



The flying butterflies are brought down by an electric discharge, instead of one of smokeless powder.

We Pay a 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.

EDITOR.

Roulette Wheel

A LARGE disc with numbers from one to twenty on it is mounted upon four legs. A large pointer is pivoted on a pin in the center. This pointer is in the shape of an arrow, and is made of steel nickel plated.

The performer steps forward, and explains that his magnetic personality has such a great effect upon the arrow that he can cause it to stop anywhere, and then he throws some of the old, time-worn phrases in such a manner that the audience really believes he is good. With that, he gives the pointer a sharp little tap, whereupon it spins rapidly upon its pivot.

"Will someone please call out a number?" the performer exclaims.

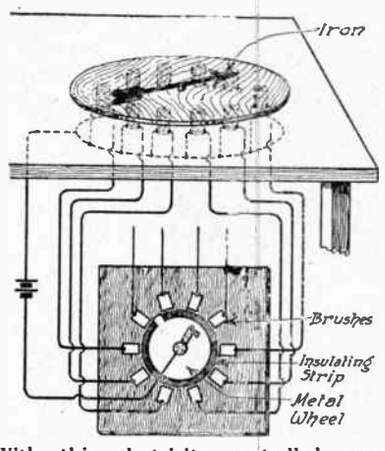
"Number nineteen," is called loudly.

The needle slows down gradually and finally stops at nineteen.

The performance is repeated time and again with different numbers, and each time the needle will stop at the point indicated. Sometimes the needle will slow down so as to pass a point at a very low rate of speed, and immediately thereafter start to speed up again. The trick is without a doubt very mystifying but the method of its operation is simple.

Under each of the numbers, a magnet from an old bell is arranged, and these are connected through the legs to a commutating device illustrated in the diagram. An assistant controls the arrow by revolving the commutator, causing the arrow to speed up, slow down, or stop whenever he chooses. A switch is provided, so that while the arrow is spinning freely, due to the motion imparted to it by the performer's initial impulse, the commutating device is not in use.

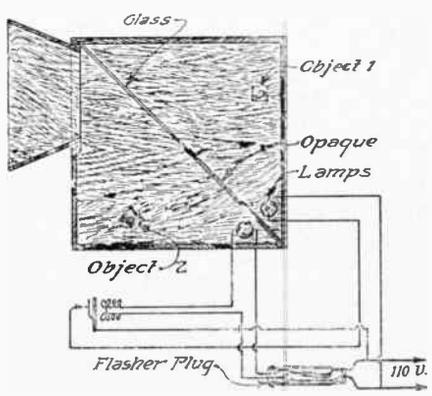
When the arrow slows down, however, and while the assistant is watching it, he can throw in the commutating arrangement, without permitting the audience to know it. He then slows the speed of the crank down gradually and stops it at a prearranged point, or at the number called out by one of the audience.



With this electricity controlled arrow, there should be little difficulty in breaking the bank, perhaps not at Monte Carlo however.

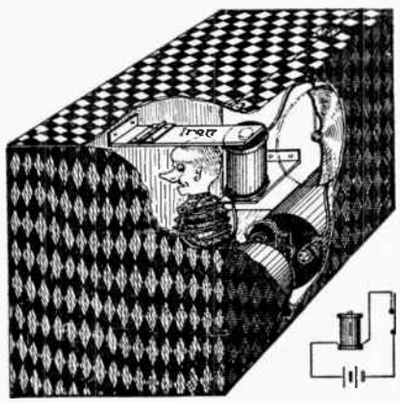
Dust Thou Art, Etc.

IN the store or window is a pretty little doll-replica of some well-known person; slowly and right before your eyes the scene dissolves and a skeleton looms before you. The illusion is very easily carried out and it is really surprising that more experimenters have not attempted it. A square box is divided diagonally by an ordinary sheet of glass, the thinner the glass the better. The box is painted a dull black on the inside, and a lamp is mounted in each compartment. About half of the glass is covered with black paper or black cloth. The objects are placed in either compartment, as indicated in the accom-



This is a version to some extent, of the famous Pepper's ghost, involving the reflection of ar object from a diagonal pane of glass.

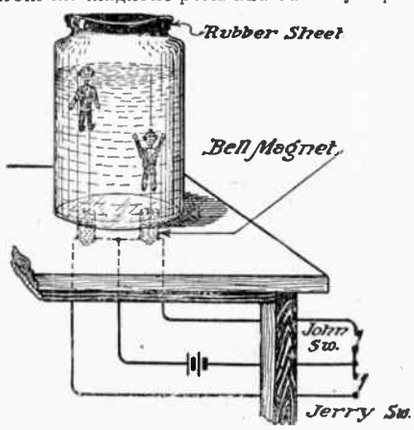
panying sketch. An ordinary flasher controls the light in one compartment. This flasher is in series with a bell, which has been so arranged as to give a single stroke at each connection. This at the same time assists in closing and opening the circuit of the second light. It is advisable to rewind the magnets of the bells with a heavier wire. With this additional contrivance, one light goes out while the other is blinked on immediately. But due to the fact that the filament of a lamp, particularly the nitrogen lamp, requires a small fraction of a minute before it is out completely, advantage of this dimming is taken, which causes the scenes to slowly dissolve into each other. The experimenter can arrange clock-work to perform a similar function and can likewise use this magnetic "make and break" for the other circuit of the contrivance, when employing batteries instead of the household current for the lighting effects.



An electrically controlled Jack in the Box of the most obedient description.

The Jack In The Box.

HOW would you like to have an electric Jack in the Box? Well here is how it is done. In the bottom of the box is mounted an electro-magnet so arranged that it securely holds a hinged steel plate as its armature. The jack in the box is under the plate, and presses against it. The back of the box is simply a large diaphragm about 3½ inches in diameter, made of metal. Suspended from the top of the box is a metallic button which makes contact with the diaphragm, thus throwing the battery into the circuit, as illustrated. Care must be taken in proportioning the size of the magnet to the force exerted by the jack in the box. When a spectator claps his hands, it causes the diaphragm in the back of the box to vibrate rapidly, at the same time disturbing the electrical contact between the metallic button and the diaphragm. Momentarily the magnet loses its intensity. This gives the jack in the box just sufficient time to force the spring away from the magnetic poles and out he jumps.



Two electrical divers who go up and down at the command of anybody in the audience. The India rubber co ver has nothing to do with the occult part of the trick.

The Obedient Divers.

MADE of cork and so mounted as to resemble to a very great extent a figure of a diver, are two little bodies floating in a glass bottle full of water. Their feet have been weighted with iron to keep them upright and near the surface. One has the name "JOHN" painted on his body and the other has "JERRY". The performer brings these into the room and sets them upon the table. The jar has been completely closed by means of a stretched sheet of rubber which covers the top. By pressing upon the top of this rubber both divers sink to the bottom and then come up to the surface again. The performer requests any of his audience to step forward and try to make only one diver go down, and although they try again and again, they do not succeed. After many trials have been made by the audience, the performer steps to a side and calls "John, sink"! and sure enough John does; then he calls, "Jerry" and Jerry goes to the bottom as his companion did, and they both remain there until the performer commands them to rise. Then in rapid succession he calls "John, down, Jerry up, Jerry down, John up, John down". As Jerry starts to rise he commands "Stay there, Jerry", and Jerry sinks again. An assistant of course can work the John and Jerry switches and two small electro-magnets mounted in the table do the trick.

The trick will be accepted as an electrical version of the well known Cartesian Diver. The original Cartesian gentleman operated by the compression of air, which increased his specific gravity, causing him to sink; and here it is the electric lines of force which pull down the little floating figure to the bottom of the jar. The great point is to have them almost exactly of the specific gravity of water. If they are too light they will not work well.

A Real Life Artist.

WE have seen the magnetic attraction draw the revolving arrow to the desired point; we have seen it draw the floating midgets down through their jar of water. Now the time comes to cause the drawing power of electricity to draw in the artistic sense. At least this furnishes the performer with a rather poor pun, and as we know, a poor pun often pleases an audience better than would a good one.

The performer now comes forward with another rather startling, and mystifying magical trick, which bids fair to hold any audience's attention. This is in the form of a large blackboard.

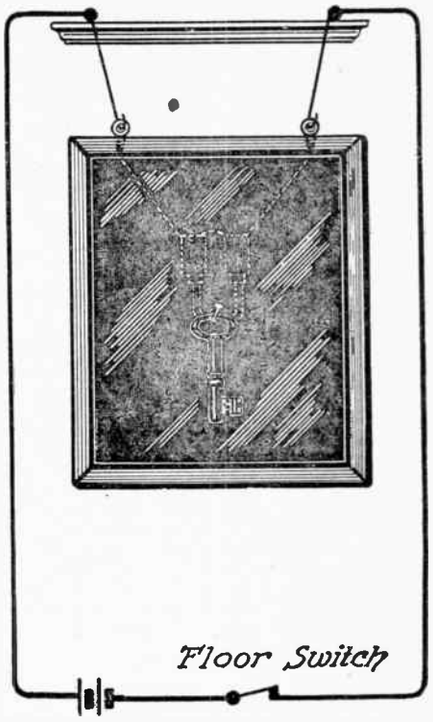
With his usual eloquence he explains to the audience that not only is he gifted along magical lines, but he is an artist supreme, saying in part, "Why, I have seen the time when I could draw so beautifully that the house cat came along and licked the paint off my canvass, thinking that the saucer of milk I had painted contained real milk. To demonstrate, I will draw a nail."

