Practical Electrics

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Over 100 Illustrations

Apr. 1924

EDITED BY H. GERNSBACK

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See Page 299

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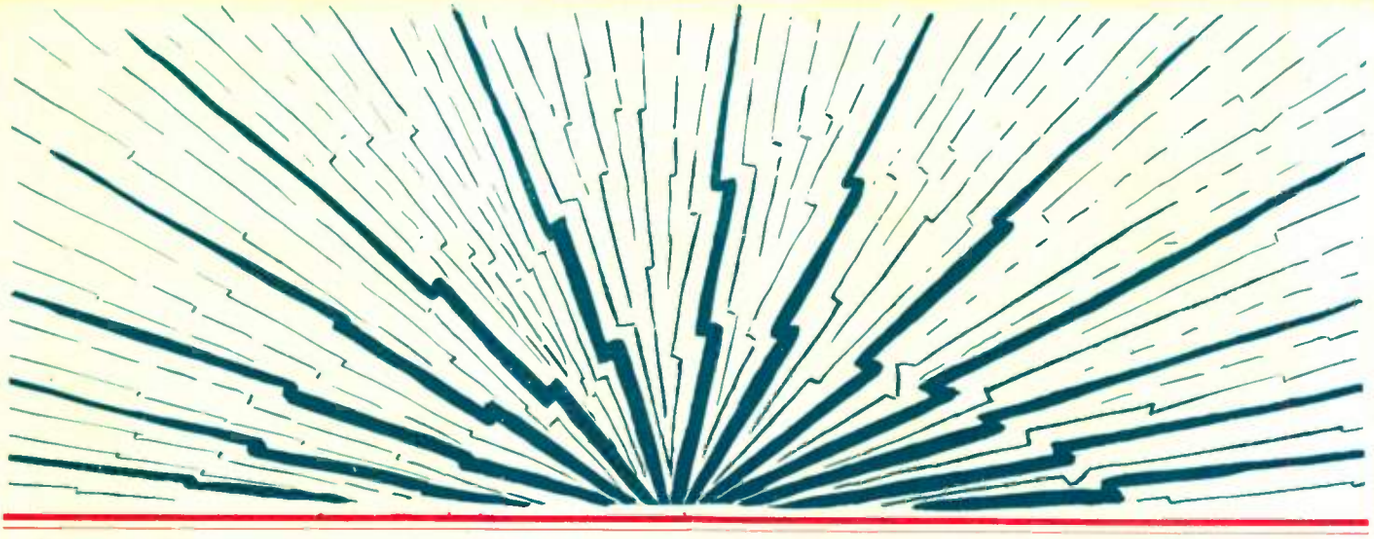

To Practical Men and Electrical Students:

Yorke Burgess, founder and head of the famous electrical school bearing his name, has prepared a pocket-size note book especially for the practical man and those who are taking up the study of electricity. It contains drawings and diagrams of electrical machinery and connections, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data is taken from his personal note book, which was made while on different kinds of work, and it will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The work on Calculations consists of Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculating Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

The book, called the "Burgess Blue Book," is published and sold by us for one dollar ($1.00) per copy, postpaid. If you wish one of the books, send us your order with a dollar bill, check or money order. We know the value of the book and can guarantee its satisfaction to you by returning your money if you decide not to keep it after having had it for five days.

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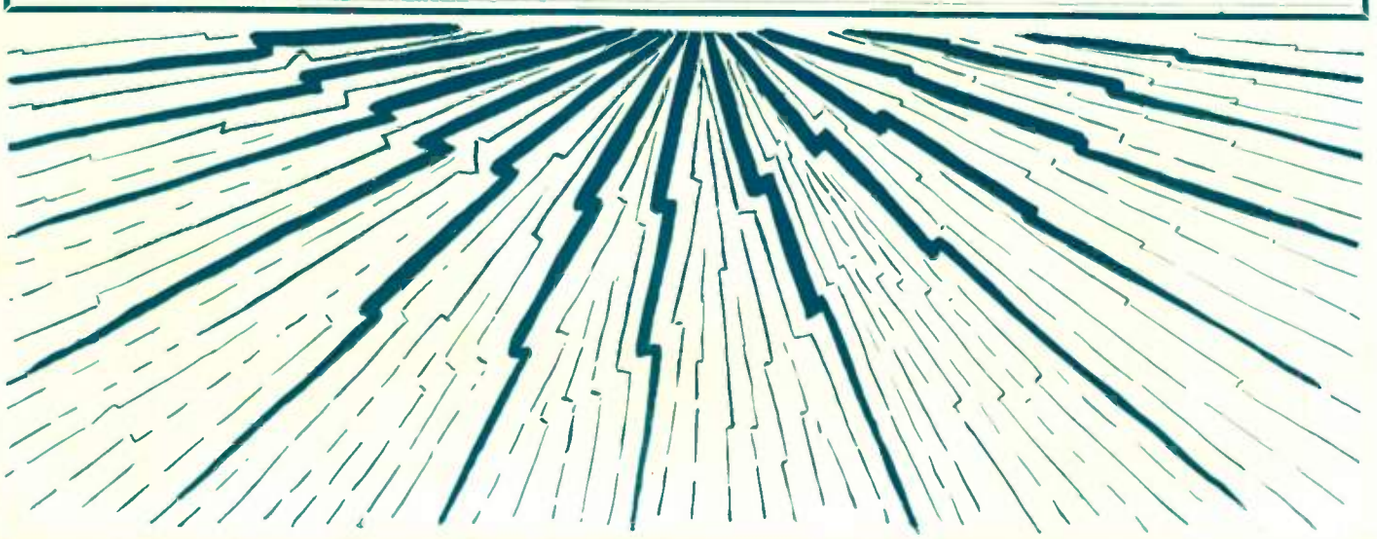

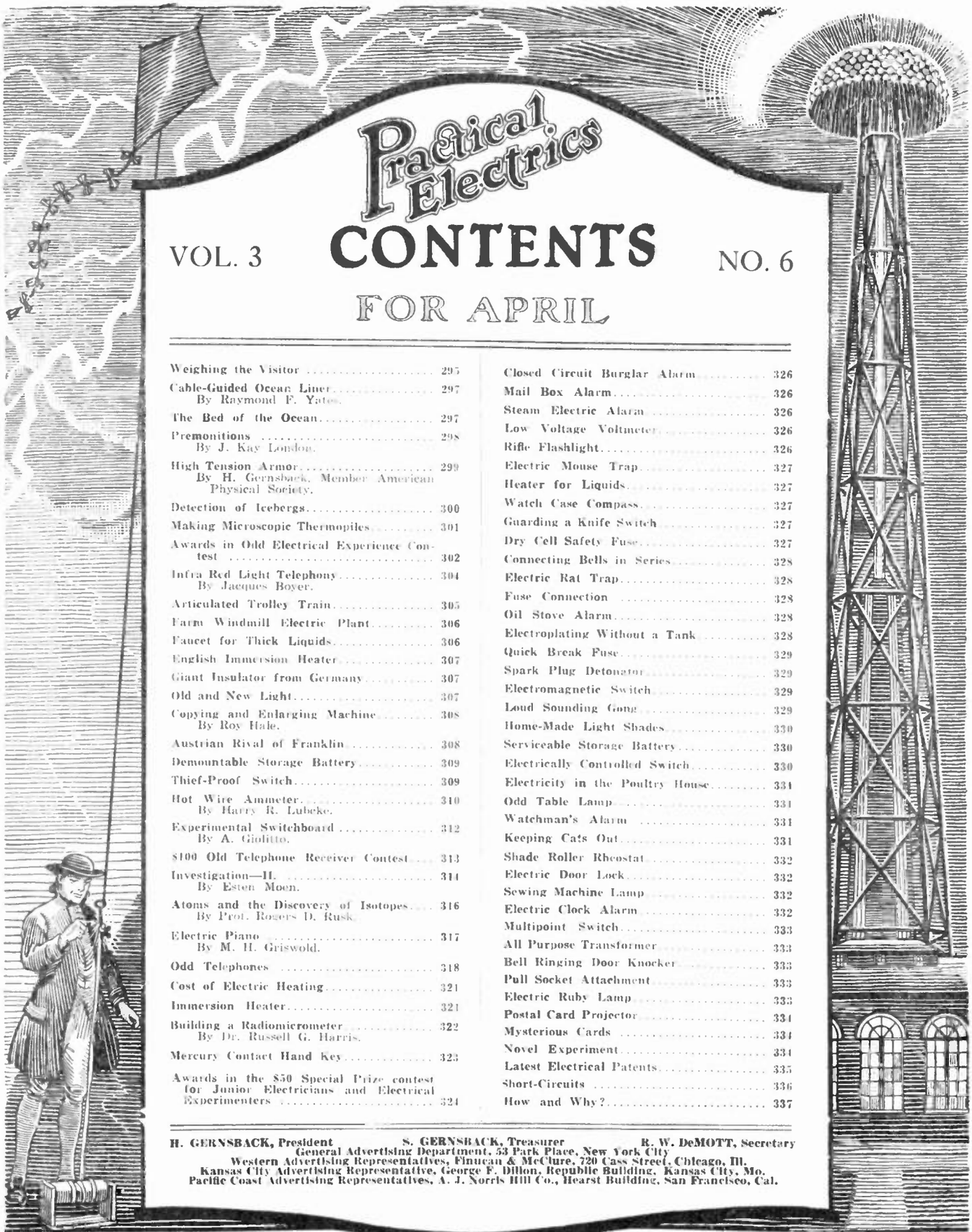

Practical Electrics

VOL. 3 **CONTENTS** NO. 6

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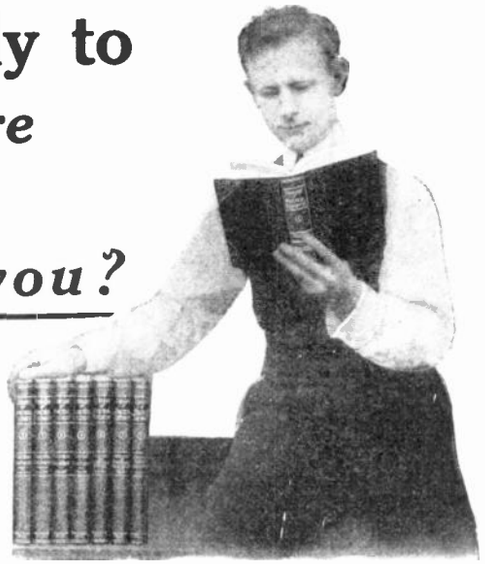

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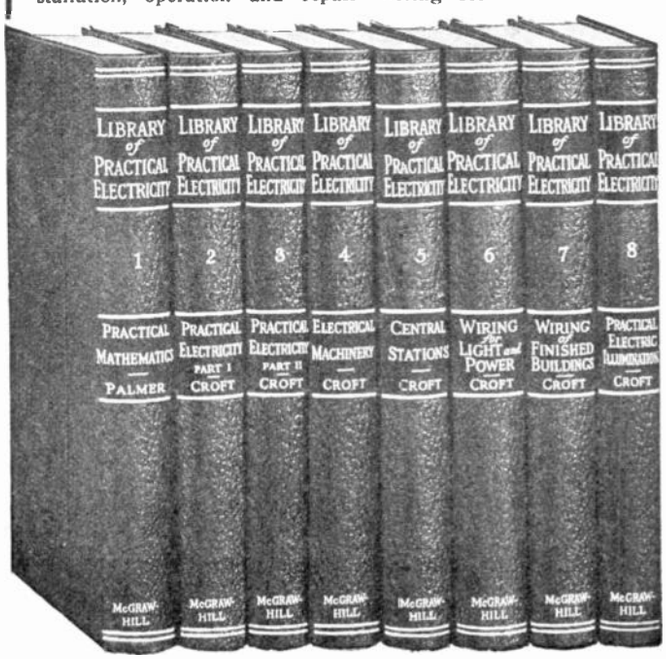

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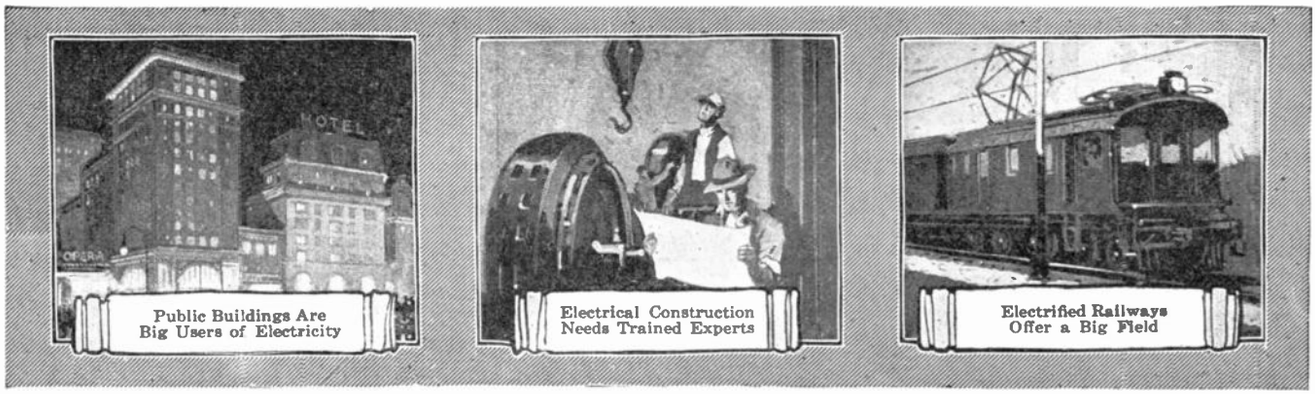

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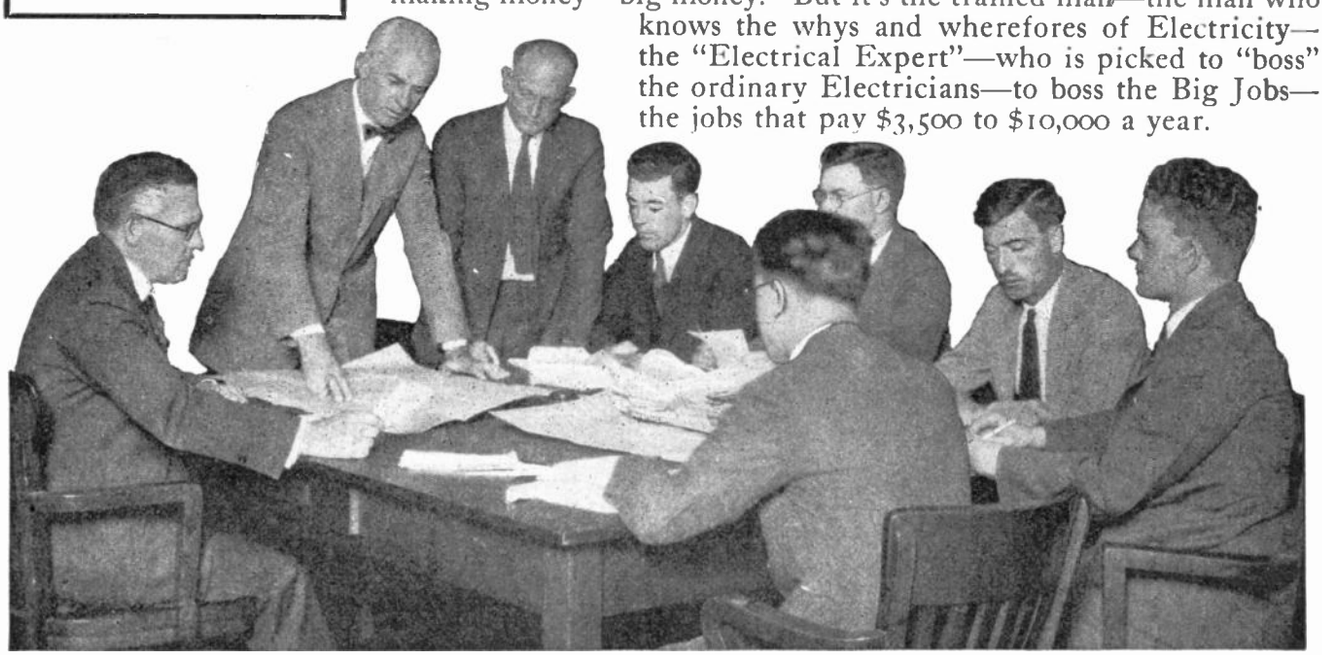

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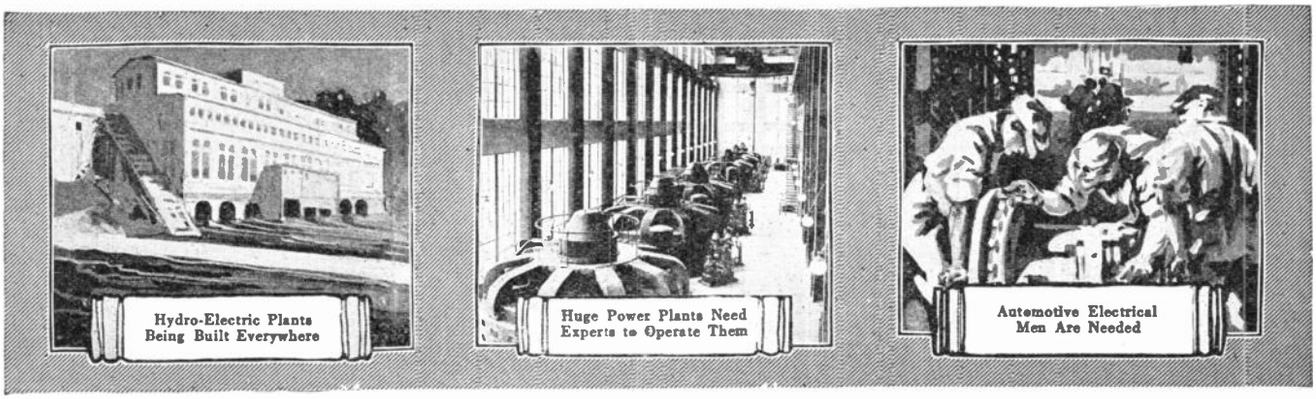

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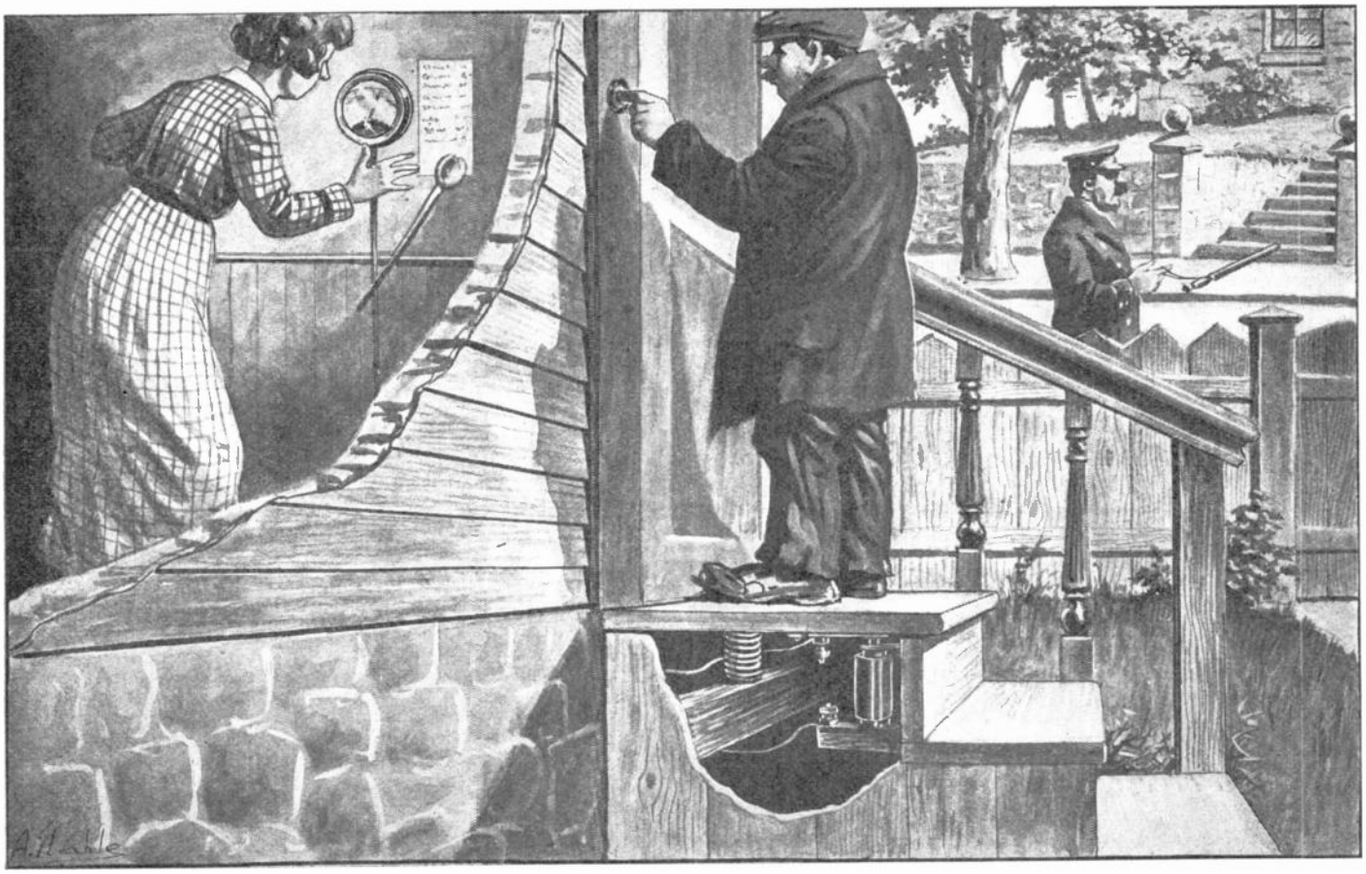
Volume 3
No. 6

Practical Electrics

April
1924

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

Weighing the Visitor



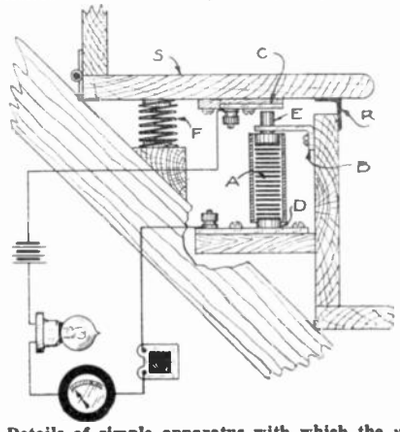
A tramp wants to get into the house; his weight is read on the galvanometer and is found to differ from the weights of any member of the family as inscribed on the card against the wall. Observe the watchful policeman.

THIS is a device which will announce a visitor at the door and give information as to the weight for identification purposes.

At homes in localities where it is not advisable to open the door at the arrival of each and every visitor it is often desirable to have some information as to who the caller might be, especially when the woman of the home is alone, perhaps at night, and expecting the husband or other member of the family to put in an appearance momentarily.

The device can be placed beneath a step just in front of a door or beneath a landing. In the latter case it should be mounted somewhat differently, so that the full weight will be thrown upon the indicating mechanism. In the drawing (A) represents a built-up pile of carbon discs which may be obtained by sawing them from a large size discarded dry cell battery carbon. Use a mitre box. After sawing off, each piece should be trued up on a flat surface grinder or with a flat file so that when about sixteen are piled on top of one another the pile will stand straight. These discs are placed inside a paper or fiber tube enough larger to allow the discs free room to move, yet to be held to very nearly coincide with one another.

If the tube is of paper it should have a good coating of shellac to keep out moisture. The top end of this tube is to be bolted to a circular brass piece (E) having a projection on the upper end to make contact with a brass plate (C) placed on the step (S). At the lower end of the tube another brass disc is attached to a brass plate on the wood base, this disc being of such size that the tube will fit snugly over it, but with freedom to move up and down. A spring (F) is placed beneath the step with expansion power sufficient to support the step and about 25 pounds of additional weight. A strip of canvas is tacked around the edge of the step.



Details of simple apparatus with which the visitor is weighed. A pile of carbon discs form the pressure rheostat affecting the reading of the galvanometer and give the visitor's weight.

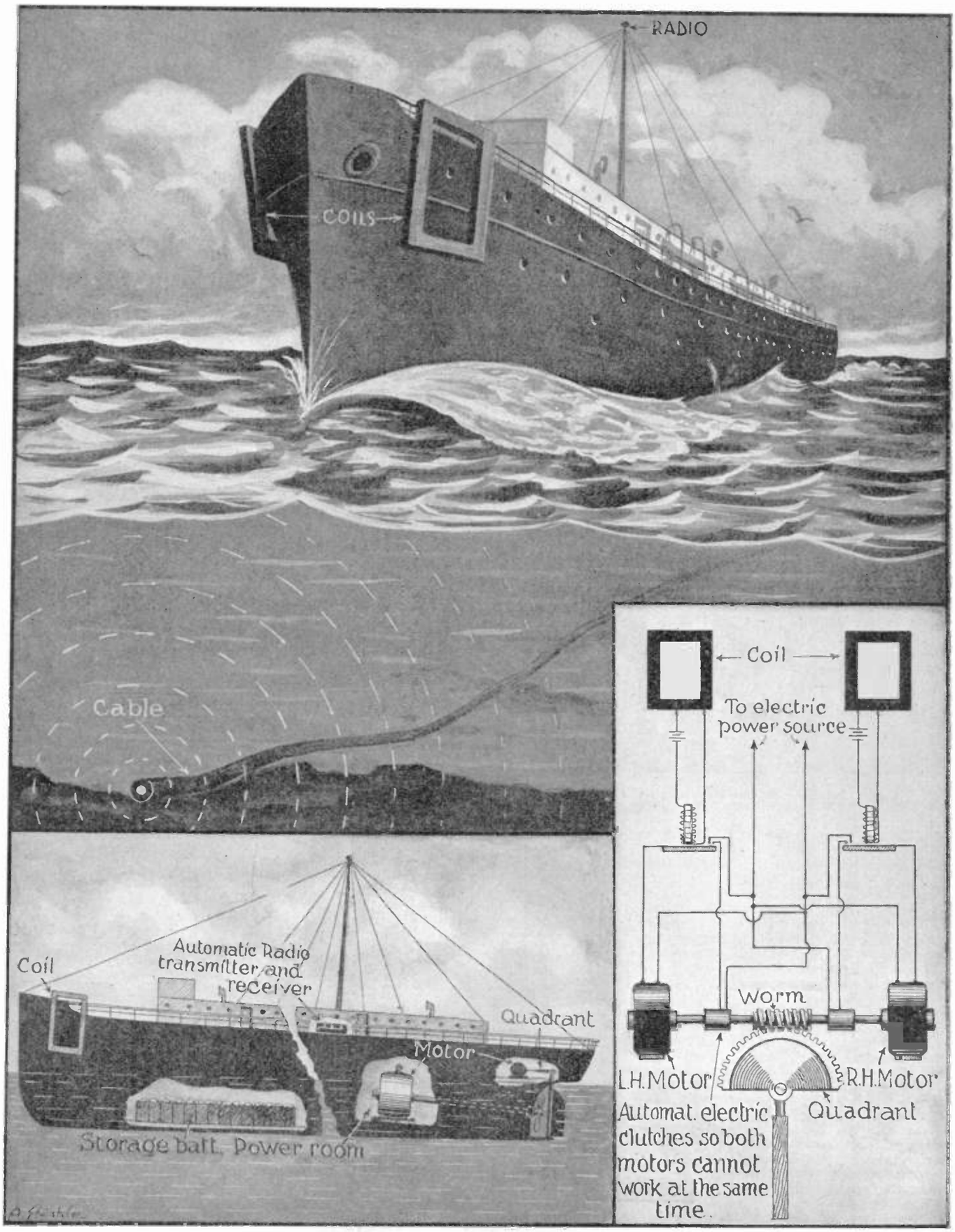
The brass plate on the lower side of the step is wired through a doorbell ringing transformer, an incandescent bulb of proper voltage, a current indicator and a buzzer to the brass plate at the bottom of the pile of carbon discs. The reading of the indicator will show by the amount of current permitted to pass through the carbon discs approximately what pressure is applied to press them together, as the resistance offered by the carbon disc rheostat will be in proportion to the weight of the person standing on the step or landing.

By making tests and comparing readings with the members of the family on the step, quite definite information will be had as to who the visitor may be.

Contributed by GEORGE MCVICKER.

Cable-Guided Ocean Liner

By Raymond F. Yates



The ship is guided by radiations from a submerged cable. Below the ship are explanatory illustrations of how it is to be done. The rudder is turned and the engine is controlled from the cable submerged in the ocean.

Cable-Guided Ocean Liner

By Raymond F. Yates

A FEW years ago Nikola Tesla said that we would soon be guiding ships across the sea to every port in Europe without a soul on board. What might be called a semi-radio ship control, which would make true Tesla's great dream, is illustrated in the accompanying illustrations.

An energized cable similar to that employed during the war to guide ships into harbors without harbor lights is used. A sort of balanced relay system is employed on the vessel. If the ship wanders too far out of the magnetic field developed by the current passing through the cable, the rudder is automatically turned and the ship is brought back to its course. As long as the ship is cutting the locus of maximum density of lines of force the electrical system aboard will be balanced and the rudder will remain straight.

Although such a system of ship guiding would not be practical today, a few years hence may find civilization with a better means of storing electric power. This would mean a simple electric drive with propellers connected to the same shaft as the motors.

By using a tuned system and currents of different frequencies the operators ashore could control the speed of the vessels. If the ship got entirely off its course through accident to its mechanism, an automatic wireless transmitter could be set in operation which would send out a peculiar kind of distress call. This could be answered by scout steamers used entirely for this purpose.

Since it costs about $1000 a day to operate the average tramp steamer it is obvious that a great saving could be accomplished by such a system of control, and it would release thousands of workers on the tramp steamers for other purposes although the workers might object.

The Bed of the Ocean

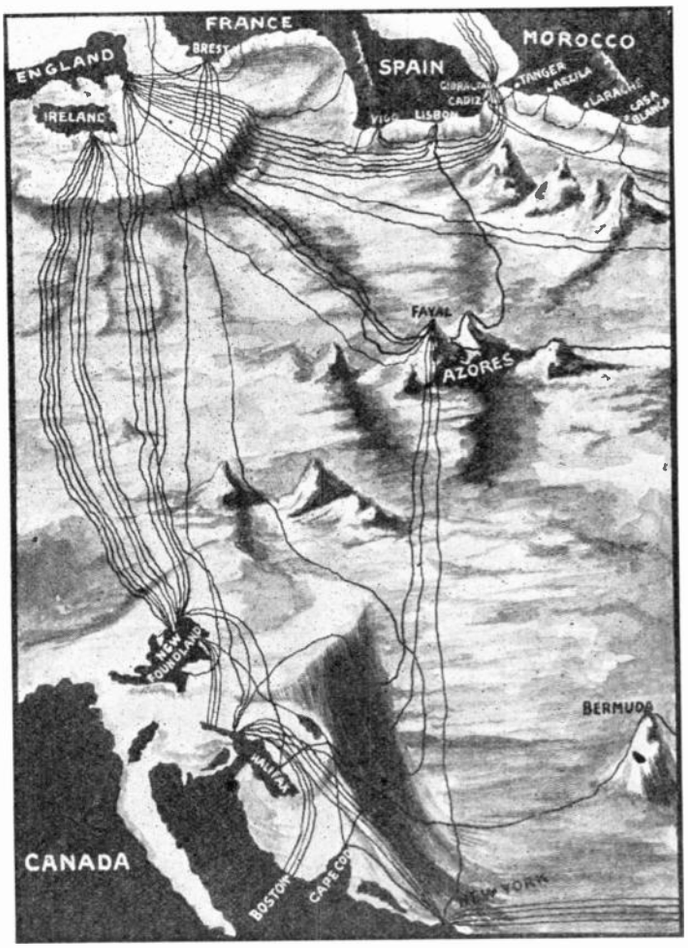
THE sea captain's old joke of telling his passengers, when in the middle of the ocean, that they were only a few miles from land, expresses the depth of the ocean. The land which he alludes to is of course the bottom of the ocean, which is never more than a few miles from the surface.

In controlling a ship's movements by radiation from a submerged cable the question of power naturally arises, and it would seem that such a system would be restricted in a sense to shallow water, for the power radiated from a system of which one element was a submerged cable, might be taken as varying somewhere near a square of the distance.

It must be remembered that it is radiation from a line, not from a point, and that the radiations represent the radii of a cylinder, not the radii of a sphere.

When we consider how simple a thing it is by relaying to get a speaking current through space from a distance of thousands of miles, and what great powers of relaying the almost inappreciable current are given by the vacuum tube, it does not seem impossible that a cable at the maximum depth of the ocean should be able to control enough power to operate a powerful relay system to govern the movements of a great ship.

The bottom of the ocean is exceedingly irregular, but at the worst the effect of the cable described would never need to make itself felt for more than what in wireless may be termed "strictly suburban distances."



The bottom of the ocean. Some of the great mountains of the earth hidden from view by the sea. Bermuda and the Azores form quite striking features of the submarine territory.

Although they no not realize it, dwellers at the seashore may be taken as living upon the slopes of a great mountain. The lowest parts of the earth's surface is under the sea, and without giving any particular dimensions, we have produced a perspective representation of the bottom of the ocean, showing it as a region of mountains and valleys, our shore level really being at a great height from the depths of the salt water.

The few islands in the Atlantic Ocean, some of which are shown, are really mountain tops, and the imposing mountainous nature of the bottom is brought out with exaggerated picturesqueness in our illustration.

If we look at the map of coasts of England and America it will be seen that they are mountainous tablelands in reality. Even the little Bermuda "far vex'd Bermoothes" appears as a tremendous mountain, but how many who have bicycled over its coral roads imagined themselves on one of the great summits of the earth.

Across this mountainous region any number of submarine cables pass, and their number is constantly increasing. They have to go up hill and down hill for no cable stretches through the water, but always rests upon the bottom. When the cable ship is running at eight knots per hour and the water is 2,900 fathoms in depth, 25 miles of cable will be suspended in the ocean between its bed and the stern of the ship. If any particular part of the cable were marked it would be found that it required two and a half hours before the bottom would be reached.

In the laying of these cables and in their repair quite astonishing achievements come to pass. While it is such an everyday matter that the electrician never thinks of it, it is remarkable that a person on shore can determine the distance of an imperfection in a cable which imperfection may be between one and two thousand miles away.

Once the fault has been discovered, it has to be repaired, so the cable ship goes out upon the pathless ocean aad by exact navigation finds its way to a point either to one or the other side of the cable and near the location of the defect, throws over a grappling iron and picks up the cable from the bottom, the really remarkable achievement, being, as Kipling puts it, all in the day's work.

The cable is then brought up on the deck of the ship, the defect is found, repaired and the cable again released.

For many generations the determination of the longitude on ships stood with perpetual motion, flexible glass, the ever lit lamp, and perhaps a few other similar things, as one of the unsolved problems of mankind. It was solved in a practical way by the production of the marine chronometer. Today, by communication with shore through wireless, it is being still further perfected.

The ship described in the preceding article is supposed to find her way across the ocean without any navigation whatever. It would seem as if the broken cable might be used to lead the ship to the faulty spot.

In the "fifties" of the last century, the City of New York had a grand celebration on the occasion of the completion of the first Atlantic cable, commemorated in one of the poems of Oliver Wendell Holmes, who immortalized the name of DeSauty, the electrician, who got a few messages through the cable before it broke down.

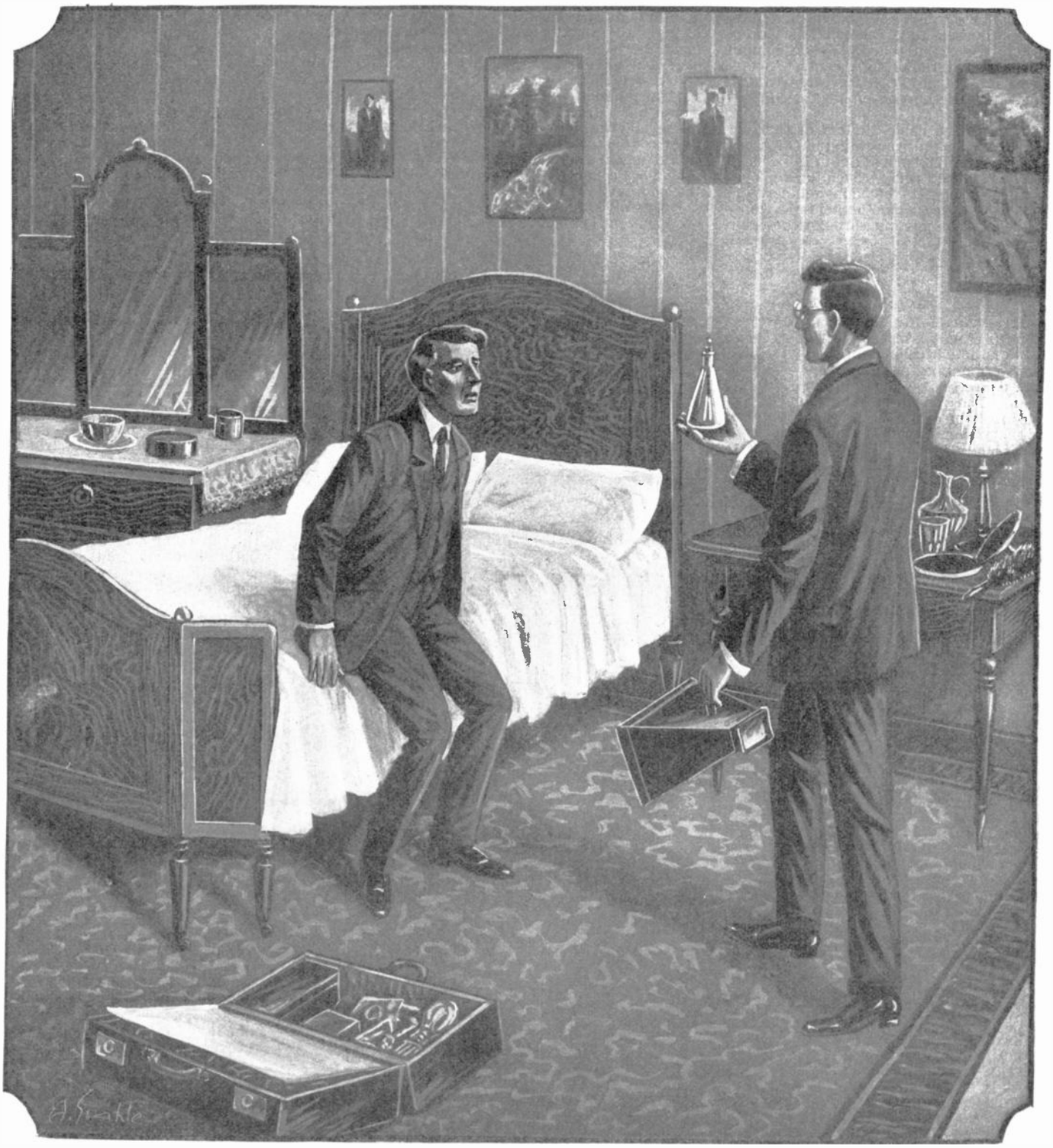
This cable was laid from two ships; they met in mid-ocean, spliced the cable ends together, and one ship started for America and the other for Ireland.

Now this work is done from special cable laying ships, the Faraday after a long and faithful service has been discarded and the modern ships can carry 4,000 miles of cable in the hold, so a single ship does the work.

(Courtesy of Eastern Telegraph Co.)

Premonitions

By J. Kay London



I rose and took the fluoroscope out of his hands. "You don't see anything now, do you?"

"WERE it not for the fact that I was personally interested in the affair, Hargrave," Dr. McAuliffe was explaining, "I would call it not only uncanny, but supernatural."

"Nonsense," I answered. "After our investigations in the psychical field you surely do not think anything is supernatural. Have we not found that everyone laying stress on supernatural occurrences has been boldly falsifying statements or exhibiting natural phenomena and ascribing supernatural causes thereto?"

"Or perhaps you can explain it, Hargrave," the doctor continued, registering the "I don't care" attitude of Eva Tanguay. "Nevertheless, although my heart was set on the purchase of the Carlton house, at my wife's request I ordered my broker to discontinue his efforts."

"You are indeed foolish, McAuliffe, I don't believe in your wife's premonition. It is unfortunate that Carlton himself committed suicide, but——"

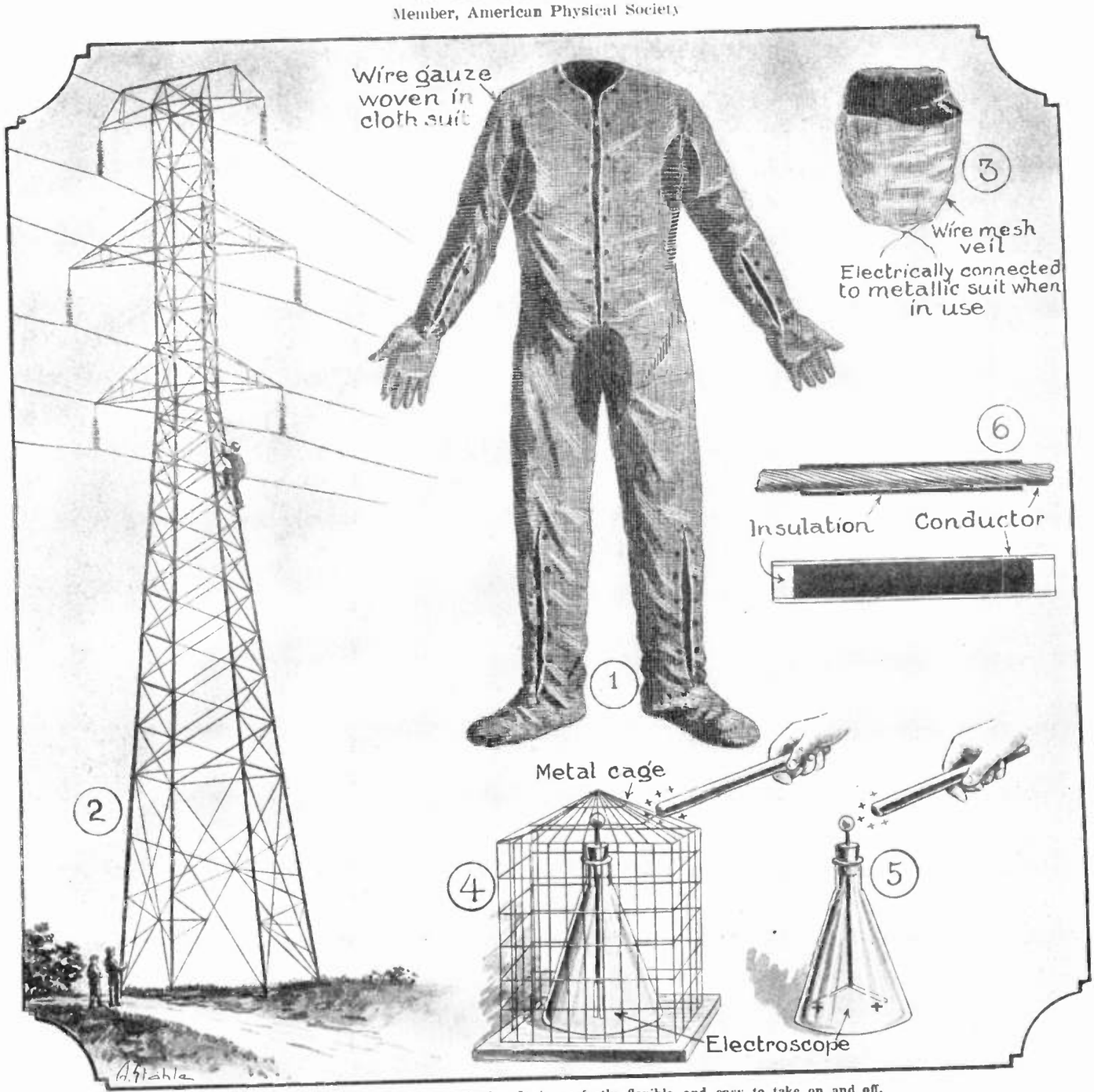
Friendships

For the moment let us depart from the dialogue and view the incidents leading to the statements passing between Dr. McAuliffe and myself. I had known Dr. Robert McAuliffe before he became a physician. We had both studied at Fordham University, New York, for the degrees of Bachelor of Science and Doctor of Medicine, a course embodying six years of ardent work. Our friendship, so intimate during the happy days at the uni-

(*Continued on page 340*)

High Tension Armor

By H. Gernsback
Member, American Physical Society



1—A wire suit of clothes to protect the wearer from shock. It is perfectly flexible and easy to take on and off.
2—The suit in use, protecting the electrician from a deadly shock.
3—The cap and veil, all protected with wire mesh and connected electrically to the suit.
4—Protection afforded from a static discharge by a metal cage, the well known experiment of Faraday. The leaves of the electroscope do not diverge.
5—The unprotected electroscope; the leaves diverge. In 4 and 5, an excited rod of sealing wax or glass is used for the excitant.
6—A protective insulator for a high potential conductor, a reverse of the insulated wire; it represents the armor, metal outside and insulation within.

