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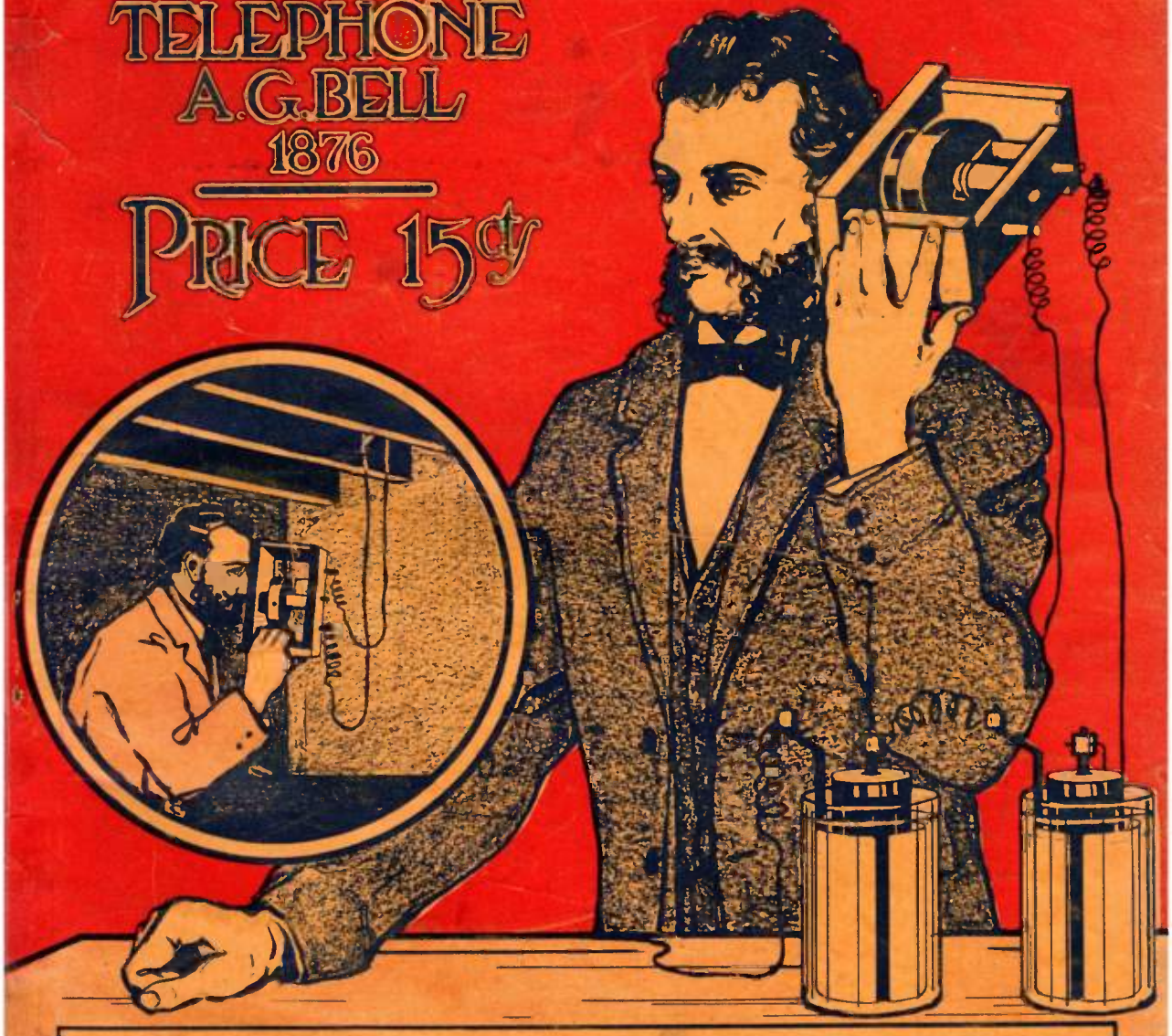

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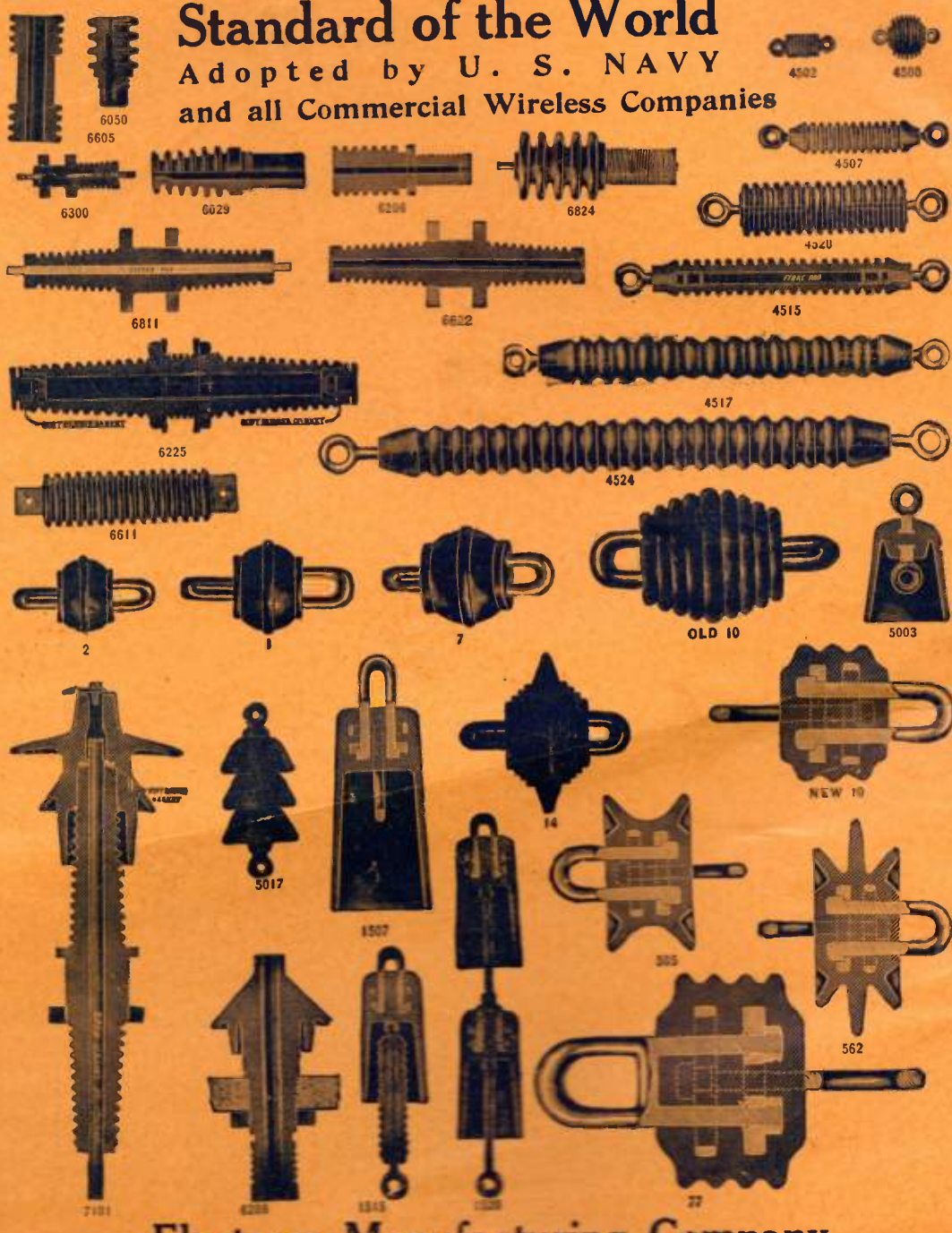

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"The Electrical Magazine for Everybody"

ORLAND J. RIDENOUR, President. CHARLES A. LEQUESNE, JR., Editor.

Volume 6. April, 1913 No. 1

Contents

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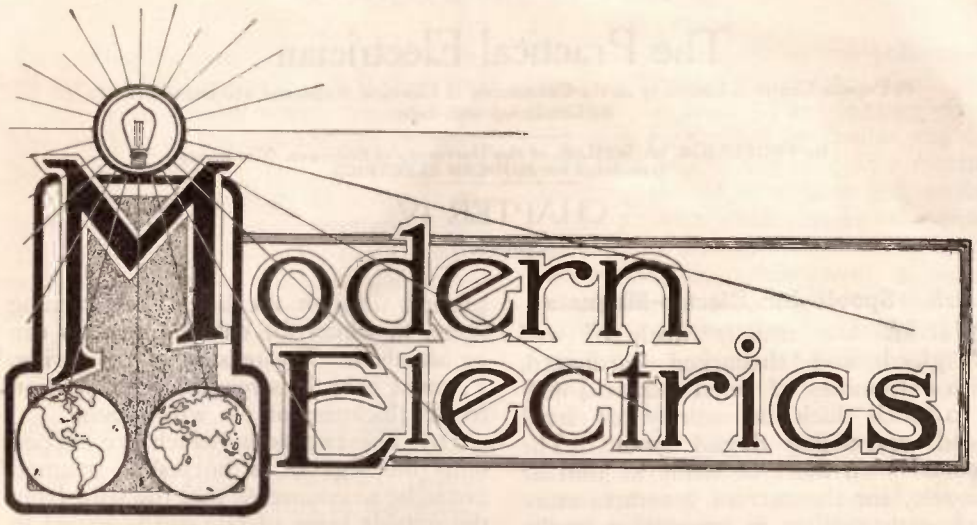

VOL. VI. April, 1913 No. 1

Announcement

We beg to announce that, on February 13th last, Mr. H. Gernsback retired from the presidency of the Modern Publishing Company, and the editorship of *Modern Electrics*. He has disposed of his entire interests in the Company to Mr. O. J. Ridenour, and in the future will have no connection with the Company or its publications.

With this number, Mr. C. A. LeQuesne, Jr., becomes the Editor. Mr. LeQuesne, who has been for more than a year the Assistant Editor, is already well known to our readers, and needs no further introduction.

The general business management will continue as heretofore under the direction of Mr. O. J. Ridenour who becomes President of the Company.

It is our intention to continue to enlarge and improve the magazine, as well as broaden its scope in many ways to the end that *Modern Electrics* will in future as in the past be "The Electrical Magazine for Everybody."

The Publishers.

New York, March 15, 1913.

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By PROFESSOR W. WEILER, of the University of Esslingen, (Germany)
Translated for MODERN ELECTRICS

CHAPTER IV

(Continued)

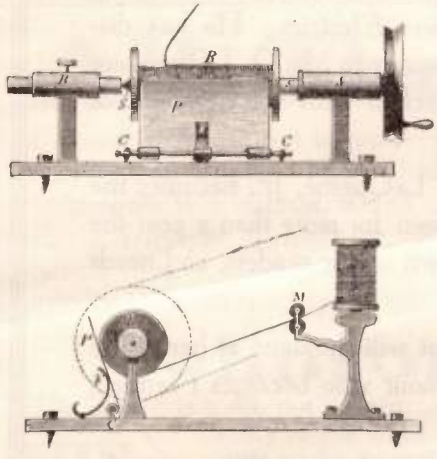
128. Spools for Electro-Magnets

THESE are usually made of well glued and shellacked cardboard, with extremities of wood from 0.4-inch to 0.8-inch thick, or entirely of hard wood, resembling thread spools. The wooden shell must be made as thin as possible, for the current generates more or less magnetism in proportion to the closeness of the wire to the iron core.

(a) The winding of the wire is done either by hand or by a process similar to the winding of thread on spools; the wires should be wound regularly and close together and in layers one over the other.

In Figs. 189 and 190 is shown a simple and easily-made device for doing the winding.

The spool, R, is placed on a shaft, S, which is revolved in the bearing, A (a



FIGS. 189 AND 190

piece of brass tubing), by means of a crank, and pressed against a hollow in the stationary shaft, B. The spring, F, presses the brass plate, P, which swings on the pin, CC, against the spool. From the spool R', the wire goes between the rubber platens, M, to the spool, R. If you attach to the crank a machine pulley, the winding can be rapidly accomplished through the belts of a turning lathe, to which the entire apparatus can be attached. The tension of the spring, F, must vary in strength, in proportion to the thickness of the wire wound.

(b) The two coils, which are slipped onto the legs of a horseshoe magnet, are to be so connected that the wire from the outside layer of one coil is joined to the inside layer, so that the path of the current through the two coils should somewhat resemble the letter S. Should both coils of an electro magnet horseshoe be wound in the same direction, then the inner (under) ends of the wire should be joined.

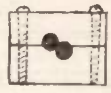


FIG. 191

The beginning of the wire is passed through a hole in one of the heads. After the winding is finished, the other end is drawn through a hole in the other coil head.

(c) Instead of using insulated wire, bare wire, together with a thread of the same or lesser diameter, can be wound on the coil, side by side, the thread serving to insulate the neighboring turns. Each layer is to be covered with glazed paper or oiled linen. On the lathe, the string and wire are run through a guiding block, such as is shown in Fig. 191.

(d) The winding-direction of a spiral is decided according to the following rules:

(1) A spiral is wound right handed, if beginning and end, looking from the poles, run clockwise.

(2) A spiral is wound right handed, if at the end where current enters, a south pole is formed.

129. Rules for the Construction of Electro-Magnets

(1) The length and thickness of the copper wire are to be so chosen that the resistance of the electro-magnet coil is the same as the outside resistance, batteries included. In practice, the resistance of the spiral should only be 3/7

(according to some authors only 5/16) of the outside resistance. It is therefore a matter of choice which decides over the winding of the coil and the grouping of the batteries.

For a small current, in order to acquire the same magnetic strength, a long thin wire should be used; for a considerable amount of current short and thick wire should be used, for the magnetic strength is proportional to the number of ampere turns.

(2) The cross section of the wire is chosen in proportion to the strength of the current. The voltage between the ends of the winding is inversely proportional to the cross section of the wire.

(3) The windings are generally put on in even layers, one over the other; windings only on the ends of the core in telephones, receiver magnets produce an unsteady magnetism, but raises the magnetic strength in these places and permits rapid attraction.

(4) As the magnetic power decreases with the distance of the wire from the core, it can also be that too many layers of wire in proportion to its resistance will do harm. In practice the depth of the coil should be, at the utmost, equal to half the diameter of the core; the rule calls for 2/5 of it.

(5) The long electro-magnet is, for attracting things from a distance, generally the stronger, because it has room for the necessary windings. Among smaller magnets the diameter of the core should be to its winding length as 1:8. In more recent dynamo-machines one can find, in order to diminish the magnetic resistance the proportion 1:3 and 1:2, because here the purpose is entirely different.

(6) A high EMF overcomes the resistance of a long current circuit; for a short current circuit and strong current one should make the iron circuit short and thick.

(7) The number of turns and the resistance of the coil grow smaller as the path of the current gets shorter, since the self-induction current increases with the length of the wire; the iron core is then laminated or divided into layers as thin as possible (alternating current magnets).

(8) The separation of the cores shall be so large that very few lines of force shall leak directly from one pole to the other without traversing the path through the iron. The distance from pole to pole, divided by double the distance of a pole to the core of a rotating armature, should be as large as possible, at least 7. With weak currents the armature is more strongly attracted by a pole placed close by, while with a strong current the distance between the pole and the armature may be increased.

(9) The area of cross section of the yoke should be one and one-half to two times that of the core.

(10) The attractive force of a solenoid grows in proportion to the ampere turns, but at a low saturation of the core it grows faster; it is also dependent upon the length and cross section of the core and its position relative to the solenoid.

A cylindrical piece of iron is less strongly attracted by equal polar strength under ordinary conditions, if the side of the cylinder is presented to the poles, than a prismatic one of equal surface, because the latter presents more surface for contact with the poles and therefore includes more lines of force.

(12) An armature to be moved quickly should be light and its iron well broken up; it must also, in dynamos and motors, rotate between poles which surround it closely.

(13) Separation of the magnetism in the cross-section of the iron core:

(a) The magnetism penetrates deeper into the rods, according to the magnetizing strength of the coil, as was discovered through experiments with iron tubes of various thicknesses and through the tearing-off of a pointed iron rod from various points on a pole surface.

(b) Every layer of soft iron has a saturation point, *i. e.*, an increase of the magnetizing current produces only a little increase in the magnetic strength, and the molecules are arranged regularly; the outside layers reach this saturation point quickest. With weaker magnetizing strength the center of the core remains entirely unmagnetized. Therefore the choice of solid or hollow, long and thin iron cores depends upon various magnetizing strengths.

Should you fit the tube at the pole with an iron plug, not too soft, it will

almost reach the magnetic strength of a solid core; a ring pushed over the tube does not strengthen it.

The thickness of the walls of the tube should at least be one-fourth of the diameter.

(c) Should an iron tube with end plate be pushed over an electromagnet we would have a sort of horseshoe magnet whose holding strength, but not attracting strength, would be about three times as great as that of the iron core alone.

(14) Remanent Magnetism:

Even the softest and finely laminated iron retains some of the magnetism which it acquired under the influence of the magnetizing current; we therefore speak of magnetic laziness and magnetic lag. (Hysteresis.) (Kennelly & Houston, 1895.)

(a) Solid and hard cores retain much remanent magnetism.

(b) Remanent magnetism is much greater, as the iron core is long in proportion to its thickness, because the poles can then exercise magnetizing influence over a lesser distance.

(c) Remanent magnetism is less if the magnetizing current be suddenly interrupted than if the current be gradually reduced.

(15) Magnetic strength and repeated magnetizing:

(a) Should an iron rod be magnetized for the first time by a coil, the magnetic strength increases faster with weaker currents than the increasing current strength.

(b) The faster increase is more noticeable in longer rods than in shorter ones.

(c) This faster increase of the magnet strength always becomes less with repeated magnetizing.

(16) Current flowing through coils and its attractive power:

(a) The strength with which a steel magnet is drawn into a coil is quite accurately a measure of the strength of the current and proportional to the number of turns to the coil.

(b) The strength with which a soft, not saturated iron rod is drawn into a coil, according to Hankel, is proportional to the square of the current strength and the square of the number of turns.

(17) If a U-shaped electro magnet be wound on one leg only it will work for a given number of turns almost as strong as if both legs were wound. The yoke can be made shorter, the two sides may be brought closer together than with two coils; the length of the magnetic current is also shortened. Application,—in bell apparatus and trap boards.