He proceeds with a very gross sample of artistic skill. The audience titters, but he assures them that it is perfect in every detail, and to demonstrate, he requests a key from several in the audience.

Selecting one, he seemingly hooks it over the nail and it remains suspended there. He erases the nail and the key drops to the floor. Thereupon he passes the blackboard out to the audience so that they may all examine it carefully.

The secret of the entire arrangement is a cleverly concealed electro-magnet whose energy is supplied by means of suspending wire hooks. Either an assistant, or the performer himself controls the device. A bell magnet answers the purpose but the core should be lengthened and shaped as shown. The board is then unhooked and passed out for examination.

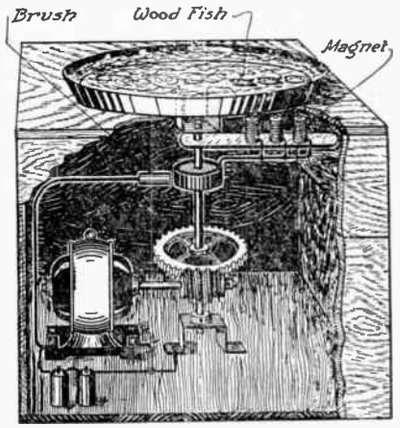
This is a most affective trick and obvious-admits of many variations. You must not try a brass key however.



Here the magician "draws" a nail—with chalk not with a claw-hammer—then he hangs a stee key on his chalk nail-the electro-magnet does the drawing this time.

The Mysterious Fish.

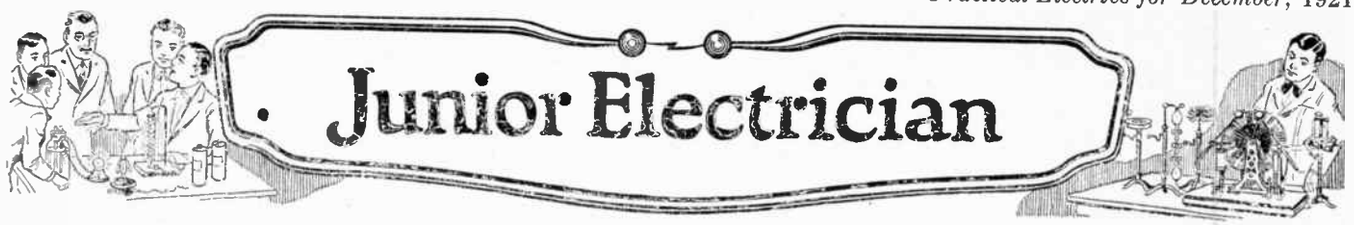
LITTLE fishes in the brook", of course you know the rest of it. Well here they are in a dish pan, and although they swim around in a lifelike manner they are just made of wood. But they certainly do like to race with each other, as they can be seen to chase around merrily.



These well-behaved fish will swim around if you want them to, only you must not use a tin pan.

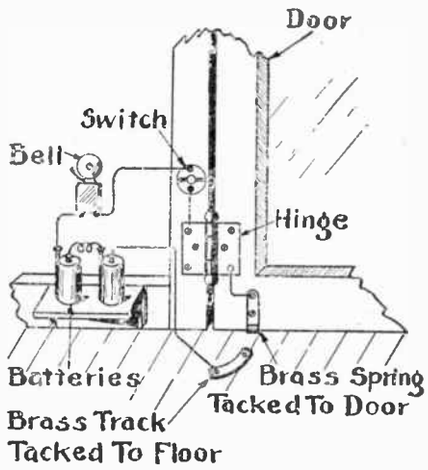
Two or three magnets are mounted upon a shaft arranged to rotate about an axis corresponding to the center of the pan. A slip ring furnishes current to them, the other end of the magnet wires being grounded to the frame. The entire device should be motor driven, but may be hand driven. The difficulty with the motor drive is that the speed is entirely too great and, therefore, a worm gear is interposed. Of course the fishes must have a piece of iron in them, and ordinary bell magnets do the driving. A china dish answers very well.

IT being the policy of this publication not to publish the names of the various manufacturers of the apparatus and devices described in these pages, our service bureau will be glad to forward the required information upon receipt of a stamped envelope or stamped postal card.



Home Made Door Alarm

THERE are on the market, several forms of door alarms, which ring an electric bell when the door is opening or closing, but not when it is entirely opened or closed.



A door alarm which gives notice when a door is opened. It ceases ringing when the door is wide open, and also when the door is closed.

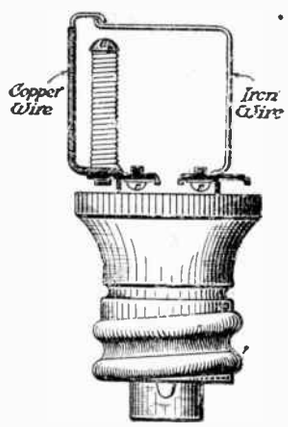
They are rather expensive and the same object is accomplished simply by nailing a piece of tin or brass on the floor, and a piece of spring brass on the bottom of the door. The brass spring on the door is arranged to touch the floor plate when the door is opened about an inch and to pass over it, as the door is opened further, finally breaking contact when the door is opened more than 8 or 10 inches. The tin or brass are arranged to complete the circuit to an electric bell and battery as shown in the illustration.

Contributed by V. H. Todd.

Miniature Circuit Breaker

By N. W. FLYE

THE accompanying sketch shows a miniature circuit breaker made from



A circuit breaker made from a separate attachment plug to prevent fuses being blown out. The appliance is so simple and effective that it is commended to our readers.

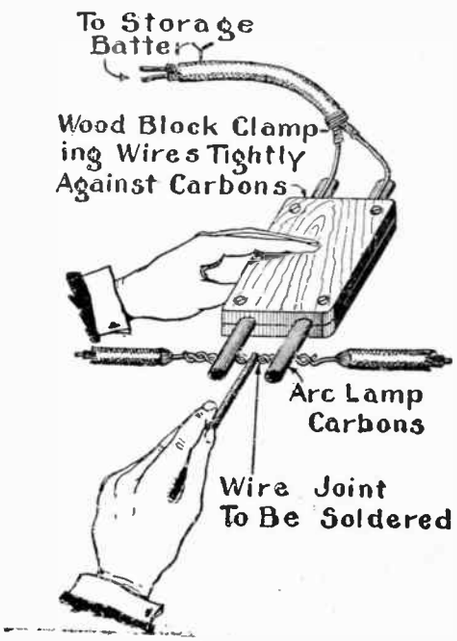
a separable attachment plug. The metal parts are removed from the cap and an iron bolt is screwed into one. About twenty turns of No. 16 wire is wound around this and one end fastened to it. The other end is bent as in sketch with a tendency to spring outward. To the other metal piece is attached an iron wire bent to spring upward.

When an excess of current flows, the iron wire is pulled down and the copper wire springs out, so that the iron wire does not touch it on the back spring. To reset simply hook the wires together again. No more blown fuses.

Soldering With Carbons

THE accompanying sketch illustraets a method of soldering wires without a soldering copper. This method utilsize the heat produced when current flows through a poor contact between carbon and copper.

To make this outfit, procure two old arc-lamp carbons about 6 inches long and make a wooden block to clamp them tightly as shown. The copper wires from the battery must be tightly secured to the ends of the carbon to prevent heating at this point. When ready to use, simply lay the two carbons on the wires to be soldered and the rush of current from the battery will quickly heat up the wires, so that solder and flux



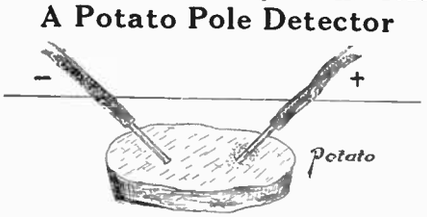
A good system of soldering electric wire splices, using carbons from arc lamps and the line current, instead of a soldering iron.

may be applied in the regular manner, making a good clean joint.

Unlike many other electric soldering irons, this outfit only takes current while it is actually being used.

Contributed by V. H. Todd.

A Potato Pole Detector

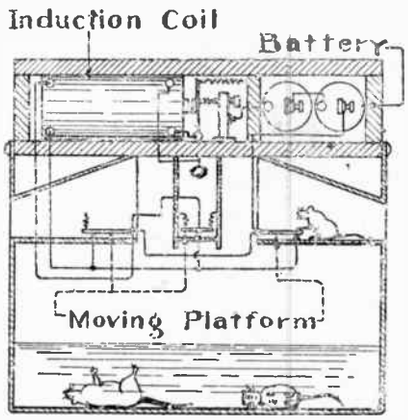


The potato as a pole detector in electric work.