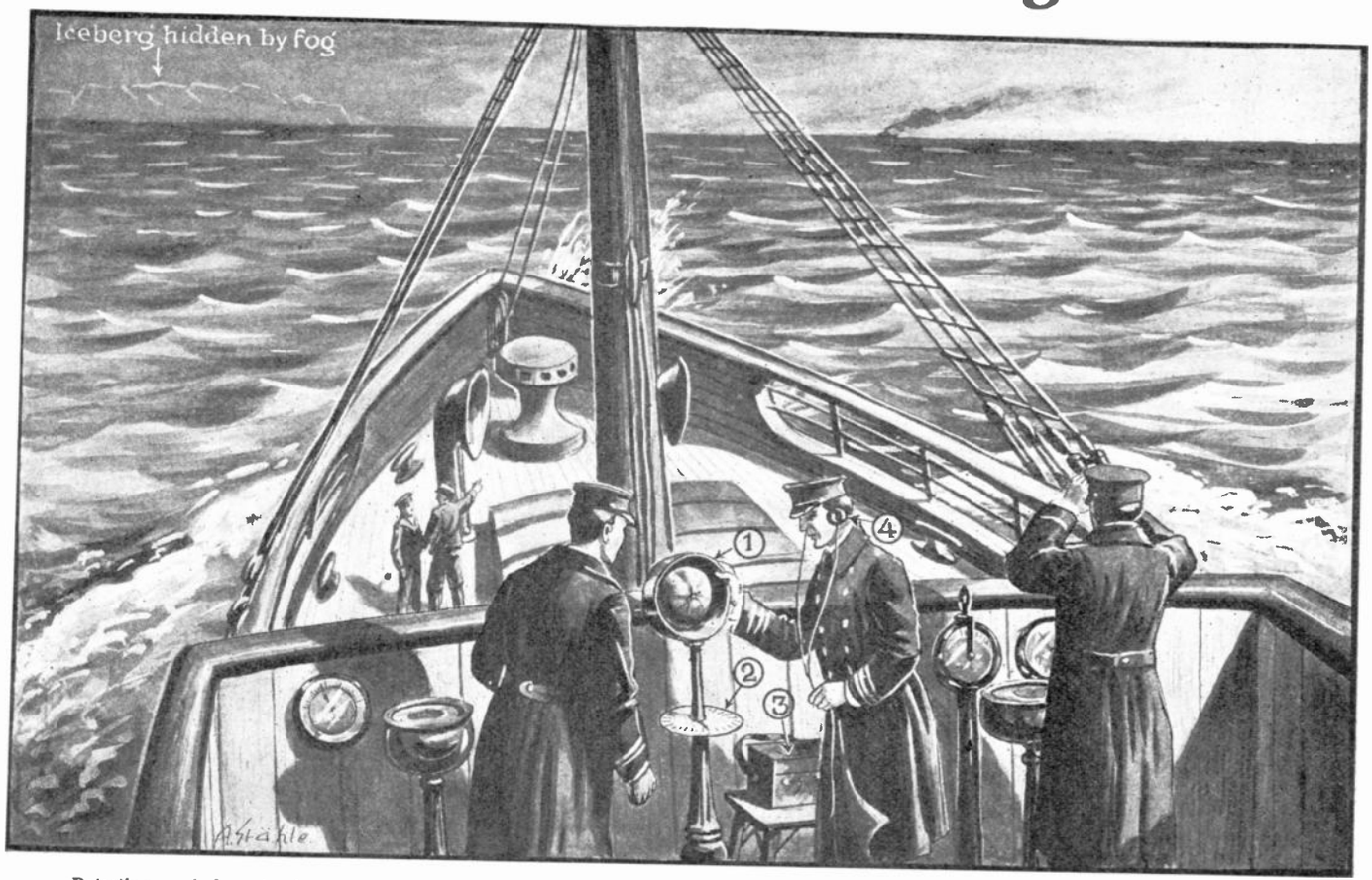
ENGINEERS are being appealed to constantly to devise safeguards against electrocution for linemen and electricians. No day passes without the newspapers telling us of fatalities among operatives who, coming in contact with high tension lines, are either killed or badly burned. Until now, no real progress has been made to eradicate the evil and with high tension on aerial circuits steadily mounting, the condition becomes more acute. When Edison first started his lighting system, we only used 110 volts. At the present time, 100,000 to 200,000 volt high tension transmission lines are not uncommon, while some of our largest companies announce that the million voltage transmission will be reached in the future.

It has remained for an Italian engineer to solve the difficult protection problem in an astonishingly simple manner. This engineer made experiments with a sort of electric armor shown in our illustration No. 1. It is based upon wire gauze woven into an ordinary cloth from which a suit is made as shown. To be sure the wire comes to the outside but by weaving the material in a certain manner, it is made integral with the cloth itself. About 80 per cent of the wire comes to the surface, the remaining 20 per cent metal mesh is merely used to hold the wire fabric to the cloth. The wire mesh is woven to carry a substantial amount of current yet light enough so as not to prevent moving the fingers, etc. The electrician or lineman dons this suit, which covers the entire body, feet, hands and fingers. The action is as follows:

The electric current always takes the path of least resistance. Consequently when the current passes through the electric armor, it will pass through the wire mesh much more readily than through the human body, which latter is of considerably higher resistance. With

(*Concluded on page 347*)

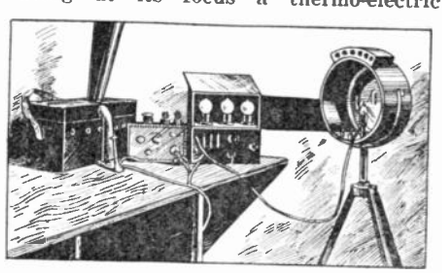
Detection of Icebergs



Detecting an iceberg in the distance by the action of infra-red rays; they are received by a reflector (1) and made to affect telephones (4). A dial (2) gives the direction of the iceberg; in the box (3) is contained the apparatus, and the headset tells of the impending danger.

THE sinking of the Titanic in 1913 was one of the great maritime disasters of the world. At that time there was no adequate method known for detecting the vicinity of an iceberg. Assertions were often made that the presence of the great mass of ice did affect the temperature of the air for a considerable distance surrounding it, but, of course, if there were a breeze blowing the chill would reach for a very small distance against the wind.

By utilizing the infra-red rays which are the heat rays of the ether, icebergs can now be detected at a considerable distance. We may imagine a concave mirror having at its focus a thermo-electric



General view of the apparatus as installed on the bridge of the ship the dial, however not being shown.

couple or battery. If this were exposed in daylight, the thermo-couple would indicate heat and would produce a potential difference which would show upon adequate instruments.

We may suppose that an iceberg would make a difference, but more than a difference is requisite. Definite signals are to be received from the floating ice; they are signals which will not be superadded upon the manifestations of daylight, and this brings us to the use of infra-red rays. By passing solar radiations through a blackened glass coated with a substance which will permit heat rays to go through it, or by using a solution of iodine in a glass vessel, light rays can be cut out completely and heat rays allowed to pass. A substance which permits the infra-red rays to pass through it is therefore diathermic. If between the concave mirror and a source of radiation an opaque diathermic screen is placed, the infra-red rays will strike the mirror, can be brought to a focus and will affect a thermocouple.

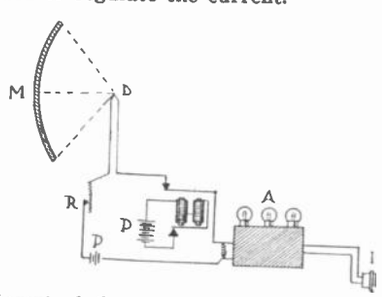
Now it is perfectly correct to say that cold is not radiated, but a cold object by absorbing radiations from a warmer one operates to cool that object and the effect produced is exactly the same as if cold proper were radiated.

We now see how simple it is to develop the idea of an iceberg detector. It is detected by the production of a current of electricity due to its coldness, which may be extremely weak, but which is relayed up to greater strength by audion bulbs, and then we come to the detector.

One of the first things noted about the telephone receiver was the fact that it operated by the action of an exceedingly weak current. So in the proposed detector it is used as the indicator. The weak potential developed by the thermopile is amplified by the audion bulbs and the current passes through the telephone. But this would tell nothing if it were a uniform unvarying current, so in the circuit there is placed an electromagnetic interrupter, making and breaking the current, so that if any excitation is felt by the thermopile it will be revealed in the telephone by clicks.

If the apparatus as outlined above is mounted on the ship all parts of the thermopile will be heated and there will be no potential developed. But if the parabolic reflector faces an iceberg, the iceberg will cause a loss of heat in the thermopile, which by the mounting of the same will affect one junction or set of junctions only so as to produce the potential which will give the alarm.

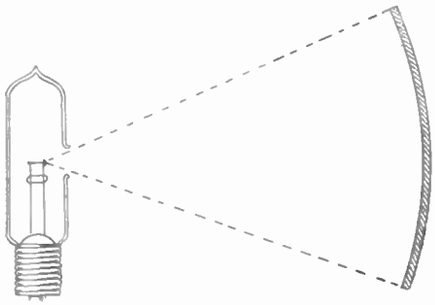
The diagram explains the system. We see the parabolic mirror (M) in cross-section. At (D) is the thermoelectric couple in circuit with the battery (P). A vibrator, whose construction is clearly shown in the cut, operated from battery (p) makes and breaks the circuit with great rapidity. A rheostat (R) is provided to regulate the current.



Layout of the apparatus, showing the tikker, amplifying bulbs and other details.

Then comes the three-stage vacuum tube amplifier (A), and finally the telephone (T). The parabolic mirror and thermopile is arranged so that it can be rotated on a vertical axis and one of the illustrations shows the apparatus thus in use. The operator is seen wearing a head set; his hand is on the case carrying the mirror. The mirror, it will be understood, is protected by an opaque diathermic screen. If pointed out into empty

space no indication will be given in the telephone, but if as it turns a definite arc is found within which sound is received, that indicates the presence of some object. The object may be a human being, the heat from whose body affects the instrument, and this it will do at a distance of two hundred feet. Here the thermopile is acted on by heat radiated from the body of the distant person. But if a great ice-



Relation of convex mirror and thermocouple in the detection of distant objects by infra-red radiant heat.

berg, such as sunk the *Titanic*, acts upon the mirror, the thermojunction is cooled, a potential opposite to that produced by the presence of a heated object is excited, again the telephone speaks, and the telephone will be similarly affected, whether a hot object or a cold one is acting on the thermopile.

This apparatus is so sensitive that an iceberg can be detected at a distance of seven and a half miles. Various kinds of thermopiles can be used; the thermocouple, named from its inventor, Larigaldie, is illustrated here. Two vertical nickel wires, one of which carries a platinum disc, are seen; a crystal of the element tellurium is soldered to the center of this disc and its other end is attached to the other nickel wire.

The junction of platinum disc and tellurium crystal is the portion of the thermocouple which is to be acted on by the radiant energy. It is mounted in an evacuated bulb, one little spot of which opposite the platinum disc is maintained diathermic and opaque by a proper coating. A sensitive galvanometer, sometimes used instead of a telephone, is explained in one of the illustrations. A frame (A) wound with wire is kept in a magnetic field between pivots (p, p) and carries a pointer (T). This is very sensitive, and by the use of a mirror reflecting a spot of light upon a distant screen can be made far more sensitive. A parabolic mirror about ten inches in diameter with such a thermocouple and galvanometer, can reveal the presence of a man at the distance mentioned before, if only his head is allowed to act upon the mirror.

Before the idea of its application to the detection of icebergs, this apparatus was proposed for revealing the approach of ships, which with their machinery and furnaces delivering hot gas into the air from the chimneys, acted vigorously upon the apparatus, and then came its application as described for the detection of icebergs, using a telephone as an indicator.

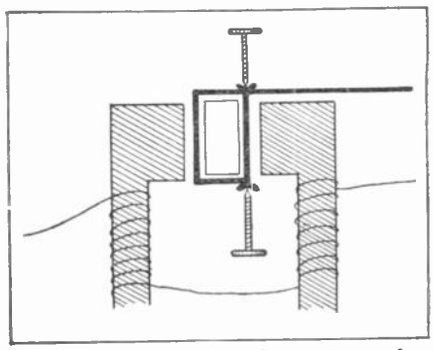
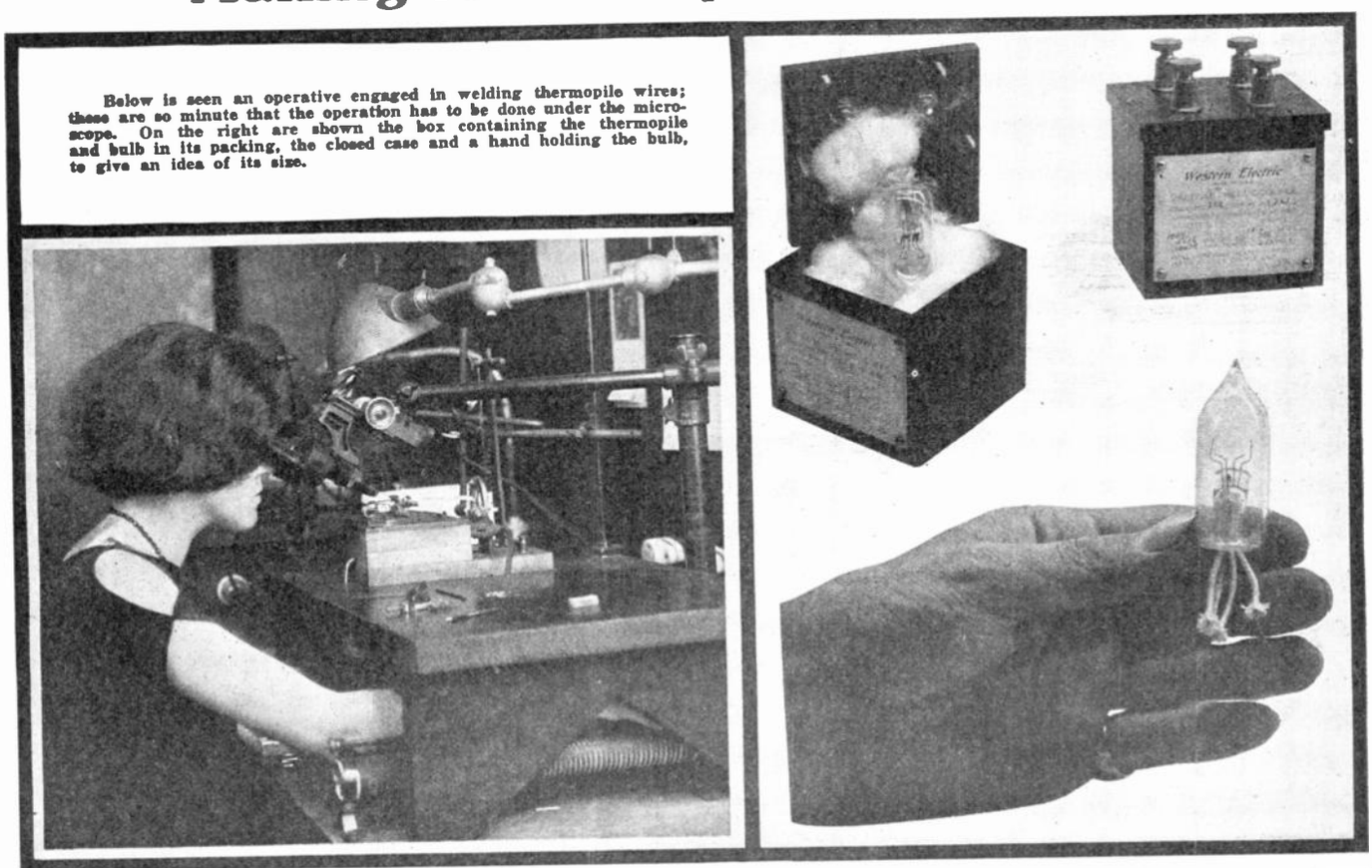


Diagram of the senstive galvanometer employed sometimes for this investigation of the infra-red rays.

It is of interest to observe that the same apparatus can detect a ship in the darkness by its heat or some distant invisible iceberg in the depths of the night by its chill.

Making Microscopic Thermopiles

Below is seen an operative engaged in welding thermopile wires; these are so minute that the operation has to be done under the microscope. On the right are shown the box containing the thermopile and bulb in its packing, the closed case and a hand holding the bulb, to give an idea of its size.



RECENT physical investigations in the realm of electricity and radiant heat, as it is still conveniently called, employ very minute apparatus. Thermocouples of almost microscopic order are used in measuring instruments, several of which have been and are to be described in our columns.

Our illustrations show an operative engaged in making minute thermopiles. One view shows an example of it, free from its container, and another shows it packed in soft packing for transportation. The wires have to be of dissimilar material and welded together at the joints. A platinum wire only two one-thousandths of an inch in diameter is used in some of the thermopiles; such wire is only one-hundredth of the thickness of a human hair. The leading-in wires are quite heavy, comparatively speaking, and to these one end of each of the wires are welded, while the disconnected ends of each dissimilar couple also have to be welded one to the other. It is this work which is done under the microscope.

Before the war these instruments were produced in Germany, but now they are made in this country in one of the great metropolitan laboratories and are considered superior to those manufactured in Europe. The platinum wire of the couple is the finer; the other wire, which is of copper-nickel alloy, somewhat like German silver, while of double the thickness of the other one, is still so thin that it cannot be die-drawn. It is put through an electrolytic bath so as to be eaten away and thereby reduced in thickness.

The little instrument with its microscopic couples is protected from burning out by a fuse.

Awards in Odd Electrical Experience Contest

First Prize, $20	Second Prize, $10	Third Prize, $5	Fourth Prize, $2.50
Charles H. Lindsley, Box 540, Rolla, Mo.	Constantine Troy, 665 Sullivan St., Elmira, N. Y.	M. R. Bonneville, Pocomoke City, Md.	W. B. Storey, 1107 Punahon St., Honolulu, T. H.

1st Honorable Mention — Aulbin Hedges, Hillsboro, Ohio

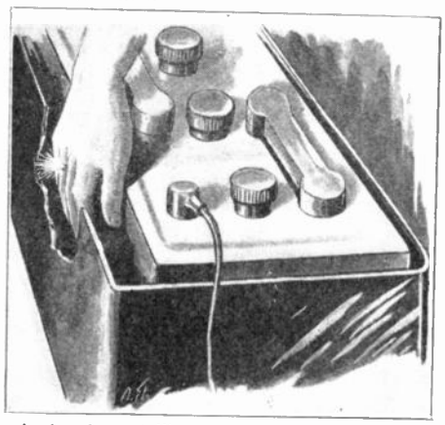
2nd Honorable Mention — John Wm. Knight, 29 North View Terrace, Toronto, Ont., Canada

First Prize

Storage Battery Melts Ring

By Charles H. Lindsley

THIS odd experience occurred when I was putting a storage battery on an old car which had its battery box on the running-board.



A ring in metallic contact with a storage battery terminal and the frame of the machine through the metallic case of the battery received so great a current that it melted and burned the finger to the bone.

While screwing up the terminals I dropped my pliers into the space between the storage battery and the metal box. I slid my hand into the space to try to fish out the pliers and as I did so, a gold band ring which I wore on the third finger made contact with the positive post of the battery and with the metal box.

The ring immediately melted and burned my finger to the bone clear around. Thus I contributed a perfectly good ring and a careless finger to "The Giant Who Lives in a Box."

Moral—Take off the rings first.

Second Prize

Shocks from Sand-Blast

By Constantine Troy

THE writer was employed recently on sand-blast apparatus by a local manufacturing concern. The apparatus was composed of a machine to blow a stream of dry sand by compressed air through a hose. There was an exhaust blower or fan to carry away the sand and dust. It is used to clean metal parts in a thorough manner.

I began the job in the summer months but it was not until winter that I noticed this phenomenon. One rather cold morning I started the machine, took hold of the metal nozzle of the hose with one hand and with the other grasped a small shaft to be cleaned. I had no sooner hit the shaft with the blast when I dropped everything!

I had received a shock through both arms that left cramps in them for the next half hour.

As there were no electric circuits nearby, I was somewhat puzzled as to the cause. However, I determined to try it again, cautiously. This time I did not take hold of the metal shaft and held the hose by the rubber part instead of the nozzle. I now saw the reason for it all! Bright blue sparks an inch in length were darting between the hose nozzle and the shaft. It was merely another form of frictional electricity!

Friction due to the discharge of a dry sand-blast developed high enough electric potential to give a shock and produce spark discharge.

Third Prize

House Painter's Shock

By M. R. Bonneville

OTHER readers of your magazine may be interested in one of my experiences with live wires.

Last year I contracted to paint a house in Virginia. The house was lighted by electricity and the work was progressing smoothly. I was finishing up on the rear end where the service mains entered.

Iron sheathing on a ladder protected the sides from wear but did not protect the painter from two severe shocks and the upsetting of his paint pot in the commotion.

As you know, most painters tack thin iron or steel strips on the under side of their ladders to keep the edges of a slate porch roof from cutting the wood. The ladder I was on was sheathed in this manner. The service wire was nearly bare of insulation on the main insulators of the house.

When the Boss came around he cautioned me about the wires. I merely laughed and replied that I could work up there all day without touching them. When he left I threw my ladder up, avoiding the wires I thought, and ascended with a bucket of paint which I hung on one of the rungs of the ladder.

Intending to make a high reach, I missed my hold and started backward, grasping one side of the ladder with one hand and the other side with the other hand. Immediately I saw the great comet, the North Star and several others. It did not take long to get free, as I just slid down the ladder, but as I started for the ground my sleeve caught in the hook which held the paint pot, turning it upside down over my head and shoulders.

There I was, a yellow man, sitting on the ground in yellow paint. I got myself together, took hold of the sides of the ladder to get up, and got twice as much as I had before. If the Boss had not come along and kicked that ladder away, I would have been hurt worse than I was.

Fourth Prize

A Shocked "Popoki"*

By W. B. Storey

ONE day, while amusing myself with the well known buzzer connected to produce a slight shock, I was called to the

* Hawaiian for cat.

$37.50 IN PRIZES

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

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

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

The more unusual the experience, the more chance you have.

Illustrations are not necessary, but the letter should be either typewritten or written in ink. No penciled matter can be considered. Contest closes on the 15th of month of issue.

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

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

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

A buzzer was arranged to give electric shocks for the health, but the Hawaiian cat seemed to consider them of an unhealthy nature and disappeared for two days.

telephone. I left the room, leaving the battery still connected and with the two handles lying within two inches of each other.

I came back just in time to see the family cat jump up on the table, sniff at the core of an apple I had been eating, tuck his tail under him and sat down. In a flash he was gone, and to this day I am wondering how far he ran, for it took him exactly two days to reach home again.

I noticed, too, that he has taken quite a dislike to the table on which the shocking incident occurred.

1st Honorable Mention

Executing Mice

By AULBIN HEDGES

IN a large factory where electricity was made for their own use, the young man employed as bookkeeper found mice scampering around the office each morning when he arrived.

So one morning, when the boss was out of town, and he was alone for a few days, he thought it was a good opportunity to get the mice.

He got some wire and a knife blade switch and connected them up to a 2500 volt line, on the switch board, which was back of the office.

He then tacked a piece of tin on the floor, and laid another piece beside the other and connected them up. About noon time when a mouse came out, he threw the switch. It killed the mouse, and also the power for a while.

2d Honorable Mention

Shock on Ship Board

By JOHN WM. KNIGHT

WHILE working on a large marine electrical installation and repair job in a Canadian Naval Dock Yard in 1920, I had my own experience; the result of a little forgetfulness.

On this occasion, a companion and myself were repairing the entire lighting system and equipment of a trawler preparatory to its long trip with several others across the Atlantic. She had been laid up idle for some time and the greater part of the lighting system was corroded and rusted.

I was working on the mast head signal light up for'ard, the leads of which, enclosed in a flexible steel cable, came down along the mast, to the deck and entered a junction box just below the deck on the ceiling of a narrow dark closet in the mate's cabin.

The packing around the cable where it entered the deck, had become dislodged and the rain and sea water had run down the side of the cable and dripped off at the junction box. The junction box consequently was rusted and corroded.

The floor of the closet was about two feet higher than the floor of the cabin, making the height of the ceiling about five feet. I had an old flat file stuck in the wall and upon this I had placed a lighted candle. Working in a stoop position in this confined space, and breathing the nauseating smoke of the burning candle, I had to come out frequently for air.

After some hard prying I got the junction box clear of the ceiling and sawed the cables off both sides of it and replaced a new box.

Now before going further I might say that the circuit I was working on was controlled from a small switchboard in the wheelhouse, but the switch nameplates were missing. So instead of wasting time testing out the different circuits to find the right switch, I went to the engine room, where my companion was working on the dynamo and main switchboard, and called to him to pull the switch that cut off all the circuits up for'ard.

He answered me by saying he had some minor repairs to make on the dynamo and proceeded to shut it down. I told him I was on a job up for'ard and to be sure to pull the "Forward" switch if he started

An ingenious individual connected two plates to a 2500-volt circuit for killing mice. He killed one but cut out the power at the factory. What happened to himself is not disclosed.

"her" up again. He answered in the affirmative and I started off quite confident that I could depend upon him to do as I asked. Evidently, I could not, as I was about to learn.

After fastening the new junction box in place, I spliced the leads and got down to get the soldering iron off the blow torch. After tinning the "iron" I got up into the closet again, and, knowing or thinking I knew the circuit was dead I carelessly crossed my "iron" over the splice nearest me and under the other splice making a dead short circuit.

Then it all happened in a few seconds.

A very bad shock and burning from a hot soldering iron as the result of a careless engineer not turning off the current. This happened on board of a ship in a confined space, which impeded the escape of the sufferer.

The unexpected suddenness of a brilliant flash close to my face momentarily blinded me. I let go of the soldering iron and it fell forward against my face burning my forehead, cheek and hand.

I instinctively jumped back and struck my head very forcibly against the projecting iron edge over the top of the door, and half stunned I fell through the door and landed on the floor of the cabin with a thud that almost knocked the wind out of me.

I lay there several seconds before I sat up dazed, my face stinging with the pain of the burns and the back of my head feeling as if was split open. I put my hand up and found my hair was matted with blood, which began to trickle down behind my ear.

I picked myself up, staggered up the companionway, and went aft to the engine room, where, as I suspected, the dynamo was running merrily and the "Forward" switch closed up tight.

My thoughtless companion was standing by watching the dynamo. He turned as I approached and his face took on a look of horror as he looked at me. Although my injuries were not very serious, the wound in my scalp bled profusely and the blood had run down my neck and face and stained my clothes and with the two red burns on my face I presented a ghastly sight.

"For God's sake, Jack, what's the matter?" he exclaimed.

"There's the matter," I answered pointing at the switchboard. "If you had pulled that 'Forward' switch as I asked you to do, this would not have occurred."

I explained to him what had happened. "Why I only started 'her' up a few minutes ago," he returned bewildered.

"Yes," I answered, "and that seems to be the peculiar part of it. You apparently had 'her' running merrily when I got up to solder those splices, for the circuit was certainly dead when I got down to get the 'iron.'

"Anyway," I went on to say, "that job has got to be finished, so you might as well finish it now. I'm going ashore to look up the M. D."

Electrical Eye

AN electrical eye that appears to see, to select and to discard with perfect judgment, is the latest addition to the list of electrical developments.

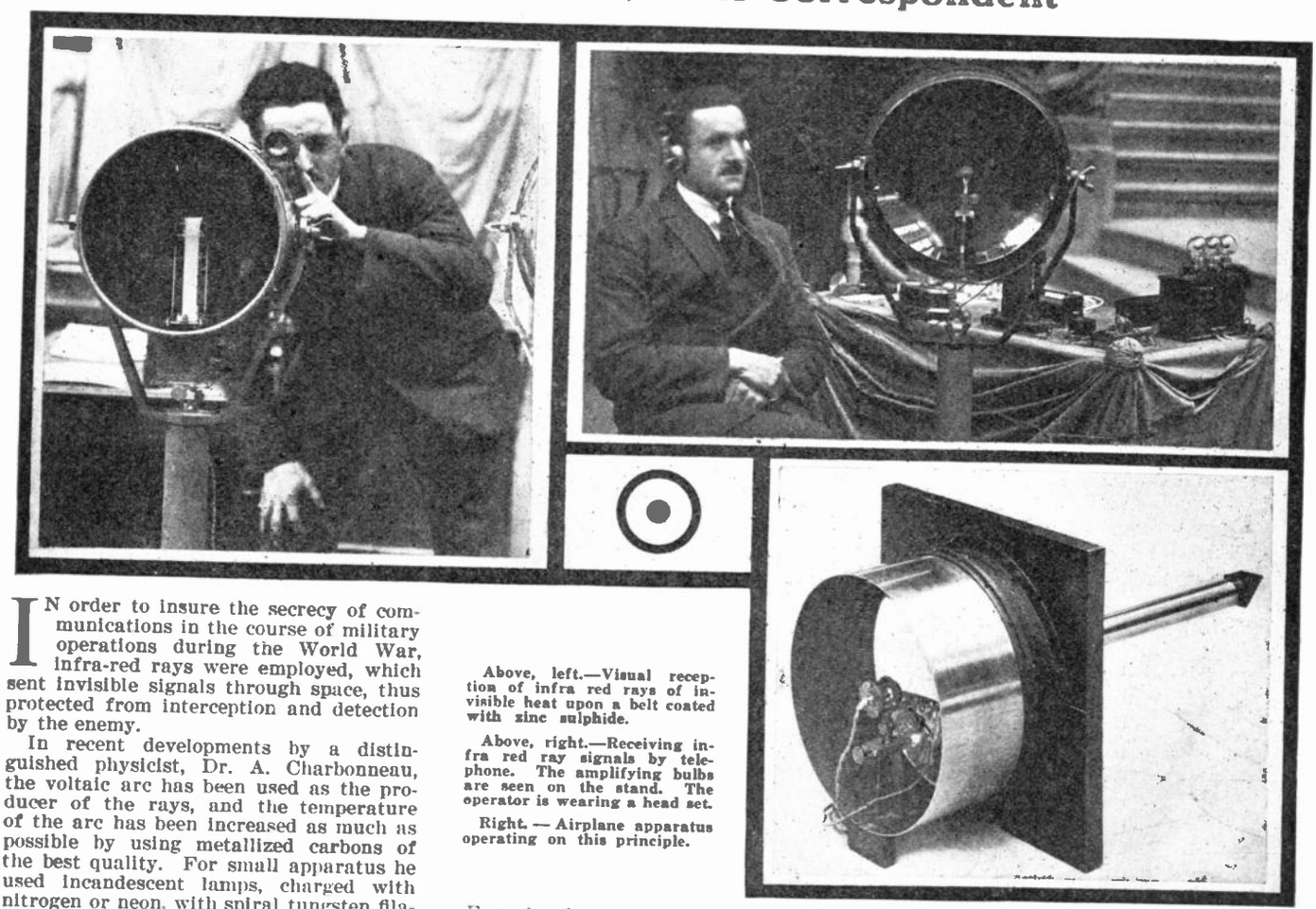
The sensitiveness to light of the strange metal selenium is the motivating force behind the electrical eye, which is already being used to sort and select fruit and vegetables in canneries.

The fruit is moved on a carrier and light thrown upon it is reflected through a tube below on the selenium cell. The least change of color, as in a bruised or blackened cherry, causes the selenium cell to alter its electrical resistance. This, in turn, alters the current from a small battery, which trips an electro-magnetic device and causes the discolored fruit to drop through a trap in the carrier. The eectrical eye returns to normal with the reflection from sound fruit.

New Things Electric

Infra Red Light Telephony

By Jacques Boyer, Paris Correspondent



Above, left.—Visual reception of infra red rays of invisible heat upon a belt coated with zinc sulphide.

Above, right.—Receiving infra red ray signals by telephone. The amplifying bulbs are seen on the stand. The operator is wearing a head set.

Right. — Airplane apparatus operating on this principle.

IN order to insure the secrecy of communications in the course of military operations during the World War, infra-red rays were employed, which sent invisible signals through space, thus protected from interception and detection by the enemy.

In recent developments by a distinguished physicist, Dr. A. Charbonneau, the voltaic arc has been used as the producer of the rays, and the temperature of the arc has been increased as much as possible by using metallized carbons of the best quality. For small apparatus he used incandescent lamps, charged with nitrogen or neon, with spiral tungsten filaments, which work with a low current and can stand an excess voltage for increasing their brightness.

At the transmitting post the source of light is placed in the focus of a parabolic reflector, which reflects the visible and invisible rays alike in a parallel-sided beam toward the distant receiving station. But before leaving the projector the beam traverses a glass plate colored by manganese oxide or copper oxide, which, while opaque for the visible rays, transmits the infra-red.

In addition, an opaque shade interposed between the lamp and the reflector enables the telegrapher to cut off at will the infra red rays, so that he can send out code signals. There is a telescope attached, parallel to the axis of the parabaloid, so that the proper direction can be given to the emitted rays. Small reflectors with 40 to 50-watt nitrogen lamps, supplied by storage batteries, are good for a distance of five miles. For greater distances, say six to fifteen miles, army or marine projectors, two feet to six feet in diameter, with a color screen, are used for the transmission. The receiving instrument has its thermo-receiver at the focus of another corresponding reflector.

Morse signals can be received by sight or sound.

For visual reception an endless band coated with phosphorescent zinc sulphide is caused to travel by clockwork in the focus of the receiving reflector. An electric ten-volt lamp enclosed in a box, opaque except for an opening protected by an ammoniacal solution of copper oxide, emits high frequency light rays, principally of the violet portion of the spectrum. This light excites the coating of the ribbon to phosphorescence.

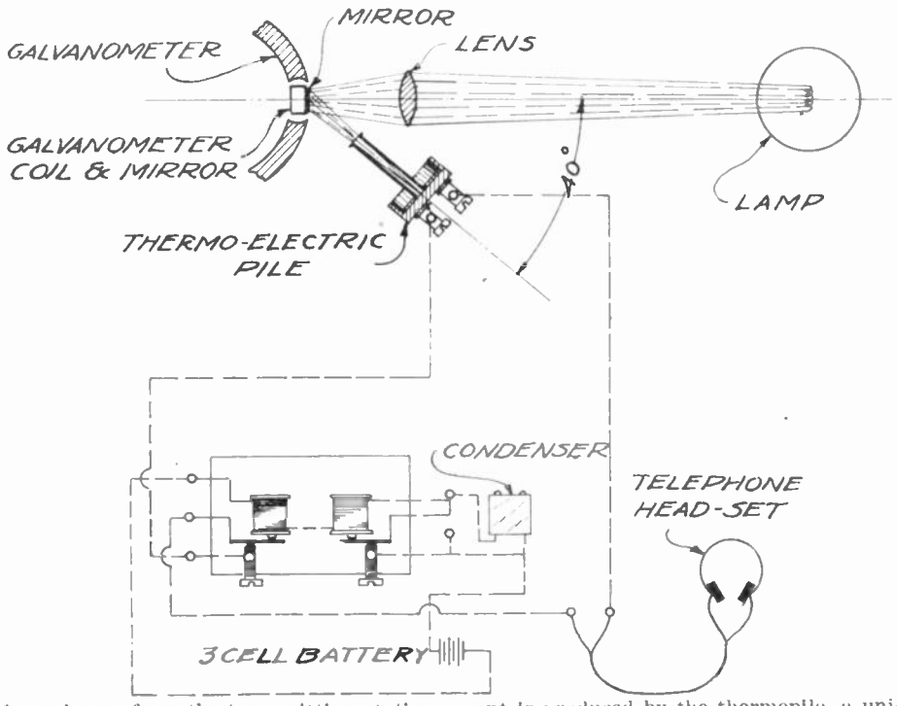
The infra-red radiations received from the distant transmitting station when they impinge upon the zinc sulphide extinguish at once its phosphorescence. The operator therefore when these radiations affect it sees a black trace produced upon the ribbon, which disappears as the ribbon leaves the beam of infra red. Thus, code signals due to the infra red and absolutely invisible beams, can produce on the paper the dots and dashes of the telegraphic poles.

Again, the signals can be photographed. Between the focus of the mirror and the color screen a sensitized film takes the place of the phosphorescent band and can give on development the image of the dots and dashes for distances up to many miles.

Shortly after the war the Central Optical Committee of the French Navy conducted experiments to see if the Charbonneau apparatus would reveal the presence of a distant vessel by these invisible rays. It was tried with great success off the harbor of Toulon, at a distance of six miles. A black dash as it may be called, an inch and a quarter long, was occasioned by the passing of a torpedo boat across the beam, which corresponded to a period of eighteen seconds, the time required by the torpedo boat to travel its own length.

We now come to sound reception. Here a thermo-electric couple of extreme sensitivity is placed in the focus of a receiving lens, with a reflecting galvanometer in the circuit. Before the rays are focused they are reflected from the galvanometer mirror to complete an angle of 40 degrees. The displacement of the luminous spot, corresponding to the fluctuations of the galvanometer and produced by the reflection from its minute mirror, corresponds to the variations of electric current, due to interrupted or varying infra-red rays falling on the thermopile.

The thermo-electric couple consists of a minute disc of platinum less than one-two-thousandth of an inch in thickness, and about a tenth of an inch in diameter. It is carried by a nickel wire. A minute crystal of tellurium is held by another wire so that its point presses against the center of the disc. This couple acts as a detector and photophonic relay. The in-



fra-red rays from the transmitting station are reflected by the mirror of the galvanometer upon the thermopile and heat it and thereby produce a current if the circuit is closed.

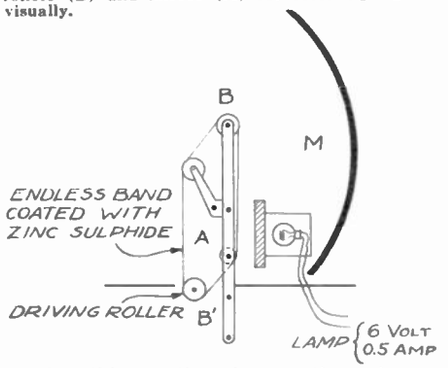
On a separate circuit there is a make-and-break apparatus which can operate up to a frequency of one or two thousand per second. The current from the thermopile goes to a headset and is amplified by three audions, and is interrupted for the one or two thousand times per second by the make and break or tikker apparatus. It follows that if a constant current is produced by the thermopile, a uniform sound will be produced in the headset, and if the current from the thermopile is made and broken in accordance with the telegraph code, the telephones will receive a true telegraphic message.

To give the utmost sensitiveness to the thermopile, it is enclosed in an evacuated case, doing away with convection losses due to the conductivity of the air. A potentiometer and induction compensator prevents the tikker producing any sound by its own action in the telephones.

After the current has been interrupted

Left. Details of apparatus for reception of infra red signals.

Below. Arrangements of zinc sulphide band (A), rollers (B) and mirror (M) for receiving signals visually.



by the tikker action, it goes through amplifying bulbs so as to give adequate current for the telephones. If the current is to be received visually, the reflecting galvanometer alone is quite sufficient.

Elsewhere we have spoken of the use of the infra-red rays for detecting icebergs, which is much along the line of the apparatus we now describe.

Based upon the same principle, Dr. Charbonneau has developed an apparatus for communicating secretly with a flying airplane by the infra-red rays, and one of the illustrations shows the receiving part of the apparatus in question. There is an electric projector with its color screen established in the airdrome. The signals are received by the apparatus shown. The rays are brought to a focus by the receiving mirror and act upon a moving band coated with mercuric chloride or silver iodine. A small telescope or magnifying glass with prismatic eye piece is a part of this apparatus, so that the pilot of the airplane can read his signals easily. The same beam is used to guide the airplane to a landing place at the airdrome.

Articulated Trolley Train

Articulated trolley train. The interesting feature is that the intermediate trucks serve each one for the ends of two cars; thus in the three-car train there are only four trucks, where normally there would be six. It has been used in England and is now to be tried out in this country.

THE Detroit Street Railway will install soon a three-car articulated train. This train will consist of three car bodies operating on four trucks, one truck being at each end of the train and one each divided between two of the cars and used in common by both. This feature differentiates it from an ordinary coupled train of separate cars.

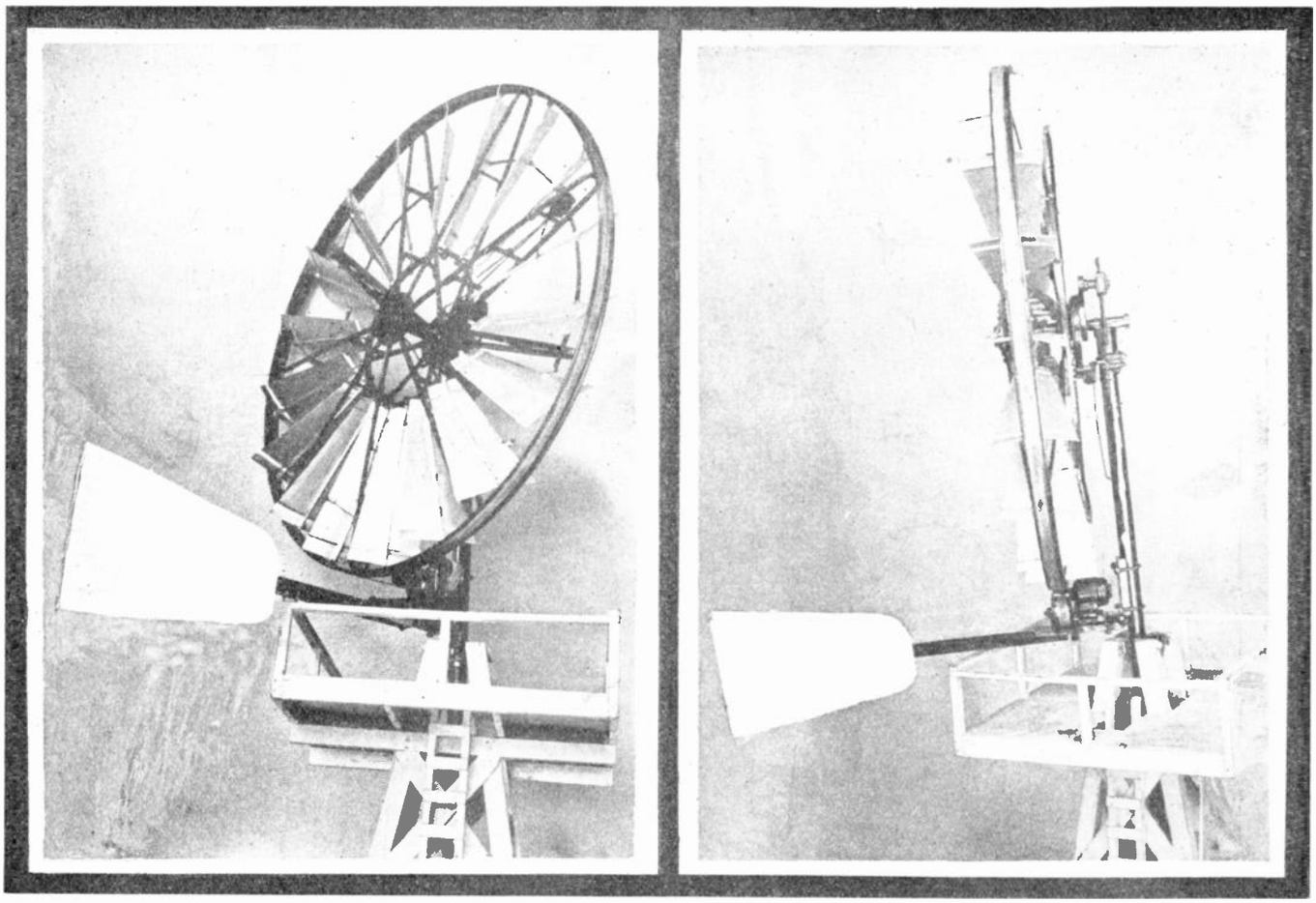
The line on which this train will operate now has in use motor car and trail car trains operating on 30-second headways. It was found that the traffic was too great to be handled with this service, and more cars could not be run because the track capacity would not allow it.

The three-car articulated unit is designed to give more seating capacity in the same space; it will present the first use of electric drive on this type of train and will be the first in this country to use the articulated unit. Trains of this type have been operating in England on the Great Northern Railway, a steam road, for several years, where they were used in units of from two to seven cars, articulated. The passage between the cars is so arranged that, regardless of the position of the cars on curves, there is always a free entrance from one car to another. This is made possible by the use of a steel drum, mounted on the truck, around the periphery of which slides the end of the car body, this end being constructed in such a manner as to fit around the circumference of the drum.

The total weight of the train is 72,000 pounds, "ready to roll." It seats 136 persons. The average seating capacity of the standard car in use in this country is about 48 persons. With the 72,000 pounds weight and a seating capacity of 136 persons, the dead weight is 530 pounds per seat, which indicates an exceptionally light construction.

It reduces to about three times the weight of the seated passengers; standing passengers would make it more favorable.

Farm Windmill Electric Plant



Farm widmill, which has an electric generator near the lower part of the periphery of the wheel. The generator is belt-driven and the speed of the wheel is regulated by the inclination of the blades.

WE hear a great deal nowadays of the development of great water powers. The old glory of Niagara Falls is succeeded by a diminished beauty, and the impressiveness of the cataract will be pretty well done away with in the next few years. At least this is to be feared.

After the water has passed over the falls it goes down the Saint Lawrence River in a succession of great rapids, which torrents it is proposed also to use for water power.

But while this impressive utilization of the great force of nature is going on, the the wind is not forgotten. Windmills are being used all over the country no longer only to pump a limited supply of water into a tank, but to drive an electric generator and operate a farm plant for doing all sorts of work about a farm, for doing the work of the housewife in the house, and for supplying electric light.

As these little plants multiply, there will soon be an impressive number of horsepowers represented by them. They generate electric energy, and power is, by the use of a storage battery, always available whether the wind blows or not.

Our illustrations show a representative farm plant. Here we have a single windmill with steel wings, which if set on an incline drive the wheel around, and if set parallel to the line of the shaft cease to propel the wheel. On the platform immediately under the wheel is the generator. This is belted to the mill wheel as shown, and an automatically acting jockey pulley is provided to keep the belt tight. The whole idea is to make it so automatic that hardly anything will ever be required in the way of attention, beyond oiling.

When Lincoln was a boy he studied by the light of a pine wood fire in a small farmhouse. Cannel coal is named from the word "candle," because its flames rival the old time tallow candle in their illuminating power. But in the modern farm house we find the light of the fire and the kerosene lamp all displaced by the tungsten lamp, the last word in illumination, and it is hardly too much to say that it is likely to continue so for many years.