(18) Electro Magnets for Alternating Current:

(a) Iron cores for alternating current magnets must be composed of thin, shellacked wire or sheet iron, so that the circulation of the eddy currents inside the iron mass may be confined to very short paths of high resistance. Furthermore, the spools for the coils should be made of insulating material, or, if of metal, must not form a closed conductor around the core. The latter may be accomplished by cutting clear through one side of the spool, lengthwise of the core, and inserting insulating material in the cut.

(b) Copper or aluminum discs laid on poles of alternating current magnets are thrown off, according to Elihu Thompson.

(19) Elevation in Temperature.

Each square centimetre of the coil surface if raised 1° C above the surrounding atmosphere, can dispel about 0.0029 Watt. If you assume: 50° C above the surrounding atmosphere as a certain limit of temperature elevation, that the electro-magnet has a resistance, r, and a surface of s square centimetres, then the highest possible current $=$

$$0.38 \sqrt{\frac{s}{r}} \text{ amperes.}$$

130. Magneto-Motive Force

An electric current whose unit strength, *i*, is magnetically equivalent to the magnetic polar unit generates, for each unit of current, 4π magnetic lines of force.

Since an ampere is 1/10 the unit current in the absolute system, it follows that 1 ampere generates $\frac{4\pi}{10} = 1.256$ lines of force.

As proven by experiment, a current

(*Continued on page 29*)

Measurement of Condenser Capacity

By Stanley E. Hyde

CONDENSERS are probably in more extensive use among wireless experimenters than in any other branch of electricity. The purpose of this article is to outline a simple method of finding the capacity of condensers, but before entering into the description of the apparatus it might be well to say something about the actions that take place in a condenser.

A condenser consists of two conductors separated by a non-conductor. It would be hard to find a simpler definition than this. The non-conductor that separates the metallic plates is called the dielectric, and a great many dielectrics are used in the construction of condensers, depending on the use the condenser is put to. The simplest form of condenser is one that has two metallic plates separated by air. Fig. I shows one of this type and also shows a current entering plate, A, as indicated by the arrow. As the current flows onto the plate, A, it distributes itself evenly over the plate, and in doing this it sends out electro-static lines of force that induce a negative charge on the opposite plate. B. The electro-static lines of force are shown as they swell out when the condenser is being charged. If the plates are close together, as in Fig. 2, it will be seen that the lines of force will be closer together, or more concentrated

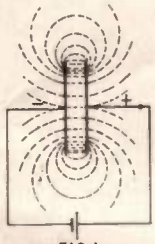


FIG 1

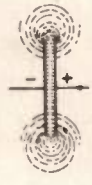
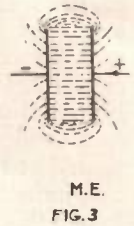


FIG. 2



M.E.

FIG. 3

in the given space between the plates, and this being the case, the condenser will hold a greater charge of electricity because the electro-static lines do not have to reach out so far to induce a charge on the opposite plate. In Fig. 3 is shown the effect when the plates are farther apart. Some of the lines will be lost before they reach the opposite plate, hence the induced charge will be much weaker and the storing qualities of the condenser reduced. Now, if we insert a piece of flint glass between the plates of the condenser of Fig 1, the storing qualities will be increased nine times

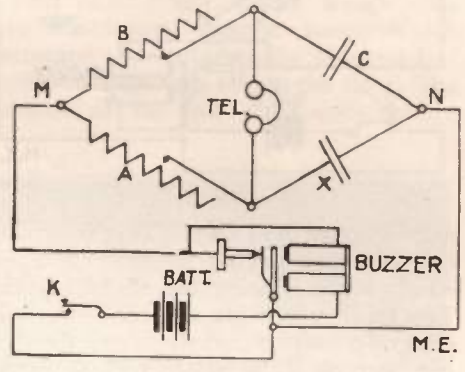


FIG. 4

from what it was when the air was between them. This is because glass will conduct the electro-static lines of force much better than air will in the same manner that iron will conduct electromagnetic lines of force better than air will. In other words, the glass makes a better path for the lines than the air alone does, so that they can have a greater effect on the opposite plate. If paraffin were used instead of the glass the capacity would be only increased 1.98 times that of air, so it will be seen that the capacity or storing qualities of a condenser depends on three things—the area of the plates, their distance apart, and the composition of the separating dielectric.

Air is taken as unity and the ratio between air and any other substance that is used as a dielectric is called the *dielectric constant* of the substance, or its *specific inductive capacity*.

The quantity of electrical energy any condenser will hold is equal to the impressed E. M. F. multiplied by the capacity, or $Q = CxE$.

When the condenser is being charged from a battery or other source it keeps on absorbing energy until the pressure in the condenser is equal to the charging pressure, and when this case is reached the charge in the condenser exactly bucks the pressure of the battery and no

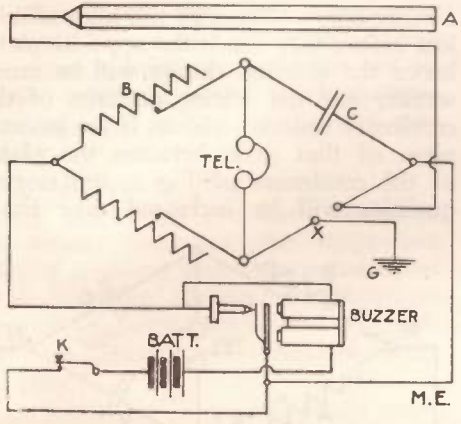


FIG. 5

more current will flow. This is analogous to a tank having no outlet and into which water is being forced by a pump. The tank represents the condenser, the pump the battery and the water the electric current. The water will be forced into the tank not all at once, but in a given time, depending on the size of the tank and the pressure. Either of two things will happen. The pump will keep forcing water into the tank until the pressure in the tank is equal to the pressure of the pump, and no more will flow,

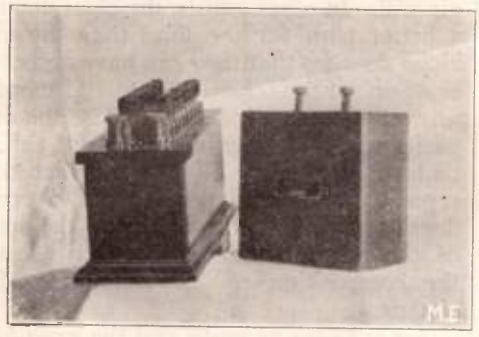


FIG. 6

or if the pump is strong enough it will exert such a pressure that the walls of the tank will break down and let some of the water (which in the case of the condenser is electrical energy) escape to lessen the pressure. This is similar to what happens in an electrical condenser when a very high voltage is impressed on its terminals. The pressure becomes so great that the dielectric is ruptured and some of the energy will escape. This would be the case where a high voltage were used on a condenser made of tinfoil with paraffin paper as a dielectric, or similarly might happen were the voltage great enough on one that had glass as a dielectric. So when making condensers the choice of the dielectric will depend largely on the use the condenser is to be put to, whether high or low voltage.

The usual method in measuring the capacity of condensers is to charge the condenser and then connect its terminals to a sensitive galvanometer and compare the throw of the galvanometer with that of some standard condenser. This is a very good method, but it takes a long time to do the experiment to obtain good results, while with the bridge method the capacity can be found in a very short time.

In Fig. 4 is shown the arrangement of the apparatus known as a De Sauty bridge, which consists of two standard resistance boxes, a standard condenser, a pair of telephones and a small buzzer with the necessary batteries to operate it. Fig. 6 shows a standard resistance and capacity used for this purpose. The two resistance boxes must be of the same make, and must be of the non-inductive type, and possess as little capacity as possible. The reader is, no doubt, familiar with this sort of winding. It consists of a small coil of wire with the wire doubled back on itself so as to form a non-inductive winding. In the case of the higher resistances a considerable length of wire is used, the result being that the coil would possess considerable capacity, and when traversed by a quickly pulsating current the coil would act as a condenser. To obviate this, the coil should be composed of a number of small non-inductive windings joined in series. When this is done it will be seen that the capacity is reduced to a minimum, for it has the effect of joining many small capacities in series. It will be noticed that the whole arrangement resembles a Wheatstone bridge, and that is why it is called the *bridge method* for measuring capacities. In the diagram, A and B are

the resistances, C the standard condenser and X the unknown condenser, the capacity of which is to be found. To the terminals, M and N, are attached wires from the interrupter contacts of a small buzzer. The buzzer is controlled by the key, as shown.

In operating, the telephones are adjusted on the head of the operator and the buzzer started. The plugs in the resistance box are adjusted until the buzzing in the telephones ceases. Then by proportion the following relation holds, A:B::X:C. For example: If the resistance of A were 20, B were 10 and the standard condenser capacity 0.1 microfarad. Then 20:10::X:0.1 = 0.2 mfd.

If the dielectric of the unknown condenser is different from the standard it will be sometimes found impossible to find a complete cessation of sound in the telephones, this being due to the unequal absorption of the two dielectrics, but in such cases the result will be correct within a few per cent. It must also be borne in mind that the condenser to be measured must not vary from that of the standard more than by a small multiple or the result will be incorrect. It is advisable to have on hand about three standard condensers that vary in capacity about 50 per cent.

This scheme of measurement can be used to measure the capacity of an antenna also, as illustrated in Fig. 5. In place of the usual unknown capacity, the leads from the aerial and ground are connected. The same operation is gone through as in finding the capacity of the small condensers. Care should be taken that no loose connections are in the circuit or the resistance will be increased and an error introduced. The capacity of an average antenna is not as large as one would imagine. It must be remembered that the antenna is well away from the earth and that the dielectric is only air. Fleming states that a wire 111 feet long, suspended vertically, and having a diameter of 0.085 inch was found to have a capacity of 0.000205 microfarad, or one-tenth the capacity of one standard leyden jar. Four wires of the same size and length, being 6 feet apart, were found to have a capacity of 0.000583 mfd., about three times that of one wire. By this it will be seen that doubling the wire in an antenna does not double the capacity. When using wires 2 feet apart the capacity increases approximately as the square root of the number of wires —that is, 9 wires would give three times the capacity of 1 wire.

A single wire 100 feet long with a diameter of ⅛ inch, when alone in free space, has as much capacity as an isolated flat metallic disc 16 feet in diameter.*

*Principles of Wireless Telegraphy, G. W. Pierce.

A CURIOUS RESULT

The photograph shows a 40 watt tungsten-filament electric lamp, which continued to burn after the filament had become broken in a fall to the floor. The distance of the fall was sufficient to

shatter any similar tungsten filament, but a close inspection of the picture at the point marked X will disclose the fact that the broken ends had come in contact with each other again, thus permitting current to light up the lamp. An additional curious fact is that the filament is stuck to the glass wall of the lamp and at the very point where the ends have crossed.—*L. R. Perry.*

Up to Date Electric Omnibuses

By Frank C. Perkins

ONE of the most up-to-date electric omnibusses of the field is seen in the accompanying illustrations and is equipped with Edison storage batteries. These omnibuses run between the large department store of Carson, Pirie, Scott

"BUS" READY TO RUN

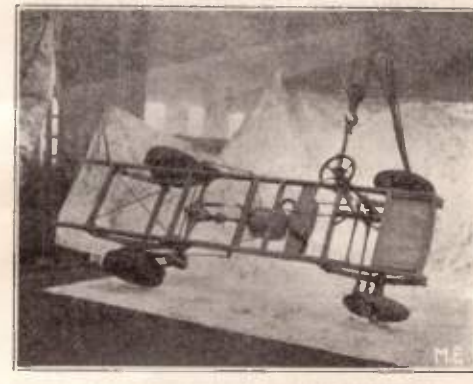
& Co. and the railroad stations on a regular schedule, for the convenience of customers of the store. The seating capacity is for 18 passengers, entrance being in front, where the fare is deposited in the fare box close to the 'bus operator.

These electric vehicles have been thoroughly tested on the streets of Troy, N. Y., and have shown very economical results in watts per ton mile. They are geared for a speed of 12 miles maximum per hour, and with the aid of the necessary boosting charge during the day can perform a full day's service of about 80 miles total run. Each 'bus has a 60-volt series wound General Electric motor with direct drive through universal joint to a jack-shaft from which the power is transmitted by chains to the rear wheels.

The controller, located close to the motor, has six speeds forward and three reverse, and is operated by a lever attached to the steering wheel column. The batteries are placed under the seats and under the bonnet in front, where they are readily accessible for examination and attention. There are two independent brake systems with four brakes. The rear wheels are 34 inches in diameter, equipped with dual 3½-inch rubber tires, and the front wheels 32 inches in diameter, with single 3½-inch rubber tires. Tests have shown that at least 69½ per cent. of the battery output is delivered in power to the rear wheels.

The 'buses in the city of London are daily carrying more passengers, earning more money and averaging more miles per hour than the tramway cars with over 140 miles of track and that omnibus lines earn bigger returns on the investment than street railway cars in view of the fact that the investment required is very much less than that required for roadbed, overhead or conduit construction and power house necessary for street railways.

It is claimed that these electric omnibuses with Edison batteries can be operated cheaped than gasoline vehicles and the maintenance and depreciation on same will be found to be very much less owing to the small amount of vibration produced by an electric motor. As evidence of this, the tire manufacturers guarantee 25 per cent. greater mileage



RUNNING GEAR

for an electric vehicle than they are willing to guarantee on a vehicle operated by a gasoline engine. The Edison storage battery will hold its 100 per cent. rating for four years and the replacement cost of such batteries is 50 per cent. of the original price. The

maximum depreciation on the batteries is figured at 12½ per cent. and experience will probably prove that a very much lower figure will eventually be warranted.

The fact that the storage battery is now available for the transportation of passengers and that the electric omnibus is a perfected machine demands attention from street railway and central station companies. It is maintained that street railways find that it is to their advantage to consider electric omnibuses in connection with their present lines, to be used in certain sections where it would not pay to install the necessary roadbed and overhead construction. The charging of these batteries during off-peak hours at night will make a very desirable load for their power plants. Central lighting stations will also be interested in the installation of electric omnibuses where the load on same is small.

It is clear that one of the important developments in this method of transportation is on boulevards and avenues where street car tracks would not be permitted, and therefore this development is of interest to the general public, and to investors, who would receive large results from money invested in omnibus lines. This return would come very quickly, because no large amount of money is invested for months in unproductive construction work, and the omnibuses would, when paid for, immediately begin to earn money. On these electric 'buses the power transmission is simple and effective and the 'bus is thoroughly under the control of the operator at all times, and these electric vehicles for regular city service have a seating capacity of 30 to 34 passengers.

There are 750 miles of telephone wires in the Hudson terminal office building in New York.

INDIRECT ELECTRIC LIGHTING IN THE BALLROOM

The accompanying illustration shows the effect of indirect electric lighting in the ballroom of the auditorium at the South Shore Country Club of Chicago. The magnificence of decoration and architectural design in the auditorium demands an illumination which adds rather than detracts. Indirect lighting supplies an illumination which fulfils this demand and provides a graceful and harmonious general scheme, while hidden lamps give a soft evenly distributed light, bringing out to the fullest extent the classic features of the interior and showing the decorations to the best advantage as well as increasing the spacious appearance of the room.

BALLROOM LIGHTED BY INDIRECT METHOD

This room measures 86 feet by 124 feet, or 10,664 square feet of floor surface. The ceiling is 28 feet high. There are three reflectors 72 inches from top to ceiling, with 97 tungsten lamps of 100 watts each, or the equivalent of 0.91 watt per square foot.

It was originally planned to use 12,600 watts with direct lighting, but 9,700 watts are now used with indirect lighting, resulting in a saving in current of 22 per cent.

THE MOST POWERFUL MERCHANT SHIP ELECTRIC SEARCHLIGHT

The accompanying photograph shows in service, ready for operation, the great 80,000 candle-power electric searchlight of the *Kaiserin Auguste Victoria,* of the Hamburg-American line. It measures in diameter 5 feet and has a depth of 4 feet. It projects a ray of light 7 miles on water, and when thrown on the sky can be seen 30 miles.

MOST POWERFUL SEARCHLIGHT ON MERCHANT VESSEL

This electric projector is said to be the most powerful electric searchlight ever carried on a merchant ship, and was a conspicuous feature of the *Kaiserin Auguste Victoria,* when it arrived in New York City. It is stated that this great electric light, which is one of the largest type ever constructed, was designed for the S.S. *Imperator,* and has been carried across the Atlantic and thoroughly tested at sea and on entering harbors.

By throwing its beam of light of 80,000 candle-power on the Scotland lightship on approaching port, this searchlight rendered the name of the ship clearly visible at a distance of several miles. It is maintained that this great light is effective for many miles at sea, and when thrown upon the clouds can signal clearly, being visible for a distance of more than a score of miles.

This new electric searchlight on the *Kaiserin Auguste Victoria* has been carried on the forward deck, but was designed to be installed in the lookout high up on the mainmast, where it could be quickly swung to any angle. This electric projector is of the type used heretofore only on the largest dreadnaught battle ships. The lens is 42 inches in diameter. It is operated by a current of 13,000 watts on a 110 volt circuit.

It is claimed that this powerful electric light ray has pierced fogs and enabled the distinguishing of distant objects at every point on the horizon in actual tests at sea, and will render impossible collision accidents with icebergs or ships in the future, thereby eliminating all possibilities of another *Titanic* disaster.

MERCURY-VAPOR RECTIFIER OF LARGE POWER

In the ordinary mercury-vapor rectifier using a glass vapor chamber the amount of electrical energy that can be converted from alternating to direct current has been limited, and the use of this form of energy converter has been confined to such comparatively small power applications as the charging of automobile storage batteries from alternating current mains and similar light work. A recent German type of rectifier has been developed for converting larger amounts of energy, the inclosing vessel being a sheet-steel cylinder. The gas-tight joint is formed by a double packing of asbestos or similar material, with a layer of mercury in between. A 220-volt, 80-kilowatt rectifier of this type has been in use since November, 1911, supplying the power plant of an iron foundry for 10 hours daily, operating from single-phase 2,080-volt mains. A 100-kilowatt steel rectifier weighs only 1,060 pounds as compared with the 4,200 pounds weight of an ordinary rotary converter of the same capacity.

Electric lamps for use in mines were first designed for rescue work, but now they are extensively used by the miners.