THE use of a potato as a rheostat is, we are sure, familiar to our readers; but its use as a detector of the polarity of a circuit is not so well known. To use it thus, the potato is cut in two, and two terminals of the circuit are thrust into it. The current acts upon the fluids of the tuber, and one of the terminals is attacked and stains the potato in its vicinity. This is the positive pole of the battery.

An Electric Animal Trap

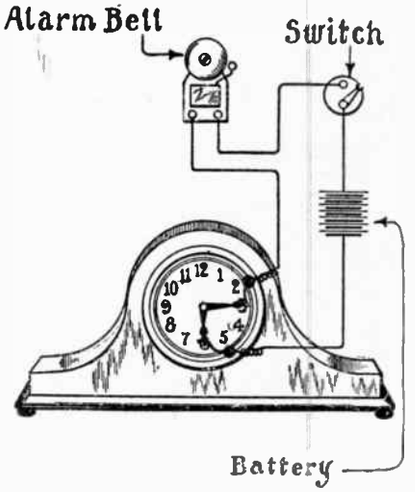
OUR illustration shows an Electric Animal trap, the invention of one J. Tupper. It includes in its upper part an induction coil, one of whose secondary terminals is connected to the hook on which the bait is attached. The animal gets one or all of his feet upon plates connecting with the induction coil, then reaching up for the bait, the secondary circuit is completed through his body and he is killed. The motion of the platforms due



An ingenious trap which electrocutes rats and mice, and drops them into water.

to his weight closes the primary circuit, so as to put the induction coil in condition to give him the fatal shock when his mouth comes in contact with the metal hook, supporting the bait. To make the case doubly sure, the lower part of the trap contains a tank filled with water, into which the animal is supposed to fall when shocked.

An 8-day Clock



A clock which gives an alarm, accurate to the minute.

MENTION has often been made of alarm clocks made by placing a copper wire, so that the hour hand touches it at the de-

Continued on page 92

Short-Circuits

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

This little grave holds,
Master Tommy Styre,
He pointed the hose
At the trolley wire.
—Jack Denns.

PRIZE WINNER
$3.00

In State here lies
Young Martha Slater,
She took a bath,
And used the vibrator.
—Joseph J. Hause.

These flowers cover
Dorothy McGorm,
She tried to phone
In a thunder storm.
—Jackson F. Hope.

Here rests in peace
Old Jeremiah Striver,
He tested his sparkplugs
With a wet screw driver.
—William Stehle.

This monument's
For Fitzpatrick Hughes,
His fingers slipped
When he changed the fuse
—F. E. Dobson.

This coffin holds
Poor May Crofton,
She twisted the cord
Just once too often.
—May M. Ottman.

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 necessar-..ily can only publish such matter as interests the majority of readers.

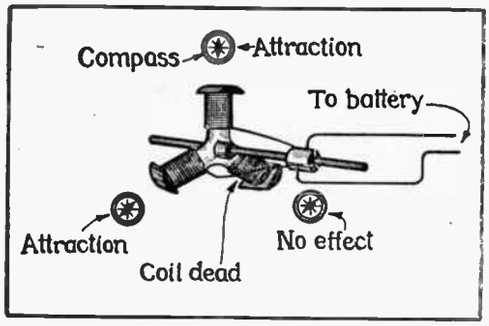
1. Not more than three questions can be answered for each correspondent.
2. Write on only one side of the paper; all matter should be typewritten or else written in ink. No attention can be paid to penciled letters.
3. Sketches, diagrams, etc., must always be on separate sheets.
4. This department does 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 considerable 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

Armature Testing.

(16) Jacob Mandery, Brooklyn, N. Y. writes.



An illustrative diagram of how to test the armature of a miniature motor. An ordinary pocket compass is all that is required for this simple test.

Q. 1. Being one of your readers may I ask how I may be able to test an armature from a small motor with a storage battery. This small 3 pole armature seems to be burnt out. The field wire I know is burnt.

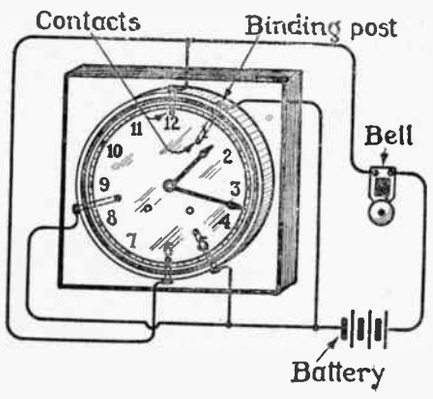
A. 1. Here is a sketch of how to test an armature in a small motor using the storage battery for that purpose. If the wires are burnt out, it is obvious that one of the poles will be dead and a compass held in that vicinity will not deflect properly.

You must, however, differentiate between deflection due to residual magnetism and deflection due to the magnetic action when the current is flowing. This is good for small armatures only.

CLOCK RINGER

17) Richard M. Mayers, Hackensack, N. J. writes as follows:

Q. 1 I submit herewith plans of an automatic ringing system on a clock. The hands when touching these points make contact which rings the bell. The minute hand should be elevated a trifle so that it would not touch the hour hand points. This method could be used to ring bells throughout a building with only the one clock. The points could be so disposed that the clock would ring any time desired. The points are arranged so that the clock will ring at one, five, six, and eight-thirty o'clock, respectively. Would it be practical?



A diagram of how one of our correspondents proposes to rig up an alarm clock.

A. 1 There are on the market at the present day, electrical clocks which ring a bell and can be set to the exact minute for any desired time, which obviously could not be done with your device, as it only provides for a limited and fixed number of contacts.

In addition, the design which you have submitted is a good deal more bulky and necessitates greater difficulty in setting, than any of those which are accepted as standard today. Hence we do not find it to be of great advantage.

Alternating Current Relay

(18) B. B. Simpson, Liberty, N. Y., asks:

Q. 1. What is the principle of operation of an alternating current relay?

A.1. One type of alternating current relay depends upon a floating contact for its operation. We do not advise you to attempt to construct one, because they are rather difficult for an amateur to handle.

Q. 2. Describe the simplest storage battery which I can make?

A. 2. The simplest storage battery consists of two lead plates immersed in acidulated water. Sulphuric acid is always used and the resulting specific gravity when mixed with water should be about 1260 Baume. This battery is now charged and discharged repeatedly so as to "form" it. After several repeated operations of this nature the battery should maintain its charge over a period of about three weeks or more.

Q. 3. Describe a simple rectifier which I can use to charge this storage battery.

A. 3. The answer to this question is given in answer No. 11 appearing in the Nov. issue of PRACTICAL ELECTRICS.

Removal of Superfluous Hairs by Electrolysis.

(19) J. Stanford, of Washington, D. C., says in part:

Q. 1. Just how are superfluous hairs removed by electrolysis?

A. 1. Experimentally, hair may be removed by means of electrolysis by simply inserting a very thin sewing needle into a wooden holder. This is connected to the negative end of the battery in series with a rheostat or other suitable current regulator The positive electrode is a sponge plate. To use the oufit, the needle is inserted to a depth equal to the distance from the surface to the root of the hair, into the hair follicle, which is the sheath or socket in which the hair is lodged. The patient then grasps the sponge electrode. The operator watches the hair follicle until a little oozing of a white liquid or bubble formation is noted. He then notifies the patient to remove his hand from the sponge electrode and then withdraws the needle. The hair is freed easily by traction upon it with a pair of forceps. In each case the needle should be inserted first, and withdrawn after the hand has been removed from the moistened sponge electrode.

Q. 2. What sort of a battery will be suitble?

A. 2. A 6 volt storage battery answers the purpose.

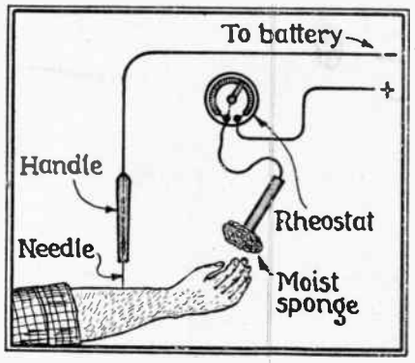


Diagram of the connections for operating the needle for removing hairs by electrolysis.

Hughes Balance

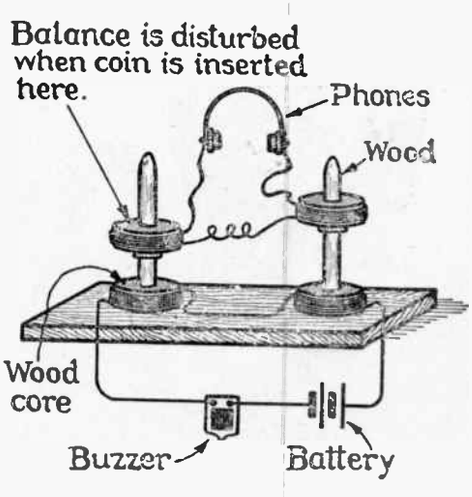
(20) Mr. J. V. McGuire, Miami, Fla., writes:

What is a Hughes Induction Balance?