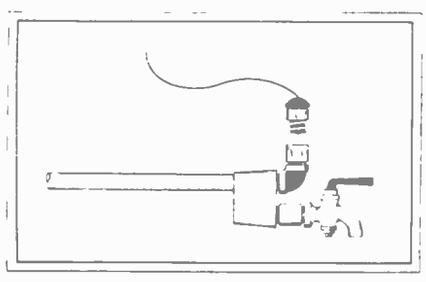
The speed regulation is affected by a centrifugal governor, such as used on steam engines. The balls of the governor as they fly outward operate a system of rods and bell cranks to turn the blades of the wheels towards parallelism with the winds. It is claimed that speed control within 2 or 3 per cent is obtained.

It is figured that the storage battery which is a definite constituent of the plant can take care of the supply for ten or twelve days in case the wind fails. Milking machines and agricultural machinery are cited in great variety as being supplied by this type of plant with the power required to operate them.

Faucet for Thick Liquids

THE faucet illustrated is for use with liquids which become thick and slow-moving in cold weather. A barrel may deliver its contents very slowly, simply because it is so thick, whereas if heated the liquid might flow out as freely as water.

The faucet illustrated is designed to use electric heat for warming the liquid in the bottom of the receptacle, so as always to keep a supply of the thinner liquid for drawing out. The faucet is fixed to a bung to be screwed into the bunghole, and from the bung a tube containing electric resistance wire projects for a distance of about two feet into the barrel.

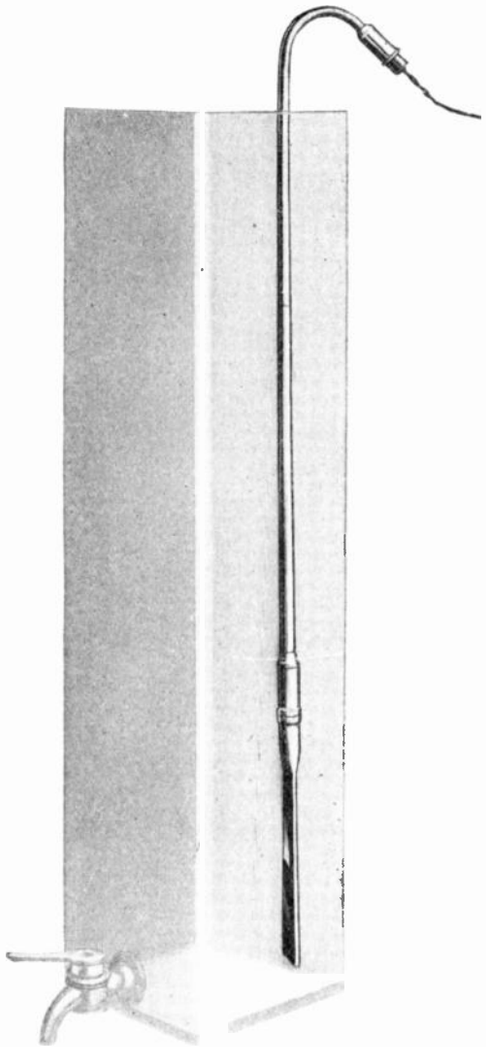


Barrel faucet in which an electric heater softens the thick fluid which may have to be withdrawn.

When the liquid is to be drawn the resistance coils are connected by an ordinary plug connection and flexible wire with a lamp socket. Almost immediately the tube becomes surrounded and filled with the hot substance liquefied by the increase of temperature, and on opening the faucet the liquid will run out quite freely.

The interesting feature of this faucet is that the heating of the fluid is not local. The long tube takes in a considerable proportion of the length of the barrel and may be assumed to heat it clear through to the top if time is given.

English Immersion Heater



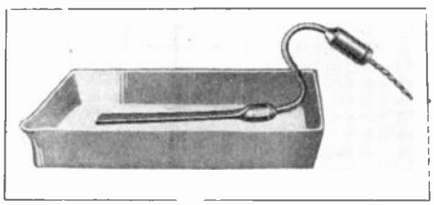
English immerson heater designed especially for photographic uses as in hypo tanks; the small illustration on the right shows it employed in heating a shallow developing tray.

ONE of the old English customs was the heating of beverages by inserting a hot poker therein. This has now been superseded by the electric immersion heater, familiar of course to our readers.

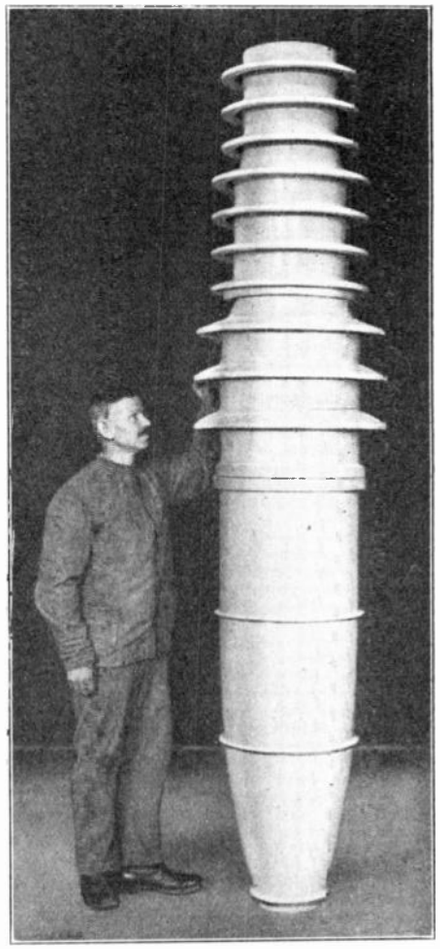
Photographic vessels are likely to take two shapes, the very deep or very shallow. For the deep ones a heater is made, which is based upon the use of a metal tube 45 inches long, whose lower portion for about nine inches is flattened, and contains within it the resistance wire for producing the heat. This can be immersed in a deep tank so as to apply the heat in the best and most effectual place, the lower layers of the fluid, and it may also be used secondarily to stir the fluid about while it is being heated. A gallon of water will have its temperature raised eight to ten degrees by four minutes' action of the heater, and the water can be made to boil.

Its consumption when in full activity is 600 watts. The same heater is made to be placed horizontally upon the bottom of a tray, where instead of having a depth of thirty or forty inches of water to heat, it may have but one. The whole essence of the matter is that in using the heaters, nine inches or whatever it may be, of the end of the tube must be kept immersed in the fluid being heated.

This device is of especial interest as showing what is being done in England. It is obvious that while such heaters may be used for general purposes, they are primarily for the use of photographers.



Giant German Insulator



Enormous porcelain insulator made in Germany. It is interesting to observe how the shape differs from that adopted in this country.

WE have had occasion to illustrate in the past several examples of high potential insulators. These are used on high potential power lines which are now being developed with such great rapidity on all sides. To take care of such high potentials and obviate leakage even in rainstorms large insulators are required, which sometimes appear as veritable triumphs of the potter's kiln.

The one we illustrate is interesting and is an example of what is being done in Germany. This insulator stands about ten feet high with a diameter of about two feet, and weighs over five hundred pounds. The man standing by it gives an idea of its dimensions.

It was made to carry a power lead with a potential of 150,000 volts, but on trial was found to do far better than this; in dry air it would stand 320,000 volts, and in a rainstorm from 250,000 to 300,000 volts.

As potentials increase, the dimensions of the insulators have to be increased in far higher proportion. It already seems, when we consider corona leakage, that the highest limit of potential is being rapidly approached and that the 220,000 volts is almost all that the immediate future will show.

The insulator was made by the Hermsdorf-Schomburg Insulator Company of Germany.

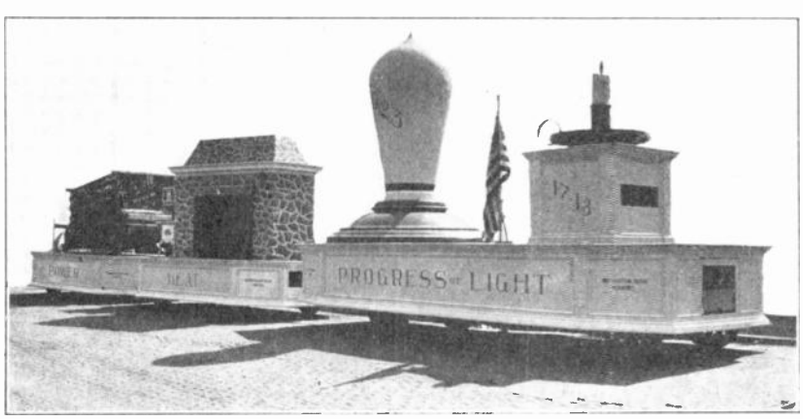
Old and New Light

AT the entrance of the Lebanon Valley in Pennsylvania, well within the frontiers of Pennsylvania Germany, is the city of Reading, which recently celebrated the 175th anniversary of its founding.

It is fair to say that in this country we often miss the appreciation of the age of some of our cities, and picture to ourselves an exaggeration of the same in many cases. A century and three-quarters is a long period in this country, and our illustration shows a float which went through the streets upon the trolley car tracks to represent the new and the old—the light of two centuries ago and the tungsten lamp of today.

It tells its own story. On the front of the float there was an old-fashioned candlestick of gigantic size, bearing a mammoth candle, which of course is a typical old-time way of lighting. They also had oil or grease lamps, something like the classic lamps of the ancient Romans and Grecians, samples of which can even now be picked up in Lebanon and Lancaster Counties.

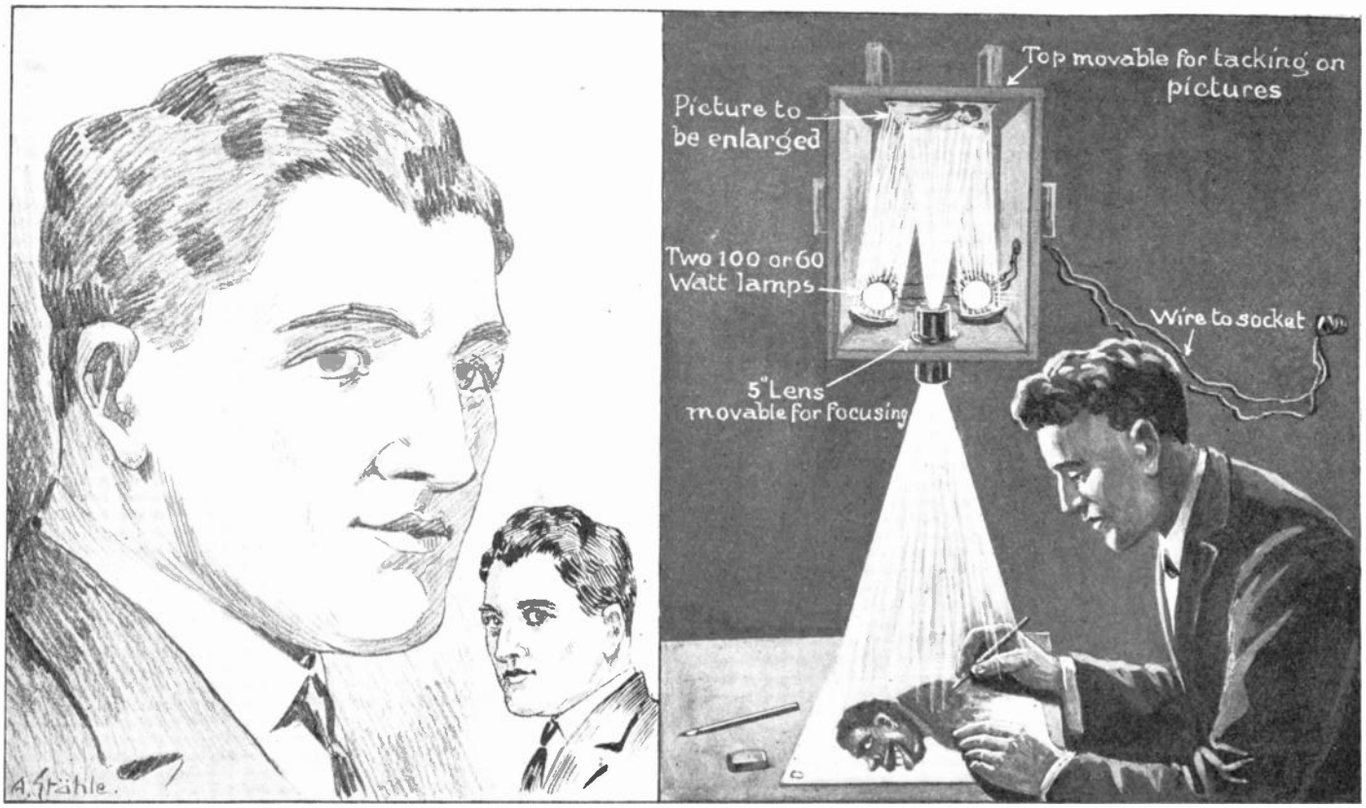
Back of the candle came an immense representation of an electric bulb or incandescent lamp. Its high efficiency, due to its tungsten filament, and its durability under high intensity of illumination tell why the incandescent lamp may be accepted as having displaced in great part the arc lamp, at one time supposed to be the leader for brilliant illumination. Electric heat and electric power were represented also.



A float running on trolley tracks, showing the contrast between the old time candle and the new tungsten lamp, and also illustrating modern heating and the electric truck.

Copying and Enlarging Machine

By Roy Hale



Enlarging machine for draftsman, projecting the picture in greatly increased dimensions upon the drawing paper for him to copy. The image is reversed and a sample of the work is shown on the left.

THIS machine is really a large sized electric post card projector. It holds the card or other picture to be copied, placed horizontally above a drawing-board. or table. The projected image appears on a sheet of paper placed upon the artist's horizontal drawing-board or table.

The lens must be of three or five inches diameter, and the size of the enlargement will depend on the distance of the lens from the paper.

The construction of the machine is clearly seen from the illustrations, and the sample of finished work shows the accuracy with which drawings can be copied and enlarged. The latter is an exact reproduction of a pencil drawing sent us.

Contributed by ROY HALE.

Austrian Rival of Franklin

By ARMSTRONG PERRY

IN the courtyard of the Stadtmuseums at Znaim, a former Austrian city now within the borders of the Czecho-slovakian Republic, stands a lightning rod that is claimed to be the first ever erected. The museum catalog gives the following account of it:

"The Lightning Rod of Prokop Divisch. Prokop Divisch was a professor in the Latin school in Bruck and applied himself to the study of electricity. He had the idea that the electricity in the air could be led off through many points slowly but steadily. For this purpose he constructed the so-called "weather-machine," which was the first lightning rod in the real sense of the word, which he set up two years before Franklin's invention of the lightning rod. Divisch's date was the year 1754. Therefore he and not Franklin should be known as the inventor of the lightning rod. The system of diverging bars on the summit of the weather-machine carried small boxes filled with iron filings. The tops of the boxes were perforated. Through these holes copper spikes extended down into the filings.

"By means of these points, hundreds in number, the electricity was led off by a conductor into the earth with definite certainty.

"In order that the birds might not be destroyed when alighting on the apparatus to rest, Divisch placed at the peak of the apparatus a wind vane. Later, he set up the weather-machine before his parsonage at Brendisz. The farmers believed that the machine drove away the rain, and urged the preacher very strongly to remove the apparatus. As he did not do this they destroyed it. He wanted to set it up again, but the abbot would not allow it, fearing that the excitement among the populace might be started anew. Divisch urged the government to set up such lightning rods as a protection against lightning but the advice of Prof. Eulers prevented it.

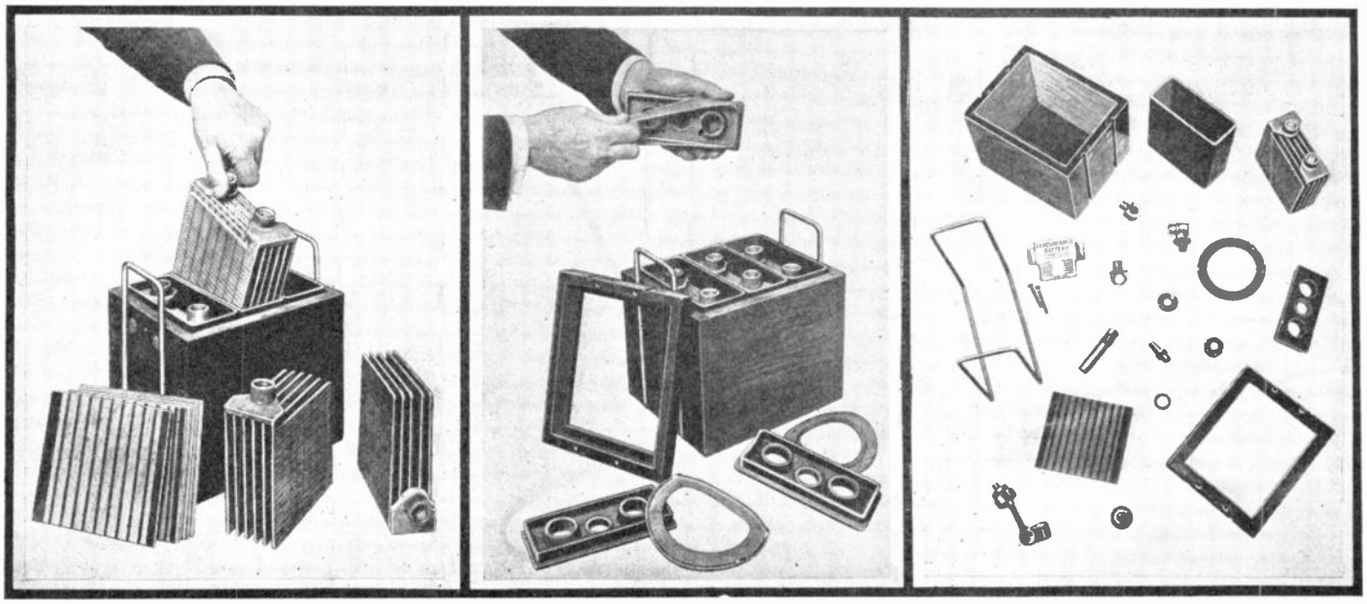
Early lightning rod, shown in Czecho-Slovakia as a predecessor of Franklin's invention.

"The inventor wanted to have a book printed in Austria on the subject of electric fire, but the government did not permit it, taking the view that no human being should be allowed to interfere with what God had ordained. The book was eventually printed in Tuebingen, Germany."

The date of Franklin's invention of the lightning rod is usually given as 1752. His famous experiment with the kite and lightning, which identified lightning as electricity, was made in that year. Superstitions such as prevented the publication of Divisch's book in Austria hindered the adoption of the lightning rod in other countries for some time. Then it had an era of popularity in which many Americans were defrauded by fake lightning rod agents. The frauds dampened the enthusiasm of the public for the device and many branded its theory as false. The United States Bureau of Standards, proved its usefulness.

Motor Electrics

Demountable Storage Battery



Storage battery which anyone can take apart and in which anyone can replace defective plates or other parts, will be welcomed by automobilists. Replacements can be made in a few minutes. India rubber gaskets take the place of cement and the whole is secured and closed as hermetically as is the regular storage battery.

THE storage battery is now in very extensive use among people, many of whom are anything but experts in electricity and mechanics, but who have a fair knowledge of how to execute various operations. We refer to automobilists. Certainly nothing has done more to educate the business man in mechanics than the automobile. In the self-starter he is confronted with the electrical installation; and of this installation there is one part which peremptorily demands attention, which deteriorates for lack of it, which needs repair and replacements occasionally, and which is hard to get at because the interior parts are inaccessible, being covered with melted cement, and with firmly soldered connections.

We refer to the storage battery. Few realize the mileage cost of this part of a modern automobile. It may easily compare in expense with that of the lubricating oil. When the battery weakens it is taken to the repair shop, and after a delay of perhaps a week or two is repaired, replacements made, and put into the car, and is again ready for use. The great trouble is that being cemented and having so many solid connections, taking down and setting it up again involves autogenous soldering, so-called "lead burning," and work with the cement, neither of which is particularly agreeable, and the "lead burning" is more or less technical.

We illustrate a battery for automobiles designed to overcome all these troubles. The battery jars are contained in a wooden box as usual, and the battery is set up with sets of plates and separators, watertight connections and all, without the use of cement or soldering. Everything is done by screwing and clamping and the use of washers and gaskets.

The illustrations tell the story. In one of them are seen the positive and negative plates ready for nesting together, while on the left are the separators. In the same illustration one of the cells is shown completely empty, the center one is parting with its plates and separators, while the left hand cell is as yet undisturbed. Each set of plates it will be observed has its threaded socket.

We may now assume that the battery is to be taken apart. A rabbeted frame sits on top of the wooden box and is held down by four screws. These screws are taken out and the frame is lifted off. The frame is seen in the left hand illustration, leaning against the box.

Terminals are to be seen rising above the cover of each cell with a central cap. The central orifice covered by this cap, is for introducing water or electrolyte. The two connecting plugs are unscrewed, as is also the filling socket in the center. This releases the cover, for each plug has a flange which draws the cover down firmly to its place.

As these three parts are removed from a cell, the cover plate can be lifted off and a flexible gasket will be found on its under surface. This makes a tight joint when all is in place, so as to be a substitute for the cement. The interior of the cell is now exposed, the plates can be lifted out along with the separators, and any parts which are impaired can be replaced.

The idea of constructing a storage battery to come apart in this manner and to be put together again without any but the most ordinary mechanical processes, is so obvious that it is surprising it has not been done long ago, and certainly in the battery we illustrate is most effectually carried out. Cementing and lead burning are done away with.

Thief-Proof Switch

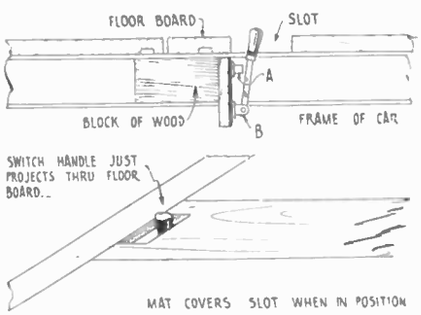
THIS switch system was installed on a Ford to prevent theft and—strangely enough—two attempts were afterward made by thieves which failed. They tried every means but towing, and finally gave it up.

The idea is simple, merely placing an extra switch in both ignition systems—the magneto and the battery.

A wooden block was fastened to each side of the car frame under the floor boards. Then a single-throw knife switch was secured to the front face of each block, with its handle up and in such a position that the handle just projected through a slot cut in the floor board. Then the terminals of one switch were connected to the magneto system and the terminals of the other switch to the battery ignition system. Switches were on opposite sides of the car. When the mat was down the handles and all were concealed.

When leaving the car, simply throw out each switch.

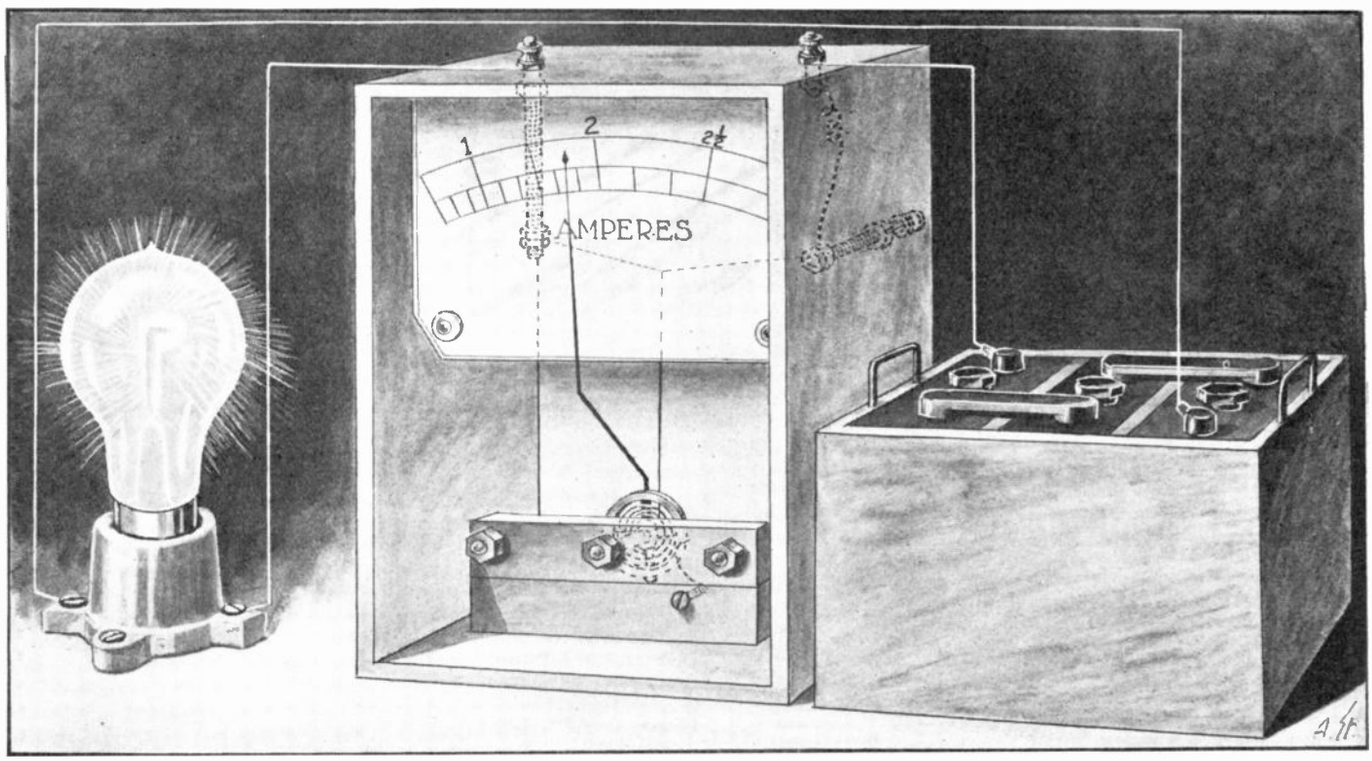
Contributed by L. B. Robbins.



Thief proof switch for automobiles; it has twice saved a Ford from theft. The method is simplicity itself.

Making a Hot Wire Ammeter

By Harry R. Lubcke



General view of hot wire ammeter. The helical spring for adjusting it surrounds the shaft and the dotted lines show the course of the conductors and the location of the wire, whose changes in length by heat give the desired reading.

AN accurate ammeter which will indicate on alternating or direct current is an asset to any experimenter. Hot wire and thermocouple instruments fill this function completely and are therefore of double value to persons of lean incomes. A hot wire ammeter is of comparatively simple construction and can be built by the average experimenter, but a thermocouple instrument is too delicate to be attempted by anyone but a proficient experimenter.

The author has recently finished an instrument of the hot wire type that has given very good service. It is shown in the illustrations. Such an instrument can be constructed with the average tools found in any experimenter's workshop. The author used a bench lathe on some parts, but these can be made without a lathe, as will be explained. A set of taps and dies (6-32 and 8-32), and a few drills will be necessary, however.

As will be seen by Figure 1, the ammeter reads from 0 to 2.5 amperes. A piece of No. 36 B. & S. gauge copper wire was used to carry the current. It was found that this size of wire would not safely indicate over 2.5 amperes. For greater amperage a shunt was used which doubled the scale reading and hence the range was increased to 5 amperes.

The case can be made in many styles, but a simple rectangular affair with a glass front was found the most satisfactory. The case should be rigid and well put together, because if it gives slightly it will alter the length of the "hot wire," making the pointer dance over the scale. As shown in Figure 2, the case is 5¾ inches high, 4½ inches wide and 2⅜ inches deep. Holes are drilled as indicated. The glass front is held in place by two strips on each side. The strips are faced with felt to keep the glass from rattling. Oak veneer was used for the material, but any hardwood one-quarter inch thick will be satisfactory. The case should be stained and given two coats of shellac or varnish to improve appearances.

For the indicating part of the instrument a balance wheel from an alarm clock is used. Two pieces of brass 2⅜ inches long, ½ inch wide and about one-sixteenth inch thick are used for the frame. These strips are drilled as shown in Figure 3. The center hole is threaded 8-32 and two setscrew bearings with locknuts are provided for the balance wheel as shown. These setscrews must have a cone-shaped hole to receive the ends of the balance wheel shaft. With a lathe this can easily be done by entering a drill, held in the tailstock, into the setscrews while they are revolving in the chuck. In the absence of a lathe put a dent in the exact center of the screws with a center punch. Two of the spacers from the alarm clock are fastened to the end holes, making the frame rigid.

The hairspring should be clamped in a piece of wire soldered in a small hole drilled in the end of a 6-32 machine screw as shown. A hole is drilled in the face of the frame and threaded so that the screw will make a tight fit. A hole is provided in the case directly in line so that the tension on the spring can be adjusted.

The balance wheel is fitted with a pointer made from a piece of No. 24 wire and soldered to the spoke. Directly opposite a drop of solder is placed to secure the balance.

The frame of the movement is fastened to the case by means of two long screws which pass through spacing washers and are screwed into a threaded hole in the spacing pieces as shown. This provides a simple, neat and rigid mounting for the frame which will insure that it will not move.

Two binding posts are located on the top of the case. One is made with a long threaded shank that extends down into the case about one inch. The hot wire is stretched between this binding post and another piece of threaded rod that serves as the adjusting screw, being secured by two nuts at each end. The adjusting screw works in a brass bushing on the back of the case and is used to adjust the pointer to the zero point. A heavy wire is soldered to the bushing and the other binding post so that the circuit is completed.

If a lathe is at hand, a special bushing can be made, but if necessary a dry cell binding post nut can be used as shown. In either case the adjusting screw should be fitted to turn hard so that there will

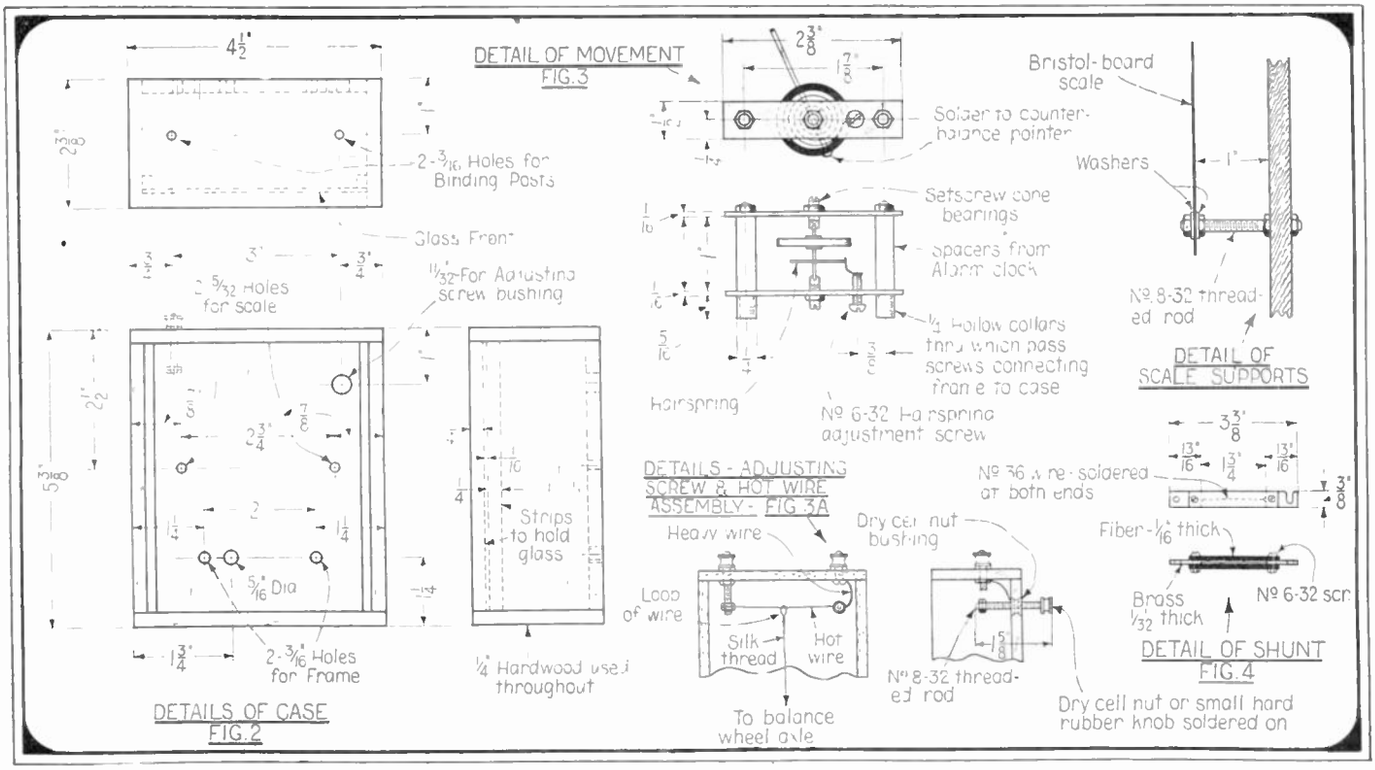


Diagram of various parts of hot wire ammeter shown on opposite page in perspective. All will be found described in the article.

be no play. If it is the least bit loose it will wabble and make it difficult to adjust the pointer to the zero reading.

A small loop of No. 36 wire is fastened to the center of the hot wire. This is connected to a piece of silk thread which wraps around the shaft of the balance wheel. With the wheel thus connected any motion of the hot wire caused by the current is transmitted through the thread to the pointer.

The scale is made of heavy Bristol board and is fastened to the case by two supporting columns. If a lathe is obtainable, these can be turned out of three-sixteenths inch brass stock and drilled and threaded for 6-32 screws. Otherwise pieces of threaded rods with nuts to hold the scale and secure the assembly to the case can be used as shown. As shown, washers are placed on each side of the Bristol board so that it can be firmly clamped without damage. The scale should have a section of a circle drawn on it with an ink compass as shown in the larger illustration. The word "Amperes" and any embellishments may be added to make the instrument look better. The scale stands out one inch from the back of the case and hides the hot wire and adjusting screws. The pointer is bent forward so that it will be about one-sixteenth of an inch in front of the scale.

When the parts are assembled care should be taken to see that the balance wheel turns freely, and that there is no play in the bearings. This can be adjusted by the set-screw bearings. A very small drop of thin sewing machine or "3 in 1" oil on the bearings will keep the pointed axle from rusting. The hairspring should be adjusted with a fairly strong tension so that it will quickly take up any sag in the hot wire and make the instrument indicate snappily. Tighten all screws and binding posts so that the whole affair will be secure. All the strips but one can be put in place, but the glass front is left off until after calibration.

To calibrate the ammeter it is connected in series with a source of current, rheostat, and a standard ammeter. Secure the most accurate ammeter that you can find, because the more accurate it is the more accurate yours will be. The cheap pocket type instruments are of no value because they are generally very inaccurate for this sort of work. A storage battery can be used to furnish the current and a few auto headlights or audion bulbs can be inserted in series with the rheostat for additional resistances. Before actually starting to calibrate be *sure* that the pointer of your ammeter is at the zero point on the scale. This can be adjusted by the adjusting screw at the back of the case.

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? Write legibly, in ink, and on one side of the paper only. EDITOR.

When all the connections are made turn on the rheostat slowly and watch the standard ammeter. Adjust the rheostat till it indicates a certain convenient amount of current is flowing, say 1 ampere. The pointer of your ammeter will have moved a certain distance across the scale. Mark the point where it comes to rest with a pencil, lightly, and put "1" underneath to stand for 1 ampere. Then change the rheostat till 2 amperes is indicated on the standard ammeter, then 2½, and mark the points. Then start all over again and secure readings in tenths of an ampere.

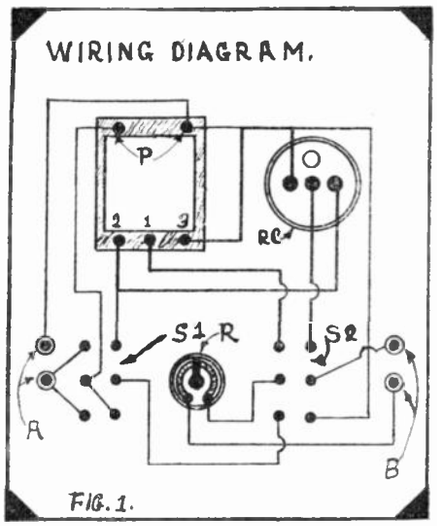
It will be found that for the small readings, under 1 ampere, the divisions will come close together until near the zero they will be illegible. At the other end of the scale the points will broaden out as can be seen in the picture of the author's instrument. This sort of a scale is characteristic of a hot wire or thermo-couple ammeter because the heating effect of the wire increases as the square of the current. That is, if a certain amount of current is flowing it will cause a certain definite temperature in the wire, but if this current is doubled it will cause *four times* the amount of heat in the wire. Consequently, it may be impossible to read any lower than about four-tenths of an ampere as the graduations will become too crowded. If it is desired to read smaller currents a smaller wire must be used and the scale must be again calibrated for it.

For larger currents a "shunt" is made. This consists of a fine wire that is shunted across the binding posts of the instrument. Then the electricity has two paths through which to go and only part of it goes through the hot wire that works the pointer. In this case the length of the shunt wire was adjusted until it made the readings one-half their original value. Thus, with a constant current of 2 amperes, by connecting the shunt, the pointer fell to 1 ampere. Hence the scale was doubled and it was possible to read up to 5 amperes. When a current of 5 amperes was passing, the shunt connected, the pointer indicated 2.5 amperes. If desired the scale for the shunt can be numbered at the top of the scale, making each number twice as large as at the bottom. Thus the scale at the top is marked "2" at the "1" mark, "4" at the "2" mark, etc.

For all practical purposes the length of the shunt wire is determined experimentally. In the author's ammeter it was approximately 1¾ inches long. No. 36 copper wire was used, the same as in the instrument. The wire is housed in the frame as shown in Fig. 4. Two pieces of brass or copper about 13/16 inch long, ⅜ inch wide and 1/32 inch thick are used as lugs. These have holes in the end that match the binding posts, which are 3 inches apart, thus making it simple to take the shunt on or off. Two pieces of 1/16 inch fiber, ⅜ inch by 2⅜ inches, form the body and protect the fine wire.

Experimental Switchboard

By A. Giolitto



Wiring diagram of a switchboard adapted for laboratory use, covering an extensive range of requirements, although of simple construction.

WITH the switchboard arrangement here described, connected to an A. C. circuit, it is possible to obtain direct current and alternating current at different voltages, which is very desirable in electrical experimental work.

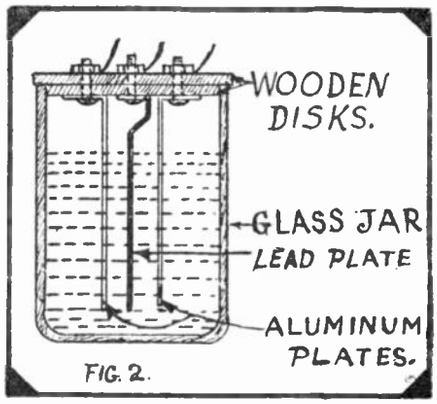
The switchboard complete is illustrated in Figure 3. Binding posts (A) are connected directly to the 110-volt A. C. circuit, and then by a proper combination of the switches (S1) and (S2), D. C. or A. C. at different voltages may be taken off at the binding-posts (B).

There are four possible combinations of the switches when in closed positions: they are as follows: When both pairs of switch blades make contact with the upper clips, which is the position in which they are shown, direct current is obtainable from the binding posts (B). But if the switch (S2) is thrown to the lower clips, then an alternating current and low voltage may be taken from the binding posts (B). With both switches thrown down, alternating current with higher voltage can be taken off from the terminals (B). Finally with (S2) up and (S1) thrown down the fourth combination is obtained, but this gives nothing new at the binding posts (B), but gives direct current, which is the same as obtained with the first combination.

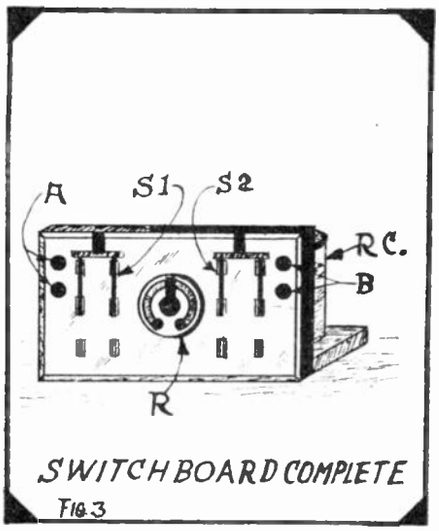
Referring to Figure 1, it will be seen that no matter in which way the switches are thrown, the rheostat (R) will always remain in series with the apparatus that might be connected across the binding posts (B). Consequently further control of both direct current and alternating current voltages can be had by simply turning the knob of the rheostat.

The switch (S1) is arranged so that it will disconnect the board from the 110-volt circuit and hence should be in an open position when the switchboard is not in use.

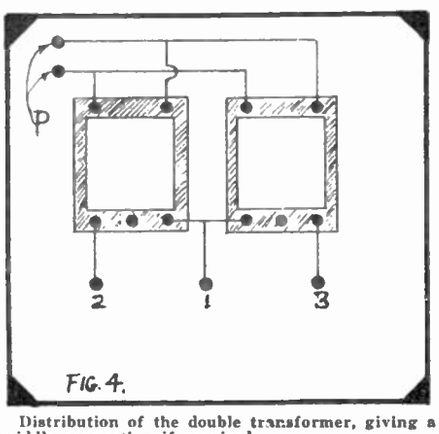
Figure 2 shows the rectifier which changes the alternating current to direct current. It will rectify both sides of the cycle when used in connection with a transformer, and comprises a glass jar containing a solution of ammonium phosphate and water in which one lead plate and two aluminum plates are immersed. The plates are held in position by fastening them to two wooden disks, which also serve as a cover for the rectifier. Screws which hold the plates to the wooden disks form the three terminals of the rectifier. aluminum ones. It is quite important that a small hole should be drilled in the cover of the jar, to allow the gas developed to escape, or otherwise the cover might be forced off, due to the pressure



Rectifier, a necessary adjunct to the switchboard, so that direct current can be taken from it when connected to an alternating circuit.



Switchboard complete as mounted, the operating parts being concealed behind the front board like a radio set.



Distribution of the double transformer, giving a middle connection if required.

When putting the rectifier together the lead plate is placed between the two of such gas. In Figures 1 and 3 (RC) represent the rectifier.

The secondary winding of the transformer used is tapped at the middle and brought out to the binding post (1), Figure 1. Then the voltage between (1) and (2) will be the same as the voltage between (1) and (3), and one-half of the secondary winding will supply the positive side of the cycle, while the negative side of the cycle will be supplied by the other half of the winding. However, if a greater direct current is desired two transformers may be employed. They should be connected as shown in Figure 4. Their primary windings are connected in parallel, while their secondary windings are connected in series.

If the two transformers were to be used the resulting five terminals of the two transformers would be connected in the place of the corresponding five terminals of the one transformer. (See Figures 1 and 4). In this case one transformer would supply the positive side of the cycle while the other would supply the negative side of the cycle.

Transformers which do not have a middle connection brought from their secondary windings can be used in the last case, since the middle connection is not used when they are connected up as shown in Figure 4.

The transformer and rectifier are mounted on the board in back of the switchboard, which is partly shown in Figure 3.

The writer has actually constructed a switchboard as here described and should any experimenter desire further details they will be gladly furnished.

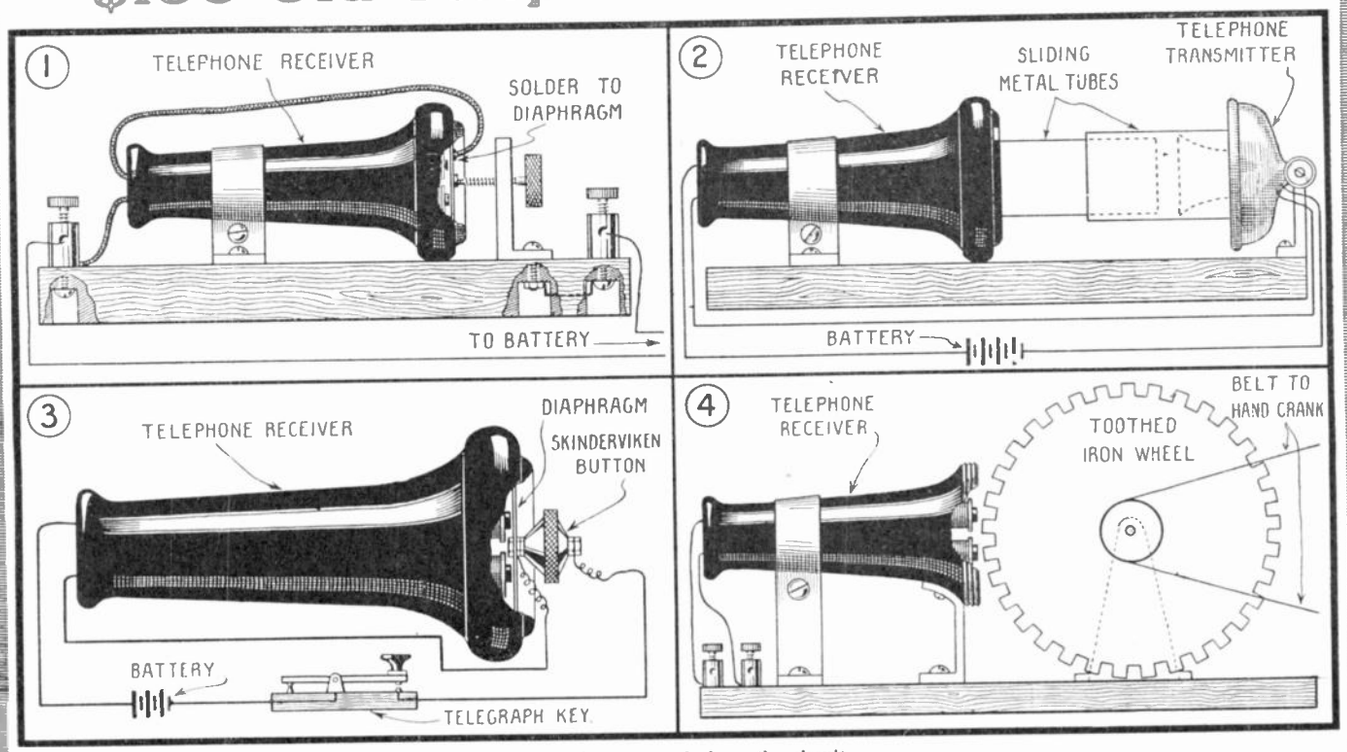
In constructing the rectifier a piece of sheet iron may be substituted for the lead plate, as it will operate as well.