MOTOR DRIVE IN A PRIMITIVE INDUSTRY

The readiness with which electric drive is coming to be adopted by large manufacturing plants is not more significant of the times than its growing popularity with small and even obscure establishments. The New York East Side, with its modest though thriving industries affords innumerable examples, one of which, that of broom making, was a short time ago brought especially to the writer's attention.

The factory, if thus it could be termed, flourished in what looked to be a delapidated basement. On entering, however, the first impressions were forgotten. A scene of method and activity presented itself that would have credited far more ambitious surroundings. Half a dozen businesslike machines clattered away noisily, while a room full of equally strenuous workmen were attentively engaged in the various details of the manufacture.

In fact, the broom industry appeared decidedly on the make. Picking his way among the piles of straw about the floor, the writer succeeded at length in locating the broom in its real beginnings. The bare stick was here seen overlaid at the end with straw in small bundles, which the operator, by frequent revolutions of the machine, bound on with heavy wire. Some four or five of these devices in the immediate vicinity were turning out these crude broom forms in as many different sizes. Presently, the cluster-like ends were seen flattened between steel surfaces in a neighboring machine and bound in the finished shape by stout twine woven in and out by a shuttle-like needle. Near by was also a peculiar-looking affair, made up of a large, hollow cylinder, studded thickly with flattened spikes. This apparatus was shortly discovered to be the thresher, where the tasseled ends of the straw, pressed against the revolving spikes, were stripped clean from the stalks.

Yonder, in a small compartment at the back, was presently observed the motive power, a 5-horsepower electric motor, energetically humming away, driving the shafting to which the different machines mentioned were belted—not the ideal individual motor equipment, it is true, but an arrangement infinitely superior to the old-time hand method.

The system was found, moreover, to extend to an adjoining room at the rear. The device in question, a hopper made up of a box-like compartment with a wire sieve across the bottom, grades the stalks, previously sorted into the desired lengths, in varying degrees of coarseness. The straw, a hardy plant known to the trade as broom corn, is produced largely in Oklahoma and parts of Illinois. In

MOTOR DRIVEN BROOM MACHINE

times of Western shortage it is obtained in sufficient quantities from points as far distant as New Mexico. — *Frank Q. Farnsworth, Jr.*

A new electric truck of unusual length is equipped with eight wheels, each with a separate motor, and so arranged that the rear four turn automatically with the forward four in steering.

In addition to their lower cost aluminum transmission wires have the advantage over copper of shedding water more readily and thus being less liable to damage by ice storms.

An Enormous Electrical Project

By Albert Marple

WHAT is proving to be the largest thing of its kind ever undertaken in the western part of this country is the project now being worked out by the Pacific Light and Power Corporation of Southern California, this proposition being simply to carry 300,000 horsepower of hydro-electricity from the snow-capped High Sierras to Los Angeles, a distance of 240 miles. The immediate expenditure exceeds $10,000,000, and the total project will cost more than twice that amount. It is the purpose of the corporation to have a portion of the undertaking completed by the first day of next August, at which time 70,000 horsepower will be available. This will be the largest transmission line in the world, it being proposed at the outset to transmit 150,000 volts. The power will be developed in the Stevens Creek country, which is more than 7,000 feet above the level of the sea.

The principal reservoir will be at the 7,000-foot level, and will have a capacity of 140,000 acre feet. This reservoir will consist of several dams, one of which is the largest in the world, being 203 feet wide at the base and 30 feet below the bed rock. This will be twice as big as the next largest dam in the country. The storage area averages about a mile and a half above the sea. Being in the region of perpetual snow, the data on precipitation shows that it is one of the best catchment basins in the country. The annual snow and rainfall is from 82 to 150 inches. This large reservoir will be filled by the waters of Big Creek and Pittman Creek, these being diverted from their natural course. It is estimated that it will require 170 days of maximum flow to empty this reservoir.

The portion of the system which will be completed next summer includes a reservoir of a capacity of 102,159 acre feet, requiring three dams of approximately 160, 90 and 75 feet in height. The reservoir will be six miles long, one mile wide and 160 feet deep. Its ultimate capacity, to be attained by adding to the heighth of the dams, will be 140,000 acre feet. Another reservoir farther down the canyon will have a capacity of 25,000 acre feet.

The work of conveying machinery and other necessaries far up into the canyon and on the mountain side was no little undertaking. The San Joaquin & Eastern Railroad conveys all the necessities to the foot of the 75 per cent. incline, Big Creek Station, from which point the locomotives, cars, and other machinery are hoisted to the comparatively level land above, a distance of four and a half miles, by a 300-horsepower electric motor. For construction purposes, the incline extends up the precipitous side of the mountain. In a horizontal distance of 6,600 feet the elevation is 2,200 feet, and in many places there is a 75 per cent. grade. The railway on the heights will, on account of the great altitude and the precipitous approach, never be able to extend any farther than the limited section. Cars, supplies, etc., are carried to the foot of the incline from Fresno, the nearest city, which is 50 miles away.

For the purpose of hauling cement and gravel for the construction of the dam, large and substantial trestles have been erected paralleling the dams. The concrete is prepared by the mixer, is dumped upon the flatcars, and these cars are rushed to the dams and dumped. The army of 3,000 workmen keep a steady line of cars on the way to the dam loaded with concrete. It is stated that 2,200 barrels of cement are used daily and that 300,000 barrels of this material will be used in the dam construction in this basin. As much as 50,000,000 lbs of electrical and hydraulic machinery will be hauled to the power-house sites. It is proposed to have the dam completed in time for the melting snows of next May and June, so that there will be plenty of stored water in time for the starting of the first plant in August.

Plant No. 1, which will first use the water, will be installed at the foot of the Kerckhoff Dome, with a static head of 2,100 feet and installed capacity of 60,000 kilowatts. The great rock dome is being tunneled and the walls are being

lined with concrete. The tunnel is about a mile long and is 12 feet in diameter. The water from the diversion works will enter immediately into this tunnel, and upon coming out to the forebay will be taken by means of five steel pipes almost precipitately down 2,100 feet into Power Plant No. 1.

From Plant No. 1 the water will pass into a settling basin, after which it will be taken through a cement-lined tunnel three and a half miles long. It will then fall through steel pipes 1,900 feet to Power Plant No. 2. It is believed that the increase of the volume of water from Pittman Creek will more than offset the difference in the height of the falls, and for this reason the capacity of the two plants will be identical. These plants, combined, are being erected to furnish at least 140,000 horsepower, and it is believed that their capacity may be readily increased 50 per cent. by adding the required number of units. Later on, a third power-house will be erected, this having a fall of 1,300 feet, and will have all the water of the Big and Pittman Creeks after it has passed through Plants Nos. 1 and 2, and in addition a considerable volume diverted from the San Joaquin River. The maximum capacity of the three plants will be 300,000 horsepower. The water wheels will be of the tangential type and directly attached to the generating units. The transmission line will consist of a double set of steel towers, each tower supporting six wires. The line is being built according to its ultimate intended voltage of 150,000, even though only a part of it will be used at this time.

This Pacific Light and Power corporation furnishes all of the power used by the Los Angeles Street Railway Company, and 80 per cent. of that used by the Pacific Electric Railway Company. The corporation maintains several power plants at this time, one of which is located at Redondo Beach, this having an aggregate capacity of 75,000 horsepower, and is being already overtaxed.

The Pacific Electric Company is the most extensive railway system in California, having 1,000 miles of track and plying between Los Angeles and all of the beach and foothill towns for many miles around. It is the intention of the Pacific Electric Company to lay 1,000 miles more of track, some of this work having already been done. It is believed that 150,000 horsepower of electricity will be needed by the railway companies in the course of three years, it being the proposition to form a network of electric lines throughout Southern California, with the central point at Los Angeles. Next year the Pacific Electric Company will extend its system to the citrus belt, connecting Los Angeles with San Bernardino, Redlands, Riverside and other points. Lines will also be erected to Santa Barbara and San Diego. In addition to this work the local section will be enlarged to keep pace with the growth of the city.

An interesting feature of this power enterprise is the question as to what will become of the water when the corporation is through with it. The outlet of the corporation's pipes is in the San Joaquin Valley. The people of that section have about decided to form a vast irrigating project and to use the water for irrigating the thousands of acres in that section needing water. Millions of gallons of water will be released annually, and as this is the minus quantity in the Golden State, the people of that section will pounce upon it eagerly.

LARGE STEEL CASTING THROWN FROM CAR

While the train was rounding a curve, a casting for the frame of a large electric generator which was on a flat car

was thrown off onto the ground by centrifugal force. Although the only injury done was to tear a large hole in the ground, it was necessary to call the wrecking crane to replace the casting on the car.

ELECTRICITY KEEPS AUTOMOBILE BRIGHT

It isn't an easy job to keep the lamps and other metal parts of an automobile bright, especially if the usual method of polishing it by hand is used. At the same time even those who take care of their own cars don't want their machines to look untidy. Nothing makes a new automobile look two or three seasons

old like dull and tarnished metal work, and it is also true that the appearance of a car two or three seasons old can be greatly improved by keeping its metal parts bright and polished. This can be done very easily and in just a few minutes every week by a small motor equipped with a flexible shaft and a small buffing wheel. The motor, of course, must have enough conductor cord to obtain its current from the nearest electric light connection.

Electrically driven drills have been invented for surgical operations on the human skull.

New York has more than 1,300 electric trucks and nearly 500 electric pleasure vehicles.

To promote the mutual interests of wireless telegraph operators and their employers an international operators' union has been organized.

Two musical tones, received through a telephone though sent by the usual key, are being used to replace the dot and dash in telegraphy in an experimental way in England.

A NEW CONDUCTOR, NEARLY 100 PER CENT. EFFICIENT

Anyone who works or plays with electrical contrivances is soon made aware of the great differences of materials between absolute insulation or absence of conduction, and the excellent conductivity of certain varieties of copper wire. A good copper wire may successfully transmit a fraction over seventy per cent. of electricity, and a good Nernst glower, after it has been heated by an alcohol lamp, may be able to conduct even more of the current.

Now it has been the endeavor of every investigator, whether he was a physicist of the university laboratory or an electrician of an electric company, to discover some material that might save the usual loss of thirty per cent. of energy. If wires, joints, bolts, nuts and other connections in electrical apparatus were manufactured with some such metal, the ensuing economy would result in greater efficiency and immense saving of money and time.

To this end, then, electricians have labored for many years. They had experimented with practically every known element and mineral, so finally the investigators at work in the General Electric Company's laboratories in Schenectady undertook experiments for making every possible combination and alloy. Iron was alloyed with all of the rarer mineral earths and metals and tested. Then silver, then zinc, then lead, and even tin were alloyed with innumerable mixtures of zirconium, cadmium, tungsten, boron, carbon, tantalum and the other elements. Even the most successful of these did not surpass ordinary copper wire in conductivity.

Finally, however, after much money and many tests had been expended, one of the scientists hit upon an alloy which has proved to be most remarkable in its efficiency and high conductivity. The resistance and loss of electrical current sustained at the hinges, joints and connections of most electrical machinery is now completely done away with. Instead of losing forty or fifty per cent. of the current at such points, with this new alloy at least ninety per cent. of current is guaranteed to cross the blocks.

The new alloy is a suboxide of boron,

—the metal in boracic acid,—with copper. Technically and chemically it is cupric-boronsuboxide and it is destined very quickly to revolutionize the whole electrical business. It is not by any means too wild a prophecy to make to predict that within two or three years every single, solitary bit of machinery now in use will be replaced with all of the connections made of this new boron-suboxide of copper.

Indeed, it is not beyond possibility that every strand of wire now hanging or buried will have to be removed and this new ninety per cent. efficient conductor be laid in its place. One large central station is now being fully equipped with the new alloy, and at least one factory in Baltimore has already arranged with the General Electric Company to have its equipment rebuilt with copper-boron-suboxide material. The president of this concern says that he will save in efficiency within one year all of the extra expense necessitated by installing this revolutionary conductor.

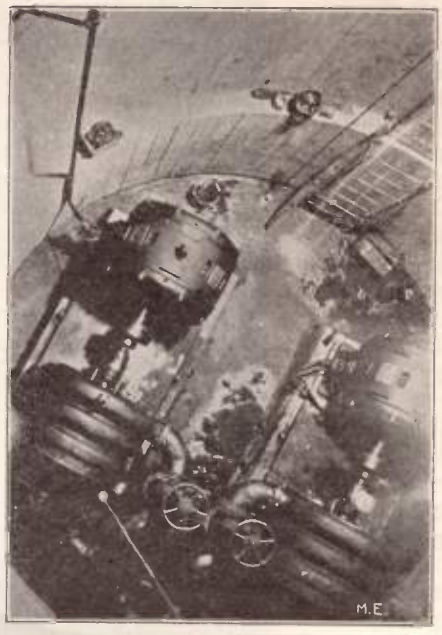
The patents on this new conductor have not yet been granted, but they soon will be, so there is no concealment or delay connected with the use of it. It is to be hoped that all machinery now ordered be shipped to the purchasers only with this new equipment.—*Dr. L. K. Hirschberg.*

TELEGRAPHING 40,000 WORDS AN HOUR

The first American demonstration of the Pollak-Virag system of rapid telegraphy, with which, it is declared, 40,000 words can be dispatched per hour, was given by Antoine Pollak, the inventor, at New York, January 31. By means of a beam of light controlled by motions at right angles, the receiving machine produces written characters on sensitized paper. Owing to the rapid succession of impulses involved, the system is limited in its use over very long inductive iron wire lines, although entirely feasible within present telephonic ranges using copper circuits. It is reported that during a recent demonstration in France messages were sent 900 miles with this system.

MOTORS IN DRY DOCK PUMPING PIT

In pumping operations of any kind it is desirable to have the pump as near the level of the water as possible, as this lessens the chance for air to leak into the suction or intake pipe; while if a leak should occur in the discharge pipe no particular damage would result as far as the efficiency of the pumping is concerned. The application of this principle is shown in the accompanying illustration of two 50-horsepower motors driving centrifugal pumps in a dry-dock pumping pit; the motors and



pumps are 30 feet below the surface. The suction and discharge pipes are 12 inches in diameter and the two pumps acting together are capable of handling 9,000 gallons of water per minute.

An electric process will detect accurately minute particles of bichromate of potash in solution. It is of value in chemistry and was discovered by a Parisian.

Direct wireless communication has been established between two Chilean cities on the opposite sides of the Andes Mountains without the use of intermediate stations.

SUNSHINE IN THE CELLAR

Without sunlight life would be extinct upon our globe. And because sunlight is the source of life in plants and animals and human beings, because its stored-up energy in coal warms us in winter and cooks our food for us and drives locomotives and steamboats, scientists all over the world have long been puzzling their heads in the hope of discovering some means by which the rays of the sun may be utilized directly.

A French engineer by the name of Charles Vinter has discovered a method of growing sunshine in bottles on the roof of his house. To store up sunrays in bottles and change them into electricity he uses two thin platina disks, one of which is placed in a solution of hypochlorid of iron, the other in quicksilver. The sun shining upon the platina disks, thus immersed, produces chemical changes which in turn generate electricity, the great modern driving force.

These magic bottles will store up sun energy in ordinary daylight, and can be made to do their work even on cloudy days. A battery of five hundred individual bottles exposed on the roof of a house will gather in enough sun energy—that is, electricity—to run six large electrical lamps all night.

The arrangement is so simple that every economical householder would probably go right into the electric lighting business and put the electric lighting and power companies completely out of business if it were not for the inconvenient fact that platina is extremely expensive—more expensive even than gold—so that the thrifty-minded house owner, even if he could afford the heavy initial expense of purchasing platina disks, would entertain serious doubts as to the advisability of leaving such valuable property, which ought to be under lock and key and combination in a safe, on the roof, where any enterprising burglar could help himself to the metal, which at present is fashionable as a setting for diamonds and pearls.—*Dr. L. K. Hirschberg.*

A wireless telegraph station is being constructed on Juan Fernandez Island, made famous by the story of Robinson Crusoe.

The Weaklings

"I'm great!" said the Sun, proudly, in the sky;
"The moon, the stars, what else is great as I?"
And then a pond'rous cloud,
Like a shroud,
Blackened him all out as it went by.

"I'm great!" cried the Cloud, "I stop the sun
From shining on the earth and every-one!"
But then, a lightning dart
Rent it apart,
And rushed upon its way like flash of gun.

"I'm great!" then Lightning cried, "For who rules me?
What is as uncontrolled, as wild, as free?"
But once, there came a man,
With wond'rous plan,
Who bottled Lightning up, his slave to be.

"I'm great!" cried Man, "What more is to be said?
I rule the sea, and earth, the Heavens overhead!"
But then, a mighty God,
Gave a nod;
And lo, he fell. His comrades called him dead!

—Edmund Leamy.

Electricity

Measured, but measureless, subtly conveyed,
Fluid intensity, spent and repaid,

Light-giving, heat-bringing, motor supreme,
Life bearing, death dealing force of our dream.

Working the miracles sought of our mind,
Tool of divinity used by mankind.

Little we know of it—must we demand!
Faith we have now; shall we soon understand?

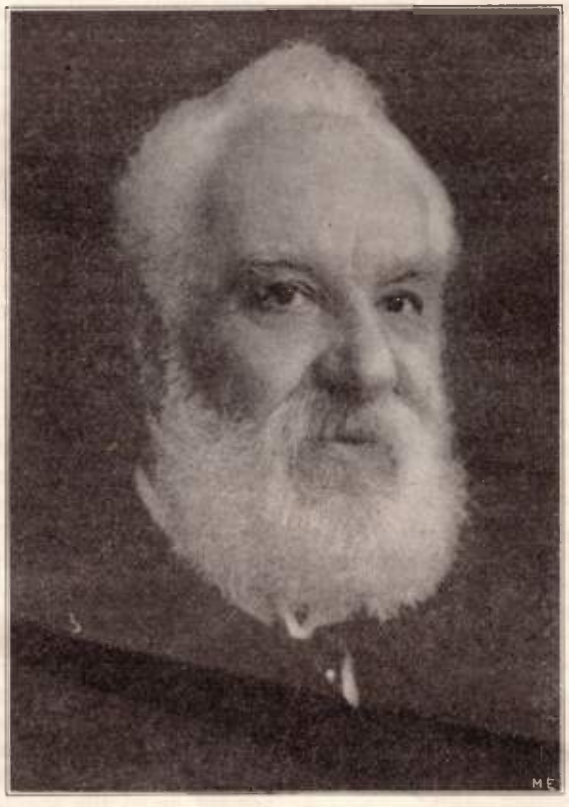
—Marguerite O. B. Wilkinson.