A. 1 A Hughes Induction Balance primarily consists of two coils which are the inductors and which we will call primaries and two secondaries. The primary circuit is interrupted rapidly and the secondary coils have a pair of phones inserted in series.

The current induced in one secondary is "bucked" by current induced in the other secondary and the coils are so adjusted that absolutely no sound can be heard in the telephone receivers.

Four five-inch coils each wound with 20 turns of No. 20 B & S gauge single cotton covered wire, and so arranged that the distance between the primary and secondary on each side may be varied; and in addition a pair of phones and a buzzer inserted into the circuit, as indicated in the diagram, will make a very efficient laboratory Hughes Balance.

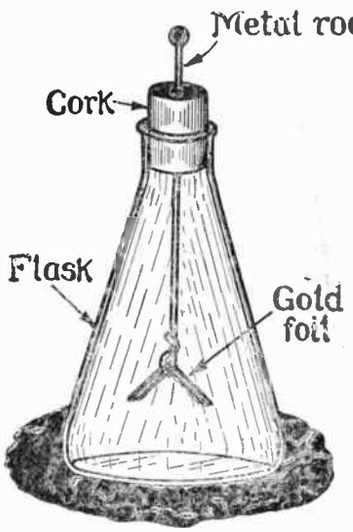


A simple illustratioon of the Hughes induction Balance, which will indicate the presence of a small piece of metal.

DETECTING ELECTROSTATIC CHARGES

(21) W. M. Whaler, of Detroit, Mich., inquires:—

Q. 1. How can I detect minute electrostatic charges?



Here we show a very simple electroscope which will do practical work.

A. 1. Electrostatic charges may be indicated by a gold leaf electroscope which consists of an Erlenmeyer flask which has a cork with a metallic rod projecting through it, inserted into its mouth. Dependent from the metallic rod is a thin sheet of gold leaf folded so as to give the effect illustrated. The presence of an electrostatic charge will cause the leaves to diverge. When it comes to really minute electrostatic charges, it is quite a delicate piece of work to construct a satisfactory electroscope; one with a condenser on the top is to be recommended for such experiments.

Pipe Thawing Transformer.

(22) F. N. Skania, Pittston, Pa., writes:

Q. 1. Please give me details of a pipe thawing transformer.

A. 1. This device will thaw ¾ inch to 1 inch lead service pipes and the time required will range from 10 to 30 minutes. The core of the transformer is made from sheets of stove pipe iron, the laminations being 1¾ inches by 6¾ inches and 1¾ inches by 9¾ inches. The core is then built up to give a cross sectional area of 1¾ inches x 1¾ inches, with the laminations dovetailing at the corners in groups of five. The primary winding consists of 520 turns of No. 12 double cotton covered magnet wire divided into two parts of 260 turns each, which are paralleled for operation on 110 volt circuits and connected in series for 220 volt circuits The secondary is made by winding 38 turns of No. 1 bare copper wire upon the other arm of the transformer, the wire being separated from the core by suitable insulation.

A MYSTERIOUS PART

(23) George T. Robinson, Monroe, Ky., sends in a sketch of the core of a motor. A hand points to one part. He says:

Q. 1. Just what is the function of this part?

A. 1. The part which you are referring to is the yoke of the field core of the motor.

Q. 2. Will the motor develop the same power without it?

A. 2. If you take the yoke away from an electro-magnet, you have two separate magnets and the power is greatly diminished. The yoke gives the magnetic lines of force a path of less reluctance than if they passed through the air and, therefore, gives a more intense field at the poles. Although the motor may work after a fashion without such a yoke, its power will be seriously impaired.

Repulsion of an Aluminum Ring

(24) F. B. Seaward, Springfield, Ill., writes:

Q. 1. Will an electro-magnet repel or push away aluminum, or is it some other metal?

A. 1. Aluminum is the right metal.

Q. 2 What is the comparison between the repulsive effort upon aluminum and the attraction of a magnet for a piece of steel?

A. 2 What the repellent force in dynes is depends upon the size of the magnet and the intensity of the current and on other factors such as the size of the aluminum ring. The relation between the repulsive force upon an aluminum ring and the attractive force upon steel, is about one 300th part, we should judge. Remember, however, that in order to get the repellent action, the magnet must be operated from an alternating current circuit.

INSULATOR FOR MAGNETISM

(25) W. H. Gridiron, Douglas, Arizona, asks:

Q. 1. Is there any insulator for magnetism?

A. 1. There is absolutely no insulator for magnetism known. The only way in which a magnetic force can be counteracted is by means of an opposing magnetic force, which will distort the lines of force from the first magnetic body, so as to make them practically unfelt in and about the region of the second body.

Q. 2. Is there any magnet or chemical which has the property of attracting copper?

A. 2. A magnet will not attract copper, neither is there any chemical which has an affinity for this metal, magnetically speaking.

MAGNETIC ORE LOCATER

(26) Thomas P. McMannus, Philadelphia, Pa., says:—

Q. 1. I have seen an advertisement in a western city of a magnetic ore locater, which was a pendulum suspended from a small stick of wood. This pendulum had been magnetized and a testing device, an ordinary iron bar, came with the outfit. This was for the purpose of determining how much magnetism this magnetic ore locater had. In your opinion is such a device of any value?

A. 1. The claims put forth in this advertisement, which we have seen, are quite without foundation. It is absolutely impossible to locate ore by means of an ordinary bar magnet. As you know, copper, brass, tin, lead, and in fact any other metal except iron, is not magnetic, and, therefore a magnet would not be attracted by them. At least a possible contrivance for ore location would be a Hughes Induction Balance. The dip-compass has been used to detect magnetic iron ore deposits (magnetite.)

Some very ingenious application of radio directional transmission have been the subjects of experiment, and are based on correct scientific principles. Yet it is doubtful if there is any practical way of finding deposits.

SPARKLESS MAKE AND b

(27) T. B. Bellow, Pittsburgh, P.

Q. 1. I have a small chicke bator which is electrically operated. great difficulty in preventing sparking tween the contacts, and hence in maint ing constant heat. How can I remedy

A. 1. There are two methods of justing your make-and-break device in s a manner that the contacts will not a One of these is to shunt across the make-and break, a condenser of sufficient capacity. The second is to change your make-and-break, so that the contact is made between a point and mercury held in the bottom of a small cup or receptacle. On top of the mercury a layer of oil is poured. As soon as this contact point dips down into the mercury, the circuit is closed and when it comes up again the circuit will be opened, while the oil will have sufficient insulating effect to prevent sparking.

STEP UP TRANSFORMER

(28) F. X. Rhumey, North Warren, Pa., asks:—

Q. 1. Please give me specifications for a step-up transformer consuming 100 watts on a 110 volt 60 cycle alternating current circuit. I want to use this transformer for an ozone generating machine.

Q. 2. Also describe the very simplest form of ozonator.

A. 1. The transformer should be made as follows. An iron core made in the form of a picture frame with the sides 1 inch square, is 10 inches long and 6 inches wide. On one of the long arms are wound 700 turns of No. 15 B & S gauge wire in 7 layers. The winding depth is about .47 inch. You will need about 4.8 lbs. of double cotton covered wire. The secondary should be wound in the form of pies, each ¼ inch thick, and insulated by means of oil skin or wax paper. 16 of these pies will be necessary and each one should contain 2,092 turns of No. 34 silk covered or enameled wire. Assuming that you have taken off a tap every 100 turns upon the primary, you will find that the secondary voltage will range from a little over 5,000 to 36,000 volts, dependent upon the number of turns in the primary.

A. 2. A Liebig condenser makes a very good form of ozone generator. The central condensing tube is filled with buckshot and a wire is connected to it, which

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Another form of ozone
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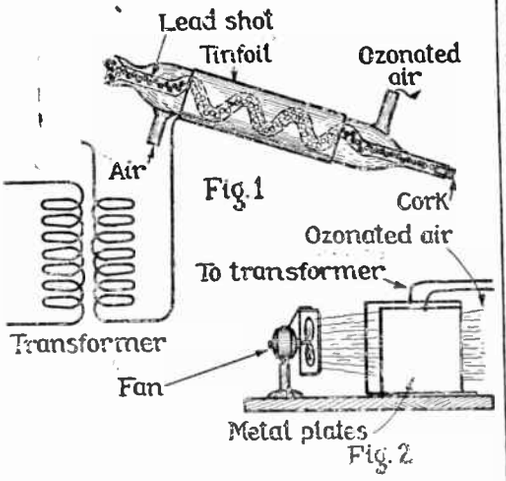


The Liebig condenser used as an ozone generator. Ozone receiving air at its inlet and delivering ozone from its outlet. Various dimensions and proportions can be obtained using the many kinds of condensers in the stores.