If the rectifier heats up too much when the desired current is taken through it, two glass jars should be used in its construction. In this case two lead and two aluminum plates are required.

In assembling it one plate of each kind is attached to the wooden covers. The connections for these two rectifier units are the same as for the single jar type: the only difference being that the two lead plates are connected together and treated as a single one.

Contributed by AMEDEO GIOLITTO.

$100 Old Telephone Receiver Contest



1. The receiver with this connection becomes a buzzer as it opens and closes the circuit.
2. Here a telephone receiver is made to relay its message to a microphone mounted on an adjustable or telescoping pair of tubes, so as to give different notes and constitute a howler.
3. Again the relay appears, but this time it operates directly upon a granular carbon microphone button.
4. A toothed wheel of soft iron is turned in close proximity to the poles of the telephone magnet. The change of field intensity makes it a magneto.

WE are pleased to present a new contest this month which we are certain will be of more than passing interest to our readers.

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

Any number of receivers can be used. They may be of any ohmage, for instance, 5 ohms to 10,000 ohms,—if rewinding will make a new use for the old receiver. But remember, the receiver in its entirety must be used —no parts of the receiver. In other words, it would not be permissible in this contest to show new uses for telephone magnets or spools. The examples shown in our illustration cover this very nicely. Our readers will note that in every case, the whole telephone receiver has been utilized. Additions to the receiver, are, of course, permissible as shown in the above examples. If the cap has to be left off or a new or different one is needed, this will be satisfactory.

As the contest is intended to be an electrical one it follows that the removal of the coil or magnet, essentially electric parts of the telephone, would vitiate the idea of the contest. Our four suggestions given above do not depart in any degree from electricity.

PRIZES

$100 in Gold

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

If the information submitted on the new device is not clear, a model should be submitted which will be returned to the contestant at the close of the contest. All entries of this kind should be accompanied by description, and if possible a working drawing of the idea, giving all dimensions and photographs. Where no model is submitted, a drawing with photographs, if possible, should be sent with the manuscript.

Manuscripts entered in this contest cannot be returned. We reserve the right to publish all worthy photographs and descriptions or ideas that do not win a prize, and shall pay our regular space rates for such material. In publishing such articles, all rights revert to the publishers, except ownership of models submitted, which as stated above will be returned to their makers. Write clearly, and on only one side of the paper. Use ink or typewriter, and double space it. Manuscripts written in pencil will not be eligible. Contestants may enter more than one model or manuscript in this contest, which is freely open to every one except manufacturers of telephonic appliances. Please observe the following rules:

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

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

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

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

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

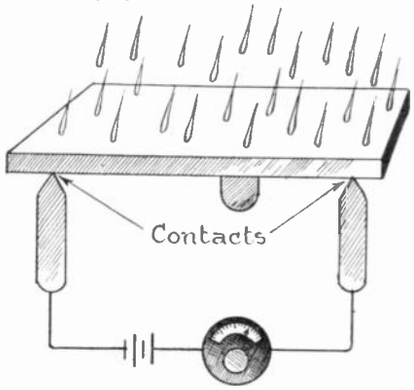
6.—This contest closes at noon, May 15, 1924, at which time all entries will have to be received by us in order to qualify. Should two contestants submit the same idea, the same prize will be awarded to both.

7.—Address all communications and packages to Editor, *Old Telephone Receiver Contest*, care of Practical Electrics, 53 Park Place, New York City.

Investigation—II

By Esten Moen

YOU remember the time when you connected your ground wire to a rod stuck into a flower pot? Sure, today, you know better than to do



Our author's idea of investigating and finding out how far raindrops have fallen. We wonder if he ever tried it.

that. But are ye such a hornswoggled investigator that I insult ye? Beg pardon.

Our eyes see the lightning. Our ears hear the rain. We humans depend a lot on our senses. Take our senses away and —no! It's too terrible to imagine such a thing.

You haven't got a connection with the elements? Well, that's tough luck. Why it's as important as a newspaper and lots more fun!

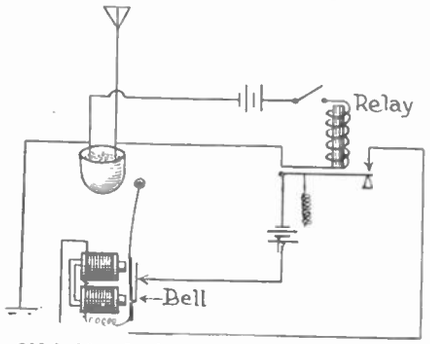
For instance, it would be great fun to know if yesterday's rain fell a mile lower down than that which fell today?

Look at my picture of a rainfall. You see there are three carbon points: Two for contact (electrical) and the third to balance a carbon plate which rests in a horizontal plane on the three. You know the principle of operation—pressure on carbon lowers its resistance. With this simple contrivance it is possible to find the ratio between the inertia of snow, rain, hail, wind, etc.

Which you agree is all—too simple?

The drops of rain or snowflakes are supposed to hit harder, according to the distance they fall, on the theory of old Bob Fitzsimmons, the prizefighter, that the bigger they are the harder they fall. In this case the idea is that the greater the distance the harder they fall (but unfortunately they don't).

You remember our old friend Static? He's the cuss that crackles in the radio and spits fire in the open. I just happened to think that quite a large current



Old-fashioned coherer applied to tell how far off a thunder cloud was when the lightning struck. We generally can tell without a coherer.

of static jumps into an aerial every time lightning strikes. To prove this, we'll make use of an instrument called the "coherer." It was used in the pioneer days of radio.

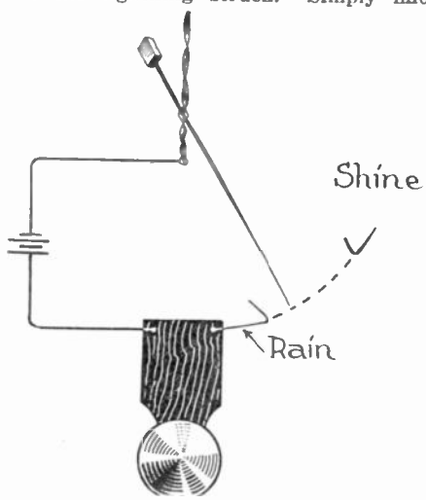
Briefly it is:

1. Some metal filings in a cup.
2. Two wires dip into filings.
3. Hammer of an electro bell is situated so it can tap the cup.

Look at the picture. You see, the bell rings every time lightning strikes.

When lightning strikes the filings become a conductor, closing the relay circuit, which closes the bell circuit so that the bell rings, and incidentally the coherer is decohered.

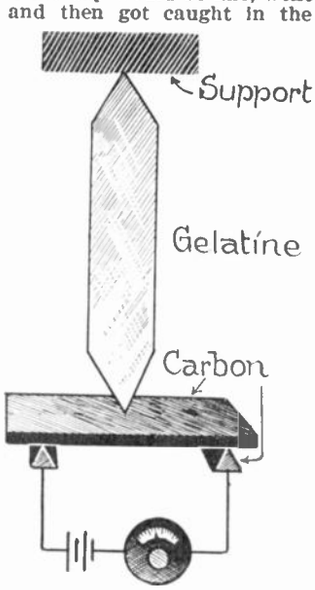
Get a watch (with a second hand) and you can figure the miles away from you that the lightning struck. Simply find



A hygrometer used to ring a bell electrically when moisture increases so that rain seems threatening. It is made with twisted catgut.

how long the interval from the time the bell rings to when you hear the thunder. Multiply the number of seconds by one thousand feet.

Were you ever peeved because you thought the day would be fine, went swimming and then got caught in the rain?



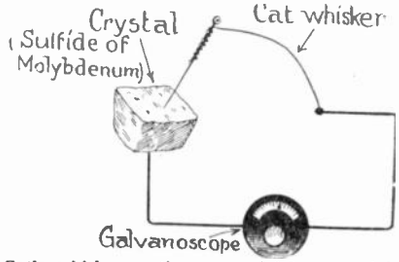
Similar instrument, this time using a strip of gelatin instead of twisted catgut to ring an electric bell.

Now, of course, you did have a weather prophet at home on the porch—but never gave it any notice. Well here's a way to make the hygrometer give you notice.

Look at the prophet. The active member is a twisted catgut string (from a sausage or "weenie").

The twisted catgut changes its twist, according to the humidity of the air, opening and closing a bell ringing circuit, showing what catgut can do, while in a few minutes the reader will see what a cat's whisker can do.

This reminds one of another similar "patent." It was invented by Edison and



Cat's whisker resting on molybdenum sulphide crystal, which is supposed to tell something about the heat of the sun.

he called it an odoroscope. Instead of a catgut string, the main part is a strip of gelatin.

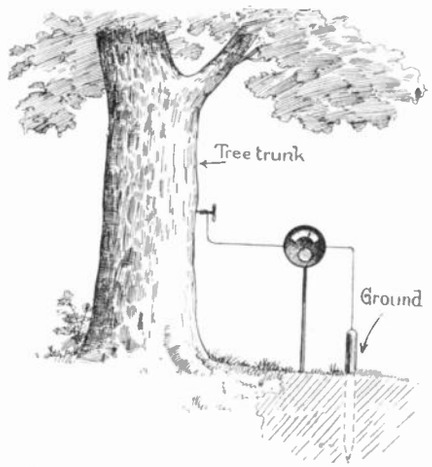
The strip of gelatin under the influence of varying humidity is supposed to lengthen or shorten. If it grows longer it increases the pressure on the carbon points and reduces the resistance and vice versa, so as to indicate on a galvanometer what is going on.

Ever notice after a rain how deep blue the sky is? Then, did you wonder after a rain if the sun shines more strongly than before a rain? or what?

It is the heat of the sun we should measure to find out. How—oh yes there's a way to do it. There's a crystal (chemist calls it molybdenite) some goof found that heat radiations affected its surface in some way or other.

It's like this—the crystal is firmly held in a metal cup (like the radio crystal) similarly a fine wire (catwhisker) touches the surface. Now the peculiar thing is that heat waves coming on to the surface will generate an E. M. F. in the crystal. The whole thing is a battery (on a small scale). Well then it's a simple thing to hitch a galvanometer on to it and find out if the sun really—just a tip brother. The catwhisker is a pesky thing. Better solder it in some way.

Coming back to the rainbow (pardon, I mean end of the rain) did you also notice how rejuvenated everything looked after a rain? Many many years ago (in 1920), Mr. *Science and Invention* (P. E.'s uncle)



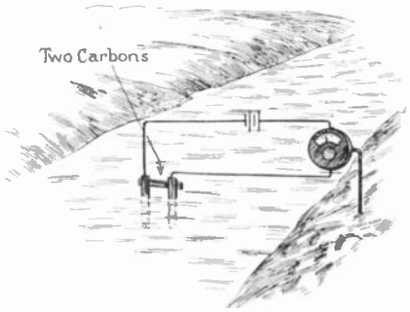
If a tree generates electricity our author proposes to utilize it by grounding the tree. Most trees, however, are already grounded.

told me that trees generate electricity. Just hitch a galvanometer from a ground

connection to a nail driven deep into a tree trunk.

Suppose the galvanometer should show an increase of juice after a rain? Why not have the galvanometer connected winter and summer?

Do you remember having heard your chemistry teacher in school say that falling rain absorbed carbon dioxide? Also that carbon dioxide dissolved in water formed carbonic (not carbolic) acid? And why repeat that acid conducts electricity?



Mr. Moen's idea of how to tell whether it has been raining upstream. Decidedly more interesting than practical.

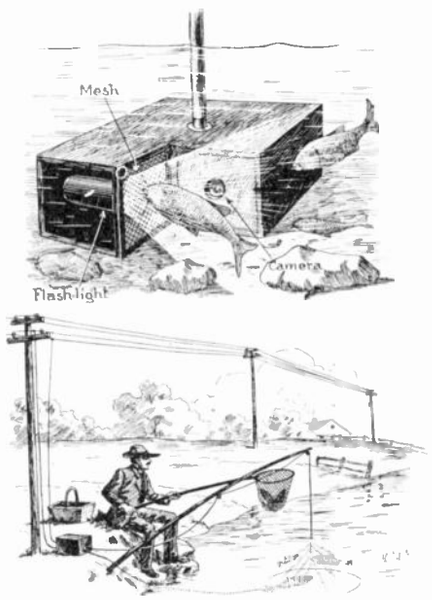
Therefore, we show a scheme, whereby (if you live near a river) you can know very soon whether there has been a rain or not farther up the river. This ought to constitute a warning of flood, etc. The carbonic acid is supposed to reduce the resistance of the water.

Now suppose—if the neighbor's horses took a bath in the river would that cause an alarm? I—disclaim any honors you would give me for my invention until you have tried it thoroughly.

Were you ever curious, my dear, about what forms of life exist under the ocean? Or maybe just a lake or perhaps a river?

We know, of course, that peculiar vegetation and fishes exist there. If we could be so lucky as to don a diving suit and go down into a lake with a strong electric light, we would get the swellest treat in life. But, unfortunately, expense and trouble are ever ours.

However, let us consider some method. Since we can't go below water, why not put a camera and a flashlight in an airtight box, with one side of the box, a plate of glass. Then in front of the glass



These illustrations show how Mr. Moen disposes of the fish question. One fish is photographing himself, while below the fisherman is electrocuting fish by an induction coil.

plate is a fine web or mesh of cotton. The fish pokes his nose into the web which trips the camera shutter, and then—but ah! We forget; a shark could easily break or damage our box. No! It won't do at all.

A fish is a creature foolish enough to nibble on a baited hook. There are three species of fish: the natural, the shark, and the sucker.

The first of the species is the natural. He is the gentlest peace-loving fish in the world. So the method described will do for getting pictures of him. He is found in any lake or river. Just ask some Nimrod. (Better ask Isaak Walton.—Ed.)

Here, perhaps, I had better warn you not to bring high voltage into the water. It kills fish. Examine my illustration carefully and you will see just how it kills (both young and old fish.)

An alternating current generator is maintained in operation, one terminal grounded and the wire from the other terminal taken into the lake so that when the fishes go smelling around it they quietly pass into the next world and also into the stomach of the fisherman.

The second of the species, the shark, is more difficult to find and more hard to photograph. Sharks also vary as to size, shape and motive. Each shark is invisible until it has a motive. For instance:

A robber disturbs the balance of a Hughes induction apparatus. We notice Mr. Moen is not absolutely certain of this either.

A common dog (homo gazabo) is a latent shark. Tie a can to his tail and away he goes!

Of course, a dog is a poor example. He doesn't do any harm—the poor fish. But take a burglar, for example. Give him a motive. Behold! He snoops forth, cracks a safe, slinks away, and—the shark is gone! Now you see we must have adequate apparatus to get his photo.

Did you ever hear of the Hughes' Induction Balance? The idea is that any piece of metal is capable of upsetting any electro-magnetic field.

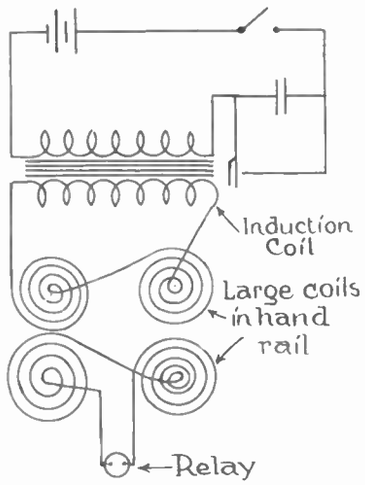
Now, we know for a fact that a burglar has some metal (gun or jimmy) somewhere on him!

Accordingly, we'll place fake banisters leading up to your safe, so a person must go between the banisters to reach the door of the safe. Inside of the banisters we'll place four large coils.

These coils are part of the induction balance, as shown in the diagram appertaining to this picture. Of course, a burglar loaded down with a kit of burglar's tools spoils the balance of things.

Now you will comprehend that the "metals" on the shark, (excuse me, burglar) will upset the electro-magnetic field, which will disturb a sensitive relay; the latter will turn on the light, also click the camera shutter, then turning on a phonograph telling the fish to beat it and—you asked if the safe was metal, why shouldn't it also disturb the alarm? Just a moment please while I answer the phone. . . .

Now, I was discussing, fish. Oh, yes! The third of the species, the sucker, is the most peculiar of all mentioned. He comes into being only after the sun has



How Mr. Moen would arrange his induction balance. Where is the robber?

gone down and is only fully grown when these conditions are fulfilled.

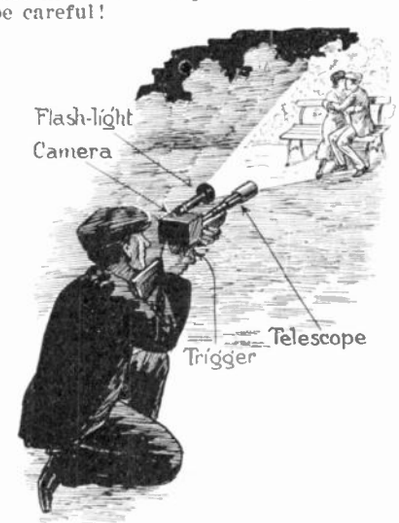
1. Perfectly dark night.
2. Place—some lonely park or country road.

The queer thing about it is, that you wouldn't recognize him in daytime. It takes the presence of his girl on a dark night to develop his "sucker face."

The fish is too easily scared to regain his "poker face." Since we want the "fishy" face the only suitable instrument I can think of is the "gun camera."

As you see in the picture you will need three instruments: A camera, a telescope and flashlight. I mean such a flashlight as will cast a 300-feet beam of light. You must mount everything on a wooden frame, similar to a gun. The trigger will turn on the flashlight in an instant, and also trip the camera shutter. Don't forget to move the camera film.

To use the contraption, I suggest that you get hidden in a bush or something 100 feet in front of a park bench, etc. Now be careful!



Further studies in what Mr. Moen considers ichthyology; photographing loving fishes in the park.

The fish may be Bolshevik or Ku Klux but it's best to take precaution!

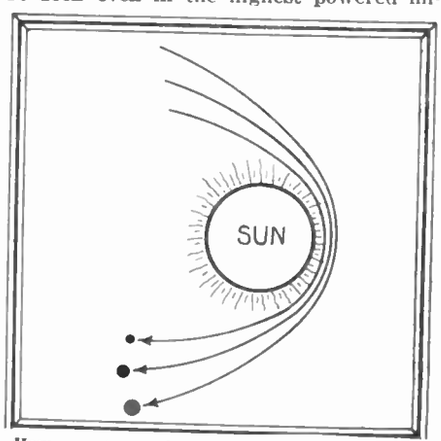
I hope you enjoy my discussions as I do, on the printed page. If we meet again, I may have found some good material on light and color.

Atoms and the Discovery of Isotopes

By Prof. Rogers D. Rusk

IF you met an atom face to face, would you know to what family of atoms it belongs? Let us take a trip into Atomland and see just how atoms are grouped into families, and how the latest and most sensitive electrical methods of analysis have enabled even some of the families to be subdivided. The members of any one family which has been subdivided are called isotopes, and the discovery of isotopes marks one of the greatest and most recent steps in solving the problem of what matter and electricity really are.

Imagine the world suddenly magnified so that a foot becomes a hundred thousand miles, and a six foot man becomes 600,000 miles tall. Then an atom of hydrogen gas would be ten inches in diameter and the other atoms would be somewhat larger. The inhabitants of Atomland are evidently very tiny and cannot be seen even in the highest powered microscope. So if we cannot look into their faces, we must judge them by those characteristics which we are able to detect.



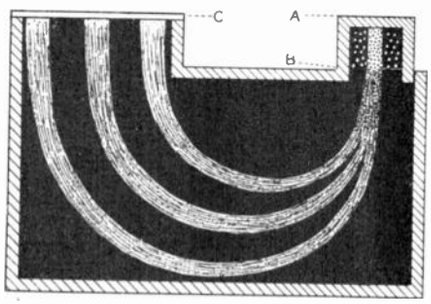
How comets acted on by the sun compare with charged atoms acted on by an electric field.

Atoms to some extent are like people. All the members of any one family of atoms have certain identical characteristics, by which they may be classified. Some years ago it was thought that atoms could be classified by their weights, and that all the members of one family have exactly the same weight. In other words, it was thought that the family an atom belonged to could be determined by simply finding the weight of the atom. When arranged according to their weights, however, certain families did not come in the proper order of chemical activity, and this led scientists to look for something more fundamental than weight which determines the family and chemical activity of the atoms. It was found when the electrical nature of the atom was discovered.

It used to be thought that two atoms of the same element are as much alike as two peas. This is not a very scientific statement because no two peas are exactly alike, and indeed we now know that atoms are no more alike than peas are. One atom of chlorine gas, for instance, may be more than ten per cent heavier than another atom of chlorine, and yet, both atoms will unite with sodium atoms to form ordinary salt. They behave alike chemically, that is, they interact with other elements in exactly the same way. The explanation of this is found in the electrical charges in the atom.

The families of Atomland are not very numerous but they make up in size what they lack in numbers. At ordinary atmospheric pressure a cubic inch of helium gas would contain over 400 billion billion atoms of helium. The lightest atoms known are those of hydrogen and helium. So far these atoms have not been found to vary among themselves in weight, and this suggests that they must consist of a particularly fundamental and uniform structure.

If a fat man makes a gain of ten per cent in his weight, his watchful friends begin immediately to suggest remedies, but the same per cent of change in the weight of an atom is not so easily noticed. It would take about three cubic inches of air to weigh as much as a postage stamp and, as there are over 400 billion billion particles in every cubic inch of air, the weight of each particle is rather small. It is evident that ten per cent variations in weight cannot be detected by any ordinary means. It can be done, however, by what is called an electrical mass-spectrograph. This instrument spreads out the atoms according to their mass or weight in very much the same way that light is spread out into the various colors of the rainbow by the prism in an ordinary spectrograph.

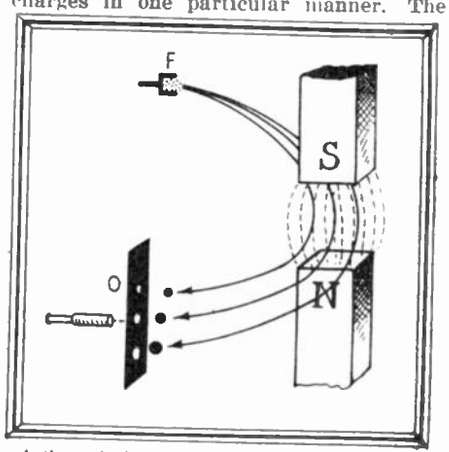


Path of the rapidly moving atoms as affected by an electric field causing them to take the path shown, varying with their weight.

Above is shown how it is done. The substance is first vaporized so that the atoms are separate from one another, and then they are electrically charged by the action of an electric discharge. Next they are caused to travel with high speeds by a strong electric field between (A) and (B). On passing through the slit at (B) they are bent in the arc of a circle by a strong magnetic field. The heavier atoms are bent the least. The single beam of atoms between (A) and (B) is broken up into as many curved beams between (B) and (C) as there are different weights. These beams of atoms are detected at (C) and measured. By this method variations of a few per cent in the weight of an atom may be detected, even though the atoms are identical chemically and can be separated in no other way.

The name isotope is given to an atom of different weight but the same chemical properties as another atom. The name means "equally-placed," that is, belonging to the same chemical family. Mercury has six isotopes, chlorine has three, oxygen has none.

The reason why some elements have no isotopes is thought to be because they can only be built up from electrical charges in one particular manner. The atoms of those elements possessing isotopes may be built up from electrical charges in several different ways, and yet keep the same chemical characteristics.



Action of the magnetic field. Charged atoms from (F) are bent by a magnetic field and the extent of their deflections is observed on the screen (O).

It is pretty well established nowadays that the chemical nature of an atom is determined by the number of electrical charges in the periphery of the atom. These charges are negative electrons and possess a weight of only 1/1800 the weight of a hydrogen atom. Hence it is evident that most of the weight of any atom must be associated with the remainder of the atom, which is the central portion called the nucleus. The positive charge on the nucleus must be exactly balanced by the negative charges of the surrounding electrons else the atom would have a resultant net charge and would not be an ordinary uncharged atom. If the positive charge on the nucleus be decreased by one unit

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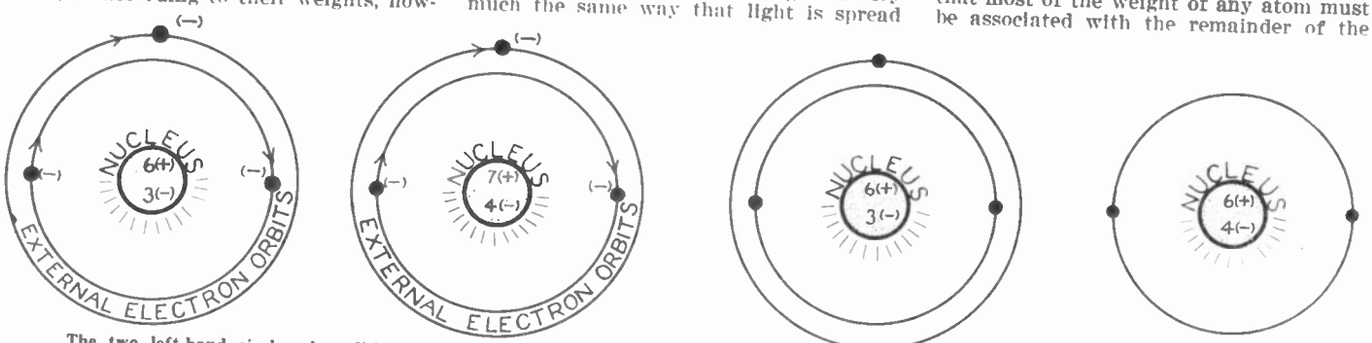
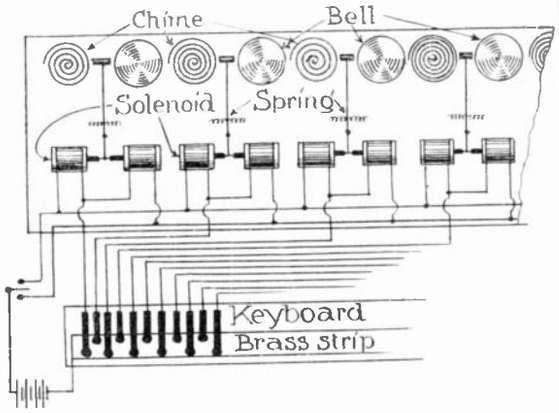


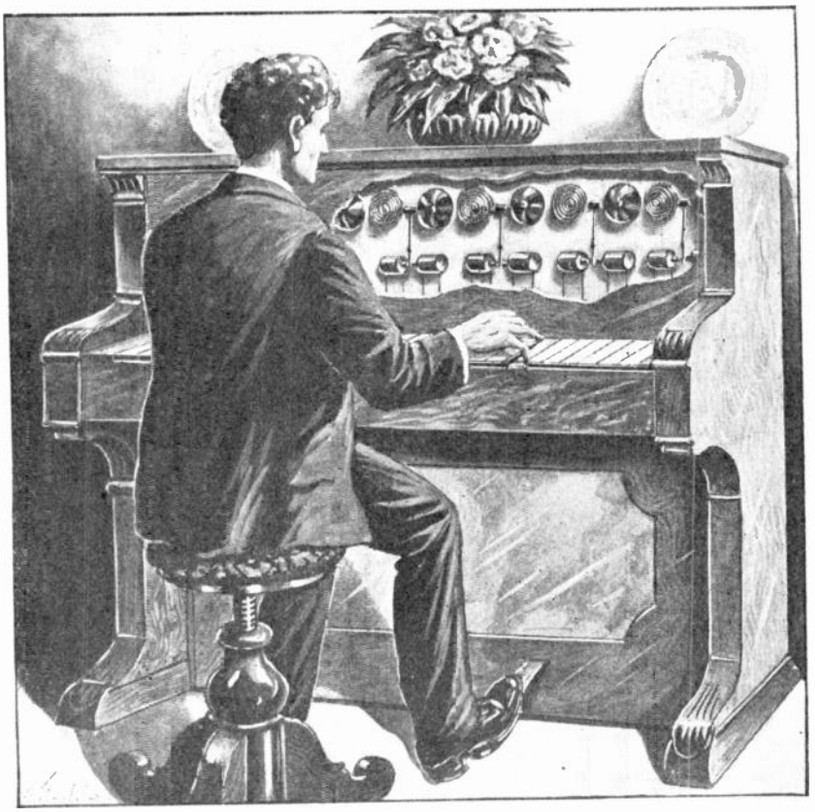
The two left-hand circles show lithium atoms of different weights, isotopes, but of identical chemical properties because they have the same number of external electrons. The two right-hand circles show two possible atoms of the same weight but of different chemical properties because they vary in their external electrons.

Electric Piano

By M. H. Griswold



This is a variation on the electric piano as generally understood, because there are introduced for each note a chime and bell. This enables the player to produce various effects and by a foot pedal the chime or the bells or both are made to respond to the touch of the key.



THE experimenter who faithfully constructed all of the electric pianos and other musical instruments described in this magazine would soon have enough apparatus for a large orchestra, and with the addition of a few tin pans and Ford horns he could render classic musical selections which would compete with Hallowe'en or New Year's Eve parade bands. He would have no difficulty in signing up for a contract with any popular vaudeville circuit and in less than a year's time all musical instruments of today would be obsolete.

We have described electric xylophones, electric carillons employing wine bottles as the resonance bodies, electric pianos employing various sizes of door bells and buzzers, and many other types. Now we have an electric piano which embodies both bells and cathedral chimes, such as are used in the finer striking clocks. The keyboard is arranged similarly to the keyboard on a piano, and by means of an extra switch either the bells or the chimes may be struck.

The illustrations show how the apparatus is assembled and connected. Bells and chimes are of the single stroke type, so that any ordinary door bell mechanism may be used by simply short circuiting the vibrator contact points with a piece of wire underneath the frame of the bell, so as not to interfere with the movement of the armature. But this would require a separate mechanism for each bell and each chime, so that the use of solenoids shown in the illustration may be found more convenient.

Two solenoids are used for each note, with their armatures connected together and also connected to a hammer, which is held centrally located by means of the springs. With the switch on contact 2 the chimes are operated when the keys are depressed. When the switch is on 1, the bells are operated. By pressing the keys and quickly changing the connection back and forth from 1 to 2, the chimes and bells are operated alternately.

With this arrangement many beautiful combinations are available in rendering musical selections. The switch should be placed conveniently near the keyboard. It can be operated as a foot pedal, with two limits of depression. The keyboard carries a long brass strip directly under the keys, upon which small brass strips representing the keys of a piano are depressed, closing the circuits, through one or the other of the respective solenoids, thus attracting the plungers so as to strike the bells or chimes. Direct current is used, either from dry cells or a storage battery. It is unnecessary to say that both bells and chimes should be correctly tuned, corresponding to the notes of a piano.

A special feature is the combination of bells and chimes. The bells can be tuned an octave higher than the chimes, and, as both are struck by the same hammer, when a key is depressed and the switch connections changed, the notes from the two different pieces, bell and chimes will harmonize and beautiful effects will be obtained.

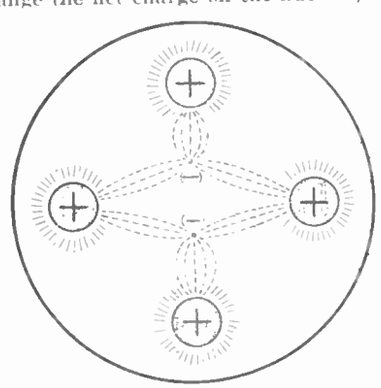
Atoms and the Discovery of Isotopes

(Concluded from page 316)

the atom would also have to lose an outer electron to remain neutral, but this would change the chemical nature of the atom because its chemical properties depend on the number of outer electrons. Such an atom would now belong to another family.

However, the nucleus actually contains more than has been mentioned so far. No nucleus could be made up of positively charged particles alone, because they would mutually repel one another and fly apart. Every nucleus contains some electrons called binding electrons, and an equal number of additional positive particles to neutralize these. For example, a helium nucleus has four positive particles bound together by two electrons as shown here. That leaves a net positive charge of two on the nucleus which is neutralized by the two external electrons surrounding the nucleus.

In an atom which has a larger number of particles in the nucleus, a loss of one positive and one negative would not change the net charge on the nucleus, and



Complicated nucleus of the helium atom. It leaves free two positive charges which take care of two electrons in the outer orbit of the atom.

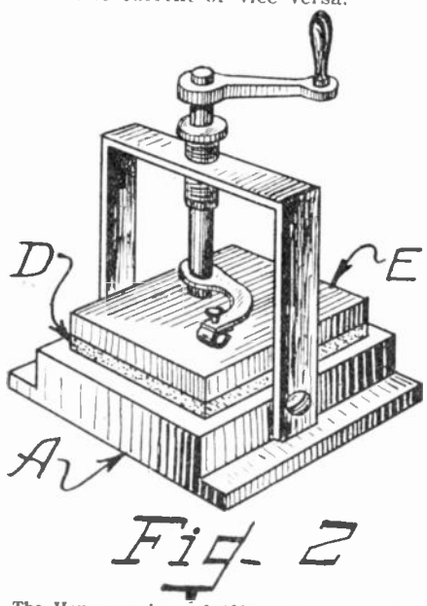
hence would not change the number of external electrons or the chemical nature. The loss of the positive particle does change the weight very materially however, and we would have a new atom with a different weight, but with exactly the same chemical properties. This is an isotope of the former atom.

The atoms of any element as separated by chemical analysis are mixtures of the isotopes of that element. That the mixtures are always in exactly the same proportion indicates that the isotopes were present during the early history of the earth when the elements were formed. The weights of the atoms measured by the chemists are known to be average weights due to the mixture. For example, the weights of the chlorine isotopes are 35 and 37 and they must be present in the ratio of 3.3 to 1 so as to make the average weight 35.46 as found by the chemists.

Odd Telephones

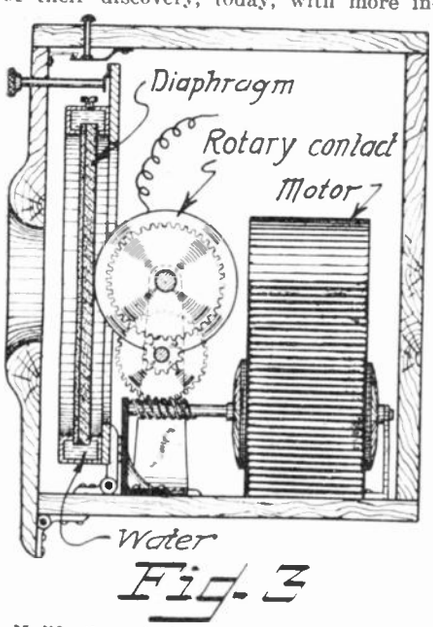
By Clyde J. Fitch

IN studying the history of the telephone one is impressed by the multiplicity of instruments developed by the early experimenters, each operating under a different principle and producing the same result, namely the translation of sound waves into vibrations of an electric current or vice versa.



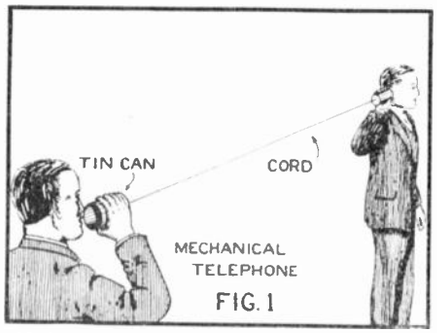
The House receiver of 1887. (D) is a carbon block saturated with an electrolyte. The handle is turned by hand or clockwork during the operation. It really speaks.

The majority of these early telephones have been forgotten as time passed, and today there is but one outstanding type of telephone receiver in general use in our telephone and loud speaking equipment, the original Bell telephone, which depends for its action on the magnetic attraction between an electromagnet and an iron diaphragm. Although many of the old types were not found practical in the days of their discovery, today, with more information and improved equipment at our disposal, the principles they embraced may be found useful.



Modification of the House receiver, using a motor; the diaphragm itself is saturated with an electrolyte.

To date nothing has been found which is as practical as the simple Bell telephone receiver for line telephony, but there is now a demand for an efficient loud speaking telephone for radio use, and some of the types to be described may be developed for this purpose. Description of all of the telephones devised since the first discovery of the telephone is beyond the scope of this paper, and only odd and out-of-the-ordinary ones will be described.



Mechanical telephone, the so-called acoustic telephone, which for distances running up to some thousands of feet was very popular in its day.

Mechanical Telephone

The mechanical telephone is mentioned here only because of its historical interest. It is not operated by electricity at all, the action depending simply upon the transmission of sound waves through a solid body. It consists of a cord or wire stretched between two diaphragms, such as the bottom of two tin cans, Figure 1, the sound waves striking one diaphragm passing through the cord and vibrating the other diaphragm.

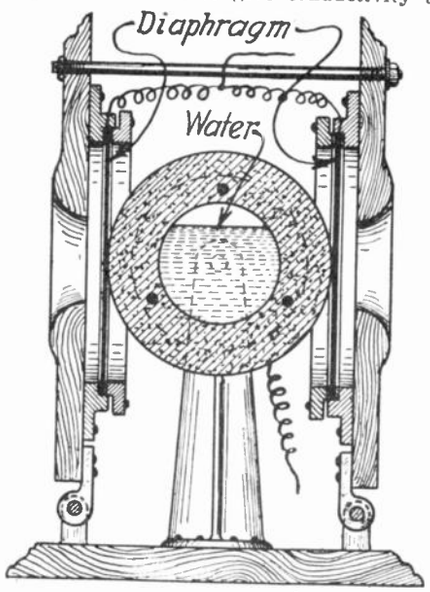
The invention of this telephone is attributed to Robert Hooke, in 1664. In the 19th century Wheatstone made it operative over distances of 2000 feet. There are modifications of this telephone, such as the warning of an approaching car by means of the vibrations carried along the wire and emerging as sound through the roof of the waiting car and also the detection of submarines by the sound waves carried through the water.

Electrochemical Telephones

There have been many odd electrochemical telephone receivers developed but none has found any practical application as yet. There are possibilities of developing a very efficient receiver of this type. Dolbear found that sound was emitted from two plates between which extended a few drops of a solution of ammonium chloride that was decomposed with the generation of bubbles of gas as the telephonic currents passed through it. Gore discovered in 1859 that sounds were produced by the passage of pulsating currents through cyanide of mercury and potassium.

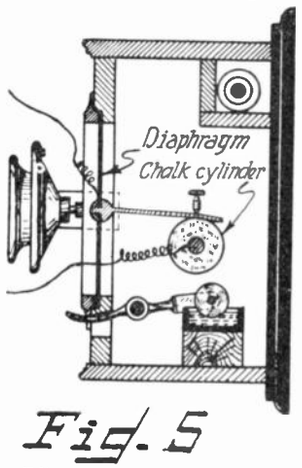
An electrochemical receiver was patented by House in 1887. This receiver was based on the molecular vibrations set up in an electrolytic material during the passage of the undulatory current. The illustration, Figure 2, shows this receiver in detail. On a base support (A) rests a carbon plate (D). Upon this carbon block is placed a block (E) composed of an electrolytic substance or saturated or impregnated with the same. Contact between the carbon plate and the electrolytic block throughout their contiguous surfaces is made as intimate as possible and is preferably secured either by carefully smoothing the surfaces and joining them by screws or otherwise, or by moulding and compressing the material composing the electrolytic body upon the plate.

The electrolytic material is some substance that will be decomposed by the passage of the electric current, such as pulverized carbon and sodium phosphate intimately mixed in a dry or moist condition and formed into a suitable shape, the percentage of carbon employed being so chosen as to give conductivity to the block, but not sufficient in quantity to prevent electrolytic action during the passage of the currents. A block of plaster of Paris compressed and saturated with an aqueous solution may be employed. It may be soaked in a solution of sodium phosphate, sal-ammoniac, muriatic acid, or even water alone. Sometimes oil may be used to decrease the conductivity of the block. The block is kept moist by capillary attraction.



Another development of the electrolytic telephone. It carries a charge of water and operates two diaphragms.

Mounted on a rotating arm is a spring contact, that presses against the electrolytic block, the pressure being adjusted by the screw. This contact is of platinum or nickel, although silver, copper, German silver or other metals may be used if amalgamated with mercury.

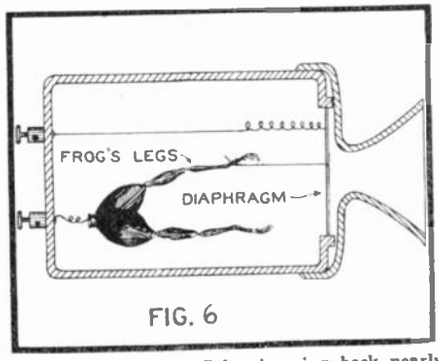


Famous Edison electro-chemical receiver. This spoke very loudly and attracted much attention in the early days of the art.

This receiver is connected as shown, with the rotary electrode preferably to the negative pole of the battery. This electrode is slowly turned by hand or

clockwork during operation. The passage of the telephonic currents causes molecular vibrations at the contact point, which are communicated to the air. Better results are obtained by mounting the receiver on a sounding board.

Figures 3 and 4 show the two modifications of this telephone, also invented by

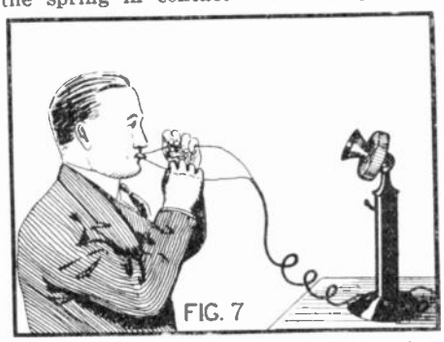


Old experiment of Galvani, going back nearly 150 years, is made to operate a telephone diaphragm. Vibrations of frogs' legs respond to a talking current and reproduce the voice.

House. In Figure 3 the diaphragm itself is of an electrolytic material and the rotary contact is driven by a motor. Under the diaphragm is a vessel containing a solution that keeps the diaphragm moist by capillary attraction. The one in Figure 4 employs two metallic diaphragms in contact with a wheel of electrolytic material. The wheel is kept moist by means of water inside of it as shown. One of the line wires connects to the two diaphragms and the other to the wheel.

Figure 5 shows one of Thomas A. Edison's early inventions, which is an electrochemical receiver based on surface friction. This receiver consists of a cylinder of compressed chalk soaked in an electrolytic solution, such as a caustic alkali, so that it may become a conductor. The cylinder is secured to a shaft and turned by the operator, although a motor may be used.

Resting upon the cylinder is a flat spring connected to a diaphragm as shown. This spring is pressed upon the chalk with a pressure of several pounds. The wires connect to the spring and to the shaft of the chalk cylinder. If the cylinder is rotated in the direction shown and no current passes, the normal friction of the spring upon the surface of the cylinder will be very great, and the spring will be carried forward in the direction of rotation of the cylinder and will pull inwardly on the diaphragm. If a current passes whose direction is such that hydrogen will be produced upon the surface of the spring in contact with the cylinder,



This is supposed to be a physiological receiver, the operator "tasting" the current and interpreting the voice.

the friction will be reduced to an extent proportionate to the strength of the current; hence the diaphragm will regain its natural position and remain there as long as the current passes.

If the current ceases, the friction is instantly reestablished, the traction increases, and the diaphragm is pulled forward again. If the current passes in the opposite direction, the effect is scarcely noticeable, as the evolution of oxygen upon the surface of the spring does not decrease the friction like hydrogen, but, on the contrary, generally tends to increase the normal friction; hence, a direct current should circulate through the receiver, so that both waves of the telephonic currents may be utilized.

Below the chalk cylinder is a vessel containing water in which is dipped a sponge or felt roller. This roller is mounted so that it can be pressed against the cylinder, so as to supply the chalk with moisture lost by evaporation.

It is interesting to note that this receiver may also act as a transmitter, by reason of the fact that when the spring and chalk are at rest the resistance of the whole is generally about 2500 ohms. and this resistance is reduced instantaneously to 200 or 300 ohms by the slightest movement of either the chalk or the spring. Hence it will operate as does the ordinary carbon microphone.

In preparing the chalk, some salt of mercury mixed with caustic soda is used, the action taking place no matter what the proportions are. Preferably mercury acetate is used for the mercury salt. The spring is tipped with platinum or palladium.

There are other forms of electrochemical receivers based on surface action. Breguet used a sort of Lippmann electrometer, modified into a telephone receiver. Gray found in 1873 that vibratory high tension variations increased the adhesion between the finger tips and a metallic plate.

Electrostatic Receivers

As few interesting electrostatic telephones, employing the successive attraction and repulsion of oppositely charged conductors such as the leaves of a condenser, have been made, little will be said of them here. Perhaps the simplest form of electrostatic receiver is the familiar "talking condenser," in which the opposite plates of a condenser vibrate when connected to a circuit of fluctuating high tension. The construction of a practical electrostatic receiver was described in the June, 1922, issue of PRACTICAL ELECTRICS. Another form of electrostatic adhesion receiver was described in the August, 1923, issue. This depended for its action on the friction developed between a polished metal plate and a rotating agate cylinder. The passage of an electric current between the two increases the friction.