Alexander Graham Bell

ALEXANDER GRAHAM BELL, the inventor of the telephone, was born in Edinburgh, Scotland, March 3, 1847. He received his education at the high school and the university of that city and was especially trained to follow his father's and grandfather's profession for the removal of impediments of speech.

In 1870 he went to Canada and in 1872 took up his residence in the United States and introduced his father's invention of visible speech in institutions for deaf mutes, and was subsequently appointed Professor of Vocal Physiology at Boston University.

He occupied his leisure time during many years in working out his telephonic discovery, and first exhibited it publicly, but in an imperfect form, at the Centennial Exhibition in Philadelphia in 1876, in which year he received the now famous Bell patent. It was not only in the specific invention of the speaking telephone that Doctor Bell gave his greatest service, but in the long litigation in which the invention was involved; he was a sturdy fighter for what he considered were his rights, and we find him all through the early development of the apparatus continuing his experiments and giving to those who had taken up the development of the apparatus, the great powers of his inventive genius.



DOCTOR BELL AS HE LOOKS TO-DAY

For the invention of the telephone, he received in 1882 the diploma and decoration of the Legion of Honor of France and the French Academy bestowed upon him the Volta prize of fifty thousand francs, and with this sum, together with substantial additions, he founded in 1883 the Volta Bureau, an institution for the study of problems by the solution of which the condition of deaf mutes may be improved.

In the field of aerodromics and aerodynamics, he has taken a leading part. He was keenly interested in the experiments made by Secretary Langley of the Smithsonian Institution and contributed quite a sum for carrying on the work.

At his summer home in Nova Scotia, he finds time to devote considerable attention to his hobbies. One of these as just mentioned, is the science of kite flying, and aerodynamics and his personal work in this direction in the development of the tetrahedral kite has done much to solve the problem of buoyancy in the air of heavier-than-air machines.

In addition to the honors bestowed upon him by the French Government

(*Continued on page 28*)

WIRE VS. ETHER

The word "telegraph" and the adjectives, etc., of the same set, are becoming anachronisms. The *"tele"* part of them becomes more and more appropriate; but as far as the *graphic* end is concerned, it is going out of fashion; for one does not write, "draw or grave" at a distance nearly so often as one sends oral or aural messages.

And even the slang word "wire," used as noun and verb, is becoming inappropriate; for now-a-days the only wires concerned in communicating at a distance are often only those of the antennæ or their equivalent. It will soon be a fight to the death between the wire and the air—or perhaps more correctly speaking, the ether.

"What hath God wrought!" was the pious sending of the first "wired" despatch; but the wonders of that day were eclipsed by those the ocean cable of 1858; and now this is considered old-fashioned.

Yet not entirely; for each of the systems has its advantages, as well as its disadvantages. It is like the question of train vs. automobile, or airship, vs. flying-machine. For some conditions one system is best, and for others the other is properly to be chosen.

As far as the ordinary overhead land wire is concerned, it offers the advantage of comparison; it is cheaper than an underground line and still cheaper than a subaqueous one.

The overhead wires permit of very rapid work over them; they do not get "loaded" after the manner of leyden jars and hence have to be "discharged" for each signal. Their possible speed, like that of the typewriting machine, is far greater than the highest which the human hand can attain; so that they never offer any hindrance to even the most expert operator. This is proved by the automatic apparatus used in connection therewith, which transmits four to five times as many words per minute as the most rapid hand operator, and enables several "punchers" to work simultaneously at different parts of a long message, which is then rushed through at lightning speed.

Then the capacity of the overhead wire is greatly increased by the ability to send over several messages at once, not only in the same direction, but in opposite directions. The Hughes apparatus and its congeners enables telephonic writing or printing at a rapid rate; the Baudot, used in France, is still more speedy, running four to six messages at once.

The insulated subterranean cables have some of the advantages and some of the disadvantages of the overhead wire, as well as of the subaqueous lines. The principal trouble with the latter is that of the loading and discharging after each signal; and one great hindrance is that the optical signals which it gives to the receiver are with difficulty deciphered without long practice. Then the cables are expensive to make, lay and keep in order. A German estimate of the cost of such a line and the apparatus at the ends runs up to four thousand marks per kilometer, or say $1,500 an English mile. That they pay, however, is shown by the fact that each private company that has gone into the business steadily extends its lines; and that many go into their neighbors' fields and cut the rates.

Even wireless advocates as important as Count Arco recognize that the cable is not to be despised, and not to be driven out entirely; even when the wireless service costs only half as much per word as that by cable. For the latter has in its favor four points—it is surer, more "discreet" and fully independent of weather, temperature, time of day, etc., which are the bug-bears of the wireless service; and is more rapid in transmission. On the other hand the plant for the latter is cheaper; say for a thousand miles three or four times as cheap as an ocean cable plant. But the crowning advantage of the wireless system is that it enables communication with and between ships in motion, from any part of their course.—*Robert Grimshaw.*

NAVY STATION DOES GOOD WORK

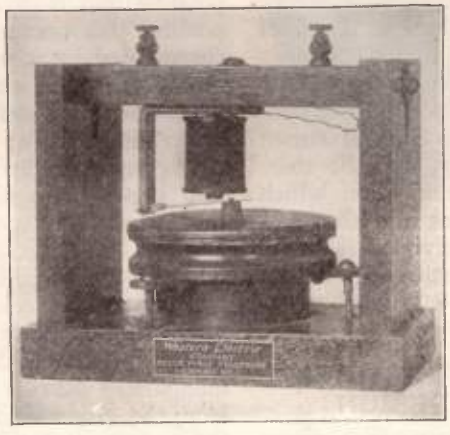
The naval radio station at Newport, R. I., recently picked up the steamship *Berlin*, which had left Germany the previous day, and was sending out wireless messages.

At this station they have heard the naval radio station at Mare Island, San Francisco, operating.

The First Telephone

ON a hot afternoon in June, 1875, a tall young man was desperately toiling in a machine shop in one of the narrow streets of Boston, not far from where Scollay Square now is. This man, Alexander Graham Bell, then a professor at Boston University, was making a queer machine, which resembled nothing in particular; a sort of crude musical instrument with a clock spring reed, a magnet and a wire. He had been working on the device for over three years without apparently accomplishing much, until on this afternoon the machine gave forth a very faint sound.

He rushed into an adjoining room, where his assistant, Watson, was working with a duplicate of the instrument, and which was connected to the other by a wire, and found that Watson had pulled the reed and let it snap back again, making a sound which was reproduced in the other instrument. This little sound, so faint that it would not have been heard by anyone but an expert in acoustics, did not amount to much of itself, but it was the first sound that had been produced at one end of a wire transmitted over the wire by the aid of electricity and faithfully reproduced at the other end.



THE FIRST TELEPHONE
FROM A MODEL IN THE POSSESSION OF THE WESTERN ELECTRIC CO.

This was the birth of the telephone; but, like all infants, though it could make a sound, it could not talk. The discovery was by no means an accident. Bell had known the correct principle, but had not, up to that time, been able to make the machine make a sound.

Some time previous to this, while in Washington on business with his patent attorney, he met Professor Joseph Henry, to whom he showed his device. After carefully examining it, the scientist told him that he had the germ of a great invention and advised him to keep working at it until he completed it, to which he replied that he had not the necessary knowledge of electricity.

"Get it," said Henry, and Bell proceeded to study as well as experiment until the machine was able to make a sound. After weeks and weeks of further work and study the machine was brought to the point where, on March 10, 1876, it talked—and the first thing it said was, *"Mr. Watson, come here; I want you."* This was spoken into the telephone by Bell, in an upper room of the house in which they lived, to Watson, at the other end of the wire, in the cellar. Watson rushed upstairs with the joyful news that he heard every word of it. The telephone was then a reality, and on his twenty-ninth birthday Bell received from the government his now famous patent, which bore the serial number 174,465.

In June, 1876, he went to the Centennial Exposition, where the device was on exhibition among a lot of displays of school equipment. He waited hour after hour at his table for the judges to come to inspect the machine. They arrived about 7 p. m., and when they did come seemed indifferent to the invention, until Dom Pedro, Emperor of Brazil, accompanied by the Empress, walked up and greeted Bell cordially. It seems that Dom Pedro remembered visiting one of Professor Bell's classes in Boston. This incident saved the day for the struggling inventor, for the judges promptly forgot their indifference and took a lively interest in the device.

Dom Pedro placed the receiver to his ear while the professor went to the instrument at the other end of the room and spoke into it. The Emperor, after

listening to it, looked up and exclaimed, *"My God, it talks!"*

Then the judges, one after the other, Professor Henry, Sir William Thomson, afterwards known as Lord Kelvin, and all the others listened to the instrument, and it talked to them, and they understood what it said, hardly daring to believe their senses. And they stayed until after 10 o'clock that night talking and listening to each other over the telephone.

Next day the apparatus was moved from its obscure location to the judges's stand, and throughout the remainder of the exposition this crude device, which had been given but a few words' notice in the official catalogue, became the chief attraction.

This is the story of the telephone, up to the time it was introduced to the public. Its development into the convenient instrument in use to-day, and the marvelous system of communication which covers the United States and those of practically every other civilized country on the face of the earth, is another story, quite as fascinating as that of its early history.

CHANDELIER DESIGN

It is pretty well known that those chandeliers having square stems are made with either two or four arms. While it is common for fixtures of round tubing to have three arms, it would be unharmonious to make three branches on the fixtures having the square effect.

I was recently going over a lady's house preparatory to furnishing the lights in order that I might see what was required. Coming into the library, I asked, "What sort of a chandelier would you like for this room?"

"I think a three-light fixture with square tubing and square shades would be very nice," was her innocent reply. Of course, I could not supply her with that, but it only goes to show how unobserving many people are in regard to anything electric.—*Marshall S. Loke.*

FACTS ABOUT THE MODERN DRY CELL

The manufacture of the common dry cell engages the attention of forty or more separate companies and the magnitude of the industry is little appreciated by those not familiar with it, says the *Electrical World*. A year's production of dry cells in this country approximates over $10,000,000 in value. At the present time it is probable that over 50,000,000 standard 2.5-inch by 6-inch batteries are manufactured yearly, 5,000,000 flash-lamp batteries consisting of approximately 15,000,000 single cells 13/16 inch by 2 5/16 inch., and about 2,000,000 other cells of special sizes. The present type of dry cell consists of (1) a zinc container, or negative pole, (2) a paper, or porous partition, between the positive and negative poles, and (3) a positive pole comprising a rod of carbon surrounded by a mixture of manganese dioxide, ground carbon and electrolyte. The zinc container is rolled from zinc 0.020 inch thick; the paper partition may consist of three layers of thin blotting paper or a single layer of heavy pulpboard; the positive pole mixture consists of pyrolusite (85 per cent. manganese dioxide), 100 parts by weight; ground coke, 80 parts; artificial graphite, 20 parts; sal ammoniac, 20 parts, and zinc chloride, 7 parts. The manganese dioxide acts as the depolarizer; the ground carbon which is next to the paper separator collects the current at the periphery of the mixture and conducts it by means of the other carbon particles to the center carbon plug; the graphite is employed to reduce the internal resistance; the sal ammoniac is the electrolyte, while the zinc chloride is used only to improve the life of the cell by reducing local action. The zinc container is the most expensive part of the cell, and the total manufacturing cost has been given by one authority as approximately 8 cents per cell.

ALEXANDER GRAHAM BELL

(*Continued from page 25*)

and the French Academy, the Society of Arts in London in 1902, gave him its Albert medal. In 1883 he was chosen a member of the National Academy of Sciences of the United States. The National Deaf Mute College of Washington and the University of Würzburg have conferred upon him the degree of

Doctor of Philosophy. The photophone, induction balance and the telephone probe for the painless detection of bullets in the human body are his inventions and for the latter he was awarded the honorary degree of Medical Doctor by Heidelberg University, Germany. The degree of Doctor of Laws has been conferred upon him by Harvard, Amherst and St. Andrew's Colleges; that from Harvard being in recognition of his method of improving the condition of deaf mutes.

THE PRACTICAL ELECTRICIAN

(*Continued from page 12*)

of 10 amperes with 50 turns in a coil has the same magnetic power as a current of 5 amperes with 100 turns or of 1 ampere with 500 turns. The product $10 \times 50 = 5 \times 100 = 1 \times 500$ is designated as ampere turns.

One ampere generates on each centimeter of its length $4\pi/10 = 0.4\pi$ lines of force; therefore I amperes in N turns develop $\frac{4\pi}{10} N\ I$ lines of force. This product is called magnetizing or magneto-motive force and is usually designated by the symbol M.M.F.

On the inside of the coil (solenoid) the field strength, $H = \frac{4\pi \times I \times N}{10 \times L}$, where L is the length of the coil in centimeters.

For a circular current path of radius, r, the field strength at the center of the circle, $H = \frac{2\pi i}{r}$

If we have instead of a single turn, N turns, which compose a coil, whose length and thickness compared with its diameter are small, then at the middle point $H = \frac{2\pi N i}{r}$.

If the current is given in amperes, then $H = \frac{2\pi N i}{10 r}$.

(*To be continued.*)

TWO THOUSAND VOLTS DIDN'T KILL

Mrs. C. R. Hoffman, while attempting to turn on the electric lights in her husband's bakery in Lewiston, Pa., recently, due to some defect in the lighting transformer, received a shock equivalent to more than 2,000 volts. Electricians who came to repair the defect afterward vouch for the truth of this.

Aside from being severely stunned by the shock Mrs. Hoffman seems to have suffered no ill effects from the accident. —*E. Ellsworth Clapsby.*

TRANSPACIFIC WIRELESS STATIONS

The Marconi Wireless Telegraph Company has placed contracts with the J. G. White Engineering Corporation, New York, for the erection of eight wireless telegraph stations, two pairs for Atlantic service and two pairs for Pacific service. Receiving and sending stations 30 miles apart will be constructed at Oahu, in the Sandwich Islands; Tamales Bay and Bolinas, Cal.; near Belmar, N. J., and in eastern Massachusetts at a point not yet definitely selected. These stations will be part of a globe-girdling system which will continue to the East by way of Japan and thence ultimately to India. Twelve towers ranging in height from 400 feet to 450 feet will be spread out over a semicircle covering a square mile at each station, and it is estimated that the range of each station will be from 4,000 to 6,000 miles.

In the electric furnace gold boils at 2,400 degrees centigrade. By this thermometer water boils at 100 degrees.

AUTOMATIC FLOAT SWITCH

The switch shown in the illustration is used in connection with motor-operated pumps which fill tanks and reservoirs. The action of the switch is entirely automatic and the liquid in a reservoir is always kept within certain predetermined limits without any attention whatever. The air-tight galvanized metal float is mounted so as to slide on

a vertical switch rod, which extends downward from the switch into the reservoir. When the liquid level falls to a certain point the weight of the float is impressed on a nut on the rod, drawing the rod down, closing the switch and starting the motor. When the level of the liquid rises nearly to the height of a nut on the rod above the float, the buoyant force of the float on the nut raises the rod, opens the switch and stops the motor. The switch can be used with either direct or alternating current motors up to 10 horsepower capacity.

LARGE D. C. TURBO GENERATORS

The Westinghouse Machine Company is now furnishing two sets of machines to the Cleveland Electric Illuminating Company which are not only noteworthy in their application, but are also interesting in their combination. Each set of apparatus consists of a 6,000 horsepower steam turbine, a 6,000 horsepower direct current generator, and a Westinghouse reduction gear of corresponding capacity. The steam turbine running at a speed of 1,800 revolutions per minute drives the generator, which runs at a speed of only 180 revolutions per minute, a feat that is made possible through the interposition of the reduction gear, which equalizes the speed of the entire combination. This unit represents the largest direct current generator that has ever been built for turbine drive, and also the largest turbine-driven gear in the world. The apparatus develops 6,000 horsepower of electric current, which the company supplies partly for lighting purposes to the business section of the city of Cleveland, while the balance is supplied as power to the electric railway company. Another interesting feature of this outfit is that the exhaust steam from the turbine is transmitted into pipes and used for steam-heating purposes in business and office buildings. It is the only plant of its kind in the world so far and is attracting a great deal of attention. It is expected that it will result in a great deal of similar work for the shops at East Pittsburgh.

METER NO. 1 STILL ON THE JOB

It is a matter of interest that after seventeen years of continuous service, meter No. 1 of the New York Edison Company is still in use. Quite by accident was the discovery made that the oldest meter was still a long way from the junk pile, and the investigation that followed that discovery revealed some very interesting facts regarding its wanderings.

It came to New York with the first shipment of the present type of meters, in the summer of 1896, and after being tested was installed in a dry goods warehouse. Since then it has been moved six times and now is back in its original line of commercial activity, but in an uptown establishment. Its wanderings, though, have taken it to a fish monger's

stall, a café, a retail shop, a paper warehouse and a private dwelling. yet in all that time there has never been a complaint against its findings. In the last ten years it has ticked off some twenty-two hundred kilowatts, and now in its 18th street location, it is working with the same accuracy it has shown under every test to which it has been subjected.

Although No. 1 is the oldest meter in the service of the company, it was not the first meter installed, for before the days of the mechanical meters, of which No. 1 is a type, the old chemical meters were used, and these were installed by Edison himself in the first days of central station service. At about the time No. 1 went to his present post, his brother, No. 17,832, was just entering his central station career.

BOY TAMPERS WITH TELEPHONE AND GETS HURT

An inherited desire to tear things apart and to investigate anything mechanical resulted in the serious burning of Harvey Morgan, a farmer boy living near Horton, Kas. His persistency in investigating the "works" of the telephone which his father recently installed in his home was the immediate cause of the accident.

Dissecting a watch which was given to him for Christmas, he started in on the telephone, unscrewed the transmitter and was surprised when some black powder which came from the transmitter fell to the floor.

Evidently he thought the black substance was gunpowder, for he opened two shotgun shells, procured a small handful of powder, placed it in the transmitter and screwed the cover back in place. Then he called up a friend to see how it worked—at least he tried to call, but he never got central.