HIGH FREQUENCY EXHIBITIONS

(29) Mr. C. B. Peterson, Brantford, Ontario, Canada, asks:—

Q. 1. I am endeavoring to give some high frequency exhibitions and would like to know whether I can be seriously injured from a high frequency discharge from the secondary of an Oudin coil.

A. 1. You evidently have done very little work with Oudin or high frequency coils and we would advise you to read up some good books on the subject before giving your exhibitions. Ordinarily no danger will befall anyone coming in contact with the secondary of an Oudin coil, in that the frequency and the voltage are extremely high, while the amperage is quite low, and the current is merely superficial in its action, never penetrating below the surface of the skin.

Q. 2. I would like to give the spectators a good shock when they approach the outfit and try to duplicate my experiments. How may I do this?

A. 2. When you operate the Oudin coil, approach the secondary with a piece of metal in your hand. Upon presenting a metal rod to one of your spectators who will undoubtedly try to grasp it with his bare hand, quite a stinging sensation will be felt by him due to the heating effect of the spark. The current, of course, passes through your body.

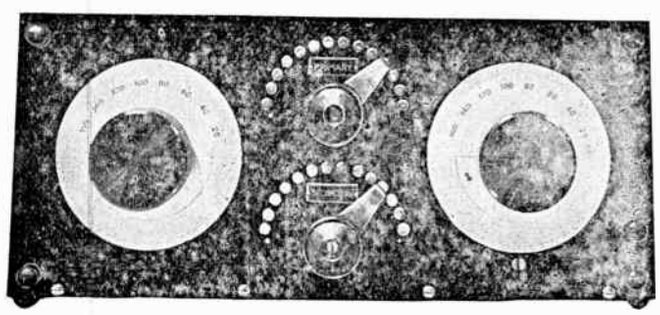
Q. 3. With the Oudin coil, I now have, I find considerable sparking between the primary and the secondary. How may I remedy this?

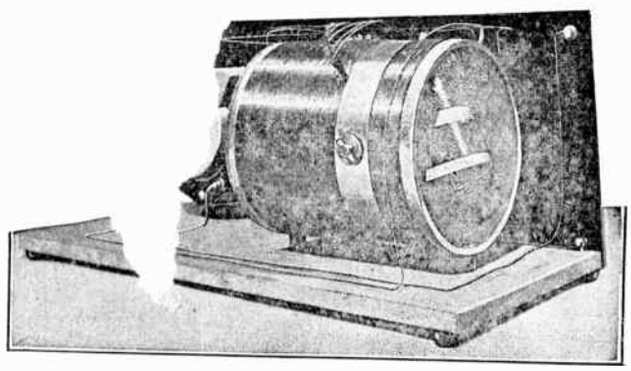
A. 3. We would advise that you immerse the lower end of your Oudin coil in oil or fill the lower portion with wax, sulphur or insulate it otherwise.

An insulator of liquid or semi-liquid consistency will present the advantageous feature of closing the gap if a spark should force its way through. If a solid insulator like sulphur is used any gap made by a spark will remain permanently and injure the coil.

SOMETHI[illegible] RADIO

MAKE YO[illegible]





You can build this regenerative receiver easily without a machine shop. With the set of patterns especially designed it becomes a simple and easy work to make and assemble the parts comprising this set with which spark, C. W. signals and Radiotelephony may be received.

WE hereby offer the first of our series of "Make Your Own" apparatus set, the first one being a

Complete short wave regenerative set.

One of the foremost Radio engineers has constructed this set for us, specially for the amateur, and by our modern, novel methods of construction, anyone is able to make an efficient apparatus for the reception of wave-lengths up to 800 meters.

The circuit used is of the single inductance type and is the same as that used in new and well-known expensive sets recently placed on the market. With this circuit, a good selectivity is obtained, owing to the fact that the resistance of the winding in this set is rather low and so does not practically affect the resistance of the aerial, which consequently operates as a wave collector with maximum efficiency.

Another benefit resulting from the use of this circuit is the simplicity in tuning, a factor not to be neglected by the amateur not having had a long experience with regenerative circuits, in the reception of damped, undamped and radio telephone signals.

In building a Radio apparatus the lack of mechanical knowledge often handicaps the amateur in such a way that the instrument he builds has not the standard made appearance which is desirable in any Radio apparatus. In order to remedy this, and give the amateur a chance to turn out an efficient and handsome looking instrument, we have designed a special set of patterns enabling anyone to make a standard receiver with all the improvements that can be found in expensive ready-made apparatus.

With this set of patterns and by following the instructions given it is very easy with the use of only a few tools to turn out the short wave regenerative receiver shown in our two photographs.

The novel departure in this set of patterns is that we do not merely give you pictures of how the apparatus looks, and mere diagrams—BUT EACH AND EVERY PATTERN SUPPLIED IS FULL SIZE.

Take for instance the pattern for the panel. It is printed on heavy blue-print paper exactly the size of the panel to be used. The position of the holes and other markations are exact, so that all you have to do is to paste the pattern on top of your bakelite panel by means of ordinary library paste, and when dry drill right through the pattern wherever the marks are located.

This does away with all fussing and calculating as we have done all the laying out in our own shop, and you need not worry that the final instrument does not come out right.

Similar methods are used for winding the tubes, where a complete pattern is furnished so you cannot go wrong. For instance, the pattern is wound upon the tube; then you can wind the wire right on top of this, if you wish. *We have done the thinking for you.*

BEFORE SELLING YOU THIS PATTERN WE HAVE GONE TO THE TROUBLE OF ACTUALLY BUILDING THE OUTFIT AND WE KNOW THAT IT IS ABSOLUTELY RIGHT IN ALL PARTICULARS.

The original may be inspected at any time. Only standard parts are used in making the outfit. It is possible to build the entire set as illustrated for about $12 to $15.

Complete and very explicit directions go with the pattern which is furnished in a heavy envelope 9 x 12".

Complete pattern for short wave regenerative set each prepaid

50c.

Either Direct from us or for sale by the following responsible Dealers:

Am. Electro Tech. App. Co., N. Y. City
Alamo Sales Corp., Indianapolis, Ind.
American Hdw. Stores, Bridgeport, Conn.
Atlantic Radio Co., Boston, Mass.
Bamberger & Co., L., Newark, N. J.
Benwood Specialty Co. St. Louis, Mo.
Brode Electric Co., Los Angeles, Cal.
Brown, J. Edw., Glenbrook, Conn.
Bullock's, York, Neb.
Bunnell & Co. J. H. New York City
Burham & Co., Deptford, S. E. 8, England
California Elec. Co., San Francisco, Cal.
Catton, Neill & Co. Honolulu, T. H.
Central Radio Co., Independence, Mo.
Central Radio Co., Kansas City, Mo.
Chase, Geo. H., Newport, R. I.
Chicago Radio Ap. Co., Chicago, Ill.
Con. Radio & Elec. Corp. N. Y. City
Cutting & Washington, New York City
Delancey-Felch & Co., Pawtucket, R. I.
Detroit Electric Co., Detroit, Mich.
Dewey Spig. Goods Co. Milwaukee, Wis.
Doubleday-Hill Elec. Co., Pittsburgh, Pa.
Dunn, J. J., Pasadena, Cal.
Electric Motor & Eng. Co., Canton, O.
Electro Importing Co., N. Y. City
Findley Electric Co. Minneapolis, Minn.
Fuller Co., Seth W., Boston, Mass.
Gurd & Co., Wm., London, Canada
Hall Electric Co., Wm. Dayton, O.
Hico Wireless Sup. Co., Marion, Ill.
Hickson Electric Co., Rochester, N. Y.
Holt Electric Util. Co., Jacksonville, Fla.
Hughes Elec'l. Corp. Syracuse, N. Y.
Jenkins, Lester I., New Bedford, Mass.
Karlowa Radio Corp. Rock Island, Ill.
Katzenbach & Co., F. S., Trenton, N. J.
Kendall Co., W. D. Worcester, Mass.
Killoch Co., David, New York City
Klaus Radio Co., Eureka, Ill.
Kluge, Arno A., Los Angeles, Cal.
Krause & Co., A. F., Detroit, Mich.
Kusel Co., D. & F., Watertown, Wis.
Lehigh Radio Co., Bethlehem, Pa.
Liberty Radio Sup. Co., Chicago, Ill.
Linze Elec'l. Sup. Co., St. Louis, Mo.
Luther, H. E., Centerville, Ia.
McCarthy Bros. & Ford, Buffalo, N. Y.
Manhattan Elec. Sup. Co., N. Y. & Chic.
Marshall-Gerken Co., Toledo, O.
Meter Elec'l. Const. Co., Oshkosh, Wis.
Meyberg Co., Leo J., San Francisco, Cal.
Mohawk Elecl. Sup. Co., Syracuse, N. Y.
Nat'l Radio Institute, Washington, D. C.
New Era Shop Milwaukee, Wis.
Newman-Stern Co., Cleveland, O.
Nichols Radio Sup. Co. Bwlg Green, Ky.
Nola Radio Co., New Orleans, La.
Noll & Co., E. P., Philadelphia, Pa.
Northwest Radio Serv. Co., Seattle, Wash.
N. S. W. Bookstall Co., Sydney, Australia
Pacific Electric Co., New York City
Paramount Radio Sup. Co., Atlantic City
Pearlman's Book Shop, Washington, D. C.
Penn Radio Apparatus Co., Reading, Pa.
Penn. Marconi Wireless Schl. Phila.
Phila. Schl of Wireless Tele. Phila., Pa.
Piedmont Electric Co., Asheville, N. C.
Pioneer Electric Co., St. Paul, Minn.
Pitts Co., F. D., Pittsburgh, Pa.
Pittsburgh Radio & Appliance Co Pittsburgh, Pa.
Pitts. Radio Sup. Co., Pittsburgh, Pa.
Post Office News Co., Chicago, Ill.
Precision Equipment Co., Cincinnati, O.
Radio Distributing Co., Newark, N. J.
Radio Electric Co., Pittsburgh, Pa.
Radio Equipment Co., Boston, Mass.
Radio Equipt. & Mfg. Co., Minneapolis
Radioelectric Shop, Cleveland, O.
Ray-Di-Co., Chicago, Ill.
Reuter Electric Co., Cincinnati, O.
R. I. Elec. Equipt. Co., Providence, R. I.
Riverside Laboratory, Milwaukee, Wis.
Rose Radio Supply, New Orleans, La.
Roy News Co., Fro'k J., Toronto, Can.
Sayre-Level Radio Co., Phila., Pa.
Schmidt & Co., R., Rochester, N. Y.
Sears, Roebuck & Co., Chicago, Ill.
Service Radio School, Washington, D. C.
Shotton Radio Mfg. Co., Scranton, Pa.
Smith Bros., Sarnia, Ont., Canada
Smith Novotny Elec. Inc., Charlotte, N. C.
So. California Elec. Co., Los Angeles, Cal.
Southern Elec'l. Sup. Co., San Diego, Cal.
Southwest Radio Sup. Co., Dallas, Tex.
Sprott-Shaw Schl. Vancouver, B. C.
Sterling Electric Co., Minneapolis, Minn.
Stubbs Electric Co., Portland, Ore.
T. & H. Radio Co., Anthony, Kans.
Tuska Co., C. S., Hartford, Conn.
United Elec. tores Co., Braddock, Pa.
Warner Bros., Oakland, Cal.
Western Radio Elec. Co., Los Angeles, Cal.
Whitall Electric Co., Westerly, R. I.
White Co., The, Columbus, Ga.
White & Boyer Co., Washington, D. C.
Williamson Elec. Co., Seattle, Wash.
Wilmington Elec. Spec. Co., Wilmington
Winner Radio Co., Aurora, Colo.
Wireless Mfg. Co., Canton, O.
Wireless Press, New York City
Wolfe Electric Co., Omaha, Neb.
Y. M. C. A. Los Angeles, Cal.
Zamolski Co., Jas. M., Baltimore, Md.
Zibart Bros., Nashville, Tenn.