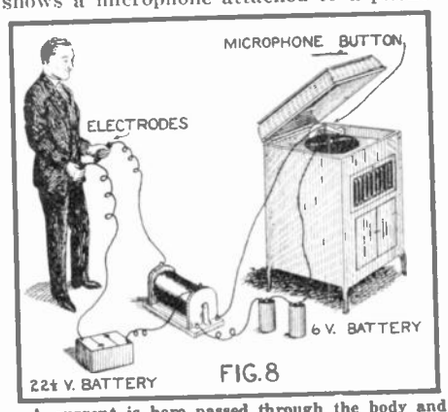
Electrostatic transmitters also have been successfully employed. They consist simply of two metal plates forming a condenser, the capacity of which is varied by the vibrating of one plate when acted upon by sound waves. Connected to a high potential line, the current flows in and out as the capacity is increased and decreased.

Physiological Receivers

Receivers based upon physiological effects are not very practical and will only be briefly discussed here. Perhaps the most curious one comprises a frog's leg attached to a diaphragm. The twitching of the frog's leg due to the fluctuating electric currents sets up vibrations in the diaphragm which are communicated to the surrounding air.

Another modification of this receiver is said to have been resorted to in an emergency when a telegraph operator at a railway wreck received messages by taste as he held his tongue to the wire.

In a physiological telephone—termed the Physiophone—patented by H. Gernsback, the sound vibrations are first translated into electrical impulses and then felt physiologically by the human nerves. This is accomplished by stepping up the voltage of a microphone circuit by means of an induction coil and feeling the high potential impulses by grasping two metal rods which are connected to the secondary terminals of the induction coil. This principle is clearly shown in Figure 8, which shows a microphone attached to a phono-



A current is here passed through the body and it is said that by practice remarkable results can be obtained.

graph and connected to a battery and induction coil. By grasping the two electrodes which are connected to the secondary terminals, the rhythm of the music will be felt faithfully and with astonishing fidelity. A detailed description of this apparatus appeared in the *Electrical Experimenter,* April, 1920.

Figure 8-A shows a method in which the regulation sound box of the phonograph was made into a microphone. The mica diaphragm was removed and a carbon diaphragm substituted. Behind the carbon diaphragm is placed a carbon back plate and the space between is nearly filled with polished carbon grains. The carbon diaphragm, of course, is mechanically connected to the needle just as the mica one was. With this arrangement powerful electrical impulses are set up in the microphone circuit.

Thermoelectric Telephones

There are many practical telephones which depend upon heating effects for their action, and before discussing any of these the reader would do well to refer to the lengthy article on Thermic Telephones which appeared in the October and November issues of this paper. The talking arc light is an example of a thermic

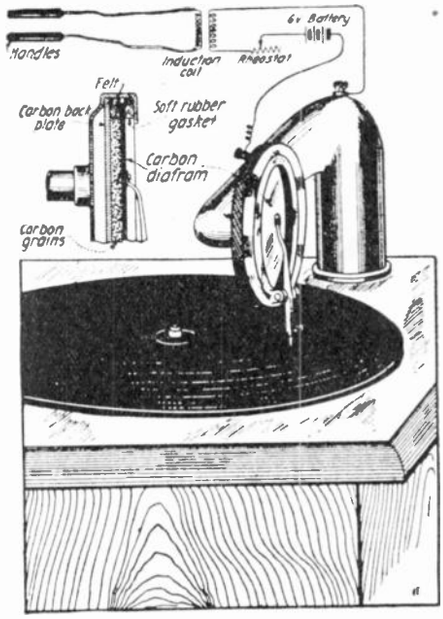


Fig. 8-a. This is a reproduction of a diagram showing the full development of this interesting instrument, originating with Mr. H. Gernsback. It will be found fully described in the article.

telephone, descriptions of which have appeared in earlier issues.

A simple thermoelectric telephone, patented in 1886 by Spaulding, is shown in Figure 9. This instrument is called "Krotophone" and may be used both as a receiver and transmitter. As shown in the illustration, it comprises a pointed carbon pencil in contact with a carbon

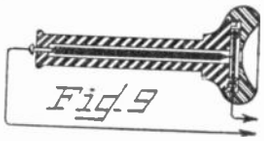


Fig. 9

Very simple thermoelectric telephone. In our issues of October and November, 1923, we gave a very elaborate article on thermo telephones, to which we refer our readers, in connection with these typical instruments.

diaphragm. Current passing through the contact heats the electrodes, which expand and force the diaphragm out. A fluctuating current, therefore, will cause the diaphragm to fluctuate in unison and set up sound waves in the air.

It is claimed by the inventor that the elongation and contraction of the carbon pencil is due to polarization of the atoms or molecules of the carbon, but whatever the action may be there are possibilities of great improvement.

Another thermoelectric receiver patented by Bergmann in 1890 which appears very practical is shown in Figure 10. The movement of the diaphragm in this receiver is produced by the expansion and contraction of the constantly touching electrodes caused by the thermal effect of the current at the junctions of the electrodes. As shown in the illustration, one electrode is attached to the diaphragm and all are arranged so that they may be adjusted to loose contact. The buttons are cylindrical in shape and are of any conducting material faced with tellurium and placed in a tube of glass or other insulating material.

The current passes through the series of electrodes, and at the contacts variations in expansion or contraction of the tellurium are produced by the variations of the current transmitted to the instrument. Vibrations of the diaphragm corresponding to such current variations are produced. An increased effect is obtained by employing a battery in the circuit so that its current will maintain a good working temperature for the instrument, and also act as a polarizing battery.

It is well to note that galena crystals, such as are used for wireless detectors, give excellent results in a receiver of this kind. The galena should be in contact with carbon balls, and a series made up of alternate electrodes of galena and carbon is comparatively efficient. It is noted for the absence of distortion in the reproduced speech.

Figure 11 shows a simple krotophone receiver patented in 1887 by Watkins.

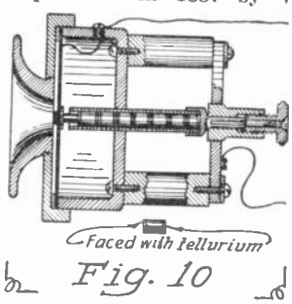


Fig. 10

Another thermic telephone, electrodes contracting and expanding, making the telephone talk.

This receiver has a carbon diaphragm and a cone-shaped metal cup adjacent to it. Carbon balls in the cup maintain a loose contact between the cup and diaphragm. This receiver depends for its action, of

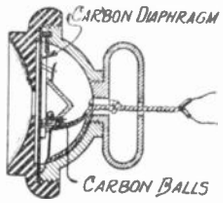


Fig. 11

This is termed a simple krotophone receiver. But again it is a thermic telephone. Loose contacts are heated and cooled during passage of the talking current.

course, upon the expansion and contraction due to the heating effects at the loose contacts during the passage of current.

Molecular Telephones

One of the most interesting types of telephones is the molecular telephone. As yet no practical application of this receiver has been made although many odd models have been developed. The phenomenon was first discovered by Page in 1837, who heard sounds from electromagnets. These sounds were later shown to be caused by magnetic-mechanical strain. Receivers were made based upon the longitudinal expansion and contraction of

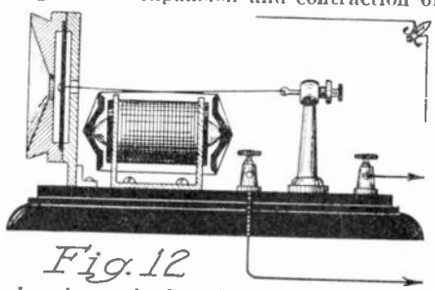


Fig. 12

Ingenious molecular telephone, depending upon action on the wire attached to the center of the diaphragm. The wire vibrates in unison with the talking current as it is acted on by the core of the magnet, which expands and contracts as the field of force changes.

a stretched iron wire magnetized by a coil. Peukert made the field of a large dynamo talk loudly enough to be heard all over a large room. Sounds were also heard from telegraph sounders. Such sounds seem to be molecular and to be

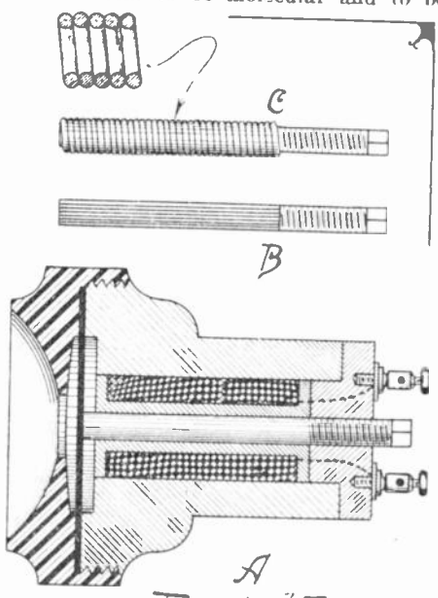


Fig. 13

Another molecular telephone. Here the core of the magnet which may be variously constructed, presses against the diaphragm, which may be of mica, and talks.

distinguished from sounds from a thin diaphragm.

One ingenious type of molecular telephone receiver patented by Field in 1880, is shown in Figure 12. The action depended on the production of vibrations in a resonant plate or diaphragm by multiplying the motion produced by the elongation and contraction of an iron bar surrounded by a coil of wire, when under the influence of an electric current of varying

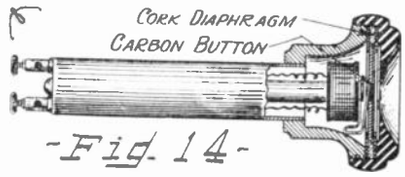


Fig. 14

Molecular receiver with cork diaphragm. As the armature varies in length under varying polarity, it acts upon a carbon button resting on the center of the cork, producing a rasping effect.

strength traversing the coil. Movable angular pole pieces are in contact with the bar as shown, and a wire attached to the diaphragm passes around and over the pole pieces and is attached at its other end to a fixed adjustable post. Hence, the longitudinal vibratory motion of the magnet core is greatly amplified by the lever action of the pole pieces and communicated to the diaphragm by the wire.

A simple molecular telephone receiver patented in 1881, by Eaton is shown in Figure 13. Three forms are shown. At (A) the longitudinal expansion and contraction of the iron bar acts directly on the diaphragm. The diaphragm may be of any insulating material, such as mica. Although a magnetic diaphragm may be used, it is not required, as the pole tip of the electro-magnet is always in contact with the diaphragm. In this receiver a solid iron core is used, but better results are reported with the iron wire core shown at (B), made of a number of soft iron wires in a bundle. The most interesting one is shown at (C), which employs a core shaped like a helical spring, wound so that successive turns are in actual contact. This one is claimed to be far superior to either of the other two, comparable in results with an ordinary magneto-telephone receiver. The helical core is preferably made of annealed piano wire.

An interesting molecular receiver patented in 1882, by Lockwood is shown in Figure 14. The salient features of this receiver are the constructional details of the diaphragm and the method of transmitting the vibrations of the electro-magnet to it. The diaphragm is made of cork or equivalent non-resonant and non-magnetic material, provided with a central button of carbon, forming a hard rasping, and non-magnetic wear plate for the reduced extension or recurved arm of the magnet to rest and act upon. This will

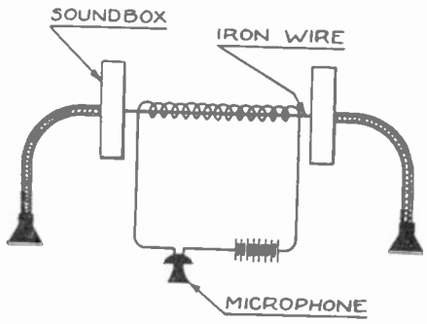


FIG 15

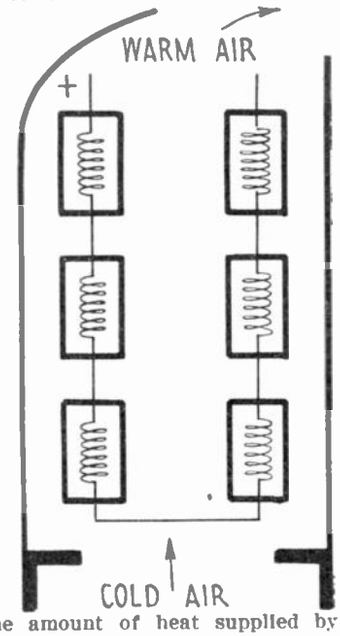
Development of the molecular telephone clearly shown in the diagram, and which will be fully explained in our next issue.

serve to impart the disturbances in the magnet or in the line wire or circuit to

(*Continued on page 348*)

Cost of Electric Heating

A FRENCH contemporary has been investigating the cost of electric heating. In France charcoal is used in the houses in many cases where we would use coal, and charcoal, of course, is an expensive fuel. Our authority puts the cost of charcoal at 300 francs per ton, which at present rates would be $12 to $15, and takes the cost of electricity at 90 centimes per kilowatt, which again is about five cents. It is figured that the cost of one thousand calories from charcoal is about one-tenth the cost of the same amount of heat supplied by electricity.

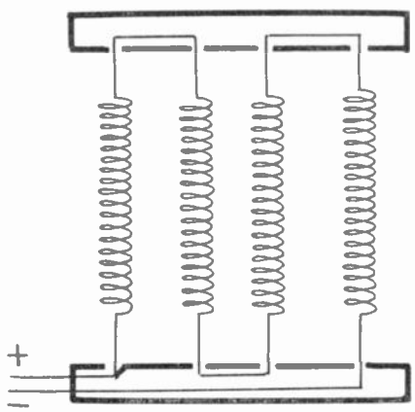


Sometimes it is claimed that an open fireplace will send 90 per cent of the heat up the chimney. It seems the French have a theory that slow combustion stoves heat a room best; this is said to be entirely because the restricted heat is prevented from going up the chimney. In general coal is burned to considerable disadvantage.

With electric heating it is easy to make the waste practically nothing. The electric heater can be put in the middle of the room without any chimney to carry off the heat; for cooking, the heater is put directly into the saucepan. The heat produced is utilized almost up to 100 per cent.

All apparatus of electric heating operate like a lamp and the application of heat may be divided into two classes, one luminous and the other non-luminous. We are all familiar with the parabolic mirror with a heating coil in its center as near the focus as may be, carried by a porcelain or fire clay cylinder. This is heated to redness, because the material of the coil is of high resistance. The temperature of the heating wire is about one-third the number of degrees attained by an electric incandescent lamp. There is little loss by luminous radiation. Tubular lamps with carbon filaments, five or six times larger than those of ordinary lamps, each one absorbing 250 watts, are used as heaters for rooms, so that a battery of four of them will give a kilowatt. Such a battery has a reflector behind it, to throw the heat where it is needed.

The apparatus just described is operated at a red heat at least. By using a larger wire, heating apparatus giving quite obscure or perhaps low red radiations are produced. The resistance wire may be supported in the open air; it may be coiled up around a mica core and surrounded with aluminum, so as to increase the heating surface. The bare wire alluded to above may attain a temperature of about 750 degrees Fahrenheit, while the coils cased in aluminum will keep the plates at a temperature below 275 degrees Fahrenheit.

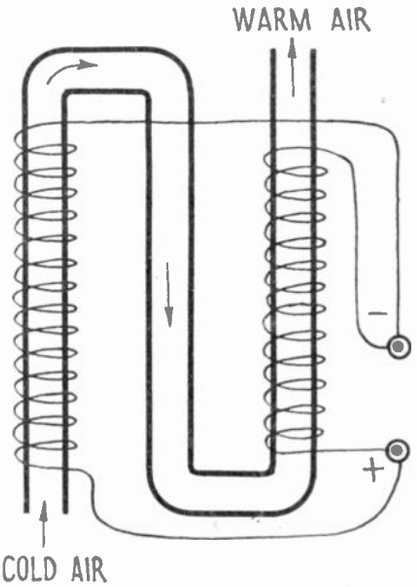


On the left is shown a radiator with deflecting screen. Above is shown the very simple arrangement of heating coils exposed to the air so thoroughly as to give good efficiency. On the right is shown an arrangement for heating pipes which are uptakes for heated air delivered eventually into the room.

A third arrangement comprises a sort of chimney of metal, shaped as shown in the diagram and surrounded by a heating coil. One end of the tubular core, as it may be termed, communicates with the outside air so that a constant current of fresh air heated by the coils is delivered to the room. The rapidity of circulation of the air is governed by varying the current in the heating wires.

Electric energy is sometimes sold at different rates, according to the hour of the day. In such cases a sort of accumulator may be used; large masses of fire brick are heated during the hours when the energy is sold at the lowest rate. It may in some cases be the day time and in other cases the night time. When the hour for high prices comes, the current is shut off and the heated mass of bricks gives off its heat for a long period.

Our authority calculates that with a loss of 90 per cent of the heat of coal and charcoal, electric heating will still cost three times as much on its face. But this difference is in great part compensated for by the absence of cost of maintenance, need of cleaning the apartment, and of deterioration of the furniture and hangings.



But the 90 per cent loss is extreme. Furnace heating is supposed to give back 60 per cent and a gas radiator 75 per cent of the heat. So that here the 100 per cent electric stove is certainly at a great disadvantage. The relative cost comes out fifteen times more for electric heating than for an economical coal or charcoal stove.

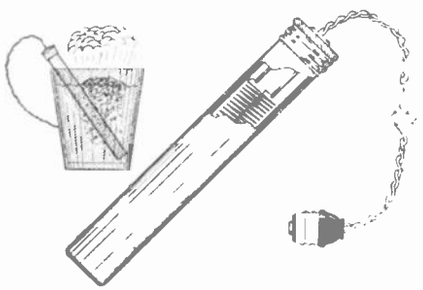
The result reached by the author, F. Honoré, is entirely to the effect that electric heating is very expensive where coal or electricity are used for equal periods. But, of course, there is an immense saving in cutting off electricity the instant we are through with it, and its convenience is making it more and more indispensable to the housekeeper.

Immersion Heater

THE most economical way to heat small quantities of water is with an immersion heater, as all the heat given off by the heater is used. Much less time is required to heat the water to the required temperature than would be necessary if the heat were applied to the outside of the vessel.

An old bicycle pump is used as the shell of the heater shown in the sketch. The inside of the pump is lined with mica, a thin sheet being rolled up and placed inside to insulate the walls, and a circular disk cut for the bottom.

The heating element is a spring-like coil of fine resistance wire. The length of the wire used in the coil depends upon the size of the wire; length, size and material of the wire should be so proportioned that it will heat up quickly. It is then placed in the shell in the manner shown, with the ends twisted around the bare ends of the flexible cord which enters through the hole in the pump cap.



Simple immerson heater for heating liquid in a glass; it is effectual and compact and of home construction.

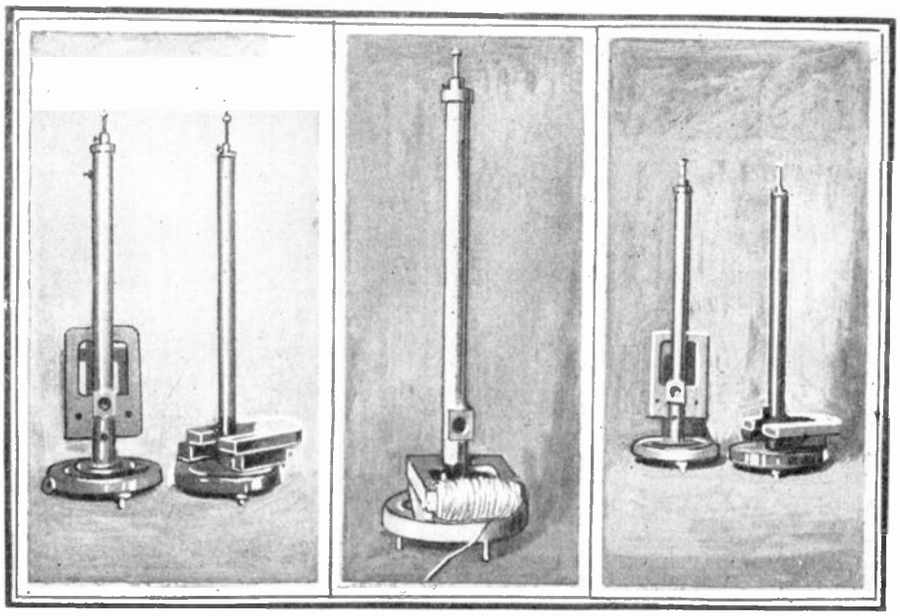
When the connections are securely made the entire space is filled with a very wet mixture of fire clay and water, jarring the pump as the clay is poured in so that the doughlike mass will reach all parts, leaving no air bubbles. A knot is tied in the flexible cord under the cap to take the strain. The other end of the cord is fitted with an attachment plug. As soon as the clay has set the heater is ready for use. Heat slowly until it is perfectly dry.

Contributed by HAROLD JACKSON.

Building a Radiomicrometer

By Dr. Russell G. Harris

THIS is a very sensitive detector of radiation, which can be simply constructed by any electrical experimenter. Recently many articles have been appearing on measuring the heat from stars by means of thermocouples connected to a sensitive galvanometer. Most people do not know that in 1887 Boys invented an instrument, which he called the radiomicrometer, which combines a thermocouple and galvanometer in one instrument, and is easier to construct than either. It has only been used by about half a dozen people since it was invented, and is more commonly known in a slightly different form, where it is employed as a galvanometer to measure high frequency currents, in the Duddell thermogalvanometer. The writer has constructed several radiomicrometers, all of which were as sensitive as most of the thermocouple-galvanometer outfits used for measuring celestial temperatures.



Various illustrations of this very beautiful apparatus are shown above. The apparatus was personally constructed by Dr. Harris.

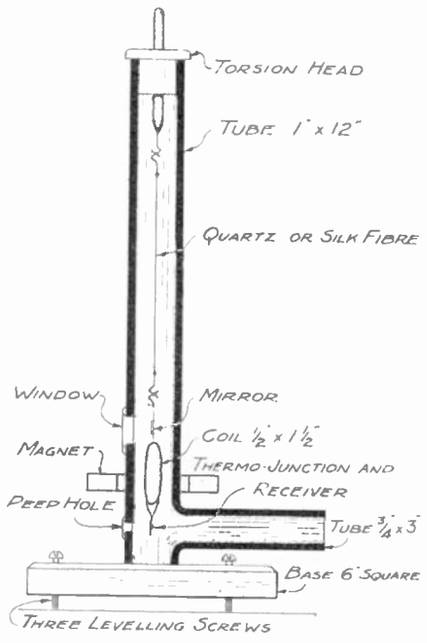
The illustration of the device described in the article explains its principle. When the thermojunction is heated by radiant energy in the form of light, heat, ultra-violet light, or X-rays, a current is sent through the coil. The magnetic field from this reacts with that of the permanent magnet, and deflects the coil. The angular deflection is measured with a beam of light from the mirror, as in a sensitive galvanometer. The instrument is thus simply a galvanometer containing a thermocouple attached to its coil; it has the advantage over the thermocouple-galvanometer combination ordinarily used, however, of having no external electrical connections, a simple coil of one to fifteen turns is sufficient, and the suspending fiber need not be conductive, as in the D'Arsonval galvanometer.

The tube for suspending the coil may be of anything but iron or steel; brass, cardboard, or glass will do, and it should be painted inside and out with a mixture of lampblack and shellac, so as to diminish scattered light. The various dimensions found most convenient are shown in the illustrations.

The wooden base is provided with leveling screws, which can be made by threading machine screws through it. The two windows are cut into the tube on opposite sides, so that the light illuminating the mirror will not affect the thermo-junction. Since any air currents will disturb the instrument, the top window and peep-hole should be closed with thin glass, mica, or celluloid, stuck on with sealing wax or a half-and-half mixture of beeswax and rosin. The window for the radiation receiver should be open if ultra-violet light or radiant heat is to be measured; if visible light is being used, it may be closed with glass. It should in any case be protected with the long receiving tube.

The top should be arranged so as to turn freely in the tube, so that the spot of light from the mirror can be set where desired. The permanent magnet may be of almost any size or shape; one taken from an old bell-ringer, magneto, or ammeter would serve nicely. The mirror should be as light as possible; electrical supply houses generally carry such small mirrors for galvanometers, or they may be made by silvering small pieces of microscope cover glass.

The two most important parts of the instrument, and to which the most attention must be paid for sensitivity, are the suspension fiber and the thermo-junction. The writer makes quartz fibers by taking two pieces of a broken quartz beaker, holding them together an instant in a carbon arc, and quickly pulling them apart. It is easy enough to make coarse threads this way, but only the finest should be used; when held in the air by one end, the other end should float. A silk thread from a cocoon, or even a piece of silk thread, or a very fine wire, may be used, but the great sensitivity of the instrument depends on having a very flexible suspension.



Full outline of the radiomicrometer showing the location of the polarizing magnet.

After the thread is cut to the proper length, two tiny hooks of copper wire are fastened to its ends with sealing wax. Similar hooks are on the bottom of the torsion head and on the top of the mirror staff.

The thermocouple may be made of any two metals, one being taken from each of the following lists:

Antimony
Silver
Copper
Iron
Manganin
Platinum
Nickel
German Silver
Constantin
Bismuth

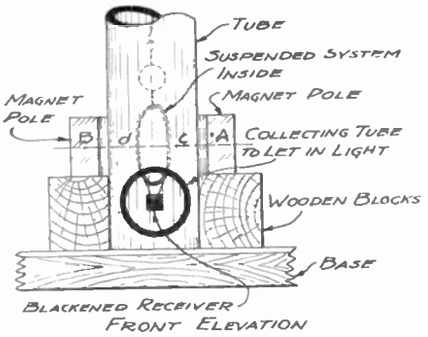
Bismuth and silver are the best and easiest to handle, or bismuth-copper is excellent; copper-constantin would probably come next. If none of these combinations is available, two metals as far apart on the lists as possible should be chosen; *i. e.*, bismuth-antimony is best of all, but rather hard to handle. Since fine strips are desired, the metals, excepting bismuth, may be hammered thin and then sliced with a razor blade. Bismuth should be melted, and hurled down on a flat plate of glass, from which fine strips can be picked with a safety-razor blade mounted on a handle like a hoe.

Take a piece about half an inch long of each of the two metals, if possible as thin as a piece of tissue paper and about the width of the shaft of a common pin, and to the end of the strongest one solder a tiny bead of tin cut from a sheet of tinfoil. This may be done with a welding tool made by inserting a short piece of No. 18 or No. 20 wire, preferably nichrome or iron, in a soldering iron. The wire should not be tinned, as the surface tension will tear fine strips of thermocouple wire. Use a little resin as flux if necessary.

Next weld the other strip to this bead of tin. Then place the junction so formed over the center of a small square of tinfoil, about three-sixteenths of an inch on each side. Put a thin piece of mica over this, and apply the welding tool to the mica; the bead will sink into the tinfoil, yet this will not be melted. Then with the razor-blade hoe scrape the junction from whichever it sticks to, the mica, or the glass plate upon which the work is being done.

Finally make the coil, of from one to fifteen turns of copper wire of any size smaller than No. 28. Bare half an inch at each end of the wire, and solder two small beads of tin to the ends. Then weld the free ends of the thermojunction to these, using the mica as before. Fasten a light staff of wire, or glass drawn out in the arc, to the coil, using a little sealing wax; then fasten the mirror on with

a light touch of wax at its center, and finally the hook. Now very carefully paint that face of the square tin receiver opposite the face of the mirror with a small quantity of lampblack in some shellac, very much diluted with alcohol. When this dries the receiver should be black enough for the metal not to show through, but no blacker.



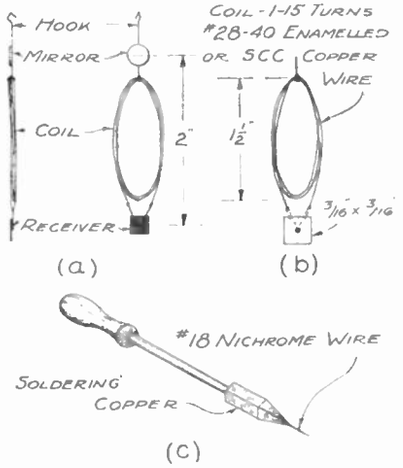
Enlarged view of base of instrument, giving an excellent idea of the operating parts.

The moving coil system may now be hung on its fiber, and this in turn from the torsion head. Very carefully lower the coil into the tube of the instrument, and finally, when it is in place, level the base until the mirror and receiver stand before their respective windows, and turn the head until they face correctly. Then place the magnet in position.

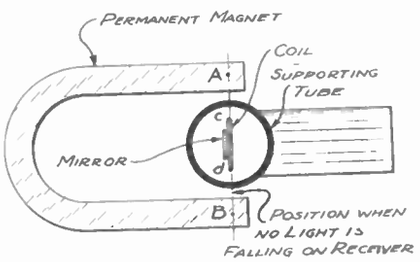
Sometimes there is enough magnetic material in the wire of the coil for the fiber to refuse to turn the coil even when the torsion head is twisted clear around; if this is found to be the case, a coil should be made of a different sample of wire, or else fewer turns used. In some cases a single turn is found best. Any magnetic material in the coil gives the magnet control over it, and is equivalent to having a coarser fiber; hence this should be avoided.

A scale may be constructed by stretching tracing cloth or waxed (or oiled) paper on a frame. A weak spectacle lens can be obtained for a few cents from an optician; it should be as weak as possible, preferably having a focal length of two feet or over. Set an incandescent lamp, covered with a light-proof screen containing a slit arranged so as to let light from only one filament shine out, so that the light goes through the lens and strikes the mirror. The distance from the light to the lens should be such that an enlarged image of the light is formed on a screen about four feet away from the lens. Place the lens six inches or so from the mirror; then put the scale where the reflected image of the filament is in focus, no matter on what part of the scale it may fall when the mirror moves.

When the radiomicrometer is properly shielded, the spot of light on the scale should remain quiet. A candle held in front of the receiver opening should produce a large deflection of the light spot; if it goes the wrong way, turn the magnet over. If, when a candle is placed a yard from the receiver, and the scale is a yard from the mirror, the candle flame produces a deflection of over a foot on the scale, the instrument is as sensitive as it can easily be made, and is quite sufficiently so to measure the heat from a star with the large telescopes used for the purpose.



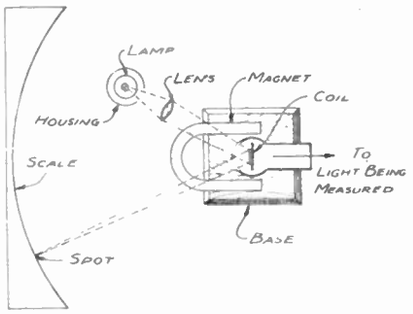
Further details of the manipulation and construction of coil and thermocouple with special soldering iron.



Disposition of polarizing magnet and coil in base of apparatus.

If the sensitivity is less than this, it can probably be increased much by doing one or more of the following:

1. Using a finer suspending fiber, or a longer one.
2. Using fewer, or more, turns in the coil.
3. Making the magnet stronger or weaker.
4. Using a lighter mirror, coil, etc.
5. Making the receiver larger.
6. Using less or more lampblack on the receiver.
7. Using different metals in the thermo-junction. The first thing mentioned is the most important. It should take the mirror over half a minute to swing from one side to the other. If no deflection at all is obtained, the thermo-junction circuit is probably open.



Relation of apparatus to concave scale, lamp and focusing lens.

The experimenter will be able to think up plenty of things to try when he has the instrument completed, but a few possibilities may be mentioned:

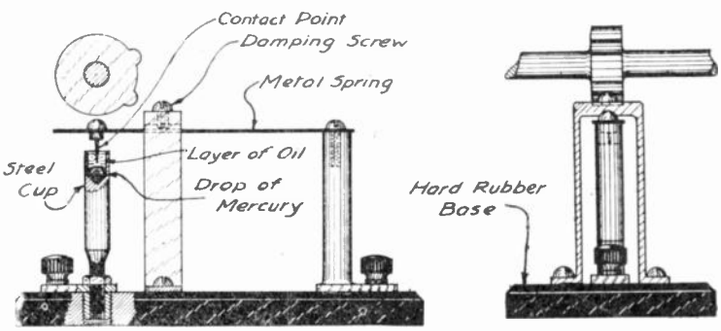
1. Shine sunlight from a mirror through a reading glass, focussing it on the receiver. Be sure it is not too strong; probably no lens will be necessary. By observing the deflections, you can tell when an invisible cloud of water vapor passes across the sky. This makes a pyrheliometer.
2. Since the instrument will indicate the heat radiated from a human hand or face twenty feet away, you can tell when someone gets in front of the receiver in the dark.
3. By comparing deflections, you can measure very accurately the energy in two light sources, and compare their intensities. If the light shines through a glass vessel with flat sides containing water, much of the heat rays will be filtered out, and what is left will be the visible energy.
4. The absorption of a pane of glass can be measured by taking the deflections before and after it is inserted in a beam of light.
5. Long distance signalling can be done by shining sunlight steadily towards the radiomicrometer, focussing it on the receiver with a lens, and varying the intensity of the light by slight amounts. In this way no one will see any flashes, or be aware of signalling, but variations will be apparent by watching the spot of light on the scale.

Many other experiments where a very sensitive detector of radiant energy is useful present themselves when the instrument has been built. In an early issue, directions will be given for adapting the above instrument to the measurement of very minute currents of any frequency, a feature very useful in radio experimenting.

Mercury Contact Hand Key

A RELIABLE hand key is something very much desired in the electrical laboratory. The apparatus pictured here is such a centrivance for small currents and has been used with excellent results to operate relays and instruments of a similar type.

A platinum or nickel contact-point is mounted on a metal spring. In order to close the circuit this contact-point is depressed slightly into a drop of mercury, located at the bottom of a steel cup. On top of the mercury floats a layer of oil which suppresses sparking. The contact-points is always submerged in the oil.



Very interesting hand key, which utilizes a mercury contact, the mercury being covered with oil to prevent oxydation.

To prevent harmful vibration of the contact-carrying spring a simple damping device is provided. When it leaves the mercury and springs upward contact with the damping screw restricts its motion and prevents vibration. The mercury contact covered with oil is protected from oxydation and evaporation; in a sense it is a self-renewing or self-clearing contact.

Contributed by ERNST KEIL

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

First Prize, $25.
Joe Cerny,
541 E. 72nd St., New York City.

Second Prize, $15.
Harold Jackson,
R. 4, Box 141, Kankakee, Ill.

Third Prize, $10.
Albert Law,
44 Somerset Ave., Taunton, Mass.

First Honorable Mention—Sherman Hafley, 821 N. 4th Street, Albuquerque, N. M.
Second Honorable Mention—Jacob Schmidt, 255 S. Caroline Street, Baltimore, Md.
Third Honorable Mention—Orville N. Bonnett, Box 103, Birmingham, Iowa.

First Prize
Dry Storage Battery

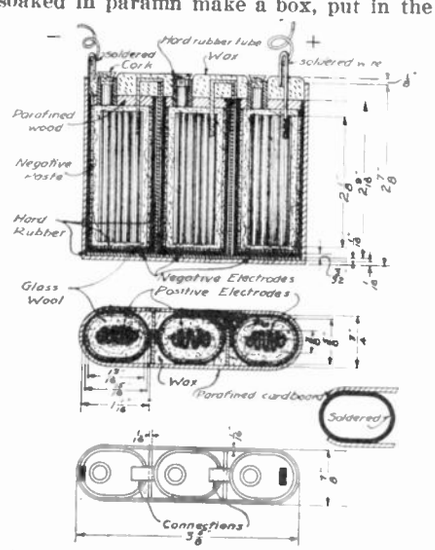
By Joe Cerny

LAST summer several readers requested the Editor to publish a description of a dry storage battery. After many experiments I found one simple but very effective type of small dry storage battery; it can be used on bicycles to operate the bells for motor boats, etc.

The negative electrode in each cell is a lead tube and serves also as an acid recipient. To prevent the leakage, solder the bottom and the side seam very carefully. On the bottom of the tube put a piece of glass or hard rubber; then solder the connections. Before pasting, clean well inside with sand-paper. For negative paste use 75 per cent litharge, 25 per cent red lead and enough battery acid to make a stiff paste.

Positive electrode. Give to the positive electrode the form as shown in the illustration. Solder connections, rasp terminals and clean well with sandpaper. For positive paste use 80 per cent red lead, 10 per cent litharge and 10 per cent magnesium sulphate, $MgSO_4$. Add diluted sulphuric acid to make a stiff paste. Let the plates dry in a ventilated room for three days. After the positive electrode is dry wind two or three layers of glass wool on the electrode and tie with asbestos wire. The finished and wrapped positive electrode must fit the negative tube tightly.

For the lids use ⅛ or 3/32 inch hard wood, well-soaked in paraffin. Drill two holes in the lid, one for the connection, the other for the acid tube. The battery is now ready for assembling. Solder the connections together and put the separators between the cells. With a cardboard soaked in paraffin make a box, put in the



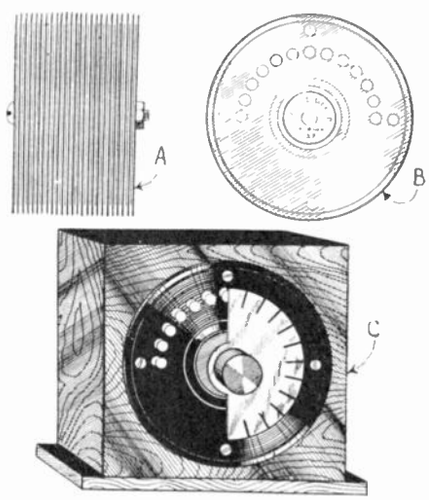
A storage battery along the lines of a dry battery, so-called water glass being used to produce a silica jelly to retain the liquid.

battery and seal. For sealing I used the following composition: Broken phonograph discs, tar, paraffin; when melted add shellac. Keep the acid holes closed, pour the wax slowly between the cells and the tops of the cells. Let cool, then pour in the acid. The acid will dissolve the asbestos wire in two days and loosen the glass wool.

The battery must be formed with very weak current, 0.25 amperes for 5 to 6 days. The capacity is about 2 ampere-hours, weight one half pound.

Second Prize
Phonograph Record Condenser

By Harold Jackson



Very elegant condenser made with old phonograph discs as the dielectrics.

THE dielectric of this adjustable condenser consists of a number of five-inch diameter phonograph records.

The records are supposed to be too badly worn to be of further value for their musical qualities. As shown at (A) they are clamped together by an insulated bolt with circular sheets of tin-foil between them. A one inch hole is cut in the center of each sheet to provide ample clearance around the central tie-bolt. Thin brass leads are connected to each tin-foil sheet before assembling.

The condenser, thus made up, is placed in a small box made of thin wood 6 inches long, 6 inches deep and 4 inches wide. To the front of this box is secured, by means of four small screws, another record of the same size with a number of ⅛ inch holes drilled through it as shown at (B). This record forms the switch panel and is mounted on the front of the box as shown at (C).

The semi-circular row of holes are provided with switch points, the number of which depend on the number of plates in the condenser; one point being required for each pair of plates. Alternate sheets of tin-foil are connected to these points. In the center of this record is mounted a rotary switch with a fan-shaped blade, which is slotted at intervals, corresponding with the spacing of the switch points, to insure contact with all the points covered by the switch.

Turning the switch varies the capacity of the condenser. Two binding posts are provided at the back, one is connected to the switch, the other to the remaining half of the condenser.

$50 IN PRIZES

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

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

Total $50.00 in gold

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

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

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

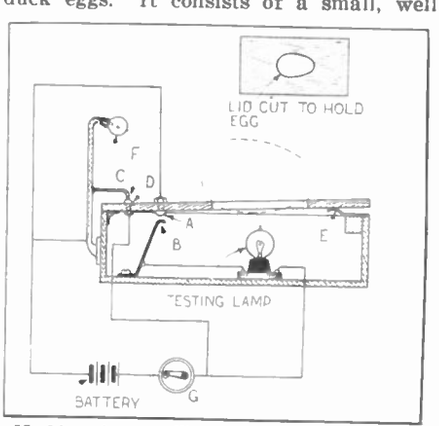
This prize contest is open to everyone. All prizes will be paid upon publication. If two contestants submit the same idea, both will receive the same prize.

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

Third Prize
Electric Egg Tester

By Albert Law

THIS egg tester has been very useful to the writer in the hatching of hen or duck eggs. It consists of a small, well



Machine for candling eggs. This turns the light on and off automatically.

made, wooden box with hinged lid. The lid has a hole cut in it, to hold the egg as shown. When the lamp is not being used for testing, the small leaf-spring at (E) holds the lid up and makes contact at (CD) causing the current to flow through the small lamp (F), giving light to see the condition of the eggs to be

tested, in the trade term to "candle" them.

When an egg is placed in position on the lid, the weight of the egg forces the lid down, breaks the contact through the small lamp at (CD), and makes contact at (AB), thus lighting the big lamp light under the egg; the egg can then be examined for fertility or newness. When the egg is removed from the lid, the spring (F) raises the lid, breaks contact at (AB) and makes contact with the small lamp at catch (C), thus lighting the small lamp.

A switch is placed at (G) to disconnect the battery.

1st Honorable Mention

Mending Electric Lamp Filament

By Sherman Hafley

THIS is an idea for making burnt out bulbs useful again for a certain length of time according to care exercised.

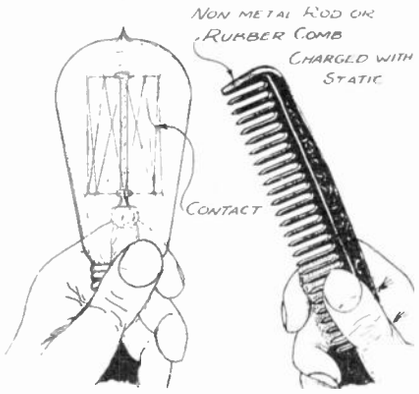
When the filament becomes broken or burnt out the bulb is usually discarded, but it can be rendered useful again, by static excitation.

If there is only one break in the filament it may be repaired as follows:

The attraction between one object is utilized. A rubber or amberoid comb which has been run through the hair gives an ideal method. See that the charged end does not come into contact with a ground or it will be discharged.

After charging the comb, or other suitable article, tap the bulb and hold the comb near the longer end of the broken filament. It will be attracted by the static charge on the comb, and, due to this fact, it may be drawn across the nearest wire, thereby shorting the broken place and completing the circuit so that the bulb is in working order once more. The end of the filament will adhere to the other portion readily the instant current passes and, with a little care, will remain attached a long time. However if it should become dislodged, it is only necessary to repeat the process.

This process decreases the resistance of the lamp, thus making it burn brighter than formerly.



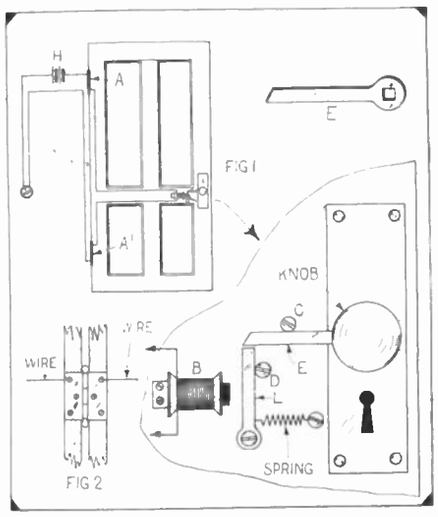
Repairing broken filament of a lamp by static attraction. It is to be hoped that our readers will succeed in accomplishing this with some of their derelict lamps.

We often hear of lamp filaments being rewelded by shaking while the circuit is connected. This seems a very uncertain method, but what is shown above is more mechanical and practical. The idea is that an instant welding will take place.

2d Honorable Mention

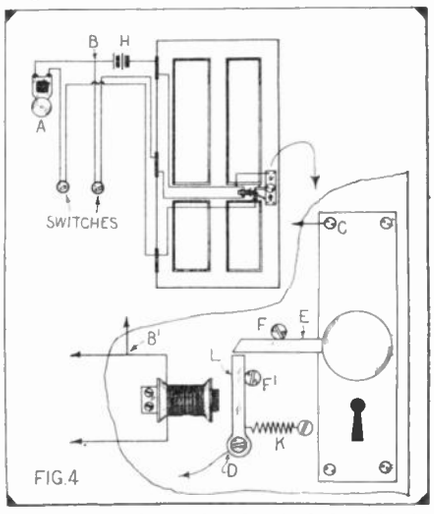
Electric Door Opener

By Jacob Schmidt



Details of an electric appliance for a door lock, which prevents the knob from being turned until a button which may be at any distance is pressed, so as to close the circuit.

AS is shown in the illustration, Fig. 1, it is impossible to open the door due to the fact that the knob cannot be turned upward on account of (E) being stopped by the screw (C), and cannot be turned downward on account of (E) being stopped by (L). When, however, the circuit is completed, (B) becomes an electromagnet, and attracts (L), thereby preventing interference with (E); the knob can then be turned, thus making it possible to open the door.



Further details of the electric lock, this time embodying a burglar alarm. The least tampering with the knob will make the alarm ring.

The accompanying drawings illustrate clearly how the wiring is done. Fig. 1 shows the general arrangement. Fig. 2 shows the connection on the hinge, and Fig. 3 shows the disposition of (E). In order to attach (E) do as follows: remove the knob from the bolt to which it is screwed, then place (E) on the same bolt.

For explanation of the symbols used in the explanation refer to the key below:

(A) and (A1) are the hinges and (B) is an electro-magnet; (C) is a screw which prevents the rod (E) from moving upwards; (E) is the stop rod placed on the same rectangular stem to which the knob is attached. (H) is the battery; (L) the rod which is attracted by the electromagnet; (D) is the screw which prevents the spring from drawing the rod beyond this point; (R) is a screw by means of which (L) is fastened to the door.