As he took the receiver from the hook an electric spark exploded the powder and blew the transmitter in pieces. The boy was badly burned.

The first large electric smelting plant is being successfully operated at Sault Ste. Marie, Canada.

AN OPEN LETTER

To the Readers of Modern Electrics.

As announced elsewhere, I retired as Editor of *Modern Electrics,* as well as President and Secretary of the Modern Publishing Co., on February 13th.

As this announcement may come as a surprise to many readers, I feel that an explanation on my part might be in order.

For some time past my other interests have grown to such an extent, that in fairness to myself I could not devote as much time to *Modern Electrics* as was necessary. Of late the demands upon my time have been such that it was only possible to devote a small portion of it to *Modern Electrics,* and for this reason I deemed it best to retire altogether from the publication of the magazine.

I leave *Modern Electrics* with no fears as to its future. Mr. C. A. LeQuesne, Jr., who with this issue becomes Editor of *Modern Electrics,* is already well known to every reader. I wish to thank Mr. LeQuesne here for his efforts during the past year, during which time he has ably assisted in bringing the publication to its present standard. I am sure that the readers will continue to enjoy *Modern Electrics,* and sincerely hope that they will support Mr. LeQuesne in the future as they have in the past.

As to the business end of *Modern Electrics,*—it could not be in better and safer hands than in those of my former associate, Mr. O. J. Ridenour. Since Mr. Ridenour took over the management of *Modern Electrics* it has had a remarkable growth from a 64-page to a 112-page magazine. The average reader of course buys the magazine for its text only and is apt to forget that it is the business end of the publication which pays for this text, and which provides for more text, better and more illustrations, etc., in short, makes for a bigger and better magazine. For that reason I do not take the credit for making *Modern Electrics* what it is to-day; as Mr. Ridenour and Mr. LeQuesne are certainly entitled to the greater part of it.

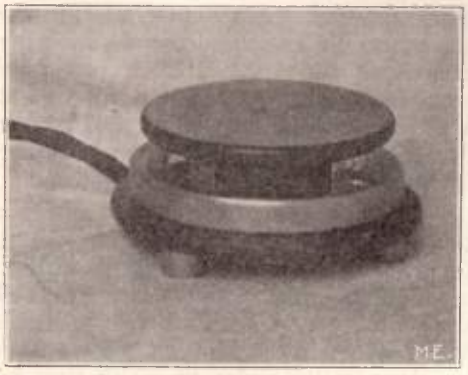
In closing I extend to the readers my sincere thanks for their loyal support and for their enthusiasm shown in upbuilding this magazine, and I feel sure that they will do everything in their

power to help the new management make *Modern Electrics* the greatest electrical magazine published. Long live *Modern Electrics!*

H. Gernsback.

SMALLEST ELECTRICAL STOVE

The illustration shown is of the smallest electrical stove made. It is not, however, a toy, but is thoroughly practical. It is only two and one-half inches

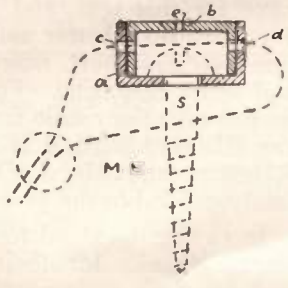


THREE-INCH ELECTRIC STOVE

in diameter and weighs only five ounces, and for this reason it is very convenient for travelers, as most hotels nowadays have electric light, and the stove, which operates by electric current, has a plug and cord by which it can be connected to any lamp socket. It is very efficient in heating small quantities of liquids, boiling water or warming small objects.

SEALING METER SCREWS

A simple and effective means of applying lead seals to meter screws is shown in the accompanying sketch. The small cylindrical box, *a*, is placed over the hole into which the screw, *s*, is to be driven, and after *s* is screwed home the cover, *b*, is put in place and a lead wire threaded through the holes, *c*, *d*, in the box, *a*, and cover. *b*. The ends of the locking wire are bound in a lead seal in the usual manner. To remove the screw it is only necessary to cut the lead wire and remove *b* by a hooked wire slipped through the holes.—*Electricity.*



QUICK COMMUNICATION IS URGED ON WIRELESS SHIPS

The Secretary of Commerce and Labor has issued a circular with reference to communication between the wireless operator and the bridge of the ship, in which he says:

"The Department is not convinced that a bell and messenger service will meet the requirements at all times, and is acquainted with at least one instance in which two vessels were seriously damaged, due to the inefficiency of the messenger service described.

"In some cases the radio-room is about one hundred feet from the bridge and the messenger would be required to use one ladder and one stair en route, involving considerable loss of time.

"Where the radio-room is located on or near the bridge, so that the officer on duty may hold direct verbal communication with the operator without either leaving their posts the communication is efficient at all times under the statute.

"In other cases a telephone or speaking tube should be installed. This may readily be done in such a way that at the bell signal the radio operator may have one of the wireless telephones at one ear, the bridge telephone or speaking tube at the other and one hand on the transmitting key."

ELECTRICAL EQUIPMENT FOR NAVY DEPARTMENT

Rear Admiral H. I. Cone, chief of the Bureau of Steam Engineering, has asked for the sum of $2,927,000 for electrical machinery and equipment for the navy for the coming year. Of this, $666,500 is for radio-telegraphic apparatus for land and sea use.

A Wave-Meter For Amateurs

By P. Mertz

An instrument that is extremely useful to the ordinary amateur, but the uses of which he generally does not seem to appreciate, as can be seen from the fact that not a single contestant has ever mentioned his possession of one in the Wireless Contest, is the wave-meter. Probably the reason for this lack of appreciation is due to the comparatively high cost of the wave-meters found on the market, most of which, anyway, are designed for commercial purposes rather than for experimenters of small means. The reason for the high prices of these is due to the fact that a variable condenser of high maximum capacity is employed.

By varying the inductance instead of the capacity, and by making use of a new principle for quantitative determinations, the writer has designed a new form of wave-meter, accessible to practically every amateur, and whose capabilities are not far from those of the much more expensive ones.

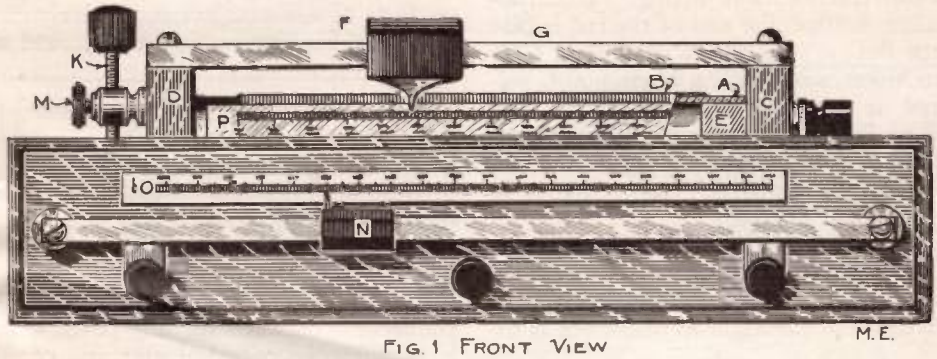


FIG. 1 FRONT VIEW

Essentially, the instrument consists of a small single-slide tuning coil, two fixed condensers, a detector, a potentiometer (for quantitative determination), and a set of receivers. Three views of the assembled wave-meter are shown in Figs. 1, 2, and 3, respectively.

The tuning coil consists of a cardboard tube, A, 2¼" outside diameter and 6" long (see Fig. 4), over which are wound 100 turns of No. 18 S.C.C. wire, B. The wire will occupy a length of about 5", leaving ½" free at each end. The coil ends, C and D, are made of two pieces of wood, with holes drilled, as shown in Figs. 5 and 6, respectively. The tube, A, is tightly fitted to plugs, E, which are screwed to C and D, respectively, thus holding the whole together. The slider, F, moves over a rod, G, as usual, but is of a special construction, as shown in Fig. 7. This, while having defects not found in certain other styles, permits of reading (by means of the pointer) the exact turn of wire it is in contact with.

The larger of the two fixed condensers consists of a total of 6 tinfoil sheets 2" x 3", overlapping 2 3/16"; this gives a total active surface of 21.9 square inches. The tinfoil sheets are separated by paraffine paper 0.01" in thickness. The smaller condenser consists of 2 tinfoil sheets 2" x 3", overlapping 2 3/16", giving an active surface of 4⅜ square inches. The tinfoil sheets are separated by 5 thicknesses of paraffine paper, 0.01" thick, giving a total thickness of dielectric 0.05". A two-point switch located on the coil-end, C, is used to change from a high to a low capacity condenser, and therefore wavelength. The condensers are concealed inside the tube, A, for the sake of neatness and compactness.

The detector is mounted on the coil-end, D; almost any mineral capable of withstanding heavy currents without detriment can be used in it. Carborundum

is very good for the purpose, as with a good piece no battery is needed; molybdenite is also very good. The mechanical parts of the detector, as can be seen, are extremely simple and easy of construction. The mineral is clamped at I between a piece of spring-brass, J, bent as shown (see also Fig. 8), and a piece of brass machine-screw, K, mounted in a binding-post, M. This screw carries a hard-rubber or composition knob,

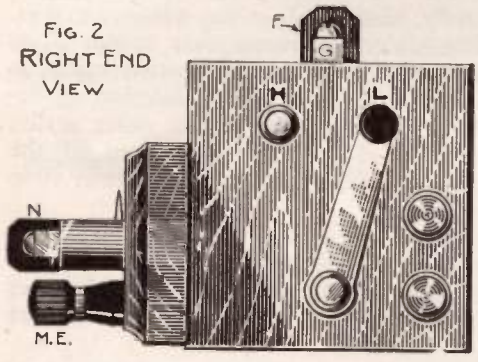


FIG. 2 RIGHT END VIEW

for convenience in adjusting. If carborundum is used, the end of the rod is best when flat; a small piece of No. 22 German silver wire with a blunt point, soldered or forced into a hole at the end, will be found best with most other minerals. As can be seen in Fig. 8, the end of the brass spring, U, has a hole in it, to steady the crystal.

The potentiometer (its use in quantitative measurements will be described later) can be of any non-inductive type, provided the variation in resistance is di-

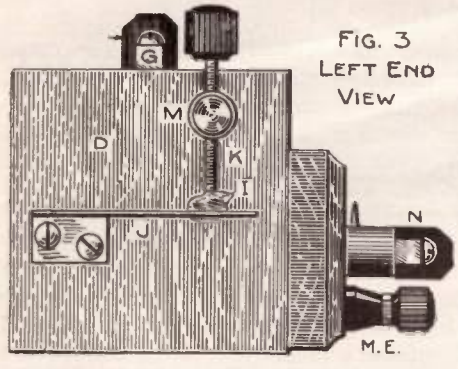


FIG. 3 LEFT END VIEW

rectly proportional to the motion of the slider. For example, if when the slider is moved 1" the resistance introduced is 20 ohms, and when the slider is moved 3" the resistance introduced is only 50 or 55 ohms; the variation in resistance is not proportional to the motion of the slider. The type shown in the illustrations is the straight carbon rod type, sold by wireless supply houses (most rotary potentiometers using short pieces of carbon rod joined in series cannot be used for this purpose, as the variation in resistance is not proportional to the motion of the pointer). It will be noticed that a small pointer is forced in a hole in the lower part of the slider (see Fig. 9); this pointer indicates on a paper scale, the graduation of which will be explained later.

The telephone receivers can be of any variety, even a 75-ohm one will do.

The wave-meter is now complete, and should be wired as shown in Fig. 10. When the instrument is employed for tuning or for experiments with the transmitting set of the station, the telephone receivers are connected across the binding-posts, 1 and 2. When experiments are to be carried on in connection with the receiving set, each of the interrupter contacts of a buzzer are respectively connected to binding-posts 3 and 4; and all

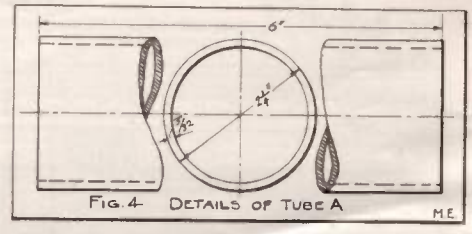
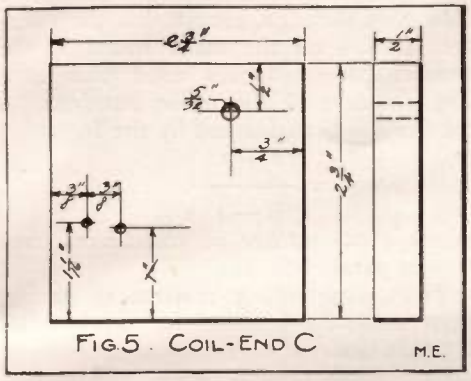


FIG. 4 DETAILS OF TUBE A

connection between binding-posts 1 and 2, through the potentiometer and receivers, opened.

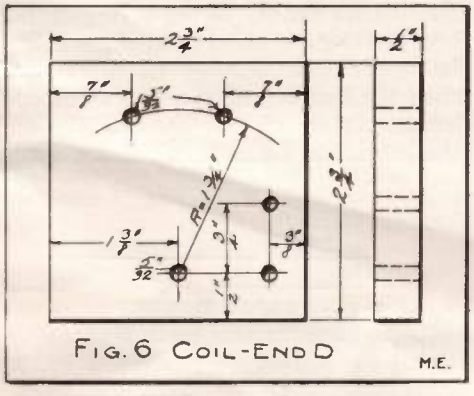
If desired, a D.P.D.T. switch can be used for changing over from the receivers to the buzzer. If such is used, the hinge-posts must be connected to the lower connection to the arm of the switch HL, and the end of the inductance, B, which is connected to the condensers, respectively. The jaws on one side should be connected to the detector-point, K, and the binding-post, 2, respectively. The jaws on the other side are connected to binding-posts 3 and 4, respectively. These are then disconnected from K and 2. Care should be taken that all these connecting wires are as short as possible, or they may appreciably affect the accuracy of the instrument.

The instrument is now complete and ready to be calibrated. The calibration of the potentiometer scale, O, will be



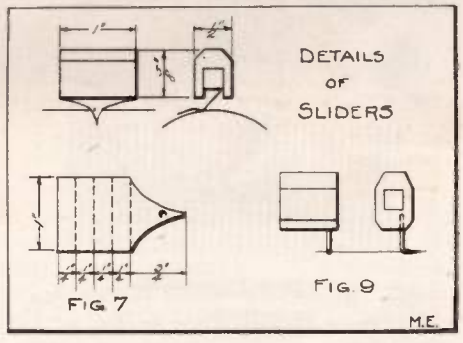
considered first. The principle of operation of this potentiometer is as follows:

The receivers and the potentiometer being in shunt, the current will divide, the amount flowing in each branch being inversely proportional to its resistance. Thus, no matter how much current (without considering extremes) is flowing through the circuit, there will be an adjustment of the potentiometer slider where the resistance of the potentio-

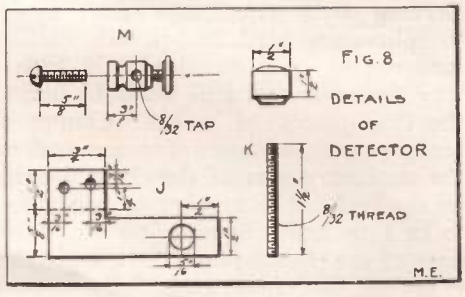


meter will be so low that just enough current will flow through the receivers to render its presence known, *i. e.*, to make a sound); and any further lowering of the resistance of the shunt will stop the sound. As the position of N will be different for every value of current flowing through the circuit, this position can be used as an indication of the value of the current. In other words, the position of the pointer, N, just before the sound in the receivers ceases, indicates the relative strength of the current flowing through the circuit.

The graduation of the scale upon which this pointer indicates is now to be considered. If the resistance of the receiver is no greater than the total resistance of the potentiometer (about 300 ohms), a point should be found where the resistance between posts 1 and 2, through the potentiometer, is exactly equal to the resistance of the receiver. The method of doing this is shown in Fig 11. A represents the receiver, B dry battery, C a galvanometer or low resistance telephone receiver, G the potentiometer, D, E and F the bared ends of



the wires shown, or a two-point switch. D is then touched to F, and the deflection of C (or the intensity of the sound it emits, if it is a telephone receiver) is noted. Then F is touched to E, and the potentiometer slider adjusted until the deflection (or sound) at C is the same as before. The resistance of G is equal to that of A at this point, which should be marked opposite the pointer on the slider, and labelled 2. Then a mark should be made opposite the pointer when the slider N is as far to the right as it can go, and marked ∞ (infinity).



Half this distance between ∞ and 2 is marked and labelled 3. One third of the

distance is taken and marked 4, ¼ taken and marked 5, etc. To find intermediate numbers, and numbers less than 2, use the formula:

$$x = \frac{1}{n-1}$$

where x = distance measured to the left of the mark in terms of distance 2 to ∞.

n = number to be marked.

Thus to find where to put the 1.9 mark; $x = \frac{1}{1.9-1} = \frac{1}{0.9} = \frac{10}{9}$.

Therefore the mark is placed at a distance, to the left of ∞, equal to 1 1/9 times the distance, 2 to ∞.

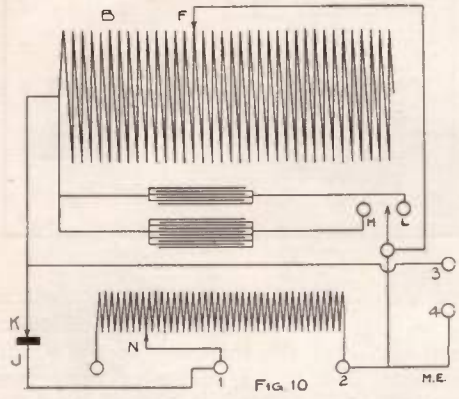


FIG. 10

For telephone receivers of higher resistance than the potentiometer, the procedure will be somewhat more difficult. Resistances of exactly the same number of ohms as the phones should be made in the same method shown in Fig. 11. These resistances can be constructed with German silver wire, but a better way is to split open hard lead-pencils (taking care not to crack the lead), in such a way that the lead still holds to one of the two pieces of wood. Clamps or binding-posts are used for connections, the stationary part of the clamp bearing on the lead. The number of resistances to be thus made depends on the resistance of the phones; one, if the resistance is around 500 ohms; two, if it is around 700 ohms; three, if it is around 1000 ohms; or four, if it is around 1300 ohms. Having made the above, the potentiometer, battery, etc., should be set up as in Fig. 11, and the resistances just constructed, each connected in parallel with A. The procedure described before is then gone through, except that the number labelled on the mark found is the number of resistances used plus two. The position of the other numbers on the scale is then formed by the formula:

$$x = \frac{r+1}{n-1}$$

where r = number of resistances used in parallel to A.