Consolidated Radio Call Book Co., Inc., 98 Park Place, New York City

What

A Knock-Out

EDITOR PRACTICAL ELECTRICS

A magazine wholly electric is what been watching for. When you say, pledge yourself to "100% Electrics," I lieve that's what it will be.

I know, just from subscribing to SCIENCE AND INVENTION, that, when you said a thing it was carried out. For instance, when the readers asked for more science, they got it and good articles too, not little pick-ups from here and there with no sense to them. So I believe, Mr. Gernsback, that PRACTICAL ELECTRICS will be more than a success, it will be a "knock out."

Raymond D. Schulze.

Cleveland, Ohio.

What Times Require

EDITOR PRACTICAL ELECTRICS

Allow me to congratulate you on your new electrical magazine. PRACTICAL ELECTRICS to my mind, is just what the times require. I wish you success. How about taking up some such subject as, say "Armature Binding and Design," "Storage Batteries," etc., starting from the first steps to the end. I think it would enhance the value of your publication.

W. M. Everall.

Department of Public Works,
Victoria, Canada.

His Kick

EDITOR PRACTICAL ELECTRICS

I have just bought my first copy of PRACTICAL ELECTRICS and I like it very much. It's the kind of a magazine we have been looking for. However, I would like to make a few humble criticisms, which perhaps are narrow-minded, but I believe many amateurs would make the same criticism.

I believe there are too many articles showing newly patented articles, as "Electrical Seat Indicator," "New Electric Dish Washer two articles on "New Kitchen Motors," etc., and not nearly enough "Experimental Electrics."

The articles on Tesla apparatus were fine.

I would like to see some articles on X-ray experiments, high temperature experiments with electric furnaces, and Einthoven galvanometer and an electric heater for the chemical laboratory for heating, etc.

John Wohl.

From Prof. Richards

EDITOR PRACTICAL ELECTRICS

I have carefully examined the first issue of your new magazine, and feel that you will shortly bring it to the commanding position enjoyed by SCIENCE AND INVENTION. I wish you every success in your new venture, and shall follow the growth of PRACTICAL ELECTRICS with great interest.

Harold F. Richards, Ph. D.

Department of Physics,
University of Cincinnati,
Cincinnati, Ohio.

Fills the Gap

EDITOR PRACTICAL ELECTRICS

It affords me the greatest of pleasure to tender you my heartiest congratulations on the success of your latest venture—PRACTICAL ELECTRICS.

I have read the first issue with the greatest of interest. Your magazine fills a gap that was in evidence for a long time. It is edited along the correct lines.

Frederick C. Raeth, Director.

School of Engineering,
Milwaukee, Wis.

Wants First Copy

EDITOR PRACTICAL ELECTRICS

I have received your notification of the launching of your third magazine, and I hasten to express the hope that your new venture may be crowned with success. At

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CAL ELECTRICS from its incep-
see it attain a healthy vigor.

Rev. J. F. Kerwan.

ewfoundland.

Electro-Culture

PRACTICAL ELECTRICS

el that I can call you a friend, Mr.
back, as I have bought every issue of
y and all magazines you have had any-
ng to do with, and congratulate you on
ne new one, for which you will find my per-
sonal check enclosed. You certainly are to be congratulated on the many fine, interesting things you have given to the thousands of young men throughout the country, that have had a chance to study and learn all the modern inventions, and their usefulness.

There is no doubt in my mind, that you have done more for the advancement of young people through the medium of good reading in your various publications, than have all of the different organizations in the world to-day.

You will pardon my request, but I am very much interested in the art of plant culture by electric discharge, and ask if you can refer me to some extensive works, if any, on the subject.

I have recently moved from Galveston, Texas, to my present location, and desire to try some new experiments on the culture of orange and grape fruit trees, both for growth, and to remove the many little insects that eat down their efficiency. Will greatly appreciate any information, you can give, to get me started on the right path, and I will be glad to let you know results.

George Ray Clough.

Bradentown, Florida.

An Old Timer

EDITOR PRACTICAL ELECTRICS

I was fortunate enough to get the first issue of RADIO NEWS and subscribe for five years. I have every copy of The Experimenter (SCIENCE AND INVENTION) from October, 1916 to date, so you see I am an old "customer" of yours. I bind all Gernsback publications into books for future reference.

I am sending check for $1.50 for first year and PLEASE see that I get the first issue, as I want the series complete.

A. E. Coe,

Central Square, N. Y.

One Million!

EDITOR PRACTICAL ELECTRICS

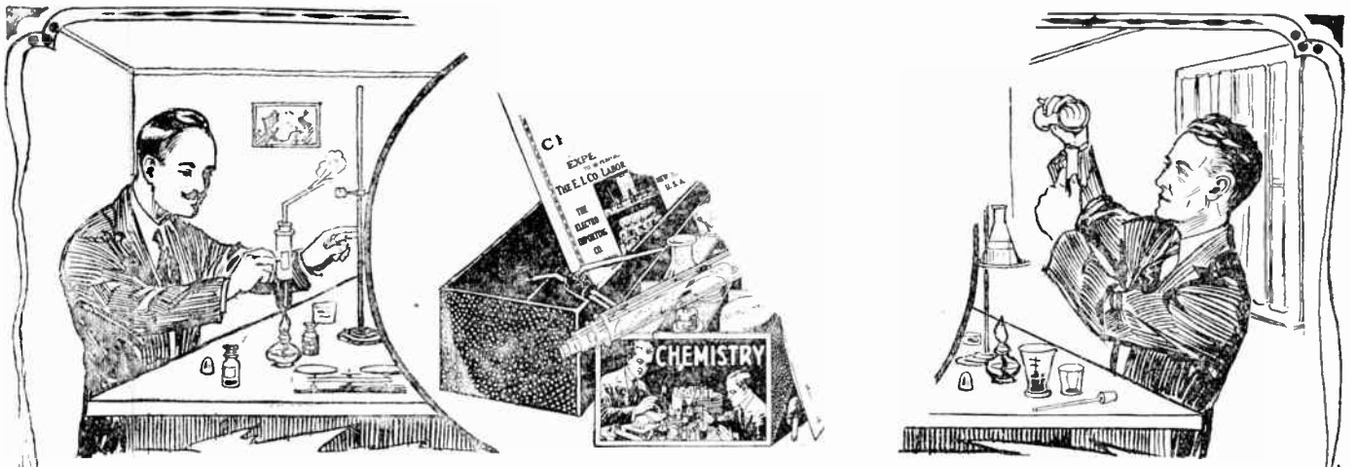
If PRACTICAL ELECTRICS is in the same class as RADIO NEWS, and SCIENCE AND INVENTION, I'll be satisfied.