Fig. 4 is the door opener in combination with a convenient knob-bell which serves as a burglar alarm at night. The operation of the door-opener is the same as the one described in Fig. 1. The operation of the alarm is as follows: When the knob is turned (E) touches (L), completes the circuit running from the battery through the upper hinge, lock, plate, lower hinge, and switch, thus causing the bell to ring. During the day this is a signal to open the door, whereas at night it is an excellent burglar alarm.

In this slightly more complicated appliance (A) is the bell; (B) and (B1) connections; (C) screw of lock plate to which a wire running from (B1) is connected. (D) is the screw by means of which the bar (L) is attached to the door. (E) is the bar which placed on the same rectangular shank to which the knob is secured. (F) is a screw which prevents knob from being turned upward; (F1) screw which prevents (L) from being drawn beyond the point by the spring (K); (H) battery; (K) spring which will draw (L) back in place when circuit of electromagnet will be shut off.

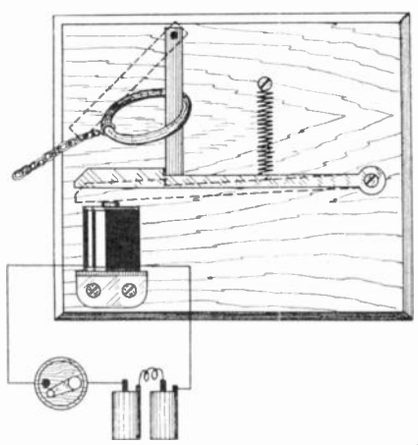
3d Honorable Mention

Electric Dog Release

By Orville N. Bonnett

THIS contrivance is for those who keep a watch dog but do not wish to leave him loose at night. By installing the arrangement in the dog house and slipping a ring over the trigger the dog is held.

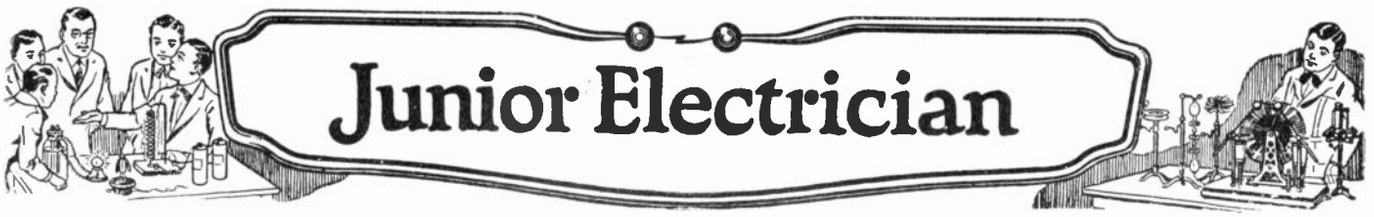
The wires are run to the house; they are best concealed underground and led into the bed chamber where a switch and batteries are placed. By closing the switch the latch is pulled down, releasing the dog in case of danger.



Electric attachment to hold a dog fast, but which can be released from the interior of the house by closing a switch or pressing a button so as to protect the house from an intruder.

A Mercury Flashlight for Photography

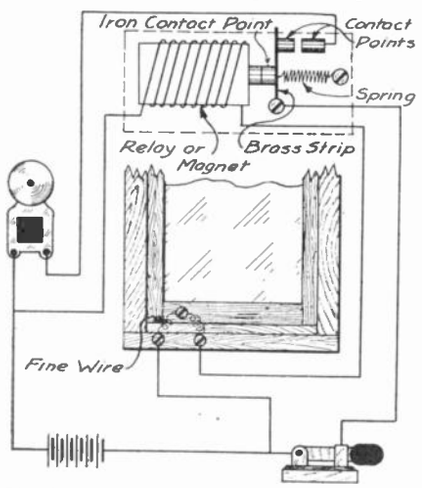
THE *Japanese Journal of Physics* contains a paper by Kyoji Suyehiro on an "Electrically Deflagrated Mercury Filament as a Flashlight for Instantaneous Photography." In investigations on the taking of photographs of rapidly moving objects Professor Anderson's experiments on electrically deflagrated wires as a source of light led to a trial of this method with fine tin and copper wires, but the results were not encouraging. Filaments of mercury were tried with success. Mercury is sucked up into a glass capillary tube, and in each end of the tube a "hair wire" is secured with sealing-wax. Thus filaments of any size are easily prepared. The duration of the flash is shorter as the filament is reduced in length and diameter, and it is also affected by the thickness of the wall of the tube. The most intense light is given out by the mercury arc lit just *after* the explosion. The paper is illustrated with photographs of flashes.



Closed Circuit Burglar Alarm

THE alarm illustrated is of the last degree of simplicity, so much so that the illustration is self-explanatory.

There is a magnet with armature, the latter on a vertical spring or arm pivoted



This burglar alarm operates on a closed circuit, but one of very high resistance, so as not to waste battery. When a thin wire is broken by the opening of the window, the magnet ceases to operate and the armature drawn back from it closes the contact so that an alarm bell is rung.

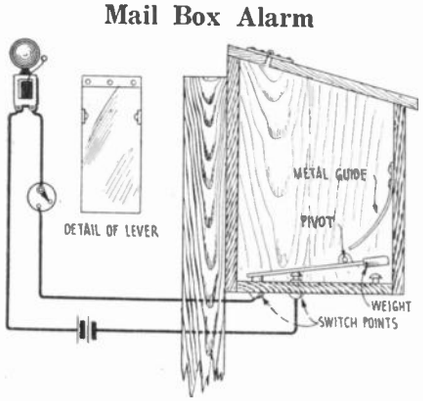
at its bottom. When the armature is attracted to the magnet the bell or alarm circuit is open. The local circuit, or the one which excites the magnet, is completed by a very thin wire, two of whose ends are attached to screws in the window frame, while its center is looped over or attached to a screw in the window sash.

By having a high resistance magnet, but little current will be used in keeping the armature in contact with the magnet. It is well to have a small piece of paper cemented to the armature so that metal will not come in contact with metal.

If the window is opened the thin wire will inevitably be broken. This opens the local circuit; the electro-magnet is no longer excited, the armature leaves it and closes the relay circuit, and the alarm bell starts ringing and keeps on ringing until the switch is opened by the occupant of the house.

Contributed by IRVIN E. PIPPIN.

Mail Box Alarm



In this letter box, designed for rural mail delivery, when a letter is inserted it strikes a delicately balanced platform, closes a circuit and rings a bell. The bell rings until the switch is opened or the letter removed.

WHEN the rural mail box is located some distance from the house it is convenient to be notified when mail has been dropped into it. This can be accomplished by means of a simple electric bell alarm as shown.

A light but stiff metal plate is fashioned to fit loosely inside the box and to swing on pivot screws fastened to each side. The short end should be weighted as shown in detail. Provide a stop under the weight so that the plate will normally be level.

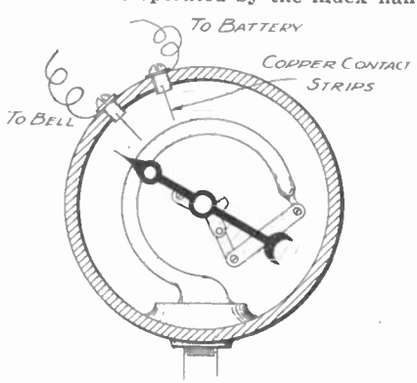
Under the free end of the plate place two contact points as indicated. The rear one must be low and the front one must be provided with a screw, which can be raised or lowered so that an exact adjustment can be obtained. Then fasten a metal guide to the inside of the front which will prevent mail from landing on the weighted end, thus preventing it from rising as it should. Wire the two contact points to the house and connect to a door-bell switch and battery.

When mail lands on the plate it tips down, makes contact with switch points and rings the bell. The bell can be stopped ringing by throwing out the switch until the mail has been collected. This idea is adaptable to round metal boxes as well so long as parts are kept insulated.

Contributed by L. B. ROBBINS.

Steam Electric Alarm

AN ordinary pressure gauge may be easily equipped with a simple home-made contact operated by the index hand



A regular steam gauge is fitted with two thin copper strips which are brought into contact by the index hand when the pressure becomes too great or too little according to the arrangement. This rings an alarm bell to notify the engineer.

of the gauge, which may be connected in series with a bell or buzzer. This device will give an engineer a signal when the steam reaches too high or falls to too low a pressure.

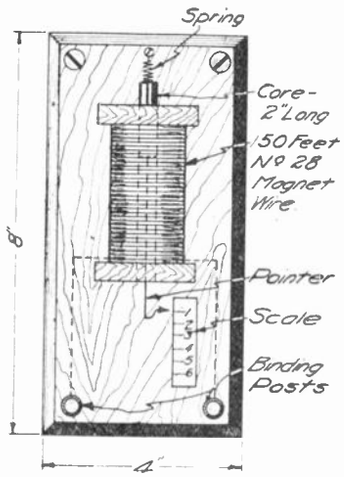
Two swinging contact strips of copper are suspended from the frame of the gauge. The hand is set by another gauge so that it will push the strips together at a pressure a few pounds less than required to operate the alarm bell circuit. The contact will close the alarm in the engine room.

The tap for the alarm gauge can be taken from the column and led to the gauge located on a shelf near it. The batteries and wire are inexpensive. An arrangement of this kind will relieve the engineer's mind of a great deal of worry.

Contributed by H. S. BABCOCK.

Low Voltage Voltmeter

OBTAIN a piece of brass tube one-half inch in diameter and four inches long. Make two wooden ends for the coil, each being two inches square. Drill a round hole in the center of each which will fit tightly over the brass tube—one at each end.



A solenoid voltmeter. This can take care of heavy current, operating at a comparatively low voltage.

Next wrap with 150 feet of No. 28 magnet wire. Make a wooden base eight inches long and four inches wide, and mount the coil in the center. Suspend a 2 by ⅜ inch rod by a small spring so that it goes down to a depth of one inch into the coil.

Attach a stiff copper wire to the bottom of the iron rod. Bend the wire to serve as a pointer.

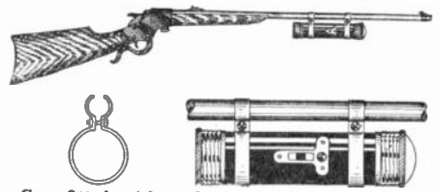
Contributed by HOWARD S. BABCOCK.

Rifle Flashlight

THIS device consists merely of an ordinary flashlight clamped to the rifle barrel by two special clamps which hold the light securely in place.

A light carried in this position is especially valuable to the trapper who visits his traps during the night; also to the hunter of raccoons or opossums, as it throws the light exactly where desired and leaves both hands free to operate the gun. Such a light also furnishes illumination for target practice at night. The weight of the flashlight being light, the balance of the rifle is not affected.

The clamps are made of strap iron one-half inch wide and one-sixteenth inch thick, bent into the shape shown. A small stove bolt placed between the light and



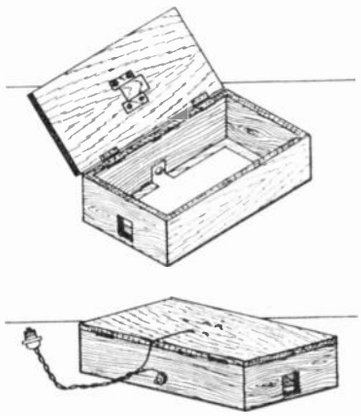
Gun fitted with a flashlight clamped on below the barrel, for use in night work.

the rifle barrel is used to draw each clamp together. The flashlight is easily detached by loosening the two bolts and sliding it off over the end of the barrel.

Contributed by HAROLD JACKSON.

Electric Mouse Trap

THIS trap is one which anyone who can handle a screwdriver can build. Moreover, its use will be unaccompanied by any disagreeable or dangerous results. The materials required are a cigar box (about two inches high), a small piece of window screen, and a small sheet of tin or other metal, five stove-bolts, and a couple of pieces of wire.



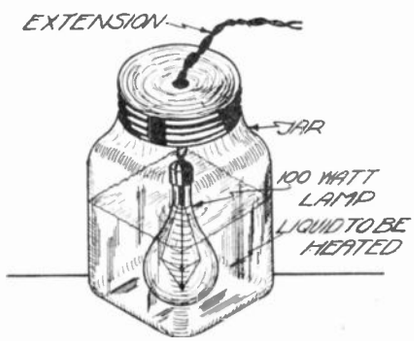
Electric mouse-trap of the simplest possible description, made from a cigar box.

By referring to the illustrations the construction hardly requires elaboration. The screen is bent so as to form a box about half an inch high and open at one end so that the cheese may be placed in it. This is attached to the top of the box with four of the bolts, one of which forms a binding-post for current connection. The plate should cover that portion of the box directly under the bait, and should be cut so that a lug may be brought through the box at the rear. To this lug the other stove-bolt should be fastened so as to form the second connection. A hole is cut through one end of the box; this forms the entrance for the mouse.

Connect the wires to a plug so they may be disconnected when it is desired to empty the trap. The operation of the trap is simple. Place cheese in the trap in the little bait box, connect the plug and wait for the mouse. The mouse after having entered stands on the plate and reaches for the cheese; his nose (a sensitive place) comes into contact with the charged screen, and there is one less mouse. The dead mouse falls to the bottom of the box, thus breaking the circuit and avoiding leakage of current.

Contributed by ROBERT A. WILKINSON.

Heater for Liquids



How to heat liquids when you have not got at hand an immersion heater or an electric grill. A simple lamp does the work.

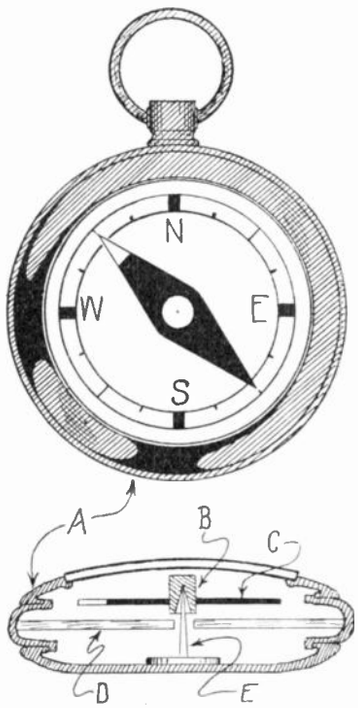
THE illustration shows a very simple device for heating water, milk, coffee and other fluids, and which is especially useful for the sick room or where a small amount of hot milk or the like may be required for a child. It obviates the necessity of building a fire, is quicker in operation, and could also be used to keep liquids hot.

The device is simplicity itself. A jar is provided whose mouth is large enough to permit the introduction of a lamp. For a half gallon jar a 100-watt lamp may be used. It is suspended from the cover of the jar, if there is one, the cord passing through a hole in the center thereof, or a cover can be improvised from a block of wood or perhaps from a shallow tin box.

The essential point is that the lamp shall not be immersed much beyond the globular part, to avoid short-circuiting. If a small amount of heat is desired, a small lamp may be used, and with the same lamp the heat may be considerably varied by changing the depth of immersion of the lamp. If the hole in the cover is made a bit too large for the flexible cord, a conical pin may be provided to wedge it in place so as to maintain the lamp at exactly the proper level.

Contributed by EARL R. COMSTOCK.

Watch Case Compass



Very nice arrangement for making a pocket compass, using an old watchcase, presumably an Ingersoll, to contain card and needle.

THE compass illustrated is constructed in an old watch case, rendering it a very convenient instrument to carry. The movement and stem are removed from the case.

As shown in the sectional view the magnetic needle (C) is pivoted on a brass pivot (E), which is soldered in the back of case (A). The needle-bearing is constructed as shown at (B), so that the needle will balance and is free to turn when the compass is placed on its back. (D) is a card board dial upon which the directions are indicated as shown.

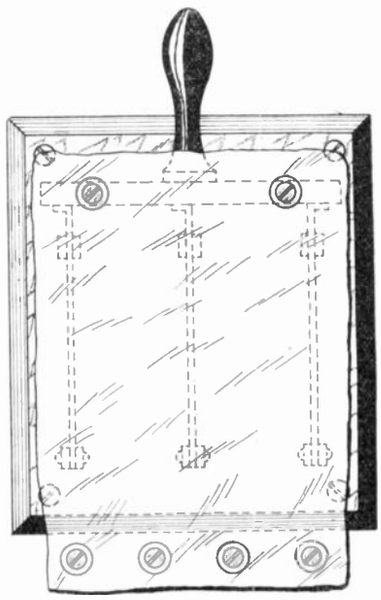
The needle is magnetized and painted black with the exception of the tip of the north pole, which is left bright. The pivot (E) should be high enough, so that the needle cannot become displaced when the compass is in a vertical position. The watch case must be brass or some other alloy that does not contain iron.

The feature which would make the watch case a good magnetic shield to protect the original movement would make it useless for a compass case.

Contributed by HAROLD JACKSON.

Guarding a Knife Switch

WHERE an ordinary knife switch is to be used, temporarily or otherwise, fastening a piece of an old inner tube over it will insure safety and prevents accidental contact with the live parts.



Knife switch protected from contact with the person by being encased in a piece of automobile tire inner tube.

Where a double-throw switch is used, slits may be cut in the rubber and both sides of the blades will be protected by the rubber apron.

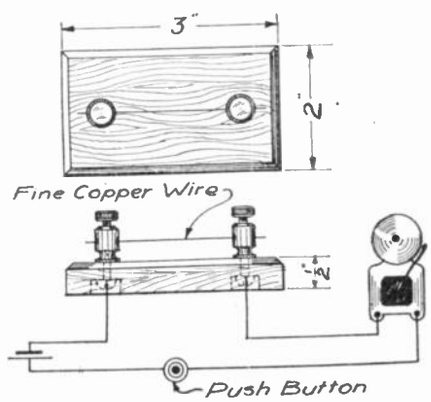
The same idea may be adapted to protect ordinary push-button flush switches when exposed to moisture and weather, by leaving sufficient slack so as not to interfere with the buttons.

Contributed by C. R. MULLIN.

Dry Cell Safety Fuse

A WOODEN base is cut as shown, measuring 3 inches by 2 inches. Two holes are drilled in each end, one for the circuit's binding post and one for a fuse wire. The terminals from the circuit are led in through the back of the block.

The binding posts are used to make good connections with the thin copper wire which may be taken from flexible lamp cord. Connect up as shown. Such a fuse will be useful in connection with anything operated by dry cells, as it will prevent



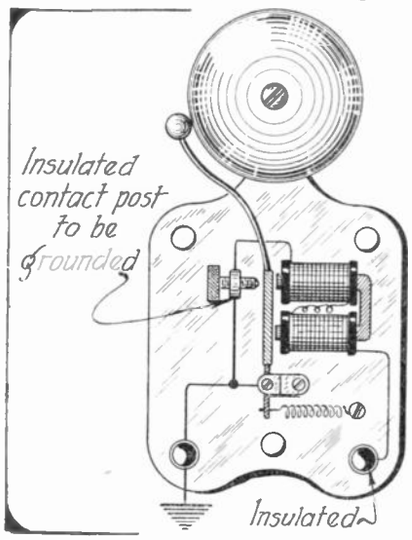
Simple safety fuse, which, however, may operate to preserve a dry cell from exhausting itself due to short-circuit.

dry cells from becoming run down through short-circuiting.

Contributed by STANLEY NORASKA.

Connecting Bells in Series

IT is not generally known that when bells are wired in series one should always be a single-stroke bell. If this arrangement is not followed, the bells ring very



Grounding of a contact point of a bell; it is taken as representing one or more connected in series with a master bell; the latter acts as a vibrator for all the others.

weakly, or else ring as though there was a swinging open circuit in the wiring.

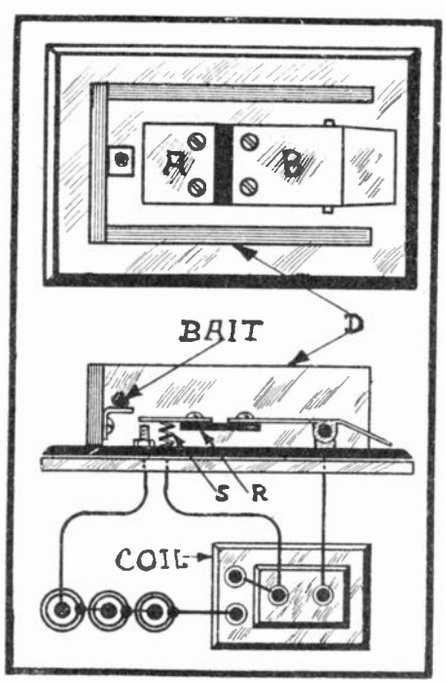
On nearly all vibrating bells, the contact post is insulated. By grounding this post the bell becomes a single-stroke bell.

Since the other vibrating bell is in the same circuit, it makes and breaks the circuit for the single-stroke bell, acting as a master vibrator. This will cause the single-stroke bell to vibrate in unison with the other bell, giving a distinct ring.

Contributed by LOUIS LIND.

Electric Rat Trap

THE electric rat trap described in the following operates in connection with several dry cells and a spark coil. As it



Rat trap, this time more elaborate than in the usual construction, and supposed to do the work without exhausting the battery.

would be uneconomical to have the spark coil permanently connected to the batteries, the trap is so arranged that, when the rat in going after the bait places itself across the secondary terminals of the spark coil, its weight brings two contacts together, which start the coil in operation.

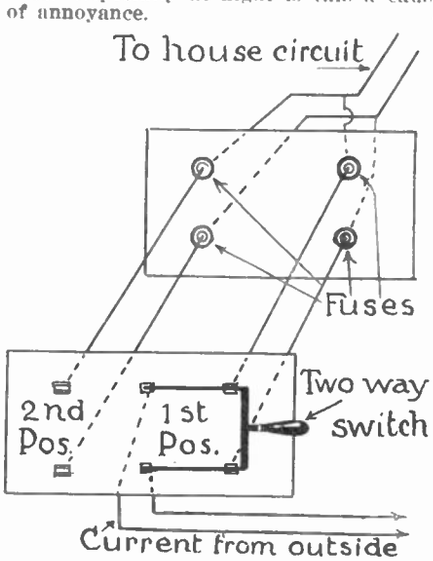
The electrocuting platform upon which the rat walks comprises two metal plates (A) and (B), insulated from each other by a piece of hard rubber (R) and arranged on a base as shown. Two pieces of wood (D) prevent the rat from coming in on the trap sideways. The lower drawing shows a side view of the trap with one of the pieces (D) removed. It also shows how the batteries and spark coil are hooked up. The tension of the spring (S) should be just enough to support the platform.

Any number of these traps can be constructed and operated from the same spark coil. The buzzing of the coil vibrator will give warning that something has stepped into the trap. In some cases the rat will be thrown some distance from the trap, due to the contracting of its muscles, which is caused by the shock received.

Contributed by AMEDEO GIOLITTO.

Fuse Connection

FUSES burning out often cause a troublesome hunt for extra ones which have been misplaced. There is also trouble in taking out old fuses and putting in good ones. Especially at night is this a cause of annoyance.



By the use of a double pole switch a new pair of fuses are thrown into the house circuit instantly, when one of the old ones burns out, giving plenty of leisure to replace the missing one.

The illustration shows a plan whereby much of this trouble may be avoided. It shows a two-way switch and double fuse blocks. When one or both fuses on one set burn out, the switch may be thrown into its second position, thus cutting out the burned fuses and throwing a new set into the circuit.

Contributed by GEORGE EDWIN HOWARD.

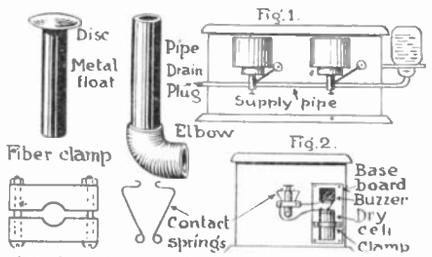
Oil Stove Alarm

FREQUENTLY the wicks of an oil stove burn out because of the kerosene supply being exhausted, causing much bother and some expense. The alarm illustrated obviates this occurrence by giving audible warning when the fuel supply is low.

The device is composed of a dry cell and buzzer and contact-maker attached to the further end of the supply pipe. Figure 1 shows the drain plug on the oil stove, which is to be removed and the contact-maker substituted. This consists, as shown in Figure 3, of a small elbow and piece of pipe, in which pipe a metal float is placed. This float is made of a closed tube to one end of which a disc is soldered. The clamp, carrying the contact springs, is constructed of two fiber pieces, as shown, and two bolts to tighten the clamp and carry the contact springs.

The alarm compactly installed and ready for use is illustrated here. To set the alarm correctly, fill just the supply pipe with fuel and adjust the clamp so that the disc on the float completes the circuit with the contact springs and the buzzer sounds. Now place the fuel tank in place and the buzzer will become quiet, sounding only when the tank is empty.

Contributed by CONSTANTINE TEOY.

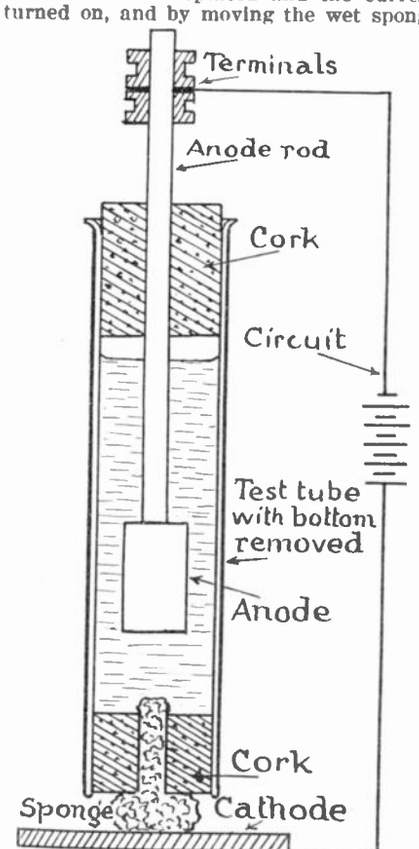


Attachment to an oil stove. The oil stove has a floating contact connected to a buzzer, so that when the oil falls to the bottom the buzzer will give the alarm of "low oil."

Electroplating Without a Tank

WITH this home-made apparatus electroplating without a tank is made possible. It is made up of an old test tube, two corks, a sponge and a threaded rod, plus two old dry battery terminals. The anode is either cut from sheet copper, or nickel, as you may require. For copper plating the electrolyte is a strong solution of sulphate of copper. For nickel plating the solution is one of double nickel-ammonium sulphate. Other metals may be plated from the standard solutions.

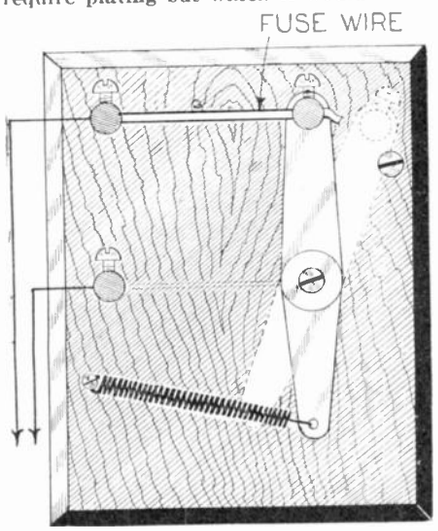
Always lead the positive or plus terminal of the battery to the anode, and the negative or minus terminal to the cathode. The tube is now filled with electrolyte by removing the anode rod and cork. The latter are then replaced and the current turned on, and by moving the wet sponge



Very nice construction of the well known local electroplater, which can be used for many purposes about a house or garage.

over the cathode or article to be plated, the latter article will be plated.

I might add, in conclusion, that this is not only an interesting accessory for the experimenter's laboratory, but it will be found very useful for the plating of faucets, various parts of your car which may have lost their finish, or practically any article around the house which may require plating but which it would be too



Safety fuse arranged to break instantly when too high a current passes, so as to avoid all danger of arcing.

inconvenient to remove to send to the plating works.

Contributed by NORMAN S. LIVINGSTON.

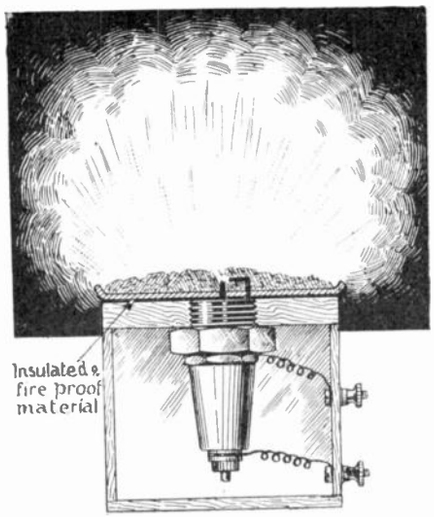
Quick Break Fuse

THE idea of the fuse shown in the illustration is that the circuit is quickly broken when the fuse wire melts.

A metal arm 4 inches long is pivoted in the center, as shown, to the base. A terminal is provided at one end. A short piece of fuse wire is connected between this terminal and one of the circuit terminals. A stout spring is secured to the other end of the arm as shown, to keep the fuse wire tight.

The other circuit terminal is connected to the arm, as indicated by the dotted line. When the fuse wire melts the arc formed at the fusing point is instantly attenuated and extinguished. The fuse is easily renewed by replacing the fuse wire.

Contributed by HAROLD JACKSON.



Firing flashlight powder with a spark plug. This is in the direction of safety, especially where large amounts of the mixture are to be detonated.

Spark Plug Detonator

THE illustration shows a very interesting application of a spark plug, this time a reasonably good one, for the ignition of flashlight powder for taking photographs.

Such powder is contained in a tray of some character to prevent any danger of fire. Through the bottom of the tray the firing end of a spark plug is introduced, which may be held by its own thread securely in place. The ignition end is uppermost and is located at a very short distance above the bottom of the tray. If immersed in the flashlight powder when a spark is caused to pass between the electrodes of the spark plug the powder will be ignited.

The illustration tells its own story. A small induction coil with battery or a magneto will suffice to produce the spark. The spark, it must be remembered, is a very short one, and being surrounded by air at ordinary pressure, requires but little voltage to act.

Flashlight powder, moreover, contains a considerable amount of metallic filings or dust which is a conductor of electricity. In use, as the end of the spark plug is buried in the powder the metallic particles tend to still further shorten the spark gap. But the particles of metal in flashlight powder are so small that there is no danger of a short-circuit, and the spark may be relied upon to light the powder unfailingly.

Contributed by HAROLD ERICSON.

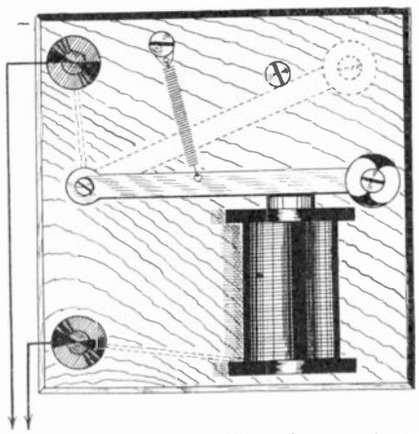
Electromagnetic Switch

THE illustration shows how to construct an electromagnetic switch which can be used to advantage in several places.

The magnet is arranged as shown, and consists of a few turns of heavy magnet wire. The switch lever is pivoted at the bottom as shown and held in the "off" position by a light spring.

One terminal is connected to the switch lever. The other terminal is connected to one end of the magnet winding, while the other end of the magnet winding is grounded to the magnet core. When the lever is swung over against the core it completes the circuit. As the current flows through the magnet-winding the magnet is energized, holding the switch in the "on" position.

Contributed by HAROLD JACKSON.



Quick-opening switch. When the current ceases or weakens, the switch opens. This obviates the danger of leaving a switch closed on a line which is opened elsewhere. If the other switch is closed it might be injurious.

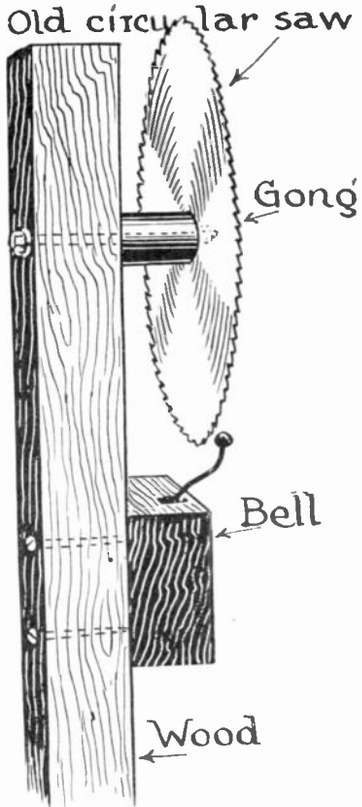
Loud Sounding Gong

ALL that is needed to construct this gong is an ordinary electric bell, an old buzzsaw or disc from a disc plow or cultivator, and a few blocks of wood.

The saw or cultivator disc is used for a gong and is mounted as shown in the illustration, after the small gong has been removed from the bell. The bell mechanism is placed so that the clapper will hit the saw when the current is turned on.

With this bell one can be assured of plenty of noise, and it will serve as a good extension bell for the telephone on a farm.

Contributed by H. M. PRICE.

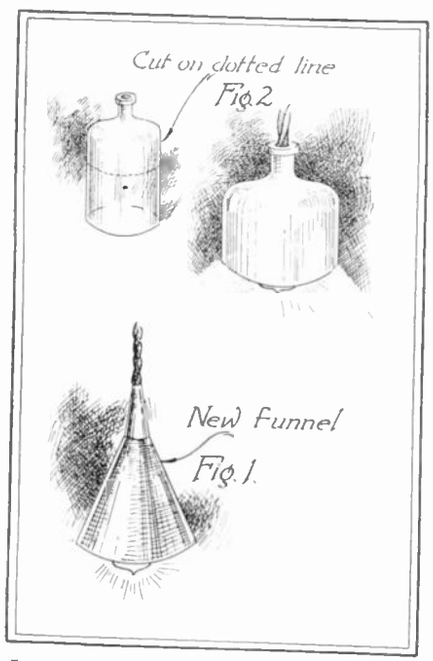


Circular saw which has seen its best days, is used as a gong, in order to give a loud signal with an ordinary bell mechanism. A cultivator disc may be used instead of the gong.

Home-Made Light Shades

HERE are two light shades which are easily made. One of them is extremely simple, yet quite serviceable. The other is more complicated, in that more time and patience are required in its construction, but it is the more attractive and efficient of the two. Either one serves the purpose and will be worth while making.

In Figure 1 is shown a light shade for an ordinary electric light drop. It consists of a bright new tin funnel, about six or seven inches across the large end. The wires are removed from the light socket, and run through the neck of the funnel. When this has been done, the wires are again connected, and the lamp is screwed in place. The funnel drops until it strikes the socket and is stopped there. A piece



Interesting examples of home-made light shades. A large bottle or a tin funnel supplies the necessary material for construction.

of adhesive tape may be wrapped about the neck of the funnel and the wire protruding from it, thus holding the two together.

Figure 2 shows a neat shade which is constructed from the upper half of a large glass bottle. When properly made, this form of shade rivals the far more expensive kind and is equally serviceable.

Get a gallon bottle, clear or green glass preferred, and proceed to cut the bottle in two, as follows: Wrap two wet strips of paper one-half inch in width about a line which designated the break to be made. These strips of paper should not be more than one-eighth of an inch apart. Then with a sharp file, scratch a line between the two, as straight as possible. By holding this line in a flame and tapping at some point slightly, a crack will start on the scratched line, and follow the scratch around the bottle until it drops in two. File off the sharp edges on the upper portion to prevent accidental cutting.

Now mix a silver-plating solution as follows: To one ounce of tin, add one ounce of lead and melt the two in a flame. When liquid, add one and one-half ounces of bismuth. A slag will form on top, and this should be carefully skimmed off. While it is still hot, add one pound of mercury and stir thoroughly. Then cool and place in a clean glass or earthenware vessel.

In silvering the shade, pour a small amount of the liquid amalgam into it, and carefully roll it around until all of the inside surface has been very thinly coated. This step should be executed with extreme care. It may be well to clean the shade prior to this step by immersing it in hot water to which has been added some vinegar, and then drying. The amalgam, too, should be handled carefully. When it is poured in, the job should be done slowly so that no air bubbles can form between the glass and the metallic liquid. In a few hours this alloy will have set and the shade is complete.

The connection to the light is made by running the cord through the mouth of the bottle at the top and then making the connections between the ends of the wires and the light socket. Since the socket is larger than the mouth of the bottle it will not slip off, and appears somewhat as is shown in the illustration. The lamp socket may be fastened in the month of the bottle with plaster of Paris.

Contributed by DALE R. VAN HORN.

Serviceable Storage Battery

ELECTRICAL experimenters can build a good serviceable storage battery at little cost.

One cell should be allowed for every two volts and each cell may contain two or more plates according to the desired capacity. A two-plate cell will give about 10 amperes for one hour when fully charged if the plates are about 4 inches by 5 inches.

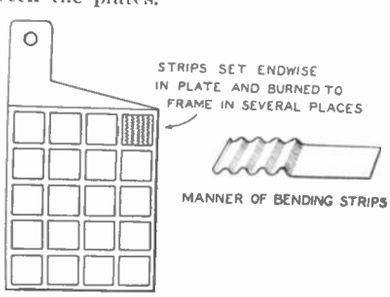
The containers may be of glass or hard rubber. Make a wooden mould for the lead framework of the plate, as shown, or if moulding sand is available mould them from a wooden pattern.

The plate should be three-eighth inch thick when finished. Provide a quantity of sheet lead one-sixteenth inch thick. Cut this into strips three-eighths inch wide, bend as shown and press into the spaces in the plates honeycomb fashion.

The plates are then ready to be "pasted." Sulphuric acid, red lead or litharge will be required. Six ounces of the latter are sufficient for six or eight plates; mix the acid with ten parts of distilled water and enough of the litharge to make a thick paste, which is pressed into the spaces in the plates.

Enough for only one plate should be mixed at a time, as it sets very quickly. The plates are then baked in an oven until hard. Curing is accomplished by wetting the plates several times and allowing them to dry.

The first time they should be merely sprinkled with the diluted acid. As the acid has considerable effect on the newly made plates, they must be wet gradually. After being sprinkled and dried, the plates may be quickly dipped again and when dry, dipped for a longer period. Increase the period of dipping till the acid has no further effect, after which the plates are ready for charging and may be assembled in the cells. Wooden separators about one-sixteenth inch thick are placed between the plates.



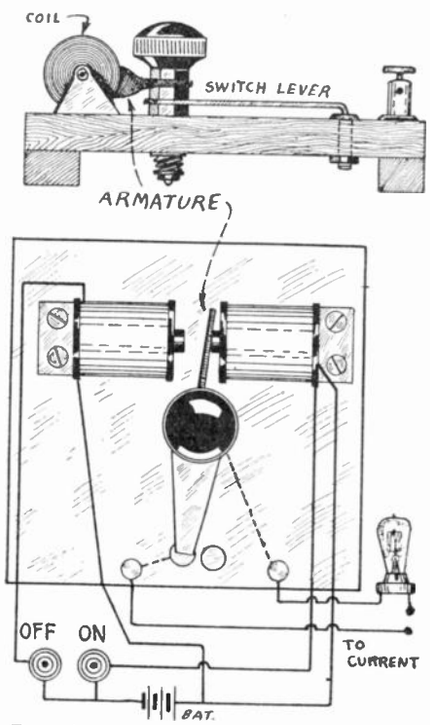
Details for making up the plates of a storage battery so as to be good surface for the paste.

Obtain regular separators if possible, as the cost will be trifling. If you make your own, use thin wood perforated with one-sixteenth inch holes. Use direct current for charging. For a six-volt battery, the charging voltage should be from eight to twelve volts. Fill the cells with acid mixed to test 1,100 with the hydrometer and use nothing but distilled water. After being charged the first time, the positive plate will turn a reddish brown.

The battery will not work at full strength until after being charged and discharged a few times. You can use a charging current of four amperes to start and two amperes to finish. The acid should test 1,300 when fully charged. If the battery is to be moved around, the top must be sealed and the plates fastened securely.

Contributed by JOSEPH S. TONER.

Electrically Controlled Switch



Two-point switch thrown to right or left by electromagnets, one for each direction.

WE often wish for a switch which can be controlled at a distance by means of push buttons. The switch about to be described may be located at any convenient place and the two push-buttons for operating it may be placed in any desired location, where they will be convenient. One push button serves to turn the current on and the other to open the circuit and cut off the current.

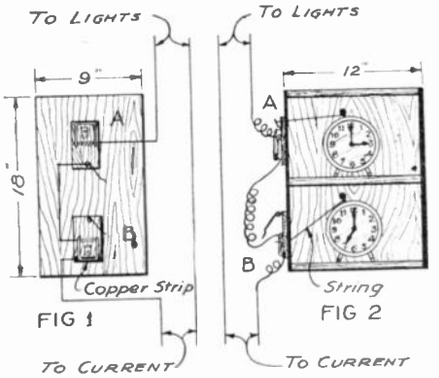
The switch is mounted on a block of wood or any other good insulating material as shown in the accompanying illustration. The switch is of the type used for radio work in connection with tapped coils. A few changes will be necessary in the switch lever, *i.e.*, a soft iron armature is cut, drilled, and bent into the shape shown, this being secured to the same shaft with the switch arm.

These magnets may be wound or taken from a door bell or other source. Two contact points are placed on the base so that the switch lever will slide over them. It is best to do a little experimenting before drilling the holes for these. The current is passed through one of the magnets so that the armature is pulled to the one side or the other according to the magnet through whose winding the current is passing; the position of the end of the switch arm is marked and the same is also done with the other coil, from which one will know where to place the two contact points. Two binding-posts are placed on the base.

Contributed by EVERMONT FISEL.

Electricity in the Poultry House

THIS device has been used for two years with entire satisfaction. It has proved very exact and trustworthy. The only requisites are: two alarm clocks, two mouse traps, some wire, a small strip of copper and an old box. A box in which apples are crated will do nicely for the latter.



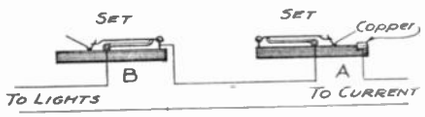


FIG 3

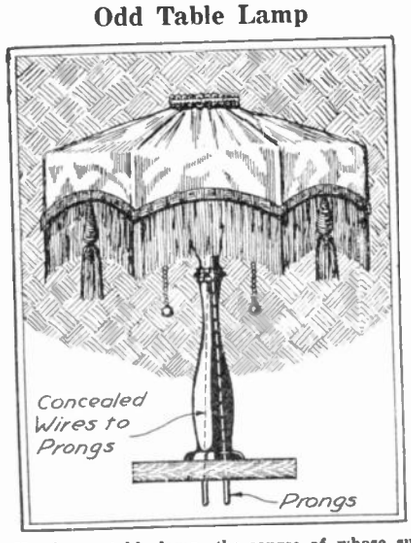
Two clocks are used, one to turn on and a second one to turn off electric current in chicken house or elsewhere.

The diagram is self-explanatory and a brief explanation will clarify a few of the points. The mouse traps are screwed to the side of the box. A small hole is then drilled through them and the side of the box to admit the string connected to the alarm clock. A small piece of the copper strip is fastened near the right hand edge of the wooden base of each of the traps. The piece of copper on (A) is taped rather than tacked on. The wire leading to "lights" and attached to (B) is slipped under the projection of the spring. The bells must be taken off the alarm clocks, so that they will not interfere with the string.

When both traps are set as shown in Figure 3 the circuit of the lighting system of the poultry house is open. When the upper clock of Figure 7 starts its alarm it sets off the trap (A) and closes the circuit and the lamps light. When the lower clock of Figure 2 goes off it sets off the trap (B) and opens the circuit and puts out the lights.

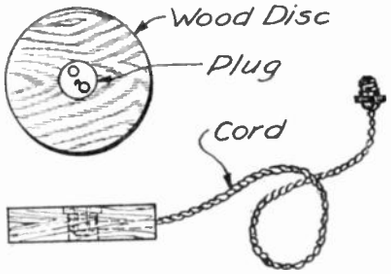
Contributed by HARRY B. JANSEN.

Odd Table Lamp



Handsome table lamp, the course of whose supply of current is hidden.

A TROUBLESOME feature of the ordinary table lamp is the flexible cord connected to it. The lamp shown herewith is a departure from the usual, in that it has no trailing cords attached, when used on the table. To the uninitiated it is also somewhat of a mystery.

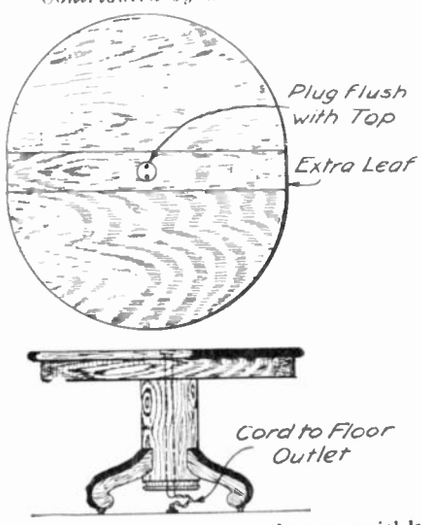


Wooden disc to be used when the lamp is to be used upon a table not specially arranged for it.

The parts of an ordinary electric iron plug serve to connect the lamp to the house circuit. To do this, the prongs are fastened in a recess in the base of the lamp, while the plug proper is set in a hole in the center of the table. If an extension table is obtainable, it may be nicely adapted by placing the plug in a narrow extra leaf. A cord runs from this plug to a floor or wall outlet.

To render the lamp attachable to ordinary sockets, the separable connection plate shown may be constructed. This serves the same function as the table top and is similarly constructed. By placing it under the base of the lamp, the latter is rendered portable.

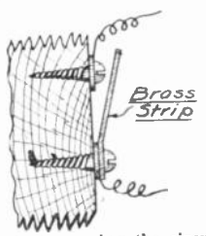
Contributed by CONSTANTINE TROY.



How an extension table may have a special leaf for the lamp just wide enough to accommodate it.