Thus, suppose, 3 resistances having been used, the position for the number 6.5 was desired;

$$x = \frac{3+1}{6.5-1} = \frac{4}{5.5} = \frac{8}{11}$$

Therefore, the mark labelled 6.5 is placed at a distance to the left of ∞ equal to 8/11 times the distance 5 to ∞. It must be understood that the same phones are always to be used on the instrument, or the potentiometer scale will have to be re-graduated when another set is substituted.

When this has been completed, the wave-length scale, P, has to be graduated. This should be so arranged that three rows of numbers can be marked; the upper row labelled L, to be used when the smaller of the two fixed condensers is in circuit, the middle one, labelled H, to be used when the larger

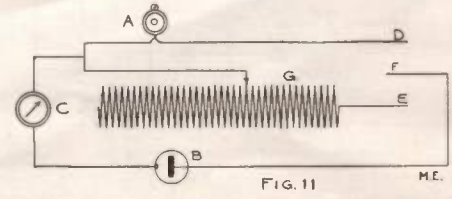


FIG. 11

condenser is in circuit. The use, and method of marking the lower row will be described in a later issue. Using the formulas $C = \frac{2248\,KA}{T \times 10^{10}}$, $L = \frac{(5 \times D \times T)^2}{1000\,(M + \frac{1}{3}D)}$, w.l. $= 1885\sqrt{LC}$, the writer has computed the wave length corresponding to every few turns of inductance (intermediate numbers can be

estimated) using each condenser separately, as follows:

Turns	λ Low	λ High	Turns	λ Low	λ High
3	8	40	53	162	810
5	16	80	55	166	830
8	26	130	58	172	860
10	30	150	60	176	880
13	40	200	63	182	910
15	48	240	65	186	930
18	58	290	68	190	950
20	65	325	70	193	965
22	73	365	72	196	980
25	80	400	75	200	1000
28	93	465	78	204	1020
30	100	500	80	207	1035
32	105	525	82	211	1055
35	116	580	85	216	1080
38	125	625	88	221	1105
40	130	650	90	223	1115
42	136	680	92	227	1135
45	144	720	95	230	1150
48	151	760	98	236	1180
50	156	780	100	240	1200

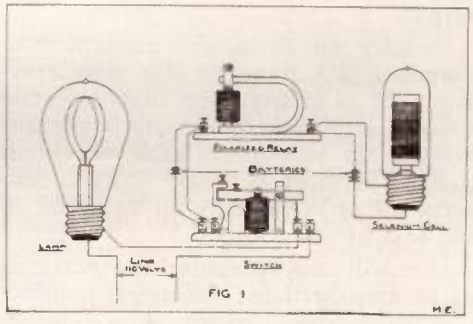
This is, however, only approximate, and accurate results can be had only by calibration with some standard wave meter.

The writer has heard from good authority (although he is not absolutely certain about it) that wavemeters may be calibrated free of charge or at small cost, at a U. S. Navy Yard, on account of the new wireless law. Directions for using this wave meter in connection with a wireless station will be described in a later issue of this magazine.

AUTOMATICALLY LIGHTING AND EXTINGUISHING ELECTRIC AND GAS LAMPS BY MEANS OF THE SELENIUM CELL

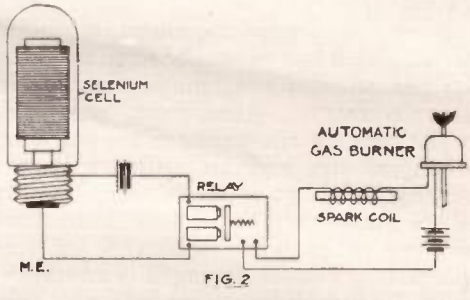
During the year of 1886 Mr. William J. Hammer, an electrical engineer of New York, at the convention of the Edison Association of Illuminating Companies at Rochester, N. Y., proposed the use of a selenium cell in controlling electric lights. He also described a practicable method of utilizing the selenium cell to control a relay and electromagnet, which would, in turn, throw off the electric lights on the approach of day and on again at night, rendering the unnecessary employment of time switches.

A selenium cell of suitable resistance, for example, 5,000 ohms in light, and 50,000 ohms in darkness, preferably enclosed in a vacuum in order to protect it against atmospheric effects, is connected in series with a current of appropriate voltage, derived from several batteries, and with a polarized relay accurately adjusted to attract an armature



or otherwise make or break contact when supplied with the current which passes through the selenium cell in light, and to release this armature or otherwise break or make contact when the selenium cell is in darkness and reduces the current.

The selenium cell is placed at the top of the street lamppost and is shielded by an opaque screen from the lamp, or the latter would be continuously lighted



and extinguished automatically every few seconds. The relay and the switching device are suitably protected from damp and placed inside the lamppost.

Fig. 1 shows Mr. Hammer's device as applied to an electric street lamp. Fig. 2 shows the method of controlling gas lights by the aid of the selenium cell.—*Samuel Wein.*

Aerial Conductors

By H. Winfield Secor

THE antenna or elevated aerial wires employed in the art of wireless telegraphy and telephony is a very important feature of such plants and many amateurs and experimenters only derive indifferent results from their transmitting and receiving sets, the latter especially, owing to poorly constructed aerials.

Usually an aerial for experimental purposes is a more or less simple affair, and, as in any other instances, the simpler a thing is, the more important become the function of each individual part. Therefore, it behooves us to conserve all of the energy on an aerial to the best of our ability.

We will now consider the material to be employed for the aerial conductors themselves, which should incorporate as many of the following important features as possible.

1. Good conductivity.
2. Low high-frequency resistance.
3. High tensile strength.
4. Fair degree of flexibility.
5. Imperviousness to climatic conditions, such as dampness, rain, sleet, etc.

It is rare that all of these desirable features are incorporated in the wire employed for aerial purposes, and a brief discussion of the different kinds of wire commonly employed is given below.

First, we may consider aluminum wire, which has probably been used for 90 per cent. of the amateur aerials in this country. Aluminum wire has 1.78 times the resistance of copper wire, of equal size and an ultimate tensile strength of 75 pounds for No. 14 B&S gauge, which is less than that of any other wire employed for this purpose. Tensile strength is an important feature because aerials are subjected to high wind stresses, which tend to rupture the wire lengthwise. Aluminum wire has had a phenomenal sale for this class of work, owing, for one reason, to the great number of feet to the pound of such wire, there being about 267* feet per one pound, No. 14 B&S gauge, and 168 feet per one pound, No. 12 B&S gauge. Aluminum wire is, of course, very light, having about 33 per cent. the weight of an equal size copper wire. But size for size, the former is weak under tensile strain on long spans and a larger size than if copper wire be employed must be used to give the same conductivity. The conductivity of aluminum compared to copper wire of equal gauge number is 54 per cent. to 63 per cent. that of copper.

*Per Aluminum Company of America.

The most serious objection to the use of aluminum wire for aerials, however, is due to the fact that it is very difficult to make a good joint with it, which results from the excessive oxide coating which forms on its outer surface. When it is considered that magnet coils are wound with bare aluminum wire and depend for their insulation entirely upon the oxide coating or scale on the wire, it is at once evident that an ordinary twisted joint between a lead-in wire and an aerial strand will present an abnormally high resistance path to the weak incoming wave current on such an aerial. As an example of such a case, the author wishes to cite an instance of an amateur station located in New York City, which employed an aluminum wire aerial. When first erected, this station, which was a small one, was regularly receiving messages from along the Atlantic coast as far south as Charleston, but in a few weeks the receiving range had dropped gradually until it was about possible to read Philadelphia, Pa. (2 kw. set sending), and this has undoubtedly been the unfortunate experience of many stations employing aluminum wire aerials with unsoldered joints.

As to the remedy for these defects, there are two ways in which to overcome the "high resistance joint" problem. One is to solder the joints, having carefully cleaned the wires where the joint is to be made. "Aluminite" solder may be used. The joint should be covered with tape after soldering. Another way to make a good aluminum wire aerial is to form it from one continuous piece, so that no broken

joints occur, and this can be managed with a little ingenuity. Having an aerial electrically good, so far as joints are concerned, the low tensile strength and poor conductivity of aluminum still remain.

Copper wire is often utilized for aerials, and, of course, presents the best conductivity, but is not very strong mechanically, the ultimate tensile strength of No. 14 B&S gauge copper wire being 193 pounds. In the comparison of relative conductivities of the different wires mentioned here, that of copper is taken as 1.

The aluminum and copper wire so far mentioned are generally single solid conductor, and it is well known that a stranded cable is much more efficient for high frequency currents, such as traverse aerials, owing to the greater surface presented by, say a stranded cable of fine wires equivalent in conductivity (with ordinary D. C. current) to a similar size solid conductor. In other words, the high frequency resistance of a stranded conductor is considerably less than that of a solid conductor of equal D. C. conductivity. Tables showing the comparative low and high frequency resistances of various conductors do not always show the decided superiority of a stranded conductor for aerials over solid conductors, but actual tests on working stations have proven beyond a doubt that a stranded conductor can improve the results at a given station, where with a solid conductor for aerial and lead-in, inferior results were obtained previously.*

Prof. R. A. Fessenden, the well-known radio engineer, has quite recently taken out patents on a stranded or woven conductor for use on inductance coils for radio telegraphic purposes.

A formula has been evolved by Lord Rayleigh for determining the high frequency resistance of a certain conductor, when its direct current or ordinary resistance in ohms is known. This formula is:

$$R_a = R_c \frac{\pi \times d}{80} \sqrt{N}$$

Where R_a = Resistance in ohms, of wire to high frequency A. C.

R_c = Resistance of wire to direct current (ordinary resistance).

π = 3.1416.

d = Diameter of wire in centimetres.

80 = A constant, and

N = Frequency in cycles per second of alternating current. This formula holds good only for comparatively high frequency currents, such as employed in Radio work, and for large conductors.

As an example of the improvement occasioned by the substitution of stranded conductor for a solid one, in one case cited by Mr. C. I. Hoppough in his book on Wireless Telegraphy, poor results were changed to good ones by using seven strands No. 22 B&S phospor bronze wire, forming a twisted cable in place of a solid No. 12 B&S copper wire. In this case the 7-22 stranded cable had a total area of 4,494 circular mils, as compared to an area of 6,630 circular mils for the No. 12 B&S solid copper wire, and yet the results were markedly improved, even though the D. C. resistance of the stranded cable was about twice that of the solid wire. It may be said that aside from commercial and Government stations, stranded phosphor bronze cable, consisting of seven No. 20 or No. 22 B&S gauge wires, is standard. Joints are readily soldered using this cable, and it is very tough, with high tensile strength. High frequency currents only travel on the surface of the conductor, hence the more surface it has or the better the conductivity of this surface, the less its high frequency resistance will be.

A new wire for aerial construction purposes is being exploited by a New York concern, and destined to be employed extensively in the future, owing to its good qualities. It is advertised under various trade names. This wire has been used by telephone and electric light companies for long spans for a number of years, and is commercially known as "bi-metallic" or "copper clad" wire. It is composed of a steel core or inner wire, with a copper jacket shrunk on over it. The copper jacket may be made of different thicknesses, and this, of course, determines

*See "A Treatise upon Wireless Telegraphy & Telephony," by C. I. Hoppough, p. 184.

its comparative conductivity with other wires.

Bi-metallic wire is the strongest electrical conductor, excepting an equivalent size of steel wire alone. Hence, it is admirably suited to long spans or high wind stresses, which often occur in aerial problems. No. 14 B&S gauge Bi-metallic 30 per cent. copper wire has a rupture strength of 330 pounds, as compared to 75 pounds rupture strength for No. 14 B&S gauge aluminum wire, and 193 pounds for No. 14 B&S copper wire.

This wire is, of course, easily soldered by means of any common flux, such as rosin, "No-Korode" paste, etc., and an alcohol or gasoline blow torch, or a soldering iron may furnish the heat for making the joint.

The resistance in ohms per 1,000 feet at 75° F. of stranded "Bimetallic" wire is as follows:

Thirty per cent. copper, 8.80 ohms; 40 per cent. copper, 6.60 ohms; 47 per cent. copper, 5.62 ohms.

This wire is furnished stranded of the same size as the regular phosphor bronze cable, at the same price. It should be noted that even though the copper-clad wire has its highest conducting portion on the outer surface, that it is much stronger than an equal size of copper wire, but its high frequency resistance is just as low as that of the solid copper, owing to the skin effect previously mentioned.

Note.—On account of the thinness of the copper coating on the 30% wire, about 0.005" for No. 14 B & S and about 0.002" for the 7-22 stranded wire, extreme care should be used in handling this wire not to damage or nick the coating, for if moisture gets at the core of the wire through such an injury, the core will rust out, thus destroying the strength of the wire.—Ed.

PLANNING TRANSATLANTIC WIRELESS SERVICE

H. Bredow, managing director of the German Telefunken Wireless Telegraph Company, has arrived here from Berlin in order to take up the question of establishing a transatlantic wireless service between the United States and Europe. Since 1906 the German Telefunken company has had an experimental station at Nauen, near Berlin, where improvements and new inventions in the field of wireless telegraphy are tested. The station has been continually enlarged and improved in the intervening years, and now works with 500 h.p. to 600 h.p. as compared to the 35 h.p. originally installed in 1906. The result has been an increase in range from about 1,000 miles to as much as 4,000 miles. It is now intended to open this station for regular public service. The company planned last year to test the practicability of transmitting radiograms to the United States, but the tower at Nauen, which was over 600 feet in height, was thrown over by a heavy storm before the tests were begun. A new tower, approximately 900 feet in height, is now under construction. The company, hoping to transmit across the ocean before the completion of this tower, began tests on January 11 with a provisional antenna 400 feet high. On the first trial the signals sent out from Nauen were distinctly received by the station at Sayville, L. I., belonging to the Atlantic Communication Company, New York, and messages transmitted from Sayville were received at Nauen so as to be distinctly legible, even though the station at Sayville operated at only 45 h.p.

CONDENSER SHUNTED TO TELEPHONE IN WIRELESS TELEGRAPHY

In practically all systems of wireless telegraphy the telephone receiver has superseded all other forms of receptor and the best results are obtained when the telephone is shunted with a capacity. The author investigated in detail the function of this capacity. His chief results are that the value of the capacity used as a shunt to the telephone which produces the maximum intensity in the telephone is not independent of the break in the primary current at the sending station; that in the general case where circuits in parallel with the telephone have a large resistance this maximum is due to resonance in the telephone circuit alone, and that the "harmonics" in the break, and not the frequency of the break itself, may be the most important factor in determining the value of the capacity to produce the best effect for any one telephone. In other words, the condenser should be variable or at least adjustable.—*London Electrician.*

This department has been started with the idea to encourage the experimenter to bring out new ideas. Every reader is welcome to contribute to this department, and new ideas will be welcomed by the Editors. WHEN SENDING IN CONTRIBUTIONS IT IS NECESSARY THAT ONLY ONE SIDE OF THE SHEET IS USED. SKETCH MUST INVARIABLY BE ON A SEPARATE SHEET NOT IN THE TEXT. The description must be as short as possible. Good sketches are not required, as our art department will work out rough sketches submitted by contributors. IT IS THEREFORE NOT NECESSARY FOR CONTRIBUTORS TO SPEND MUCH TIME IN SKETCHING VARIOUS IDEAS. When sending contributions enclose return postage if manuscript is to be returned if not used. ALL CONTRIBUTIONS APPEARING IN THIS DEPARTMENT ARE PAID FOR ON PUBLICATION.

FIRST PRIZE TWO DOLLARS

ENCLOSED PERIKON DETECTOR

A perikon detector, as shown in the illustration, which is dust and moisture proof, and having all the necessary adjustments, besides presenting a novel appearance, may be made as follows:

It consists of a top and base turned out of mahogany and polished. The top

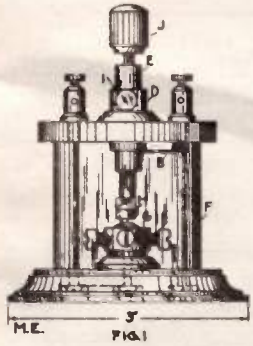


FIG. 1

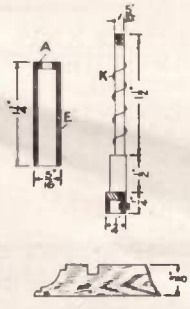


FIG. 2

is 2 inches in diameter and the base 3 inches. Grooves are turned so that the glass tube fits into the top and base. The tube can be obtained from any house carrying engine supplies, as it is used in oil cups. It should be 1¾ inches in diameter and 1⅝ inches high. This is a standard size.

A bushing, D, is turned from ¾-inch brass rod and bored to pass a piece of brass tubing 5/16-inch in diameter. The details of the plunger, tube (which holds the spring) and the small cup are shown in the drawing and nothing further need be said except concerning the part A. This is a piece of tubing forced into E and holds the spring, K, inside.

The spring is a rather light one and should be of such a diameter that it will just slide into the tube, E. The pressure is regulated by sliding the tube, E, and locking it there with the set screw I.

The cup to hold the zincite may be of any convenient size. When making the smaller cup, H, the set screw should be made sufficiently small so that it will pass through the hole in the bushing.

Contact is made with the bushing by a small flat piece of spring brass, B, soldered to a piece of tubing and forced on one of the rods. The other rod is connected under the base to the screw holding the zincite cup.

The binding posts screw directly onto the rods.

When the zincite requires changing these binding posts must be unscrewed and the top and glass removed. This is not necessary if good zincite is used, as the detector, being dustproof, the crystals do not spoil unless burned out. This may be prevented by opening the detector circuit when sending.

The detector is adjusted by the knob, J, by means of which the bornite or chalcopyrite can be moved until a sensitive spot is found.

Very good results have been obtained with this detector and I hope this will be helpful to those having detector trouble.

Contributed by

Herbert K. McGear.