To be a little slangy, "You're there." I think the two magazines just mentioned first class, and surely, only a real live editor, such as you have proven yourself to be, could sponsor such. Your scheme of binding years into volumes, and selling at subscription rates is only one of your sane, sound business judgments, and means not only much to you, but a lot as well, to those like myself who were able to step back a year and come up to date with my RADIO NEWS. It also makes a very convenient form of reference. What pleased me most was the fair price placed on same.

May your three magazines attain a million subscriptions each!

H. T. Kanagy.

Modera, Utah.



A *REAL* Chemical Laboratory

The new E. I. Co. Chemical Laboratory contains **real** chemicals and apparatus to perform **real** chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparatus and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

Complete as shown

$7.50

DESCRIPTION OF THE OUTFIT

The outfit consists of forty-four (44) Chemicals and Reagents all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) to make dozens of experiments with each.

The apparatus furnished are all of the best obtainable make and of standard laboratory size and shape.

The Instruction Book is a real Chemistry Course for the Beginner. Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature:** This explains in simple language the derivation of the chemical names of the elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, The English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; per Cent solutions; Conversion of Measure expressed in parts; poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the 100 Experiments are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

Contains the Following Chemicals and Apparatus:

Chemicals and Reagents

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate ($(NH_4)_2CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate ($(NH_4)_2SO_4$
Barium Chloride ($BaCl_2$)
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride ($CaCl_2$)
Calcium Oxide (CaO)
Calcium Sulphate ($CaSO_4 2H_2O$)
Charcoal (Carbon) (C)
Chloride of Zinc ($ZnCl_2$)
Copper Sulphate ($CuSO_4$)
Ferrous Sulphate ($FeSO_4$)
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride ($FeCl_2$)
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate ($MgCO_3$)
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride ($NiCl_2$)
Oxalic Acid ($H_2C_2O_4$)
Sodium Bicarbonate ($NaHCO_3$)
Sodium Borate ($NaBO_2$)
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride ($SnCl_2$)
Sulphate of Nickel ($NiSO_4$)
Sulphate of Zinc ($ZnSO_4$)
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate ($ZnCO_3$)

Apparatus

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
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Electro Importing Co., 231 Fulton St., N. Y. City

Construction of a Sma Tesla Coil

(*Continued from Page 75*)

the ends of secondary wires are connecte these. The condenser consists of 6 plate couples) the foils are 4¼ x 2¼ inch. The spa gap consists of 2 iron screws ⅛ inch th with nuts 1½—2 inches long, screwed in. 2 supports (vulcanite pipe mouthpieces) The nuts serve to connect wires. The gap is about 1/16 inch. The connections are from secondary A of spark-coil to condenser and spark-gap; from Sec. B of spark-coil to the other side of condenser and primary A of Tesla coil. Primary B. of T. C. is connected to other side of spark-gap. The whole apparatus is well shellaced to insure good insulation, which is very important.

Novel Use of Radio Amplifier

(*Continued from Page 55*)

The set is connected to the telephone line in place of the usual receiver, and it magnifies the incoming voice currents, until they are extremely loud. The telephone transmitter is employed as usual.

In case it is not desired to spread the conversation all over the room, as in the case of using the large horn, a section of speaking tube is attached to the loud speaker and this

d in
stomed
that, even al-
sou..d was sufficient,
a telephone all over
this apparatus for a
ear sufficiently familiar
a telephone, so that no
as experienced and the
ow in constant use.
ontributed by E. M. Symmes

hermic Telephone Transmitter

(*Continued from Page 68*)

di agm chamber is hermetically closed, ar one of the diaphragms is so thin, that it vibrates and produces the desired effect. In one patent it is proposed to subject the Wollaston wires, which are extremely fine as made, to the action of an acid, so as to etch them to still greater fineness. The current required to operate a telephone is of infinitesimal strength. This makes it possible to use such wires to carry it, and by arranging them in parallel, their current-capacity is increased, and their extreme thinness is preserved so as to make them sensitive in some way to sound waves.

Humidity Measuring Apparatus

(*Continued from Page 69*)

only necessary to wait a few instants, until the indicator has reached the lowest degree by means of the circulation of air. For both temperature readings for the wet and dry bulb thermometers, the psychrometric tables of temperature difference are used, and the percentage of humidity is calculated by the tables supplied with the apparatus. The measuring is exceedingly simple if the temperature of the dry thermometer only varies within a narrow range; in this case the difference of temperatures can be read directly on a second scale of the instrument or one can divide the scale according to the percentage of humidity. But it is quite essential for this arrangement that accurate normal and limiting temperatures are known. To connect the distant measurer with the resistance thermome ers, three conductors are required for each pair of thermometers. A 4-volt accumulator is used to supply current for the measuring apparatus. The fan motor has two conductors of its own connected to the electric service system.

Building an 8 Inch Spark Coil

(*Continued from Page 72*)

which rarely permits the core to become fully magnetized before breaking the circuit.

The general dimensions of the vibrator parts are given in Fig. 3 and these may be departed from to some extent without appreciably affecting the results obtained. It will be seen that the armature spring and soft iron hammer head, when it is attracted by the iron wire core projecting thru the cabinet, will move forward some distance before the button A, on the rear of the spring touches the contact spring proper. The hole in the contact spring through which the stem of the button moves should be made sufficiently large so that the action is free and positive. After building the coil and trying out the interrupter, the

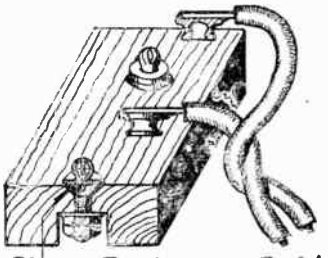
(*Continued on Page 93*)

thus
wire is
short-circu
ring with occur
hand makes contact
alarm will not ring unt
touches the wire.

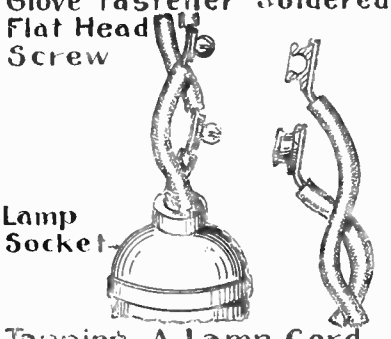
Contributed

Glove Fasteners in

INSTEAD of binding po
made electrical apparatus,
fasteners from an old pair of g
used. The lower part is soldered
which is inserted in a wooden bas
top part is soldered to a flexible l
leads may be removed quickly and
easily. These snaps also make a con
tap on the electric light wire, by so
the lower part of the snaps to a drop
cord and fastening the tops to an exten
wire. They will not, however, carry over
ampere without heating. They will be
satisfactory for curling irons, sewing machine



Glove Fastener Soldered To Flat Head Screw



Tapping A Lamp Cord

This shows how glove fasteners can be used to make electric connection for light currents.

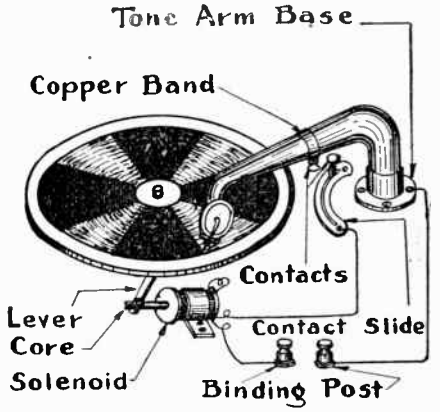
motors, extension lamps, small heating pads, etc. but not for sad-irons or toaster stoves.

When not in use, they are hardly noticeable and are not in the way like an extension socket.

Contributed by V. H. Todd.

Phonograph Stop.