Watchman's Alarm

IN shops or homes where many doors and windows are to be looked after, an electric alarm system can be constructed which will indicate the condition of each

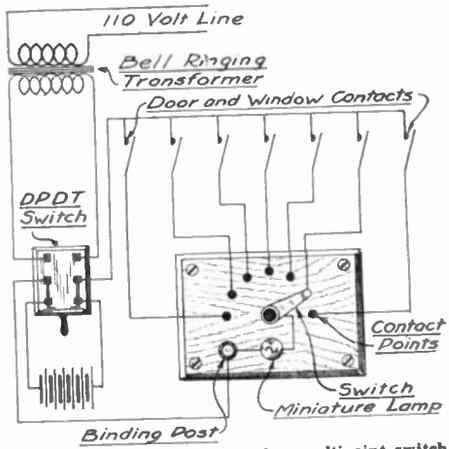


The door contact, opening the circuit unless the door is shut.

door by a simple arrangement of door contacts and switches.

A brass contact shown in the illustration is affixed to each door; each contact, if the door is closed, will complete the circuit and give a signal by lighting a miniature lamp. A wire runs to each door contact. One of the terminals of each door contact is connected to a terminal of the battery (B) by a main wire.

Several contact points are mounted on a wooden block, one point for each door, and connected one contact point at a time to the battery; a rotary switch, according to how it is set, on one or the other points, connects one contact point at a time to the battery. A wire is run from each of the remaining door contact points to its



Watchman's alarm by which a multipoint switch will disclose which doors are opened by ringing an alarm for any such.

corresponding contact point on the wooden block. A bell or miniature lamp is connected in series with a rotary switch. A lamp bulb connects the other terminal of the bell.

To ascertain whether any of the doors are open, the switch is rotated to one point after another. If the bell rings or the lamp lights, the door connected to that point is closed. If the bell or lamp does not act, the door in question is open. In this way all the doors are tried by moving the rotary switch from the first to the last contact point. If the bell rings or the lamp lights every time the switch touches a contact, the doors are closed. A bell ringing transformer or a battery may be used.

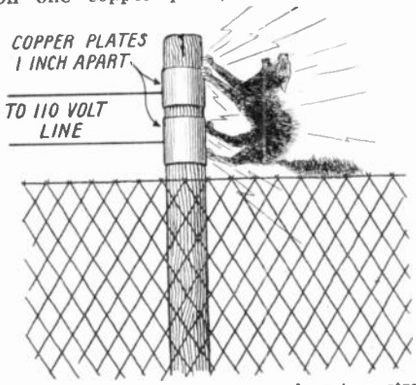
Contributed by R. J. LAMARRE.

Keeping Cats Out

A SIMPLE way of protecting small chickens in a wire enclosure from cats is the following:

On each post of the enclosure (the posts should be high enough and sufficiently out of the way so that children or other persons will not reach the plates) fasten two copper plates an inch apart, at the top of the post. Connect these plates to a 110-volt circuit.

When a cat runs up the post and steps on one copper plate, and then on the



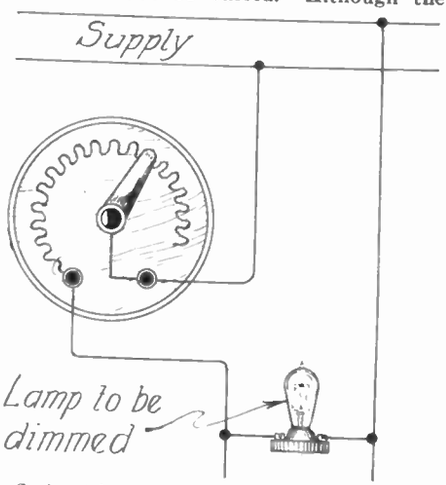
A cat which has run up a pole gets a strong electric shock.

other plate, it will fall to the ground, and the chickens will be safe.

Contributed by JOE CLEVELAND.

Shade Roller Rheostat

THE electrical experimenter often has need of a convenient rheostat whose resistance can be varied. Although the



Spring taken out of an old Hartshorne roller is used for the resistance coil of a circuit rheostat. It is shown used for dimming a lamp.

word rheostat indicates a stationary or standing resistance, it is applied to instruments whose resistance can be varied by hand.

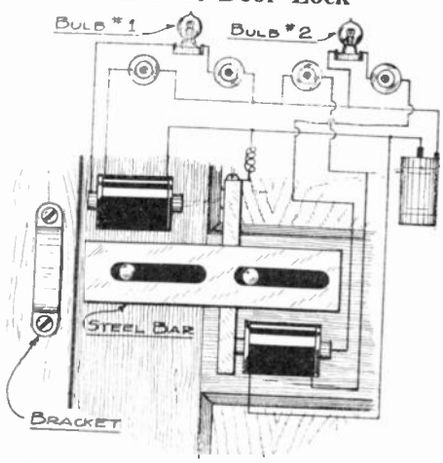
Such a rheostat as is here described will often be found convenient for regulating the speed of small motors, for dimming miniature lamps and the like, for the instrument to be described is of limited range and is not adapted for high voltages.

The instrument uses a spring extracted from a Hartshorn curtain roller for its resistance. The complete roller may be bought for a few cents, if there is no discarded one to be had. The spring is extracted therefrom, great care being taken not to injure its winding nor to introduce any bend into its convolutions.

For base, a circular piece of hard wood may be used, whose diameter would depend on the length of the spring. A concentric groove is cut a short distance near the periphery of the board to be used, and this groove must be of such diameter that the spring can lie in it without the successive turns touching each other. A radial switch arm is next required, which may be made from a strip of copper, pivoted in the center of the circle. Its outer end is bent downward and as it is turned sweeps over the spring making good contact. It will be seen by looking over the diagram that the resistance will vary with the position of the arm.

Contributed by LAWRENCE RYAN.

Electric Door Lock



Electric door lock. The bolt is pulled open by one magnet and closed by another and special buttons are provided to indicate whether the bolt has been shot or not.

THE bolt of the door lock here described is pulled back and forth by two solenoids, whose cores or armatures are attached to a crossbar passing through the center of the bolt of a lock.

At the rear end of each of the solenoids there is a spring, so that when the solenoid is excited and the armature is pulled back, the end of the armature touches the spring. There are four push buttons and two electric lights.

To lock the door, button No. 1 is pressed; the effect of this is to excite the left hand solenoid, which draws in its armature, drawing the bolt into the hasp, and when the bolt is shot home, the spring is in contact with the end of the armature.

To determine whether the door is locked or not, button No. 2 is to be pressed. If the door is locked it will be seen that this closes a circuit through the armature and through the spring at the end of the solenoid, and the signal lamp No. 1. The touch, of course, is only momentary, just to see if the lock has been shot home. To open the lock, button No. 3 is pressed; by exactly the same solenoid action the bolt is withdrawn from the hasp, the contact between the spring in the end of the solenoid cavity and the armature is made, and lamp No. 2 is lighted.

Contributed by MILTON HANES.

Interesting Articles to Appear in May "Practical Electrics"

High Tension Condensers.
By Curtis Kissel.

Electric Oil Feed for House Furnace.
By George G. McVicker.

Some Primary Batteries.

Building a Thermogalvanometer.
By Dr. Russel G. Harris.

Battery Charging Switchboard.
By Amedio Giolitto.

Efficient Electrophorus and Electroscope.
By R. G. Morgan.

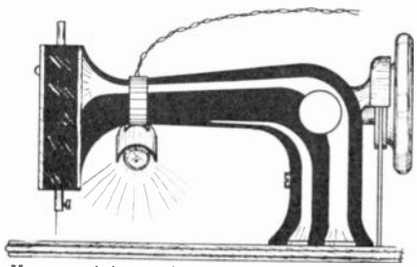
Tesla Coil.
By Horace Brooks.

Experimental Microphone.
By Frank W. Godsey, Jr.

Utilizing Solar Heat.

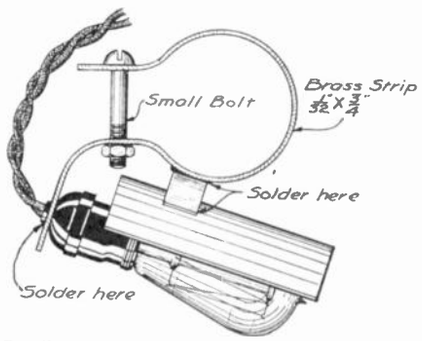
Ohm's Law
By F. S. Yamamoto.

Sewing Machine Lamp



How a miniature lamp is mounted on the arm of a sewing machine for lighting up the work.

A SEWING machine operated by an electric motor is an old story and as a sort of adjunct thereto we show our readers how a miniature lamp can be connected so as to illuminate the work, throwing the light directly where needed, and protecting the eyes by a shade over the upper part of the lamp.



Details of lamp and clamp for attachment to a sewing machine to illuminate the seam and work.

The illustrations tell the story; the lamp is fitted with a clamp and a shade varying according to the construction of the machine. The shade may be made from an empty shaving stick tube, and may be soldered directly to the clamp. The clamp has to be fitted for the special sewing machine to go around a convenient part, so as to throw light directly down on the seam. This lights up the work perfectly and its efficacy is increased by the fact that the eyes of the operator are protected from glare by the shade.

Contributed by JOHN G. LORD.

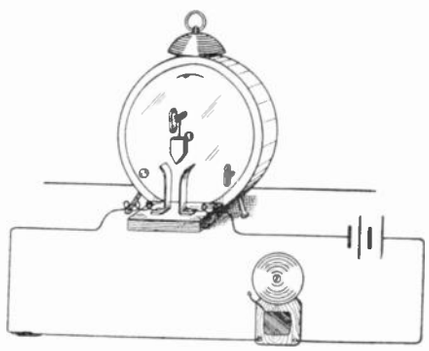
Electric Clock Alarm

WHEN an alarm clock gives the alarm, the key with which the alarm bell mechanism is wound turns around as long as the bell rings. The illustration shows a way of making it operate a sort of gravity switch.

A tape is wound around the stem of the key and to the tape there is attached a heavy weight with wedge shaped end. The object of using a tape instead of string is to keep the weight in proper position with its edge parallel with the line of the winding key.

Below the wedge on the base there are two upright springs, side by side and spreading apart a little at the top. These form terminals of an electric bell circuit.

When the alarm goes off it unwinds the tape and the weight descends between the two terminals, closing the circuit, and in doing so making a very good low resistance connection. The idea is to have an alarm clock ring a bell at a distance, and



Electric clock alarm. When the time comes for which it was set, the alarm winding shaft lowers a wedge between two springs so as to close the contact.

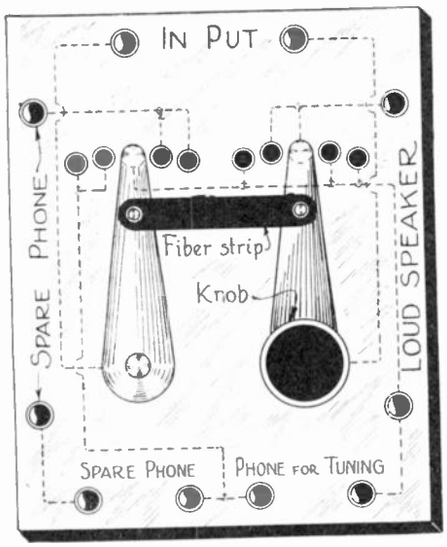
for its operation and efficiency not to be restricted to the range of its own alarm bell.

Contributed by EDGAR WALKER.

Multipoint Switch

THE illustration shows a double-pole multipoint switch. It is used for connecting several sets of telephones and a loud speaker.

On the first point one pair of telephones are connected for tuning in; on



A multipoint switch of specially good construction; a single knob on one of the switch arms over the pivot operates both arms simultaneously.

the second point a telephone and loud speaker are in series; on the third point the loud speaker is connected by itself; on the fourth two pairs of telephones are in series, and on the fifth point three pairs of telephones are in series. This arrangement is convenient when changing from a loud station which can be heard on the loud speaker to one where the telephones must be used.

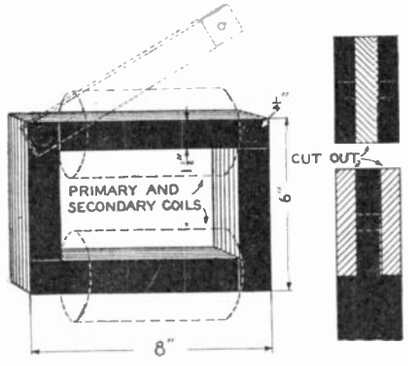
The switch points are set close enough together so that there is no break in the plate circuit, thereby avoiding the loud click.

If some good insulating material is used for the panel it is better, but in mine a piece of dry wood was used.

Contributed by A. L. CROOKS.

Although this switch is designed primarily for special use, it is an excellent representation of good construction, and we are sure that its application to ordinary lines of work will be found very practical and useful. If the connections are studied out it will be seen that they are quite characteristic and suggestive of what may be done with such an appliance.—(EDITOR.)

All Purpose Transformer



An ingenious construction of transformer, by which one of the coils can be changed so as to produce all sorts of ratios of stepping-up and stepping-down in the one instrument.

I HAVE constructed this transformer which I think will save the amateur a great deal of iron and wire, as one transformer with extra coils will represent a number of such.

The core is 8 inches × 6 inches outside and 1½ inches square in cross section, and assembled in the regular manner, with laminated iron strips. The illustration shows the method of assembly. One-quarter inch holes are drilled through the core at two corners. One end of the core is left just as it is finished, but the other end is cut out forming a tongue and groove joint as shown in section. We readily see now that the bolt may be slipped out of the core, the leg pulled out and a new secondary coil put on in a minute.

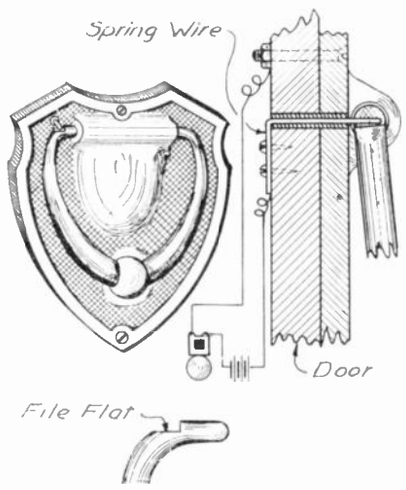
The primary winding consists of 450 turns of No. 18 D. C. C. wire; this coil is put on the lower leg of the core and is never changed.

The secondary coils may be used for any work the experimenter desires, and are wound accordingly. Thus I have for my work one charging coil, which is wound with 130 turns of No. 12 D. C. C. tapped at the 90 turn. This is for a 5 ampere tungar tube. I have also a high voltage coil for a C. W. transmitter, and a high ampere coil for welding. This combination works very well and there is no trouble due to heating of the primary winding.

Contributed by BELGRAVE F. GOSTIN.

Bell Ringing Door Knocker

A FINE old brass door knocker is considered quite a treasure in these days when colonial antiquities are exciting so much interest. The adequate oper-



Something often thought of; the highly esteemed, old-fashioned door knocker by a slight alteration is made to ring an electric bell.

ation of a good knocker would seem ample to notify everybody in the house, but people want electric bells.

The illustration gives a suggestion for connecting a bell to the base and shaft of a knocker, so that when the latter is raised it will close the circuit and ring a bell in the kitchen or wherever it may be located.

A flat place is filed upon the top of the knocker shaft, a spring contact is led through the door, and placed directly above this flat place; insulated from the metal base, is a piece of spring brass. Another terminal is carried to the frame of the knocker. The circuit therefore is open until the knocker is raised; when raised the shaft touches the spring, closes the circuit, and rings the bell.

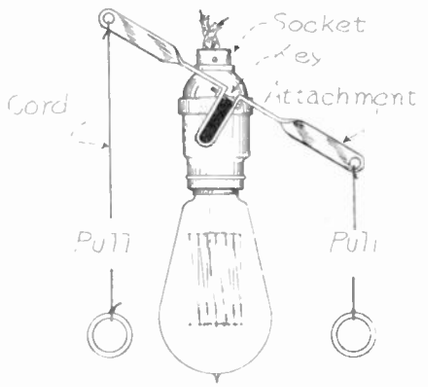
Concealed wires are carried from the knocker terminals to the upper and lower hinges of the door, from which the wires go to the bell.

Contributed by OTTO A. KOEHLER.

Pull Socket Attachment

A DROP light is often situated at such a height from the floor that a person has to strain to reach the key, and is entirely out of reach of a shorter person. This difficulty can be entirely overcome by the use of the home-made attachment shown.

With this attachment, a regular key socket is converted into a pull socket. The dimensions of this device are given



Very simple switch handle with pull pieces for ceiling lights; it makes them operative from the floor.

in the detail. It is made of rather heavy strap iron, ½ inch wide and 8½ inches long. It is bent as shown to clamp around, the key being secured by a small bolt. A stout cord with a small ring on the end serve as the "pulls." As is evident, the rocking of this arm will turn the light on or off as desired. The "pulls" are long enough to be easily reached from the floor.

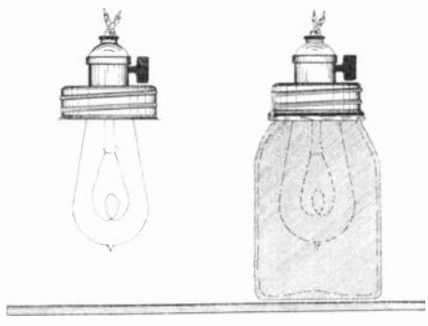
Contributed by HAROLD JACKSON.

Electric Ruby Lamp

THIS electric ruby lamp is for the photographic dark-room. It gives a very pure red light which will not injure the undeveloped negatives.

The main part in its construction is a one quart fruit jar. The porcelain lining is removed from the cap. A hole is then cut through the cap to accommodate the small end of a key socket. The cap and socket are soldered together and an eight candlepower lamp is turned into the socket; the joint between the lamp and the socket is made water-tight by the application of sealing wax to the joint.

The jar is filled about three-quarters full of water in which has been dissolved a level teaspoonful of Dark Red Diamond Dye. The cap is then turned down on the jar submerging the lamp in the solution.



Photographer's lamp for the dark room is made with an electric lamp and fruit jar. Red dye is used to color the liquid surrounding the bulb.

When the circuit is closed a red light is emitted from all sides of the jar.

Contributed by HAROLD JACKSON.

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

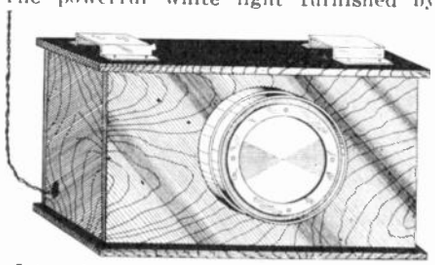
To win the first prize, the trick must necessarily be new and original. All other Elec-Tricks published are paid for at regular space rates.

Postal Card Projector

By HAROLD JACKSON

A POSTCARD projector is a very interesting and entertaining instrument.

In order to obtain satisfactory results the projector must be carefully constructed and operated with electricity. The powerful white light furnished by

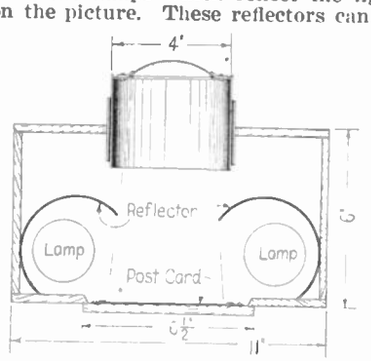


Interesting parlor toy, by which postal cards and other pictures can be projected on a comparatively large scale on a screen, employing powerful electric lights.

incandescent lamps is essential to the clear projection of the pictures. The light for this projector is furnished by two 50-watt nitrogen filled lamps.

Keyless porcelain receptacles are secured to the bottom of the projector at the back corners as indicated, into which the lamps are screwed. The cabinet of the projector is made of seasoned hard wood ⅜ inch thick. It is 11 inches long, 6 inches wide and 6 inches high. A door 6½ inches wide is hinged at the back which carries two tin cleats in the position shown, which hold the card in place.

Two bright tin reflectors are placed around the lamps which reflect the light upon the picture. These reflectors can be



Construction of the projector. The four-inch lens is shown and the two lamps with cylindrical reflectors are seen in the corners, whose light is thrown strongly upon the card or picture.

cut from a tomato can. The lens used should be a three-inch plano-convex with a focal length of about eight inches. This is mounted in the bottom of another tomato can in the manner shown. The can is then cut off to a height of about 3½ inches. This is placed inside of a metal slide which is mounted at the front of the projector. The lens can be adjusted by sliding it in or out until the proper position is found where the pictures will be perfectly clear upon the screen.

The projector should be placed at a distance of 15 or 20 feet from the screen. Then the pictures will be enlarged 10 or 12 diameters, which will require a screen about four feet by six feet; a bed sheet makes a good screen.

The entire inside of the projector should be painted with a dull finish black paint. Two ventilators are provided at the top to provide ventilation, and consist of a few small holes bored through the top above the lamps and covered with metal shields to prevent light spots on the ceiling.

The feed wires enter at one end of the projector as shown. In placing the pictures in the holder they must be put in up side down, otherwise the image will be inverted upon the screen. Do not try to produce too large views, and keep the room dark.

Mysterious Cards

By CHARLES D. TENNEY

THIS trick, in one form or another, has long delighted the audiences of stage magicians. The following method of producing the effect is based on the gradual flow of fine sand through a magnetically controlled aperture.

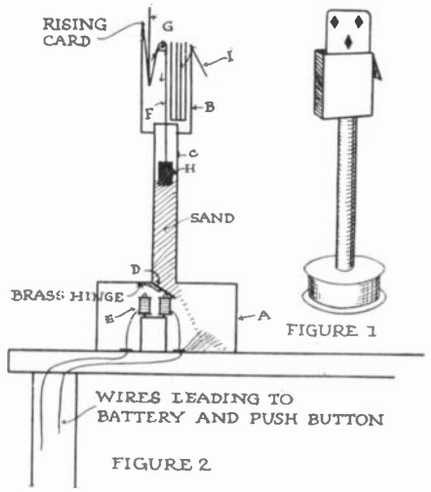
Effect: The magician allows a member of his audience to select a card from a pack, to reinsert it and to shuffle the pack. He then shows a card-case or holder, which is mounted on a small pedestal and proves the whole apparatus to be absolutely free of electrical connections. He inserts the cards in the holder, places it on a table and walks to a far corner of the stage. He requests the person who selected the card to name it and the moment this is done, the card gracefully rises from the case, seemingly of its own volition (Fig. 1).

Explanation: A cross-section of the apparatus is shown in Fig. 2. (A) is a round cardboard box about three inches high and (B) is a rectangular box of a size to easily hold a pack of cards. The boxes communicate with each other by means of a cardboard tube (C), about ten inches high and one inch in diameter. A trap (D) cut from sheet iron and held shut by a strip of spring brass, controls the aperture at the lower end of the tube.

A small electro-magnet (E) is fastened directly beneath it and connections are made to two small contact plates in the bottom of (A). Similar contact points are placed in the top of the table and are connected by wiring running down through the legs to a battery and a push button in a far corner of the stage. Thus, when the apparatus is placed on the table over the contact points and the button pressed, the electro-magnet causes the trap to open.

The pack contains cards all of the same suit. One of these cards is previously placed in one side of (B) over a thread (F) which is fastened to the top edge of the case, runs over the rod (G) supported between its sides, and is tied to a weight (H) which slides freely up and down in the tube. The flap (I) is closed while the case is being shown to the audience.

After a card has been chosen, the flap is opened and the pack placed in the other half of (B). The apparatus is set over the contact points in the table, the magician pushes the button as the card is named, and the trap is pulled open by the magnet. As the sand flows out of the tube, the weight lowers and the card is lifted by the thread. Being the same as the rest of the pack, it is naturally identical with the card selected.

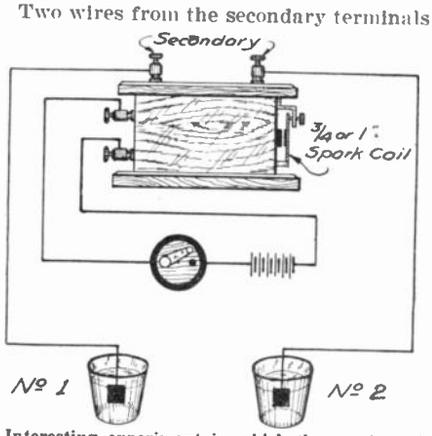


An old piece of legerdemain, this time, however, carried out by electricity, giving it a greatly improved effect compared with the old system.

Novel Experiment

A VERY striking and interesting experiment may be performed with the use of the following appliances: An induction coil, capable of giving at least a ¾-inch spark, and two glasses partly filled with any electrolyte, preferably diluted sulphuric acid.

Two wires from the secondary terminals



Interesting experiment in which the pouring of dilute acid from one tumbler into another produces a fine effect of electric spark discharge. An induction coil is required.

are individually introduced into the glasses, so as to make a contact therein. The glass poured from should contain the most electrolyte.

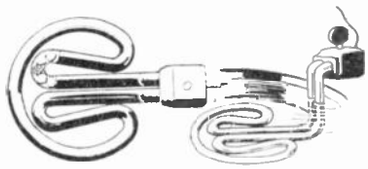
When all the necessary connections have been made, as shown in the diagram, take one of the glasses in your hand, turn on the juice for the apparatus, turn out the light, and pour the contents of one glass into the other.

Upon doing this, sparks should jump back and forth from the stream of electrolyte, until all the solution is gone.

Contributed by FRANK R. MOORE.

Latest Electrical Patents

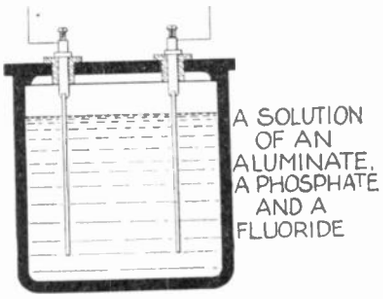
Electric Water Heater



This heater comprises a metal tube properly shaped to fit into the average vessel of liquid to be heated, and a helical resistance coil centrally located inside of the tube by means of beads of refractory material, which also conduct the heat to the tube and thence to the liquid.

Patent 1,472,197, issued to E. E. Sutherland.

Electrolytic Condenser

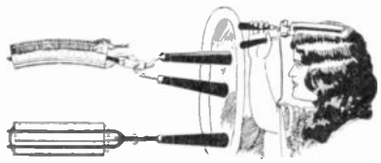


Those experimenting with electrolytic condensers and rectifiers would do well to try the following solution: Sod. aluminate, 2.5 gms.; tri-sodium phosphate, 11.5 gms.; sodium fluoride, 3 gms.; distilled water, 1200 cc.

It is claimed that an electrolytic condenser made up with aluminum plates and this solution is very efficient.

Patent 1,472,169, issued to E. J. Haverstick.

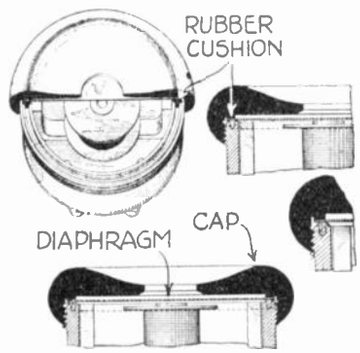
Electric Hair Waver



The inexperienced person who attempts to wave her hair with the ordinary curling iron usually causes a lot of twisting and distortion which is harmful and far from beautiful. With this waver the hair may be given a smooth wave-like effect without any trouble. It has a V-shaped frame heated by electricity and the hair is clamped into the V with a metal fork, hinged to it like a shears.

Patent 1,473,977, issued to O. Schaumberg.

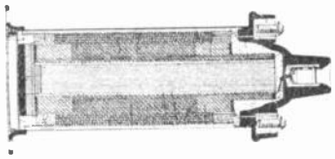
Tuned Telephone Receiver



Quality and sensitiveness in a telephone receiver depend greatly upon the length of the magnetic air gap between the diaphragm and the pole tips. If the gap is small the instrument is sensitive to weak currents; strong currents are received better with a large gap, in which case there is less possibility of chattering, caused by the diaphragm striking the pole tips; there is also less distortion. The illustration shows a receiver which can be "tuned" by adjusting the air gap for different conditions. The adjustment is effected by simply tightening or loosening the cap, which clamps the diaphragm against a soft rubber seat located in a groove in the shell.

Patent 1,478,769, issued to H. Gernsback.

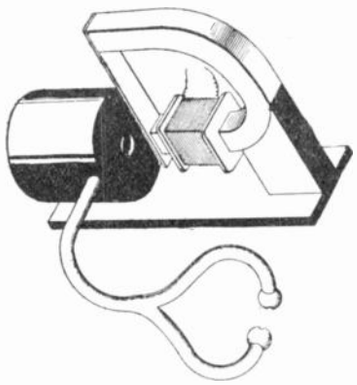
Induction Coil



This is an improved form of induction coil especially designed for ignition systems of gas engines. It has a core of fine iron wires as in the usual construction and the secondary coil is placed directly over the core, with the primary coil outside of the secondary, which is the reverse of the usual construction. The coils are thoroughly insulated and sealed in a metal case.

Patent 1,474,152, issued to A. T. Kent.

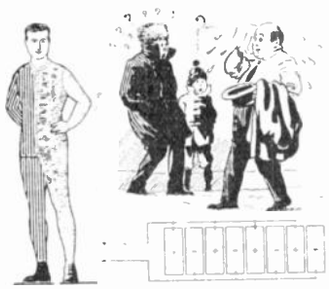
Vibrating Reed Telephone



The receiver shown in the illustration has a tuned reed mounted on a permanent magnet and acted upon by the electromagnet. A sound chamber adjusted to be in resonance with the vibrating reed is placed in front of it and the sound waves are conducted to the ears of the listener.

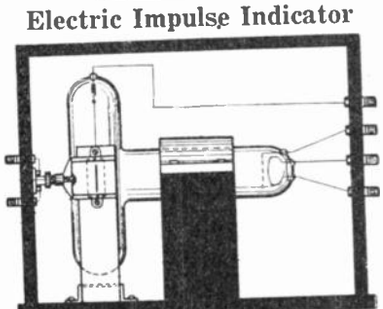
Patent 1,474,242, issued to C. A. Culver.

Electrically Heated Clothes



One way to fight the high cost of coal is to wear electric clothes like the suit illustrated. This garment has a fine resistance wire woven in with the cloth and connected to terminals on the bottom of the shoes. By properly standing or walking on contact plates on the floor or sidewalks, the circuit is completed through the heating wire and the body is uniformly heated throughout.

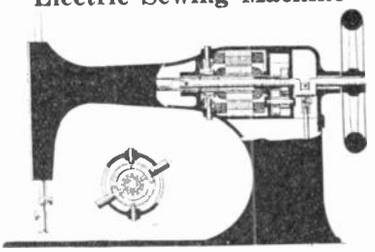
Electric Impulse Indicator



This indicator is a supersensitive device which indicates visibly slight electric impulses, such as weak radio or telegraph signals, and it may also be used as an oscillograph for making a photographic record of an A. C. wave. It consists of a vacuum tube, the anode is of flexible material and moves physically when struck by the stream of negative electrons from the hot filament. The stream is modulated by a third or grid electrode, and a reflected light beam shows the vibrations.

Patent 1,471,357, issued to Samuel Ruben.

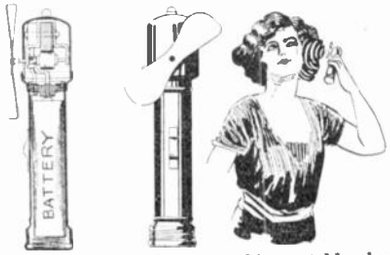
Electric Sewing Machine



The illustration shows a sewing machine with the electric motor mounted within it, properly geared to the shaft. Provision is also made for oiling, repairing and properly controlling the motor.

Patent 1,472,588, issued to C. W. H'Doubler.

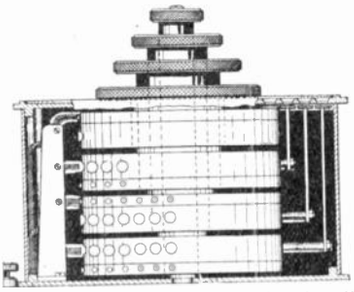
Portable Electric Fan



Little need be said about this portable electric fan as the illustrations are self-explanatory. It consists simply of a miniature electric motor which turns a fan blade. The motor is run from a dry cell battery mounted in a case similar to a hand flash-light case. The case also supports the motor.

Patent 1,473,045, issued to H. F. Puttaert and M. Moreau.

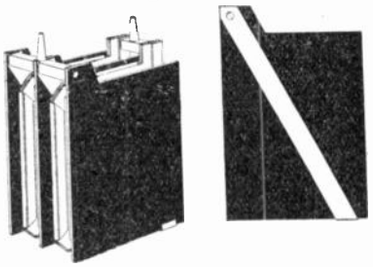
Resistance Box



This resistance box is designed primarily for use with a Wheatstone bridge, although it may be found convenient in any circuit where a variable resistance of low current carrying capacity is required. There are four knobs, each of which turns a drum in which the resistance elements are placed. They are connected into the circuit by means of the contact brushes on the side, as shown. The knobs are marked corresponding to units, tenths, hundredths, and thousandths of an ohm, or other fractions thereof.

Patent 1,441,399, issued to William Clark.

Storage Battery



Great improvements are claimed for this battery over the usual type. The main difference in construction is in the negative plates. The composition is very important, and consists of an alloy made up as follows: tin, 50 per cent; lead, 25 per cent; zinc, 17 per cent; antimony, 8 per cent. No separators are used between the negative and positive plates. The action of the negative plate is to build up a high surface resistance when heavy currents are drawn, so that under short circuit conditions the battery is automatically protected.

Patent 1,475,503, issued to S. M. Meyer and W. James.

Short-Circuits

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

Here are the remains
Of Mrs. McRath.
Who used an electric curler
While taking her bath.
—J. HOWARD SLANSER.

Here lies the body
Of Samuel McAttery.
His pipe lit the hydrogen gas
From a storage battery.
—EDWARD EMICH.

This tombstone is for
Little Josephine Ford.
She stuck a pin
In an electric cord.
—FRANK BOHNERT.

Lies sleeping here
Henrietta Grove.
She turned on the lamp,
And also the gas stove.
—C. D. CHRISTMAN also C. L. BOWNE.

LADY ELECTROCUTED WHILE IN HER BATH

Leans Out and Catches Hold of Electric Heater, With Fatal Results

(Staff Correspondence of The Globe.)

London, Ont., Jan. 13.—Leaning out of a bathtub in her home to move an electric heater which stood close by, Mrs David Williams, aged 33 years, of 25 Grafton street, was electrocuted last night.

It is claimed that the insulation had been impaired on the heater and that when Mrs. Williams stood in the tub she was in direct contact with the earth by means of the pipes that ran to the sewers, and therefore received the full force of the current. Hearing her screams, her husband ran to the bathroom and found her standing, half-conscious, with the heater in her badly burned hand. In rescuing her Mr. Williams also sustained a severe shock. Dr. Copeland was summoned, but Mrs Williams died in a few minutes.

She is survived by her husband and two daughters, aged 11 and 13 years. An investigation is being conducted by Coroner Robert Ferguson.

In peace rests here
John Alexander Rich.
It was the first and last time
He calsomined the switch.
—C. L. BOWNE.

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

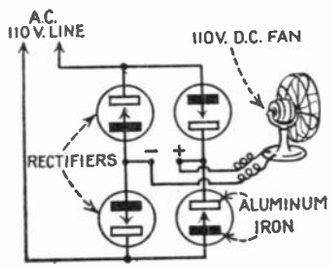
1. Not more than three questions can be answered for each correspondent.
2. Write on only one side of the paper; all matter should be typewritten, or else written in ink. No attention can be paid to penciled letters.
3. Sketches, diagrams, etc., must always be on separate sheets.
4. This department does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

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

Rectifier Query

(396)—N. G. Weber, Portland, Oregon, asks:

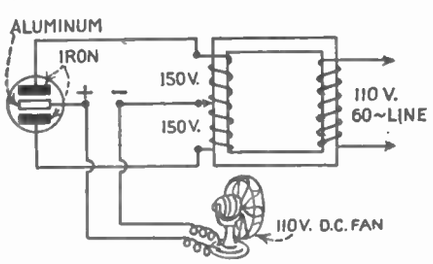
Q. 1.—Please give me complete details of the construction of a cheap but dependable rectifier that will deliver 110 volts D. C. from 110 volts A. C. The rectifier is to be used for operating small D. C. electric fans and motors from a 110-volt A. C. line, and therefore something must be used to compensate for the voltage drop across the rectifier.



Arrangement of a four jar electrolytic rectifier for operating a D. C. fan from 110 volt A. C. circuit.

A. 1.—Small 110-volt D. C. fans and motors that draw a very small amount of current may be successfully operated from the 110-volt A. C. line by using a four-jar electrolytic rectifier. Four one-quart fruit jars may be used for the rectifier. In each jar are placed two electrodes, one of aluminum and one of iron. The electrodes are each four inches by two inches by about one-sixteenth inch thick, with a long lug at the top for attaching to the wooden cover and terminals. The electrolyte consists of a saturated solution of sodium phosphate or borax and water. The jars are connected as shown in the diagram.

This method does not compensate for losses in the rectifier, which is objectionable, especially if a heavy direct current is drawn. To compensate for losses, a step-up transformer must be used, connected as shown. With the transformer, only one rectifier jar is required. Two iron and one aluminum electrodes are used in the jar, as shown. The transformer has a 110-volt



Transformer for operating a fan, as above, but in this case using a single jar electrolytic rectifier.

primary and a 300-volt secondary with a center tap. Directions for building the transformer will be found in the October issue of PRACTICAL ELECTRICS, page 543.

Distortion in Amplifiers

(397)—K. L. Kline, Pittsburgh, Pa., asks:

Q. 1.—Is a distortion of the A. C. curve ever incident to the strengthening of the telephone current by vacuum tube amplifiers, so that the transmission becomes louder but not so clear as by unamplified telephone currents?

A. 1.—It is possible with resistance coupled amplifiers to amplify the telephone currents without any distortion, assuming, of course, that the vacuum tube amplifiers are properly adjusted and are not overloaded. Usually transformer-coupled amplifiers are employed, as greater amplification may be obtained with them than with resistances with the same number of tubes, but these transformers are not equally efficient on all frequencies and hence cause a little distortion. As a rule they are more efficient on the higher notes than on the lower. The vacuum tubes will cause no distortion if they are not crowded and if adjusted to operate on the straight portion of their characteristic curve. This is accomplished, of course, by employing current values of "A," "B," and "C" battery voltages.

5 Kw. Transformer

(398)—R. L. Chapman, Findlay, Ohio, writes:

Have read your answers to the questions on the Christmas tree lamps in the December issue with interest, but do not see why a 3½ to 5 kw. transformer cannot be operated on the house-lighting circuit if it is of the right capacity.

Q. 1.—If this is the case, please give me the necessary information for building a step-down transformer of 4 to 5 kw. capacity that will deliver fifteen volts from a 110-volt 60-cycle line.

A. 1.—A transformer can be operated from the house-lighting circuit if of the right capacity, and this capacity cannot exceed 660 watts, or one kw. at the most. A transformer of any greater capacity will blow the fuses. The house wiring also is designed to deliver no more than ten amperes, so that the condition could not be remedied by installing larger fuses. A four-kw. transformer will draw 37 amperes from the 110-volt line and a five-kw. transformer will draw 46 amperes, which is altogether too large for anything but a 110-volt power circuit. The fifteen-volt secondary of a five-kw. transformer must be designed to carry 334 amperes, and would require two No. 0000 cables in parallel.

The best thing to do is to build a one-kw. transformer with a fifteen-volt secondary. In this case the transformer will draw ten amperes under full load and the primary must be wound with No. 10 B. & S. copper wire. The secondary should be wound with No. 1 B. & S. insulated copper wire, as it must carry 67 amperes under full load, or when lighting 370 lamps, each lamp consuming .18 amperes. If the core is built up of sheet iron so as to have a cross-sectional area of four square inches, 200 turns of wire will be required on the primary and 29 turns on the secondary. Of course only 370 lamps could be lighted from this transformer.

Treasure Hunting

(399)—H. F. Schmid, Anaheim, Calif., asks:

Q. 1.—Regarding the article, "Treasure Hunting in Texas," please tell me if a

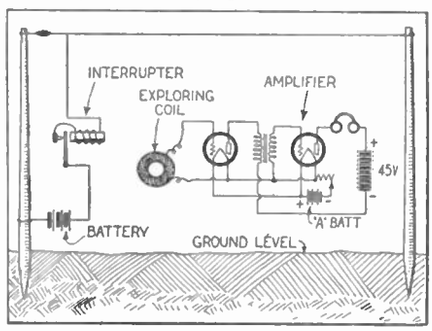


Diagram of a treasure hunting apparatus, to operate successfully there must be a treasure and this is not always supplied for the searcher.

Ford spark coil can be used for the interrupter.

A. 1.—Yes. Any form of interrupter may be used, an ordinary door bell for instance.

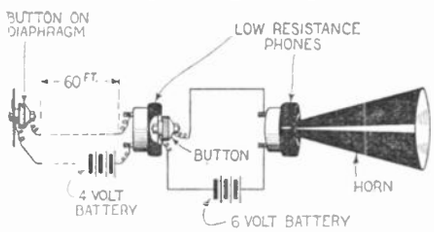
Q. 2.—How is the exploring coil made?

A. 2.—The number of turns and size of wire on this coil are not very critical but as a rule the more turns employed the louder will be the buzz received. We would suggest that you try 1500 turn honeycomb coils for this purpose. An iron core is not required.

Q. 3.—Will an amplifier make the device more sensitive?

A. 3.—Yes. A two-stage vacuum tube amplifier will make it much more sensitive and reliable. The connections are shown in the diagram. If an amplifier is not used a good 2000 or 3000 ohm headset should be used, connected directly across the exploring coil.

Loud Speaking Telephone



Loud speaking telephone using a Skinderviken button and low resistance telephone in the circuits, with two independent batteries.

(400)—R. N. Williams, Colfax, Calif., asks:

Q. 1.—Can I use the Skinderviken transmitter button to transmit the voice inside of a building about 60 feet so that it will

be sufficiently loud to be heard 10 or 12 feet from the horn when the sender is speaking three feet away from the microphone?

A. 1.—Yes. This is easily accomplished by using low resistance telephones, about 5 ohms. At the transmitting end the button is mounted on a diaphragm. The speaker talks near this diaphragm. At the receiving end two 5 ohm receivers are employed, one for the amplifier and the other for the loud talker. The amplifier consists of a 5 ohm receiver with a button mounted on its diaphragm, as shown. Although one battery may be used it is advisable to use two, as shown.

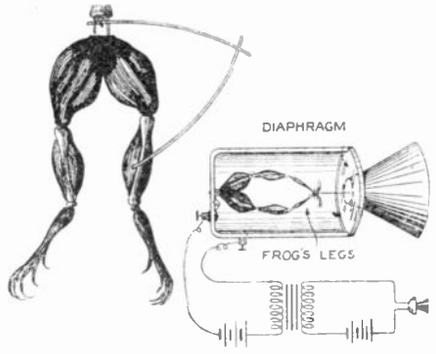
Muscular Contractions

(401)—William Kelly, Plainfield, N. J., asks for information about the muscular contractions of a frog's leg under the influence of an electromotive force.

Q. 1.—When was this effect discovered and how is it obtained?

A. 1.—It was discovered in 1678. A portion of the muscle of a frog's leg was suspended by a thread of its nerve bound with a silver wire. When both nerve and wire were touched with a copper plate, the muscle contracted. Over a century later Galvani prepared a frog's limbs as shown in the illustration. He observed spasmodic contractions in the legs of freshly killed frogs under the influence of the "return shock," experienced every time a neighboring electric machine was discharged. In preparing the frog, the hind limbs are detached and skinned, the crural nerves and their attachments to the lumbar vertebrae remaining. The limbs thus prepared form an exceedingly delicate galvanoscope, and retain their contractile power for several hours after death.

An interesting application of this phenomenon was made by Dolbear in 1886. He observed that the twitching of the frog's legs under the influence of electric impulses is practically instantaneous, so he attached the legs to a diaphragm which was, of course, set into vibration. Very feeble telephonic currents passing through the legs set up powerful vibrations in the diaphragm which produced sound waves. In this way a sensitive loud talker was made. Perhaps some day chemists will furnish us with some synthetic material to take the place of the frog's legs and muscles and which will enable us to make both amplifiers and loud talkers.



Frog's leg made to operate a telephone, bringing Galvani and Bell side by side.

Lighting Circuit

(402)—Jack Almstead, Detroit, Mich., writes:

Q. 1.—Why is it that in some cases in a circuit in which two lamps are burning the two lamps burn more brightly than when only one lamp is burning?

A. 1.—This may be due to the resistance of the return circuit which for some reason or other is less when the two lamps are burning than when one lamp is burning. The effect would be noticeable in a three-wire circuit having a high resistance in the neutral wire due to poor connections. If one lamp is turned on, the current passes through this lamp and also through the high resistance in the neutral wire, which reduces the current and the lamp burns dimly. If the other lamp is

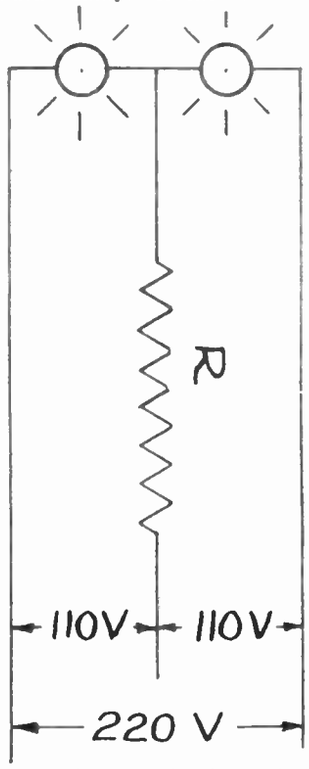


Diagram of the effect of resistance in the neutral wire in a three wire circuit explaining a curious incident.

turned on, the three-wire system is equalized and no current flows through the neutral wire, and its high resistance contacts would have no effect and both lamps would burn brightly. This is clearly shown in the diagram, in which the resistance (R) represents some high resistance contact or other high resistance in the middle wire.