SECOND PRIZE ONE DOLLAR

A TUNING TRANSFORMER

The amateur who is not using the loosely coupled tuner is not getting the best results out of his instruments. Also this type of tuner is the only one that

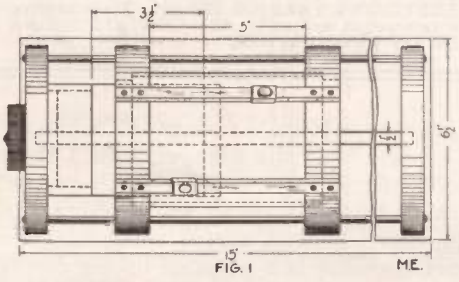
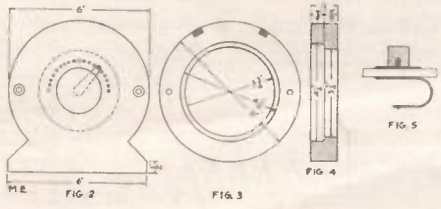


FIG. 1

will to some extent prevent interference from affecting his receiving.

This tuner has several advantages over the ordinary type. First, the secondary using the switch is stationary and eliminates all sliders. Second, it is very efficient. Lastly, it has the "commercial look" that so many amateurs desire.



The woodwork on the instrument is best made of mahogany, but a very good finish may be obtained by using maple. Sandpaper it, using fine sandpaper. Then give it a coat of black stain and wax it. The brass work is best nickel plated. Fig. 1 shows the base. It is cut from ¾-inch stock and is 15 by 6½ inches. The heads shown in Fig 2 are cut from stock of the same thickness. The upper part is circular, 6 inches in diameter. The bottom is made as shown in the drawing. The primary heads are 6 inches in diameter and turned from 1⅛-inch stock, with an opening 4¼ inches in diameter extending half way through the piece for the reception of the primary tube. Then a 3¾-inch opening is cut through the remaining half. The primary heads are mounted on each end of the primary tube, 5 inches apart. The primary winding consists of one layer of No. 22 enameled wire and the ends left dead. A ¼-inch hole is now bored through each primary head on each side, as indicated in the drawing. The secondary tube is 5½ inches long and is mounted on one of the end heads on a small wooden disc screwed to the head. The other end is plugged with another disc ⅜-inch thick. The secondary is supported on a ½-inch dowel running the entire length of the instrument. The secondary winding consists of one layer of No. 32 S.S.C. The winding starts ½-inch from the inner end and is 3½ inches long. Eighteen taps are led from it to the switch on the head. The primary is mounted on the rods, as shown in the drawings and the connections from the primary sliders made through flexible cord. The binding posts are mounted on the sides near each end.

Contributed by

Edward H. Kurth.

ANOTHER COMPACT RECEIVING SET

The following description is of a complete receiving set, mounted in such a

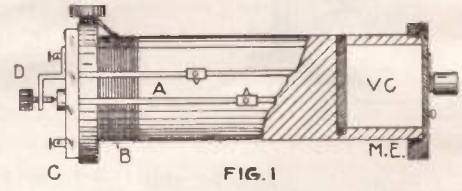


FIG. 1

manner as to occupy a very small amount of space. It will be found particularly useful as a portable set, and the striking advantage is that it contains all instruments necessary to a good receiving set.

A double-slide tuner is made and a secondary, B, wound on, as described by P. Mertz in the February issue of

Modern Electrics. Secondary is preferably No. 30 silk wire, and primary No. 22 enameled.

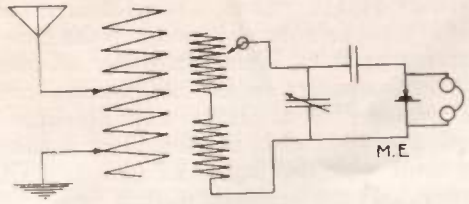


FIG. 2

The rotary variable condenser, VC (preferably a small one), is mounted in the end of the tuner, with the top of it flush with face of the coil end and knob protruding. The condenser is shunted across the secondary. The detector, D, is of the mineral type, and is mounted on a fixed condenser, C, of proper capacity, which, in turn, is fastened to the secondary end of the tuner. The condenser is in series with the detector.

The tuner is connected up as shown in the diagram. When carrying the set about, the 'phones can be placed with the head band around the coil, and the outfit can be conveniently placed in a small valise.

Contributed by

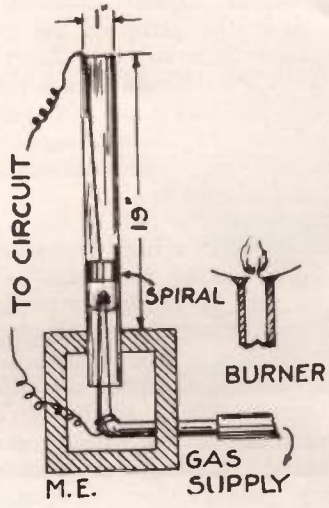
J. C. Erney.

AN AUDION TIKKER

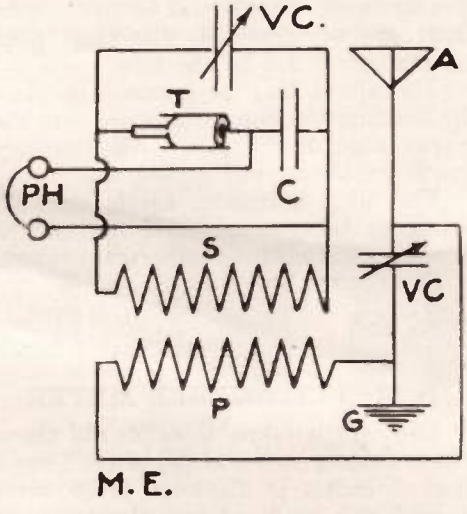
The principle involved in the operation of a wireless receiving set which has been constructed for the purpose of communicating with a station using the arc or Poulson system is fairly well understood by all. We know that to bring the extremely high frequency down to a vibrating period within the limits of audibility we must chop up or interrupt the incoming signals. This is ordinarily accomplished by using an instrument called a tikker. This apparatus as ordinarily used by the amateur has its faults, as any user will state, having also several parts difficult of construction.

While experimenting, a certain amateur discovered a principle which may be successfully applied to the receiving set, to the exclusion of the tikker. To form an idea of the principle involved in this instrument it may be well to perform the following experiments:

Take a glass tube having a bore of ¾-inch to 1-inch and 19 inches long and support the lower end in a square wooden frame. A gas burner is next



constructed by taking a 10-inch piece of ¼-inch brass tubing and hammering the end down to a small bore (about the size of a large pin hole). This tube may be bent at right angles and the open end passed through the wooden frame for



support. The leg must be long enough to project about 4 inches up into the glass tube. The other end is connected to a gas supply. The gas is turned on and lighted at the tip, the glass tube be-

ing slipped down over the burner into position. Now turn the gas down slowly and at a certain stage the apparatus will begin to emit a high piercing note, which will be lowered in pitch as the flame is reduced.

If we now take a rotating mirror (or a plate mirror rapidly vibrated back and forth in the plane of the greatest dimension, will serve) and observe the flame by it, we will see that a series of explosions take place above the existing flame. These explosions, occurring in rapid succession, produce the tone emitted by the instrument.

Again, we know that a flame offers little resistance to a high frequency current. Now, taking the facts as given above, we may by combining produce an efficient interrupter for the high potential oscillations. The instrument retains the same form as the one described above, except that a small + shaped brass piece is soldered to the top of the brass burner, leaving, of course, the necessary passage for the gas. (See the diagrams.) Now, lighting the flame when we know that an arc system is in operation within receiving range, we regulate it until the sound produced is at a fairly high pitch. Making the connections, as shown, we next lower a platinum spiral down into the tube and a certain place will be found where the incoming signals will be heard very loud and of identically the same pitch as that given out by the tube.

The spiral may be secured in place by bending the copper support over the upper edge of the tube. All necessary parts are shown in the diagram.

This idea, simplicity itself, the adjustment being coarse and rugged and commends itself to further experiment.

Contributed by

Paul Horton.

A SIMPLE AMPERE METER

The case is taken from an old alarm clock about 4 inches in diameter. Turn a back 6 inches in diameter from some ⅞-inch oak stock. Leave the center of this back about ¼-inch thicker than the outside, so that the clock case will fit over it tightly. S. Fig. 1, is a curved solenoid bobbin. This can be constructed as follows: Take some No. 18 spring brass wire and wind a coil spring 1½ inches long on a piece of 5/16-inch rod. Take another piece of 5/16-inch rod and curve about 3 inches of it to an inside radius of 1⅛ inches. Wind a layer of heavy paper around it and slip the brass spring onto it. Then run solder all over it. Also solder on the brass end pieces shown in Fig. 2. It can now be slipped off the rod and insulated, and then wound with two layers of No. 14 DCC wire. From some 3/16-inch iron rod form an armature as shown at A, Fig. 1. The curved sections should have an inside radius of 1 3/16-inch. Drill a 1/16-inch hole in the cener and balance carefully. From a piece of thick knitting needle file two pivots 1 inch long. About ¼-inch from the end of one solder a ¾-inch gear wheel, and on the other a ¼-inch pinion. These can be taken from an old clock. The pivot support, P, is shown in Fig. 3. It is made of 2 by ⅛-inch iron. The drawing is quite

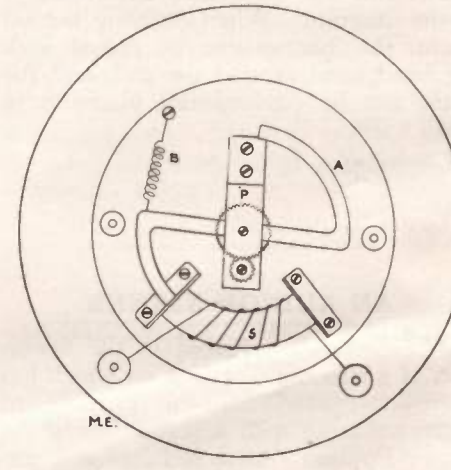


FIG. 1

clear and needs no further explanation. A piece of stiff brass wire bent as shown at A, Fig. 3, is soldered to the pivot with the pinion on it. The indicator is soldered on the end of this after the dial is in place. The dial is made of heavy white cardboard. It is held in place by two 5/16-inch round iron posts, 1⅝ inches long, drilled and tapped with a 6/32 thread at each end. By referring to Fig. 1 the reader can easily see how the meter is assembled. A very fine coil spring, B, with a thread tied to one end of it is soldered to the armature. The thread is tied tightly around a thin wood

screw, which is screwed into the back, as shown in the drawing. Bring the wires from the solenoid out through holes in the back and connect them to two binding posts. Drill holes through the back and screw on the two posts. Screw the dial on top of these, leaving a hole for the brass indicator wire to pass through. Push the armature in about half way and hold it there with a small piece of wood jammed into the solenoid. Then put the indicator on the wire and move it to the position in which you want the meter to read zero, and put a drop of solder on it. Remove the piece of wood so that the armature

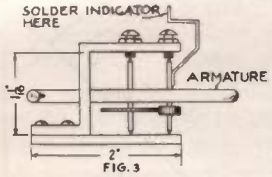


FIG. 3

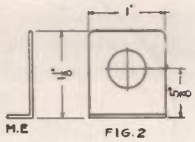


FIG. 2

moves freely into the solenoid. The meter should now be put in series with some standard instrument and the scale marked. Adjust it so that it will indicate from one to ten amperes. Place a small pin in the dial at each end of the scale to keep the indicator from moving outside the scale. The case can now be put on and the ammeter is complete.

Contributed by

E. W. Schlenker.

SUGGESTIONS TO WIRELESS EXPERIMENTERS

Many experimenters do not like to go to the trouble of constructing magnetic keys to break the 110-volt circuit. At the same time they would welcome some device preventing accidental touching of the metal parts of an ordinary key, which often gives an unpleasant shock. A very simple method of doing this is shown in Fig. 1. A hard-rubber or fibre disk, of as large a diameter as thought necessary, is clamped under the usual key knob. Besides preventing accidental shocks, this key will be found easier to operate than the usual type, as it can be worked on the edge of the disk. This is less tiresome than when the ordinary knob is used.

Switch-points having a very neat appearance can be easily and cheaply made from ordinary round-head brass machine screws by filing down the head till the slot is gone, as shown at A, Fig. 2. Since it would be hard to tighten such a screw, a slot is cut at the end of the shank to replace the one filed off in the head. Although the size of the screw should be adapted to the uses of the

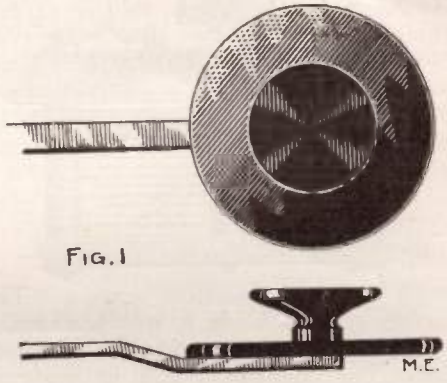


FIG. 1

switch, still the writer has found 14-24 brass machine screws to be the best for general use.

A switch of very neat and businesslike appearance, using the above type of points, is shown in the rest of Fig. 2. It is especially designed for varying the secondary inductance of a loose-coupler, but can be put to many other uses with excellent results. At A is seen a switch-point, under the nut of which is clamped the connecting wire. If a permanent and especially good connection is re-

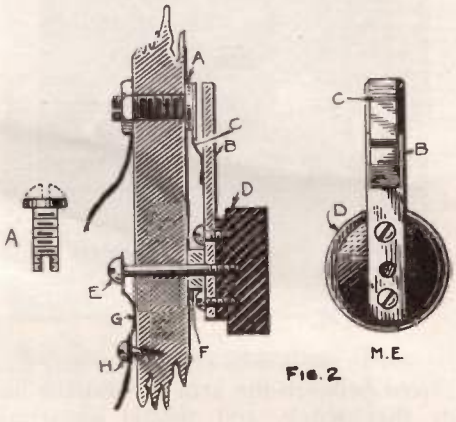
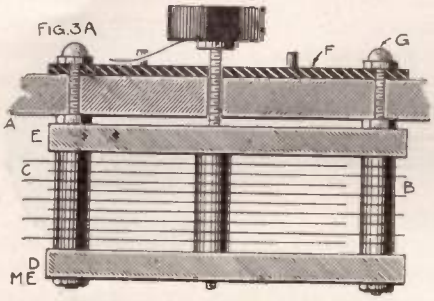


FIG. 2

quired the wire may be soldered in the slot in the shank of the screw. The switch arm, shown at B, should be made of a piece of heavy brass ribbon. If a small piece of spring-brass be soldered to the end bearing on the switch-points,

in the manner shown at C, the movement will be smoother and the contact better. The sides of the spring-brass piece are bent back slightly, so that it does not catch against the edges of the switch-points. The arm is fastened to the operating insulating knob, D, by means of



small wood or machine screws. The former are the easier to use, but cannot be employed on hard-rubber or composition. The knob, D, should be made of hard-rubber, fibre, or composition. It should preferably be from 1 to 1½ inches in diameter and have a thickness of not less than ½ inch, while the edge may be knurled or left plain. The shaft consists of a brass machine screw, E. The best size for this is 8-32, while the length depends on the size of the switch. It is screwed into a hole drilled and

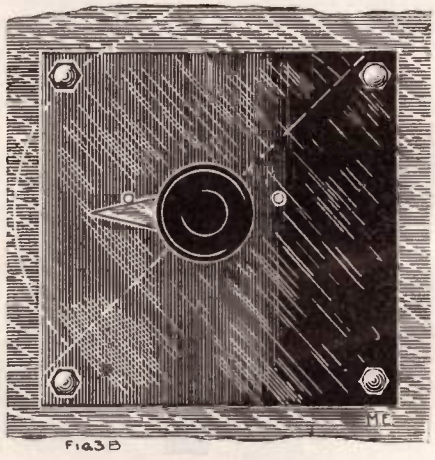


FIG.3B

tapped in the knob, D. A washer, F, is placed between the arm, B, and the base of the switch, and should electrically connect E with B. At the back of the switch a small piece of spring-brass, G, fastened to the base by a screw, H, gives a certain amount of friction which retains the arm, B, in its position, after being adjusted. The spring should be bent as shown, so that the tension may be varied by turning the screw, H, which also receives the connecting wire for the switch-arm, B. This method is far more satisfactory than the usual one of simply tightening up E, because the latter is less liable to be loosened from D. For this reason better friction is had, and adjustment is far more convenient.

A very good way of finishing fibre is to polish it with fine sandpaper and add a thin coat of vaseline with a clean rag. When the vaseline has dried, the surface should be polished with another rag, and a bright finish results. Gray fibre may be colored black by painting

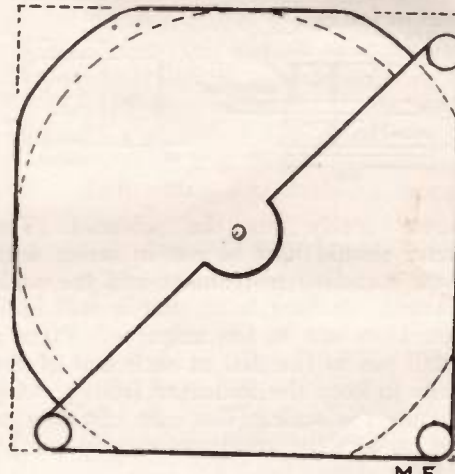


FIG. 4 A

it over with India ink, and then finishing as above. Of course, the carbon in the India ink impairs its insulating qualities to a slight extent, but it is still good enough for many purposes, such as knobs, handles, etc.

A rotary variable condenser of the usual intersecting plate type is often more convenient when mounted in the table than when put up in a case and simply laid on the table, for it is then far easier to adjust, and takes up much less room. A simple way of mounting one in a table is shown in Figs. 3A and 3B. The table is shown at A, while the fixed and movable plates of the condenser can be seen at B and C, respectively. The fixed plates are mounted in the usual triangular wooden pieces, D and E, which also hold the bearings for the shaft. The three screws clamping the whole are, however, extended from ¾ to 1½ inches beyond the upper piece, E;

the length depends on the thickness of the table. Holes are made in the table for these, and also for the shaft (the hole should be about 1-16" more in diameter than the shaft). A square piece of hard-rubber or wood from 1/8 to 1/4" in thickness can be mounted over the table if desired, for neatness; it should be drilled exactly the same as the table.