I HEREWITH show how I constructed an automatic stop for a phonograph



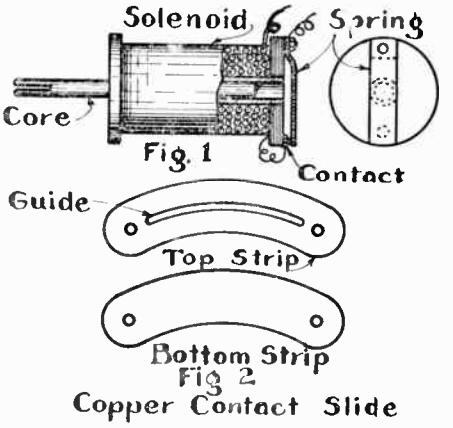
The electric phonograph stop shown in position

First procure a solenoid coil 2 inches long with ¼ inch hole. A thin brass spring and contact are fastened to the back of the

ICIAN

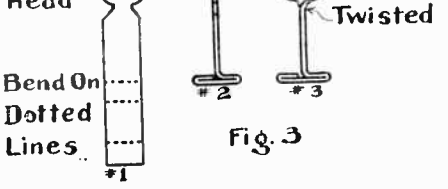
82)

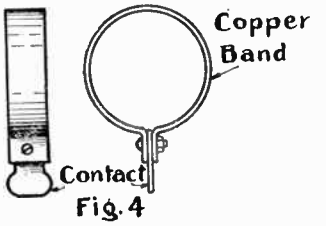
d as shown in Fig. 1. The core should inch longer than the coil, so that when re is drawn all the way in, it will push ring away from the contact, cutting l unnecessary flow of current. The oid is held in place on the phonograph a strap of brass held by two small



The solenoid and copper contact slide.

screws on each side as shown in lead sketch. The core is fastened to the lever that starts and stops the motor. An adjustable contact slide is made from two copper strips 3 inches long, and ¾ inch wide. A guide slot following the arc of a circle, 1/16 inch wide, is cut through the center of one of the strips terminating ½ inch from each end. The two strips are put together and small holes are drilled through the ends to receive small wood screws as shown in Fig. 2. A sliding contact, to move tightly in the slot, is made from a copper strip 2¼ inches long, ¼ inch wide, shaped and bent as shown in Figs. 3 and 4. It is then put through the guide of the slide and the head turned at a right angle, as in Fig. 3. The two curved strips are put together and screwed in under the tune arm as shown in sketch of the assembled parts. A copper band ¼ inch wide is made, long enough to fit tightly a-





The two contact pieces for operating the soleneid and arrecting the motion of the sound arm.

round the tune arm when its bent ends are bolted together, providing a contact piece, to come in contact with the sliding contact as the arm swings around. One or two dry cells may then be connected to the binding posts and the sliding contact is set to close when the musical piece on the record is finished. When the contact is made the solenoid is excited, it draws its armature into its coil-opening, and breaks the contact on the back.

Contributed by Ben W. Kearns

Building an 8 Inch Spark Coil

(Continued from Page 91)

ength of the button stem may have to
changed until the circuit is broken at th
most desirable time to give the maximum
secondary spark. One-eighth inch dia-
meter platinum or tungsten contacts should
be used on the contact screw and spring
and in some cases where these are not avail-
able, silver may be utilized.

Secondary of 8 inch Spark Coil.

For average use it has seemed like too much labor to wind the secondary of even as large a coil as an 8 inch one in small pies or sections, a fraction of an inch think, although this gives a very reliable coil and one not likely to break down its insulation very easily. The present design which has been built and tested successfully, calls for but four secondary windings, each unit measuring 4 inches long over-all. The drawing in Fig. 4 shows how the secondary units are wound and also how every other one is reversed, when placed on the insulating tube during the assembly of the coil, so that the current will pass around the secondary coils always in the same direction, while the lead wires from the unit coils will be connected together so as not to engender ers or short-circuits.

Each of the four secondary coils should be wound as follows: Wire required for each unit will be 2 pounds 10 ounces of No. 36 B. & S. gage enameled copper magnet wire, or a total of 10½ pounds being required. In winding one of these secondary units, paraffin paper 4 inches wide should be cut from sheets either purchased or waxed by the builder, the paper being .003 inch thick, measuring the paper before waxing of course. A layer of this paper should be placed between every layer of wire, the coil being wound on a wooden mandrel 2¼ inches in diameter, supporting the mandrel in a lathe or between two wooden uprights fastened to the work table. The outside diameter of the secondary units will measure about 4½ inches. The waxed paper will extend 11/16 inch beyond the wire at each end of the layer, the length of a wire layer being 2⅝ inches. By getting in touch with electrical winding concerns or spark coil manufacturers, these secondaries can very frequently be purchased at a labor-saving price, as it is quite a job to wind them. When all of the secondaries have been wound, they are placed on the insulating tube, as shown in the assembly drawing Fig. 1 with insulating disks between them, the disks separating the coils being about ⅛ inch thick and composed of hard rubber, bakelite or even fibre. An equivalent thickness of paraffin paper sheets has also been employed. At either end of the secondary assembly there is placed a thicker square insulating piece measuring preferably about ¼ inch thick or more. By referring to Fig. 4 it becomes evident how the two inside leads of sections 1 and 2 are connected together, then the two outside leads of sections leads of sections 2 and 3 and finally the two inside leads of sections 3 and 4. This same scheme of reversing every other coil unit on the tube so as to obviate the possibility of having a high voltage lead passing across all of the layers of wire at the end of a coil, is employed for spark coils having a greater number of sections. After the complete coil is placed in the box, the latter should be filled with woltein, paraffin, wax or sulfur.

(Concluded in January Issue)

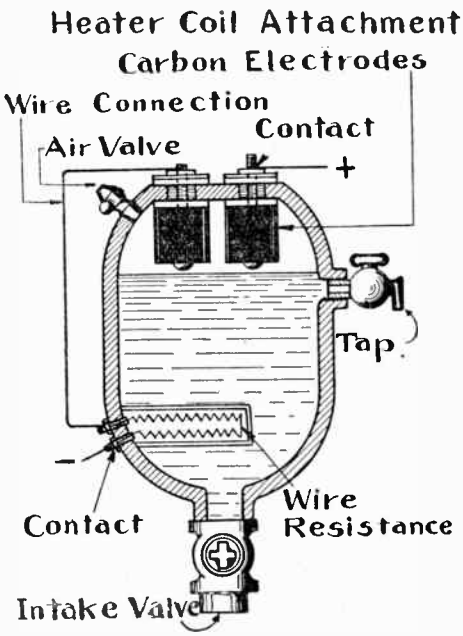
Electricity and Population Increases.

IN the last ten years the population of the United States increased not less than

...e
...f times
...t less than
... of the country
central stations, and
...e homes are wired.

ic Hot Water ystem.

...own herewith is designed
...ater and automatically to
...t any desired temperature.
a resistance heating-element at
...h of the tank and two carbon elec-
tro... the top, all connected in series.
The ...r between the electrodes forms a
resi... to the current which assists in the
hea... and affords means for regulation.
...en the water in the tank reaches the boiling point steam collects in the top and forces down the water level. This creates a gap between the electrodes and breaks the current. Should the steam cool enough to condense, the level rises, and electric action throughout the whole system is resumed.



An Electric Heater which mantains a Constant Temperature

By this means a degree of heat is automatically maintained dependent upon the amount of pressure in the supply system—the superheating of the steam being in proportion to the pressure.

If, however, less heat is desired, means is provided in the air and the intake valves. By the use of these and the tap, a small amount of air may be admitted to the tank. When now the current is turned on, the air will expand with the heat and force down the water level. The gap between the carbons breaks the current as before, but this time at a lower temperature.

The greater the amount of air admitted to the tank, the lower the point of regulation, since gas under a constant pressure expands with each degree rise of temperature; and the greater the initial volume, the less the required heat to make the air expand and fill the top of the tank and open the circuit. The return to steam-heat may be effected at any time, by opening the air valve and letting in water until the tank is once more completely filled.

The print illustrates only the essentials of the device, but associated cooking compartments, and means for entirely removing the electrodes from contact with the tap water are simple modifications of this novel patented device.

Contributed by Theodore A. Cutting.

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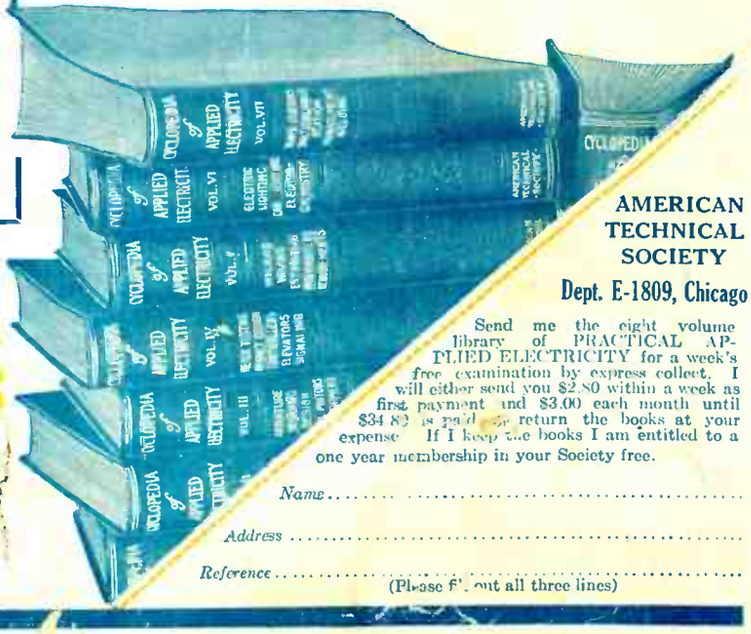

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