It may be due to the generator which may require a certain current before its field builds up strong enough to generate normal line voltage. This would be the case in a series wound dynamo.

Queer Puzzle

(403)—William Kingston, Seattle, Wash., inquires:

Q. 1.—What happens to the current in a conductor if its resistance drops to zero, and is it possible to have a conductor of zero resistance?

A. 1.—It is well known that the resistance of a conductor depends upon the temperature. It has almost been proved experimentally that at absolute zero temperature most conductors would have no electrical resistance. At the temperature of liquid helium, which is -456 degrees Fahrenheit, or only about three degrees above absolute zero, Kamerlingh Onnes found that by bringing a permanent magnet near a lead ring, the current induced into the ring flowed for four days before it fell to half its original value. At absolute zero, or 459.6 degrees Fahrenheit, according to the molecular theory, molecular activity is totally suspended and no heat exists, and it is safe to assume that the lead ring at this temperature would have no electrical resistance.

From Ohm's law, $I = \frac{E}{R}$, it is interesting to note what would happen in the lead ring if R was gradually reduced to zero. As we have limited power, the voltage E gradually drops as the resistance is reduced. In other words, as R approaches zero, E also approaches zero, and the current I increases. But when R is zero, a condition obtained at absolute zero temperature, E is also zero, so that the current

$I = \frac{E}{R}$ or $\frac{0}{0}$, which is meaningless mathematically, as I can be any value to satisfy the equation. The power is EI, which is also zero because E is zero. It is merely stored up as kinetic energy in the ring in the form of an ever-flowing electric current. If we break the ring the current will jump across the minute gap and the energy will be dissipated in the form of heat and light. The amount of current flowing, although of any value mathematically, assumes some indeterminate value depending upon the amount of energy stored in the ring.

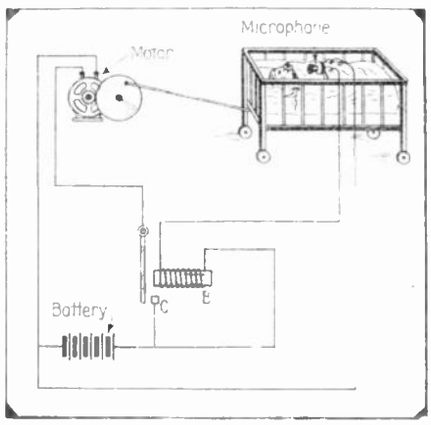
Automatic Baby Crib

(404)—D. L. Kellogg, Everett, Wash., writes:

Q. 1.—I would like some information in regard to the automatic baby crib illustrated in the January, 1924, issue. The starting of the motor by the microphone and magnet (B) is OK, but the moment the screw (D) makes contact at (C), the two batteries would be connected in series with each other and therefore short circuited. Why not simplify and use only the microphone magnet (B), and one battery? When the baby cries the relay (B) will close the circuit, but as soon as the baby stops crying the microphone diaphragm will remain quiet, the relay circuit and motor circuit both remaining open.

A. 1.—You are correct in regard to the device that appeared in the January issue. The batteries will not only be short circuited, but if they were not the motor would not reverse, because it will always run in the same direction regardless of which way the battery is connected. To reverse the motor it will be necessary to reverse either the armature or field connections, and not both.

Your scheme is much simpler and we are reproducing your circuit herewith. It has the disadvantage, however, that if the baby wants to be rocked it will have to cry.



Electric Baby crib again; how the child will start the crib to rocking or moving to and fro by its vocal exertions.

Ultra Violet Ray Machine

(405)—Don Ault, Picher, Okla., inquires:

Q. 1.—Please tell me if the ultra violet ray machine described on page 60 of the December issue will work with a Ford coil. If so, please tell me how to connect it so as to have four taps off as illustrated.

A. 1.—The Ford spark coil will give good results with the ultra violet ray machine. The illustration shows how it

(*Continued on page* 340)

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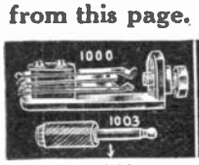
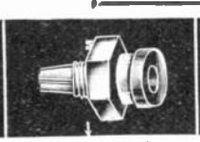


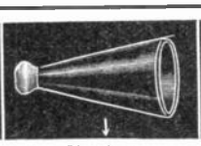
Jacks and Plugs

Best materials. Silver contacts. Factory making Postal Telegraph jacks, makes these.
A1000 Jack 4 springs $.65
A1001 Jack 3 springs .75
A1002 Jack 5 springs .80
A1003 Plug ..... .55



Cord Tip Jack

Takes place of binding posts. Cord tip firmly gripped by jack. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.
A1500 Cord tip jack
Each .....$.15

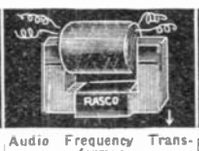


Phonehorn

Base consists of Phonodapter into which fits a fine enameled fibre horn. Size of horn 12"; bell 6½". Slip Phonodapter end on a single telephone receiver.
A1321 Phonehorn, prepaid $1.45

Radiocite Detector

Base solid black composition. Automatic crystal holder. Triple adjustments. Smallest, neatest detector made. Radiocite crystal.
A1899 Detector ....$.60
A1898 Galena detector .....$.50



Audio Frequency Transformer

No better Transformer made. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.
A1100 Ratio 4½-1 $2.00
A1150 Ratio 6½-1 $2.00

Duo-Cobweb Coil

For Reinartz circuit, 200-600 meters. 19 taps. Size 1¼" diam.; 1⅞" center opening. Coil is firm and will not fall apart.
A2650 Cobweb Coil $1.15
A2660 Coil for panel mounting. 225-600 met. $1.90

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Best popular loud speaker. Fibre horn, heavy metal base, five ft. cord. Nickel gooseneck. Greatest tuned (adjustable) talker. Horn length 11½"; bell 6⅝"; total height 9".
A255 Melotone Speaker $4.85

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Highly substantial instrument. Silk windings. ¼" shaft. Flange B when placed into AB direction makes instrument panel mounting. 180 to 650 meters. Money back if this instrument is not all that we claim for it.
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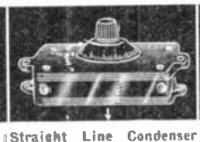
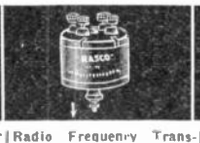


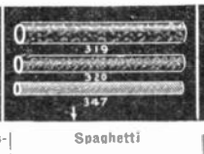
Straight Line Condenser

Simplest and most practical type of condenser.
A4330 "Rite" Condenser .001 mfd. 43 plate capacity $1.75
A4230 .0005 mfd. 23 plate capacity $1.75
A4110 .00025 mfd. 11 plate capacity $1.75
All types no dials $1.50



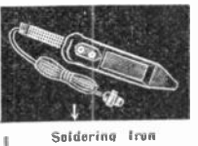
Radio Frequency Transformers

Best Radio Frequency Transformer developed so far. Designed by R. E. Lacault, Associate Editor RADIO NEWS. Air core type.
A2800 Transformer, size 1⅞"x2½" $1.50



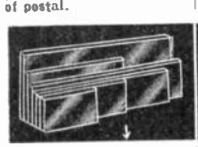
Spaghetti

Varnished flexible cambric tubing. 319 takes No. 22 wire; 320 takes 18 to 20 wire; 21 takes 16 to 18 wire; 344 takes 22 to 28 wire.
A319-320-321 Per ft. $.06
A344 Flexible soft rubber tubing; 10 feet for..$.20



Soldering Iron

Smallest and handiest made. Fits any flat iron or percolator plug. Plug then becomes handle. 5" long. Complete but without plug or wire.
A2200 Soldering Iron $1.45



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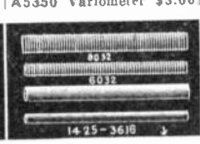
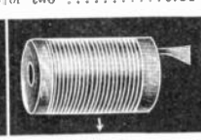
As we are discontinuing these particular sizes, this material is now offered at cost. All 3-16" thick.
A352 9x12" each $1.75
A354 6½x19⅜" ea. 1.90
A356 6x14" each .. 1.60
A357 6x4" each ... .65



Brass Rods

Sold in 6" lengths only.
A8032 Rod 8-32" thread length .....$.07
A6932 Rod, 6-32 thread length .....$.06
A1425 Rod, plain ¼" round, length .....$.10
A3616 Rod, plain 3-16" round, length .....$.06



Litz Wire

Prices are per foot. Each equals.
A823 E No. 25 B&S $.02
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10 per cent discount in 100 foot lots.

Copper Ribbon

.005" thick.
A700 ¾" wide. A701 ¼" wide; A702 3-16" wide. All sizes per foot...$.01

Copper Foil

.001" thick. 1" wide.
A5025 Copper Foil per foot .....$.10
10-foot length ..... .80

Tin Foil

All our tin foils come 4" wide. Uniform product throughout.
Best grade only A850 has 150# sq. inches per lb.
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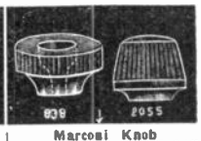
A851 Tin foil..lb. .40

Switch Knob

A199 Knob, 1⅛" dia. height ⅝"; 8-32" screw.
A4451 has 8-32" or 10-32" bushing, no screw
A199 Knob .....$.10
A4451 Knob..... .06



Marconi Knob

Has central hole of 5-32" and seat to hold screw. dia. 1¼", height ⅝".
A838 Knob, each...$.12

Fluted Knob

With 8-32" bushing. Black composition.
A2055 Knob 1" high 1¼" diam. each .....$.15

Mounted Crystal-Cup

Cup has screw and adjustment nut. Fits all standard mounted crystals. Nickel plated, polished.
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Best most sensitive mounted crystal. U. S. Navy using it. Each tested.
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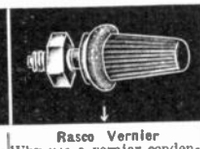

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Why use a vernier condenser when a vernier attachment will do anything and everything a vernier condenser accomplishes? Cleverest vernier made. Can be used with any dia. Soft rubber ring engages dial. Nothing to come apart.
A1450 Vernier .....$.30

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A1475 Angle piece.
Each .....$.03

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Makes 3-16" dial fit ¼" shaft. ½" long.
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Silver surface black enamel lettering. For ¼" shaft. No set screw required. All 2½" dia.
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A801 Prim. Con.; A802 Sec. Cond.; A803 Coupler; A804 Fil. Rheo.; A805 Grid Variometer.
Each style .....$.20 each
Set of six.....$1.15

Storage Batteries

Guaranteed for two years. Only NEW material used. Acid proof terminals. Patent vents.
A2400 Two volt, 40 amp. hours $3.90
A640 Six volt, 40 amp. hours 7.25
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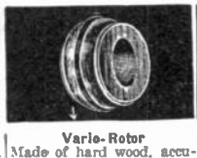

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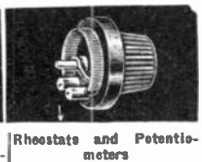
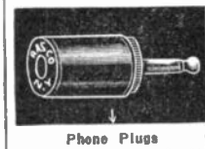
Made of hard wood, accurately turned. Takes any finish. Large hole 2" diameter. Width 2", diameter 3⅜", 2 shaft holes.
A343 Rotor .....$.30
"Rasco" Universal Bearing. Especially made to take above rotor for panel mounting.
A1375 Uni. Bearing $.25



Rheostats and Potentiometers

High heat dielectric base. Come with tapered, knurled knob, 2⅛" dia. Complete with pointer.
A4310 6 ohm .....$.45
A4311 30 ohm .... .65
A4312 Potentiometer. 200 ohms ..... .85

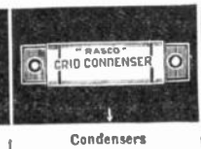


Phone Plugs

Sold from 75c to $1.00 everywhere. Hard rubber composition shell and patented cord tip holder. Finest workmanship throughout.
A1030 Rasco Telephone Plug, each .....$.35

Bakelite Socket

Octagon shape. Four nickel binding posts, phosphor bronze contact springs. Best brown bakelite.
A6510 Bakelite socket $.40
A6500 Tube Socket. Made entirely of composition. Best made. Each...$.35



Condensers

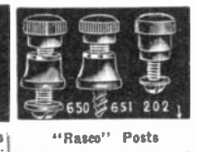
Best make, paper-impregnated condensers. Capacity guaranteed.
A5050 Phone Condenser. .001 .....$.20
A5056 Grid Condenser. .00025 .....$.20
A5059 Grid Leak Condenser, .00025 ....$.30

Name Plates

All name plates brass with silver letters.
A839 (Right or left) $.10
A809 Comes in 35 styles
Any denomination, each style .....$.04
Panel Scale. 2½", 90°. metal, silver background, black lettering.
A715 Scale Each ..$.15

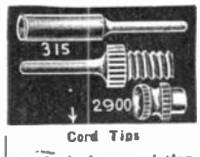
Binding Post Name Plates

Dia. ⅞". These styles: Phones, Ground, —. Output, "A" Bat. —, "B" Bat. —, Loud Speaker. "C" Bat. —, Aerial, —. Input, "A" Bat. +, "B" Bat. +, Loop "C" Bat. +.
A6000 Name Plates all styles, each ..... .$.03



"Rasco" Posts

Made of black composition.
A650-51 Each .....$.08
A202 Has nickel-plated bottom, each .....$.08
Dozen, each style...$.90
A122 Initialed Binding Posts. Six popular styles.
Each .....$.10



Cord Tips

Standard phone cord tips. nickeled.
A315 Each .....$.03

Separable Cord Tips

No solder required. Wire goes in ferrule. Shank holds it tight. Nickel plated.
A2900 Each .....$.06

THE ONE TUBE SET THAT BRINGS 'EM IN ON THE LOUD-TALKER.

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The famous Autoplex circuit described in RADIO NEWS has taken the country by storm. The only single tube outfit that works a loud-talker. Results guaranteed.

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Our special price, Complete $15.25

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Only the best make tubes carried in tock. All tubes guaranteed to work. Money refunded or tubes exchanged as long as filament lights.

		Each
A201A	5 volts, .25 amp.	$3.75
A199	3 volts, .06 amp.	3.75
A12	1½ volts, .25 amp	3.75

All above types Amplifiers and Detectors.

A200 5 volts, 1 amp...$3.35
Detector type.

Aristocrat Post

The Binding Post illustrated is the latest style and has been enthusiastically received. The illustration shows full size. Hard Rubber Composition. Fada type knob, nickel plated bottom piece. Brass screw furnished. Introduction price:
A2022 Posts—
Each .....$.07
Dozen .... .80

A2022

RADIO SPECIALTY CO., 98S Park Place, New York City

Factories: Brooklyn, N. Y. **Elkridge, Md.**

How and Why?

(*Continued from page 338*)

should be connected. It is not necessary to have four connections to the coil, as the end binding post is common for both primary and secondary leads. The condenser may be a glass plate 8 by 10 inches, coated on both sides with tin foil. The coil consists of about ten turns of wire or lamp cord on a tube six inches in diameter. The coil is not absolutely necessary.

Reproducing Pictures Electrically

(406)—G. T. Stayros, Phila., Pa., asks:

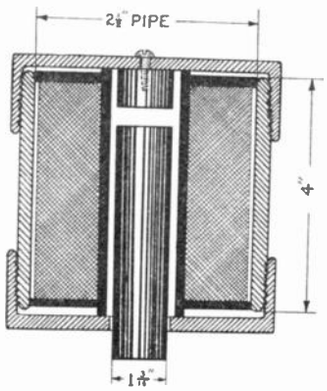
Q. 1.—Is there any way that a picture can be reproduced by electrical or chemical means without destroying the original, giving a perfect duplicate of it?

A. 1.—We know of no method whereby the picture may be reproduced electrically. The best method is to photograph it.

Solenoid

(407)—Leon Schwartz, Bronx, N. Y., inquires:

Q. 1.—Please give me construction data on a solenoid for a 110-volt D. C. circuit,



Section of a powerful iron-clad solenoid magnet with considerable length of stroke.

to pull 50 pounds on a one-inch stroke, using No. 22 double cotton-covered magnet wire for the winding, and a machine steel plunger one and three-sixteenths inch in diameter.

A. 1.—An iron-clad solenoid should be used for your purpose, as the simple solenoid with coil and plunger would have to be too bulky and would require an enormous current in order to lift the 50 pounds; and as a short stroke of one inch is all that is required, the iron-clad solenoid is better adapted for this purpose, although the simple solenoid would have a much longer stroke.

The illustration shows the solenoid inclosed in a standard 2½-inch iron pipe, four inches long, threaded on each end for a standard pipe cap. In one end is fastened a pole tip one and three-sixteenths inches in diameter and one inch long. A clearance hole is drilled in the other cap through which the plunger moves. The plunger is three inches long. The spool is wound full on the No. 22 wire and connected to the 110-volt D. C. line through a suitable resistance to limit the current to one or two amperes.

Q. 2.—How can the pulling time for such a solenoid be made to extend for about five seconds?

A. 2.—A dash pot is usually employed for this purpose. A dash pot consists of a cylinder and piston. The piston is forced into the cylinder by the action of the solenoid. Sometimes the dash pot is filled with oil or glycerine and sometimes with air. In either case it will be impossible to force the piston into the cylinder without letting the fluid or air pass the piston. A small hole in the piston or the loose fit of the same effects this and retards the motion.

Motive Power from the Air

(408)—Arthur Avery, Bow Island, Alberta, Canada, encloses a newspaper clipping in which it is claimed that an American engineer has recently invented a new device to take power out of the air and run railroad trains, automobiles, etc. It is also alleged that an experimental car resembling the foot or hand power trucks employed by railroad workmen, was built, and collected energy through a bundle of wires on the top of a 10-foot pole. Wires leading from the bundle conducted the electric energy to motors that ran the device.

Q. 1.—Do you think the clipping is correct and if so on what principle does the device operate?

A. 1.—We have heard of many cases of this kind before, but nothing seems to come of them except a few spectacular newspaper articles and then all is quickly forgotten. It is safe to say that if such a device is ever produced it will receive such wide publicity that there will be no question about it. The nearest approach to receiving power from the "air" that we have heard of appeared in the February, 1924, issue of this paper.

Tesla Coil

(409)—S. B. McKay, Tavistock, Ont., Canada asks:

Q. 1.—Please describe the construction of a Tesla coil which will give at least a 10 inch spark when operated on a Ford coil energized with dry cells.

A. 1.—You cannot produce a 10 inch Tesla coil spark by operating the coil from a Ford spark coil. At least a ½-kw. transformer operated on the 110-volt lighting circuit should be used. The construction of many such coils has been given in previous issues.

Premonition

(*Continued from page 298*)

versity, was interrupted while he continued his study at another of the allied hospitals of New York. During the third year, my services being desired by the United States, I discontinued my studies to engage in settling the international dispute. McAuliffe, however, completed his course and rendered service in a base hospital within sight of the Statue of Liberty. Letters passed between us, which although few and far between, gave an insight into each other's doings. While "Over There" I learned of McAuliffe's marriage. His marriage was not one of convenience, money or social position, but purely a love match, and even to this day the original spark of love watered by the springs of good health and blessed by the sunshine of happiness, continues to grow.

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

35c
EACH
Postpaid

Now We Have *Radio* Song and Dance Hits

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

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

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

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Radio Jazz:

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

Listen In:

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

Radio March:

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

I, meanwhile, abandoned my medical ambitions and became an investigator, a writer and an originator of magic illusions. Many of my original stunts have been featured in scientific publications, and shown on the stage by prestidigitators or illusionists. I have attacked nearly every medium and challenged them to produce under scientific conditions those effects which they claim to be supernatural. Neither did I believe in premonitions.

Carlton's Suicide

Dr. McAuliffe rose from his chair, his strong physique showing clearly against the dark background beneath the amber chandelier. Pointing a finger impressively at me, in a voice scarcely above a whisper, he said:

"Yes, Hargrave, and I want to tell you that I believe I am directly responsible for Carlton's suicide."

"What!" I leaped to my feet, upsetting the ash receiver before me.

"Yes," Dr. McAuliffe shook his head gravely, "I am certain of it." Stepping forward, I shook his one hundred and eighty pound, six foot frame vigorously.

"Why, man, you don't know what you are talking about. Explain yourself."

Beckoning me to my seat, he drew his chair alongside of mine.

The Doctor's Story

Dr. McAuliffe began his story.

"As you undoubtedly know, Carlton, also a dabbler in science and a crooked politician, was a stark enemy of mine. In 1917 when I was completing my medical course, he tried to force a bill through the State Legislature which would affect his town directly. At that time he occupied a beautiful house which I have always loved, which for years had belonged to his family. He had inherited vast properties following the death of his father, which made him independent.

"This bill, to all intents and purposes of benefit to the community, actually contained a rider which would prevent the possibility of municipal ownership of traction, water supply and electric lighting resources for the State one hundred years to come. It would force the State to permit local organizations to install, maintain, operate, and charge whatever they desired for these services, with no responsibility to the Public Service Commission at any time. My attention was called to these clauses, I instituted a campaign against the bill, and it was defeated. From this time on Carlton spread persistent rumors to defame my character, which merely served to make me more popular, and I succeeded rapidly in establishing a clientele. My time was divided by special permission, so that I could attend to military duties and home practice daily.

"In December I received a telephone call from Carlton that his wife was dangerously ill. The night was stormy, and the snow which commenced to fall at 7 o'clock that evening had increased, a furious gale sending the white blanket up into drifts nearly two feet deep. I reached the Carlton house at 11 o'clock that evening, and was admitted by Carlton himself. Why this man who detested the mere mention of my name, should call me to attend to his wife I could not understand. I had been married but two months, and although my wife desired me to ignore the appeal, I overruled her objection. Carlton glared at me as he opened the door, but assuming as charming a manner as possible, he led the way to the sick room. 'Immediately after eating a hearty meal,' Carlton explained, 'she became ill. Do you think she will live?'

"Don't you think that a peculiar question, Hargrave?" I merely nodded, being too much interested in the story to reply.

McAuliffe continued: "And when I talked the matter over with my wife she also thought it strange. The following morning I again called upon Mrs. Carlton. Her condition was worse. So rapidly did her condition change that even my use of the stomach pump on the night before, and my other administrations gave no relief. I first thought ptomaine poisoning was the cause of her illness. I still could not see why a man of his financial standing did not call in another physician also, but that question was not as important as was Mrs. Carlton's health. Ringing for the maid, I asked her to bring a sample of the food of which Mrs. Carlton partook on the previous night, and if possible the same plate of food which was left over from the previous night, unless, of course, the dishes had been washed. She informed me that the night before was her evening off, and that Carlton himself had acted as the chef and waiter. Carefully wrapping both plate and food in a towel when she returned with them, I returned to my laboratory where several germ plate-cultures were made, as well as a chemical analysis of the food. The results were positive, and I rushed to the Carlton house in time to hear Mrs. Carlton speak her last few words, before she fell into the deep sleep of death. It was 8:15 and Carlton had not yet put in an appearance.

A Devoted Admirer

"It was common talk that Carlton was a devout admirer of May Avis, a headliner at the local play house. No wonder he admired her. She was the exact counterpart of his wife—a well developed blonde—but gifted in the science of flattery, entirely lacking in his wife. I managed to reach Carlton at the dressing rooms of the Frazee Theater, where he was awaiting the completion of the day's performance, and ordered him to come home immediately. He didn't show the slightest regret at his wife's demise. Patting me on the back he remarked that I had done all I could to alleviate her sufferings, and that it was 'too bad,' and then requested the burial permit. Turning sharply I said, 'Nothing doing, Carlton. A burial permit will be granted by the coroner.' In feigned surprise Carlton informed me that I was the attending physician, and consequently should write out the burial permit. 'Your wife was deliberately murdered, arsenic was administered in her food on Wednesday night, and you yourself made up the dish and waited upon her,' I replied. In an instant Carlton was in an uproar. He swore like a madman, and came toward me. The revolver which I always carry, flashed out of my pocket and cowered him.

"I came home my nerves all atremble: my wife sprang into my arms as I opened the door with the exclamation, 'I'm so glad that you're home Bob, I felt that something was going to happen to you.' I did not tell her of my experiences. I merely informed her that Mrs. Carlton had passed away. The rest remained a secret until after the official confirmation of Carlton's suicide had been received. My wife had retired about an hour later, and I was still busy making up a report when she called and asked me to come upstairs immediately. Now whether this call was premonitive of evil or not, I do not know. I called back that I would be with her in about ten minutes, but she was anxious that I hurry matters and come up sooner. Accordingly, I removed my jacket, hung it over the back of that chair alongside of the desk, and as I was standing I noticed the shadow of a man on the bookcase opposite the window. This same shadow outlined on the blind, which was drawn down fully. The win-

dow was being raised carefully, and from the way in which the shadow flickered I knew that the light surrounding the figure was produced by the headlights of an oncoming automobile just turning the bend, about four hundred feet up the road. I stepped back alongside of the window and stood there breathlessly. My wife called again, but I did not answer her for fear that my location would be exposed. My own revolver was in the top drawer of that library table over there."

"My wife called again, and still I didn't answer her. Just then the whistle of a railroad train was heard in the distance, and the noise was becoming louder and louder. When the noise of the train was practically at its maximum, two dark barrels were pushed through the window. I did not dare attempt to reach the door as that would have placed me in the direct line of sight. While still gazing at those shafts of death my wife entered the room. There was a terrific roar as one barrel was fired after the other, and she fell. I rushed to her side and stooped down. She was not injured, the shock had merely sent her into a faint, and it was hours before she could talk coherently. Needless to say the assailant got away. The desk there is still pock-marked from the scatter shot used by the assailant." McAuliffe rose. "Come here a minute Hargrave," and removing a flashlight from the top drawer of his desk he focused it on the table top and the sides, showing me the dents caused by the shots fired at him.

"The back of the chair which McAuliffe would have occupied at the time was full of holes, and I shuddered to think of what would have happened to anyone occupying this seat, as the slotted framework of the chair would present small protection to the pellets discharged at such close range.

Searching for Footprints

McAuliffe continued:

"The following morning I arose rather early, and with my wife went out to locate any footprints in the snow. As you will remember, it was snowing quite heavily the first night that I was called to the Carlton house. It was an ideal day for an investigator like yourself to find the perpetrator of the attempted crime, but even with my scant investigative knowledge, I knew who it was."

"Who?" was my eager question. The suspense was great.

"Carlton! I knew Carlton had attempted my life because he walked with a limp. This limp was due to ankylosis, developed when quite young, and which clever osteopaths had been unable to rectify. The left foot turned inwardly in walking. These two findings established the identity immediately. That day"—

Just at this moment Mrs. McAuliffe entered the library—no wonder McAuliffe adored her; though she had almost attained the age of thirty she still retained her girlish figure, sweet smile and spiritual eyes. Every move bespoke charm and grace. She greeted me and sat down beside us. Unmindful of his wife's presence McAuliffe continued:

"That day, Carlton's hat and coat were found on King's Bridge, with the following note: 'The shock of my wife's death is too great for me to stand. Goodbye.' The river was dragged by the police, but no trace of the body was found.

Just then the musical voice of Mrs. Carlton cut in on the conversation. "Frankly, Dr. Hargrave," she interrupted, "I do not believe that Carlton is dead. I know instinctively that he is alive, and will show up some day. The best possible way to learn of his whereabouts, would be to locate May Avis, who disappeared two days later, following Carlton's reported death, from the theater. If you find her you will be able to put your hands on Carlton."

Events were getting rather warm for me. Here was one astonishing incident followed by another still more astounding. Is it possible that Carlton is still alive? was the question running through my mind.

The Missing Corpus Delicti

"For my part," Dr. McAuliffe said, "I would be more convinced were Carlton's remains found, than with the evidence which the authorities state indicate his death. There is something suspicious in the sale of the Carlton house, although I understand that all of the estate is to be sold at public auction, due to a court order permitting such sale. Carlton died intestate if he did die. Now Hargrave, you have something to investigate. Locate Carlton and I will pay you well for your services, as will the authorities.

Eight Months Later

The Carlton house had been occupied for the past six months by a young couple, the bride's parents having presented the house to the newlyweds. My investigations into the mystery had led me to New York, where I found much evidence to confirm and deny the belief that Carlton actually did away with himself on December 10th of the previous year. All this information regarding the Carlton house was obtained from letters which Dr. McAuliffe sent me from time to time. On this particular day a telegram from him asked me to hasten to the suburban town where he resided. I lost no time in getting away, expecting to hear some startling news.

Dr. McAuliffe met me at the station.

"Some information regarding the Carlton case?" I inquired as I greeted him.

"Exactly," he replied, "and we are going there now. You studied medicine, Hargrave, and know something about cancer. I will show you two of the most remarkable cases that you have ever seen in your life, and you will hear more when we reach the house."

We arrived at the mansion in about twenty minutes, and were ushered to one of the bed chambers by a trained nurse. And here I saw two of the worst cases of cancer which I have ever witnessed. After examining the victims, McAuliffe said, "Do you see anything unusual about those cancerous growths, Hargrave?"

"Nothing, except that they are both of a superficial nature, although I would not pass upon a favorable prognosis in either of the cases," was my reply.

"Neither would I, Doctor," McAuliffe said, using the term "doctor" for impression or effect, rather than of its true significance, as I was not a practicing medico, although an honorary degree had been conferred upon me by a small university for my services during the world conflict, and therefore, I was legally entitled to the prefix "doctor."

"That cancer is not due to cell proliferation as a result of natural causes, but has been *artificially* induced. Another thing in both cases here, the patients were in the best of health at the time of their marriage, eight months ago."

I whistled. This was a new angle and I wondered where the doctor had received his information.

The valise which I had brought with me from New York was in the car. With the doctor's permission I went down, procured my camera, and came back to the room to take photographs. Having taken the pictures I left the camera on the bed, and then entered into a rather lengthy discussion regarding the possible outcome of the case; both McAuliffe and I contended that there was but little hope for either of the two.

Developing the X-Rayed Films

I returned to McAuliffe's home that evening, and decided to develop the films immediately in McAuliffe's own laboratory, but imagine my surprise when upon examining the films following their development, I found distinctly impressed on each a silhouette of the lens, shutter and trigger release of the camera, as well as a rack bar running clear across the middle and a rod extending from the side produced by the focussing screw. Shaded portions surrounding the dark opaque lens holder showed the position of the bellows of the camera as it lay folded, and each of the films in the film pack which I had developed by the tank method was similarly effected, while scenes which I had taken in the metropolis were practically obliterated, giving way to these other impressions. At first I thought that the film pack was defective, and then my mind went to X-ray. I immediately questioned Dr. McAuliffe.

"Have you an X-ray machine operating in this room, or in the dark room?"

"No," was his answer. "There has been no X-ray machine operating here for three days."

"Take another look at these films. Is it not strange that a similar image should be on each one of them, identical with what would be produced were my camera closed and subject to the action of a prolonged machine for a period of time?" was my next query.

The doctor suddenly became electrified. "Quick, your hat and coat."

He rushed into his laboratory and came out with a small flask in his hand. In the other hand he carried a fluoroscope, which is used for visibly viewing the penetrative effects of an X-ray machine. It is simply a hood of square truncated form covered on one side with a screen made by coating a sheet of paper with barium platino cyanide, and having an elongated aperture fitting the eyes at the other end. Rushing out and dragging me with him, he called up the stairs:

"Ann, get a room ready. I am bringing two patients back with me." Without even awaiting her reply, he scurried pell-mell down the stone stairway, and jumped into his machine.

"Where to?" I asked, as the sudden start of the machine threw me into my seat.

"Carlton house," was his reply.

"Why?" was my next request.

To this I received no answer. The machine lurched sharply. The speedometer, already mounted to 45, was going up until we were whizzing across the road at a speed of 58 miles per hour. If something had gone wrong on that trip, not only our lives but the lives of others would have been sacrificed. Fortunately nothing did. The car slowed down as we rounded the curb of the driveway, and he was out before I even rose from my seat, rushing headlong up the stairs. I was close at his heels, when we were admitted. Without a word of explanation, McAuliffe ran up the flight of stairs, the flask bulging in his pocket, and the fluoroscope in his right hand. When we entered the room, we found the bride of eight months crying, and my heart went out to her. She evidently realized that death was an assured fact.

The Fluoroscope

"Here," McAuliffe called to me, "take this fluoroscope. Set it down and help me get these two people out of this room."

We did so after struggling vainly to prevent torture when our hands touched the irritated portions of their bodies. After making them comfortable in the car, McAuliffe ran back into the house, and I followed again. With the fluoroscope in one hand, and his other hand in front of the screen, he looked all around the room, up at the ceiling, at the four walls, down at the floor, and even crept under the bed, but the interior of the box was black.

"Damn it, Hargrave," he said, "I was positive that these lesions were brought on by subjection to X-rays, and yet when I examine the room I find absolutely no trace of the rays."

So saying, he withdrew a small electrophorus from his pocket. Rubbing this briskly with a piece of flannel, he charged the electroscope. The electrophorus is merely a tin pan filled with sealing wax, on top of which is placed a flat disk of metal secured to an insulated handle. When the sealing wax is rubbed with flannel, it becomes charged with static electricity. This charge is taken up by the metal disk, and then when held to the ball on top of the electroscope, it charges the electroscope. The electroscope is a small Ehrlenmeyer flask, an ordinary inverted cone-shaped bottle, having a rod running through the cork in its neck. To the bottom of this rod a small rectangular piece of gold leaf is secured, forming a V-shaped inverted wedge on the bottom. These leaves hang rather loosely and close together when they are not charged, but when acted upon by a charge of static electricity, the leaves diverge. Under the influence of an X-ray machine or radium, the leaves come together much more rapidly than they would in open air, due to the fact that ionization of the air takes place, and the charge is dispelled more rapidly. Consequently the discharged state occurs in half or one-fifth the time ordinarily required for the charge to leak out through the air.

Holding the electroscope at arm's length, Dr. McAuliffe walked around the room with it, at times holding it over the bed and under the bed, but there was nothing unnatural in its action; the gold leaves stayed apart for quite a while.

We were just about to leave the room, the doctor had placed his electrophorus on the table and was calling himself fourteen different kinds of fools. He thought he had solved the mystery, but no. I was rather tired from the excitement of the last few hours, beginning with my railroad trip, and terminating with this, so I sat down on the bed. Even as the doctor was speaking, I looked at the electroscope, and with a sudden exclamation, "Look, the leaves are falling," I caused him to turn rather sharply. Both of us walked over to examine the electroscope, but although the leaves had started to close rapidly, they suddenly ceased.

The Electroscope's Story

"I guess you were wrong," the doctor exclaimed, "but let me see," he paused for a moment, "No," he added, "something occurred in this room just now which caused those leaves to converge rapidly. There is something happening here. Let us wait and find out."

We waited and waited but the effects were nil. The doctor was commenting about coming back on the morrow and continuing his investigation. In fact he entered upon a dissertation of various possible theories, and was remarking that perhaps an impending shower had caused the leaves to fall a little more rapidly.

I again seated myself in my former position. The doctor picked up the electrophorus and again the leaves started to close, this time very rapidly.

"Look," he said, "give me the fluoroscope quick." I rose to procure the object called for, and was stopped in my steps by this trite command. "No stay where you are. Go back where you were. Sit down, sit down."

Immediately, as though acted upon by a concealed motor, the leaves closed up completely. He charged the electroscope again, but the leaves folded so rapidly that subsequent charging was of no value. It was impossible to keep the electroscope

charged and maintain the leaves in their diverged state. Reaching over he grasped the fluoroscope, and placing his hands in front of it said:

"Sure enough, X-rays, a trick Hargrave—a trick I tell you. Carlton is still alive. He planned this knowing that I was anxious to purchase this property, and it would be a matter of but a few months when I would join his wife on the other side of the Great Divide. A most powerful apparatus. Just look."

I rose and took the fluoroscope out of his hands.

"You don't see anything now, do you?"

I answered in the negative.

"Now, just watch and see what happens when I sit on the bed. Hold your hand in front of the screen."

I did as he requested. He seated himself rather suddenly, and as he did so, the whole interior of the box into which I was looking glowed with a pale yellowish tint, and there the bones of my hand clearly stood out. X-rays surely. We moved the bed and examined it carefully to determine whether or not there were any wires connected to it, but could find none. We then explored the floor carefully. A loose board was found. Ripping this, we discovered a hidden switch.

The Developments

We brought the former occupants of the house to McAuliffe's home, and made them as comfortable as possible in one of the spare rooms. The next morning after having had an enjoyable breakfast with Mrs. McAuliffe and the doctor himself and having spent a few moments with the patients, we again left to continue our investigation. It was a simple matter now to trace up the wiring and after ripping nearly every one of the boards from the bedroom floor from their beams, we located three X-ray tubes and a transformer coupled directly to the 110-volt alternating current circuit. The switch beneath the bed post operated by the loose board in the floor in turn controlled a second switch of the oil immersed type, so that the moment an individual lay down in bed, an X-ray tube was in full operation. The other two tubes were not excited, but were merely spare tubes. A selective relay was so arranged in the circuit that should one of the tubes blow or burn out, another would be automatically thrown into the circuit. This eliminated the necessity of an electrician for replacing the tube or cutting out any one of them due to defect. One of these tubes had already seen the end of its usefulness, or rather misusefulness, so that the second of the three was the one in actual operation at the time. This murderous machine was a masterpiece in ingenuity, and only a former professor in physics, such as Carlton was, could have devised and set up the apparatus. We left the house after severing the connections to the transformer, and replaced nearly all the floor boards which we had removed. For months neither of the Morris' took any turn for the better or worse, but Dr. McAuliffe maintained treatments, and was just as anxious to effect an ultimate recovery as I was.

It was not until eight or nine months later that by means of many operations and treatment with both X-ray and radium emanations, the cancerous growth had abated sufficiently to warrant a discharge of the patients.

Returning again to the city where my operatives had continued to trail May Avis, I found that they had also located Carlton. May Avis had found another admirer, and had given Carlton the non-technical "cold shoulder." Carlton was angered and was intent on "getting" his rival. Miss Avis and her companion were dining at one of the less frequented rathskellers.

Wine was flowing like water, and Volstead was yet unheard of. The detectives associated with me did not at any time lose track of Carlton, but we were always too far away from him, and the chances of his getting away were too great to warrant our action. Carlton visited different places daily, and it was not until this month that he established any regularity in his habits.

Carlton's Fate

At about 12:30, several of my men entered the rathskeller. I waited without, with a uniformed policeman. Suddenly I heard a shot. We rushed downstairs and found the lights out. A flashlight was being thrown around the room. Several other shots fired in rapid succession greeted us as we came through the door. By the time we located the switch to turn on the lights about half of the occupants of the place had disappeared. The others were placed under immediate arrest. We reached for Carlton and found him, an agonized look on his face, and an automatic held loosely in his right hand, where it was dropping from his grasp as he sunk to the floor. May Avis was gone as was her escort. The table had been overturned on Carlton, and two bullets in his body indicated that the opponent was a better marksman than Carlton. Two empty automatic cartridges on the floor showed that Carlton's revolver had spoken twice.

The next morning newspaper headlines read:

Man Killed in Drunken Brawl

An unidentified man was found dead in Koenigs Rathskeller, the victim of a drunken brawl. The authorities are looking for a woman who they believe precipitated the quarrel. . . .

July 28, 1921, at about 12.45, Police Sergeant Long attracted by a shot rushed into Koenigs Rathskeller where alcoholic liquors were still being served. The lights were out in the place and after the switch had been found and closed again, about fifty couples were placed under arrest. These were questioned at length by detectives, but very little information could be obtained from them. It is known that a famous actress was associated with the party of three. An argument is reported to have occurred between the two male members, and but few words were passed before the shots rang out. Each of the rivals fired two shots from their revolvers. . . .

Within a month I was again with Dr. McAuliffe. I have never been a believer in premonition, but now when Ann, for I am permitted to call her by her first name, desires me to postpone a trip, I follow her advice. When she asks Dr. McAuliffe to stay home, he also does so.

I would like to add that I cannot yet explain whether these premonitive attitudes are based on scientifically proven facts. I am still investigating. Neither can I tell how it is that on two occasions my own life has been saved by following her counsel, and how it was that Dr. McAuliffe at many times has profited by similar advice.

High Tension Armor

(Continued from page 299)

this suit, it was possible for the Italian engineer to actually demonstrate that several hundred thousand volts can pass right through this armor without the wearer thereof feeling any sensation whatsoever. It was safe for an operator to hold a pair of pliers in his hands and draw out a spark from a conductor running up to 100,000 volts without feeling anything unusual. When the current was

increased over a certain amount, the only effect was a slight heat felt below the arm pits but this was later overcome by reinforcing certain parts of the suit with heavier wire to stand more current.

The principle of the action is shown in Figures 4 and 5. Here we have an electroscope placed in the center of a bird cage. It is well known that high frequency currents travel only on the outside of conductors. Hence, we are not surprised that even a very sensitive electroscope will not be affected at all when placed in a cage as shown, because the high frequency current only travels on the outside. If we take the cage away, as shown in Figure 5, the leaves of the electroscope will diverge as shown.

There is still another way to show what happens; see Figure 6. An ordinary electric insulated wire is made of a center conductor with the insulation on the outside. If we reverse this and put the *insulation* on the *inside* and the conductor on the outside, we obtain precisely the same effect as in the electric armor.

In order to protect the lineman's face, he can wear a wire mesh helmet or veil, which is also made of wire cloth and which does not obstruct vision or good ventilation. At the same time, it proves to be a very effective protector. The suit worn by linemen in action is depicted in Figure 2, where we see a man working on a high tension line which may be of 200,000 volts or more. If a flashover occurs, the lineman will be none the worse for his experience, unless, of course, the spark is so hot that it would melt the suit. But in any event the lineman would have time to get away without being shocked and thereby avoid losing the use of arms or legs.

Odd Telephones

(*Continued from page 320*)

the molecules of the cork, to which they are conveyed by mechanical action or disturbance. By this arrangement disturbances in the current or in degree of polarity in the magnet may be imparted to the cork with greatly increased intensity, adapting them to be much more easily and distinctly recognized by the ear.

Lamp Efficiency and Total Cost

THE economy of a lamp cannot be judged by the number of hours which it will burn, for the efficiency is by far the most important factor affecting the total cost of the light produced. The life of a lamp depends upon the efficiency at which it is operated, and it is impossible to alter one without affecting the other, and the length of life which gives the most economical result in service depends on the cost of current and the price of lamps. In general, the high cost of energy justifies lamp lives being made shorter with a consequent gain in efficiency and any reduction in the price of lamps also calls for higher efficiencies to give the most economical service.

When consumers realize that the commodity for which they are paying is light, and not current or lamps, they will realize that it is not economical to attempt to increase the useful life of a lamp by such means as running it on a circuit voltage lower than the rated voltage of the lamp. Minute care is taken to ensure that the efficiency of transformation of energy in the power house is at the very highest and it is surely useless to take this care if the final transformation of electrical energy into the form in which it is required, that is, light, is only carried out at a small percentage of the possible efficiency which can be obtained.

Electrically Heated Floors

ELECTRICALLY heated floors have been introduced into Swiss dwelling houses by the Electra A. G. of Wädenswil. It is pointed out in the *Schweizerische Bauzeitung* that floor heating is best suited to rooms fitted with stone or concrete floors and mosaic flooring. The heater coils are placed within iron pipes which are embedded in the flooring, at suitable distances apart, but closer near the windows than in the middle portion of the room. When the floor is built up of concrete beams with thick webs, the pipes are placed in the recesses between the beams and are packed in these recesses with fine gravel. The concrete is covered with a layer of plaster on which the stone slabs or planks are placed. When the floor contains wooden beams the space between the beams is filled with concrete, when the pipes have been fixed, the wood itself being covered with a layer of gravel lest the structure become too rigid. Between the lower surface of the floor and the concrete containing the heaters an air space is left to prevent radiation downward. That a considerable amount of concrete is wanted for the installation is considered advantageous in so far as the concrete stores the heat, so that the current may chiefly be turned on during hours in which it is hardly wanted for lighting. The coils are drawn into the pipes like cables and are built up in links to retain flexibility. It is mentioned that the heaters are mostly fitted with two resistance coils, to be coupled in series or in parallel or to be used singly; this is preferable to providing special switches for separate heaters.

Thawing Water Pipes

DURING the last winter we paid plumbers something like $25 for thawing out our frozen water pipes three times.

The last time our pipes froze I did not call a plumber, but having a long extension cord and an electric grill, I attached it in the basement and placed the grill against the pipes. I then switched on the current and went about my housework. The grill was switched on until 10 o'clock and the pipes were thawed. The cost was less than fifty cents. Later, whenever it looked as though our pipes might be in danger I switched on the grill and warmed the pipes for an hour or so and our plumbing troubles were over.

Contributed by

MRS. ALICE LARUE O'LEARY.

Measures Lightning Voltage in Seeking to Protect Wires

A MEANS for definitely measuring the voltage of a lightning flash, which has long been a matter of speculation with scientists, was explained recently by F. W. Peek, Jr., consulting engineer of the General Electric Company, in an address before the Franklin Institute, Philadelphia.

Mr. Peek told how, with a miniature village in the Pittsfield General Electric laboratory, he had been able to measure what percentage of an artificial lightning flash from his million-volt generator was induced on a miniature transmission line at a given distance from the flash. He said the experiments proved that when lightning struck 1,000 feet from a transmission line 1 per cent was induced on the line. The voltage of this flash was easy to measure, and multiplying it by 100 the full voltage of the lightning was determined.

Mr. Peek explained that determining the voltage of lightning would prove helpful in providing greater protection for transmission lines.

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