The knob having been taken off the shaft, the body of the variable condenser is placed in the position shown in the illustration, and secured there by small brass caps, G, screwed over their respective bolts. The knob is then fastened to the shaft. If desired, a scale can be mounted on the plate, F, for the index on the knob. If no scale is mounted, stops should be placed, limiting the motion of the pointer to 180°.

In cutting the movable plates in variable condensers, there is usually about one-quarter of the sheet of metal wasted.

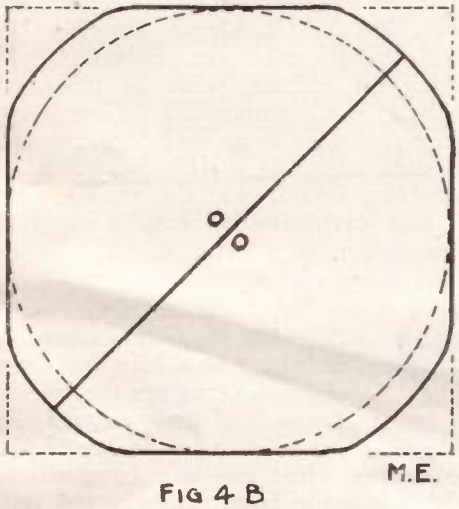


FIG 4 B

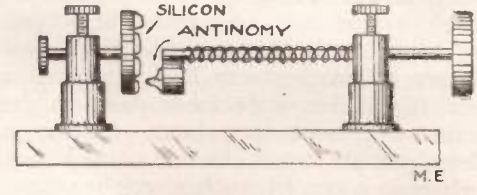
This can be easily eliminated in the stationary plates by making them triangular, but the movable plates cannot be triangular. A good way of reclaiming part of the waste is shown in Fig. 4A. Here, by cutting the plate as shown by the full lines instead of as shown by the dotted lines, less sheet metal is wasted; while the sides of the plates still have a good amount of clearance from the washers separating the fixed plates. In this illustration, both fixed and movable plates are cut from the same sheet of metal. This is necessary when a tongue is left on the side of the movable plate. However, some experimenters prefer to leave out this tongue, because greater rigidity is given to the plates. The method of cutting these is then shown in Fig. 4B. When cut in this way, from a 5" x 5" plate, a surface of about 20.4 square inches is obtained, as against 19.6 square inches when cut as per dotted lines; the radius of the plate being 2.8" instead of 2.5". Such a difference seems quite small in one plate, but it becomes a good deal when six or more movable plates are used.

Contributed by

P. Mertz.

ANTIMONY AND SILICON

Antimony and Silicon comprise a detector which has not become as popular as other types thus far. I have tried it and find it surpasses all other kinds of detectors in retaining its sensitiveness for a long period of time. I have had it remain in adjustment for over two weeks at a time. The construction of this detector is very simple, as may be seen by the above drawing. Procure two binding posts, as per drawing, and the rest of the detector will be very simple to construct. Not very much tension is required for the spring, so a small spring may be constructed out of small steel wire. A few pieces of silicon are placed in the stationary cup and in the other a piece of antimony with a rather sharp point. This antimony may be obtained at any mineral supply house for a few cents. In connecting this detector in order to get the best results, the antimony side of the detector must be connected directly to one side of the phone. I have used this detector with a one K. W. sending set



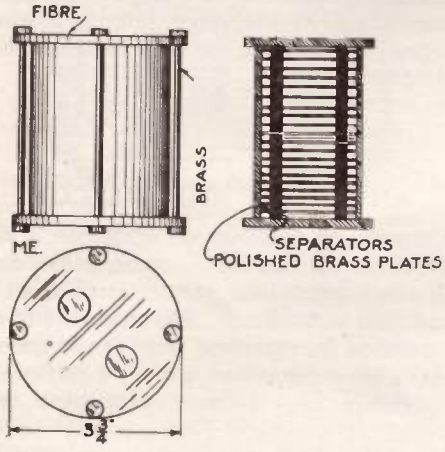
and have had no trouble with it burning out.

Contributed by

Frank Justice.

A HIGH EFFICIENCY CONDENSER FOR RECEIVING

It is well known that the ordinary condensers consisting of paraffine and tinfoil are extremely wasteful of energy. The only type, or at least the best type for conserving the energy is composed of polished brass and air dielectric. The one shown in the drawing is composed of a fibre casing within which



the plates are placed. They are separated by three or four drops of insulating compound (sulphur, resin or paraffine) or some one-inch square pieces of mica 1/32-inch thick. The plates are polished by using Bon Ami or other polish. Ears are provided on each plate for connection. The size is left to the builder, as he may compute it for his particular instruments.

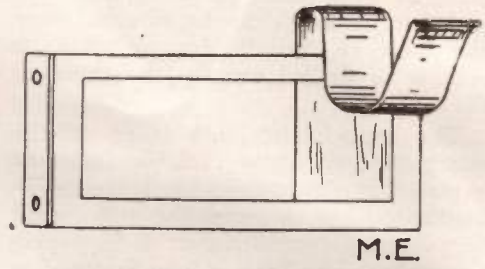
Contributed by

Paul Horton.

GRAPHIC RECORDING WATTMETER ROLL HOLDER

The paper roll of a graphic meter soon unwinds to a great length and as the operator rolls it up from the bottom to keep it out of the way after a few hours it becomes very heavy. When a roll 6⅝ inches wide feeds down at the rate of 8 inches per hour, making a length of 16 feet at the end of 24 hours, where it is cut off, such a weight proves disastrous to both the sheet and the instrument, as the tendency is to draw the paper taut and cause the pen to prick through it.

To eliminate this fault a holder was made of a small flat piece of spring brass, bent in the shape shown in the accompanying sketch. The straight lower part slipped into the panel cardholder



and the U-shaped part served to hold the roll and thus relieved the delicate meter of a detrimental weight.

Contributed by

Marshall S. Loke.

A PERMANENTLY-ADJUSTED DETECTOR

In the February, 1913, *Modern Electrics,* Mr. W. R. Organ describes "A Real Improvement in Detectors" in which the contact point is protected with a wax composition. Now anything that does away with the tiresome, constant adjusting is welcome, and after satisfying myself that the results were all that was claimed, I went a step further and made a detector which is almost absolutely fool-proof.

The materials needed are: A piece of fibre tubing ½ inch by 1 inch long two discs of brass or copper the size of the ends of tube; a small clip soldered to one disc; a few inches of No. 30 copper wire; the wax composition, which is made from ordinary red ceiling wax with some resin added to make it flow more freely and a small piece of sensitive galena.

After selecting your galena, put it into the clip and place the disc on a level surface. Place the tube over the disc and pour in a few drops of melted wax, care being used not to bury the galena or get any wax on the sensitive surface. When cold the disc and mineral will be found firmly cemented in position.

Using any approved type of stand

adapted to galena which will hold tube upright, proceed to get it into adjustment. When all is in perfect working order and a good station is coming in, pour in enough wax to fill the tube to within ¼ inch of the top. The idea in having the detector working during the filling process is that one can detect instantly if anything goes wrong. If this part of the work is carefully done nothing will be disturbed and the instrument will keep right on receiving.

When cold and hard remove from stand and solder the other disc to the copper wire. Now fill the tube full with wax and press wire and disc down while still melted. Keep under pressure until cold, then remove any surplus wax from the outside that may have run over. You now have a detector that will work in any position and can be attached to any part of your instruments by means of spring clips making it ideal for portable sets.

That it will stand considerable rough handling is shown by the following test. While receiving from Key West (1,400 miles) the detector, made along lines of foregoing description, was removed, dropped on the floor and replaced, and the balance of message heard. Extra care must be taken to guard against burning out the point, as if this happens the instrument is worthless.

Contributed by

A. P. Hall.

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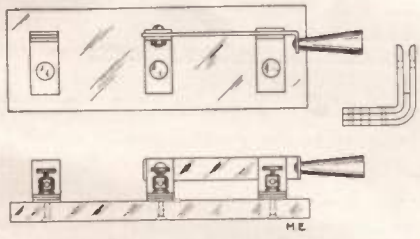
100 AMPERE SWITCH

A DTSP switch is something that should be in every amateur station. The following describes one that any amateur can make very easily. Although I



believe that the drawing is self-explanatory, I will add a few points to make it clearer.

The base is of fibre or any good insulator. It is about 10 inches long and 2 or 3 inches wide and about ⅝ or ¾-inch thick. The switch jaw and contacts are each made from three pieces of ⅛ by 1-inch copper strip, as shown in the detail drawing. The switch blade is about 5 inches long and is made of the same material as the jaws. About ½-inch of the blade is bent so as to allow the fastening of a suitable handle, as shown.

The contacts are fastened to the base by small screws and one large screw, which also holds the binding post. The binding posts are ordinarily brass posts, with the hole drilled large so as to admit a larger wire.

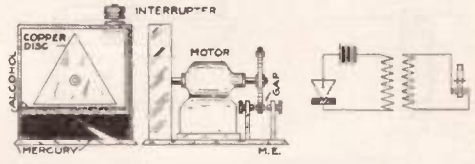
As most amateurs are familiar with its use, I will not attempt to explain its installation and connections.

Contributed by

Chester Fuss.

A SIMPLE INTERRUPTER

The first prize idea in the January issue works very well with a closed core instrument and fairly heavy current, but with an induction coil very poor results are obtained (the vibrator, of course, being screwed down tight). To



get results with an open core instrument we must interrupt and not merely abruptly reverse the current. The instrument shown fulfills the required conditions. One end of the rotary shaft has soldered upon it an equilateral triangle cut from sheet copper. This sheet rotates in a wooden box, in the bottom of which a quantity of mercury has been placed. A layer of alcohol is also added to prevent oxidation. The sheet makes three contacts per revolution and with a motor running at a speed of 2,000 r. p. m. 6,000 sparks per minute are produced, which is sufficiently great for all practical purposes. The rotary disc has three equidistantly spaced plugs with the arrangement shown on six

plugs with the common arrangement. The plugs should be in opposition just as the vertices of the copper triangle leave the mercury. A small battery motor used for speed is best and a Little Hustler or Ajax motor will make 3,500 r. p. m., or sufficient power, this materially increasing the frequency.

The connections are clearly shown in the sketch. The proportion of the parts is immaterial to the operation.

Contributed by

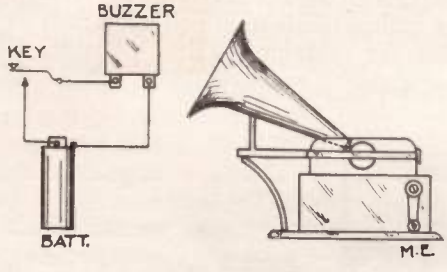
Paul Horton.

Note.—The author of the article referred to says he got good results using a spark coil. Theoretically, abruptly reversing the current should give better results than simply interrupting it.—ED.

DEVICE FOR PRACTICING SENDING AND RECEIVING

The articles required are: a battery, buzzer and key, as well as a wax cylinder phonograph equipped for both recording and reproducing.

Connect up the battery, buzzer and

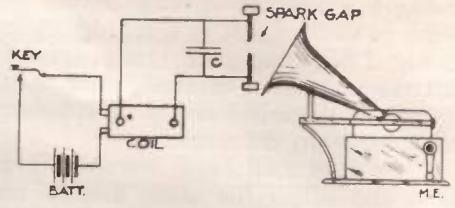


key in series and arrange the phonograph for recording. Hanging the buzzer in or near the horn, start the phonograph and commence sending a message at a speed you will be able to read. When finished remove the recorder and connect up the reproducer. Upon starting the phonograph it will reproduce your message just as you sent it.

The spark gap of a coil or transformer set may be substituted for the buzzer and placed near the mouth of the horn.

It is best to record a message read directly from some unfamilar book or newspaper article, as one is then less liable to partially memorize it and anticipate words when the message is reproduced.

While you may think that you are able to send perfectly, the phonograph will show up at once if you slur your dots and dashes and whether or not you leave sufficient space between letters



and words to make an intelligible message. You will be able to see at once why it is perhaps that your amateur friend has such difficulty in reading your wireless messages which you send him.

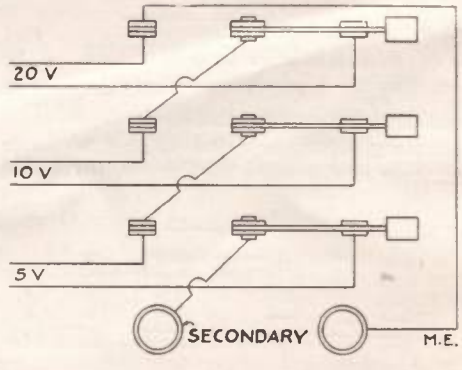
Contributed by

Raymond V. Wilson.

A NOVEL SWITCH ARRANGEMENT

The following diagram is of a switch arrangement for varying the voltage of step-down transformers.

Wind three separate secondary coils on your transformer core, doubling the number of turns in each successive coil, as, for instance, 25, 50 and 100. Con-



nect the coils to SPDT switches, as shown in diagram.

This arrangement gives seven variations. If a greater range is desired, four switches giving 15 variations may be used.

Contributed by

W. C. Wooley.

PATENT NO. 1,051,113, FOR A TELEPHONE, HAS BEEN GRANTED TO PETER L. JENSEN AND EDWIN S. PRIDHAM, OF NAPA, CAL.

The present invention is an interesting patent, showing an entirely new telephonic action, and we are pleased to give a full account of same, using the language of the inventor:

"The object of the present invention is to provide an instrument whereby, on account of its sensitiveness and its great clearness of articulation, speech may be transmitted to greater distances and with more satisfaction than with instruments now in use.

If a wire-carrying current is disposed in a magnetic field so as to cut transversely the lines of force of the field a force acts upon the conductor due to the reaction of the lines of force caused by the current flowing in the conductor with the lines of force of the magnetic field. The magnitude of the force acting on a conductor carrying current when disposed in a magnetic field at right angles to the lines of force of the field is the product of three factors: L, the length of the conductor perpendicular to the lines of force, H the strength of the magnetic field, and I the strength of the current flowing in the conductor, the equation being $L \times H \times I = F$. It is obvious that if L and H are constant, and I is a varying factor, then F will vary with I. Moreover, if L and H are made large factors F may be comparatively large even when I becomes very weak.

In the telephonic transmission of speech I is a varying factor and is generally weak, and in long distance telephony I becomes exceedingly weak.

Upon the foregoing principle this invention is essentially based; and it consists of disposing different portions of the conductor through which telephonic currents may pass to the influence of magnetic lines of force so that the force developed when current flows through the conductor actuates a diaphragm. This being accomplished by means of an apparatus wherein different portions of a very long conductor are exposed to the influence of a powerful magnetic field. This conductor is entirely free to move in the magnetic field and is rigidly attached to a diaphragm, so that any force acting on the conductor is transmitted to the diaphragm.

In telephony it is essential to utilize to the greatest possible extent the force produced by the weak varying currents representing the voice variations. With this end in view, we have devised the invention, which is the subject of this specification.

In order to produce an intense magnetic field a narrow air-gap is cut in a magnetic circuit energized by a source of constant current. In this air-gap there are disposed portions of a very long conductor in which current is flowing in the same direction so as to cut transversely the lines of force of the air-gap. This conductor is wound upon

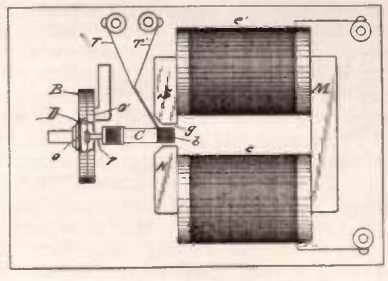


Fig. 2.

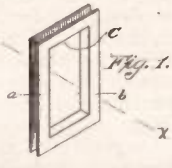


Fig. 1.

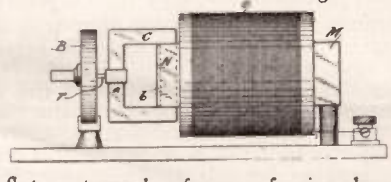


Fig. 3.

a thin, flat rectangular frame of mica, hard rubber, or any other suitable material. We have found it more satisfactory to construct this frame out of insulating material to prevent the formation of useless induced currents. This frame, carrying a conductor, is rigidly attached by an arm to a diaphragm.

When current flows through the conductor it will be seen that in the side of the frame, disposed in the magnetic field, the current is all flowing transversely across the lines of force in the same direction. The force developed tends to move the frame at right angles to the direction of the lines of force and at right angles to the length

of the conductor acted upon. In practice, in order to increase the efficiency of the instrument, we have disposed both sides of this frame carrying the conductor in magnetic fields the direction of the lines of force being such as to produce an additive effect upon the diaphragm when current flows through the conductor. If we consider the axis of this rectangular frame as being perpendicular to the plane of the winding of the conductor, then the force developed when current flows through the conductor moves the frame at right angles to this axis and at right angles to the direction of the lines of force in the air-gap, and at right angles to the length of the included side.

The invention consists of the parts and the combination and construction of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Fig. 1 shows a view of the frame on which the conductor is wound. Fig. 2 shows a cross-section view of the instrument. Fig. 3 shows a view of the instrument in vertical plane.

Referring to Fig. 1: C is a thin, flat, rectangular frame made of mica, hard rubber or any suitable material. Upon this frame and fixed to it are wound many turns of wire. This frame is made very thin and flat in order to reduce the width of the air-gap in which it is to be disposed, to a minimum consistent with a free movement of the frame in this air-gap. The two long sides of this frame may be designated as *a* and *b*, and shall be known as the active sides. The essential features of this frame upon which the conductor is wound are that it is light and strong and very flat, presenting a very narrow surface to the air in the direction of its motion. The direction of motion that this frame is designed for is important. If we consider the axis of the coil as being perpendicular to the plane of the winding of the conductor on the frame, then the direction of motion that the frame is designed for is perpendicular to this axis and at right angles to the long side of the frame. This axis of the frame, C, is designated by the letter X, and will hereafter be known as the axis of the frame. It will be seen that if a conductor is wound continuously upon this frame and current passed through this conductor that the current passing through the portions of the conductor occupying the side (*a*) will be in one direction and the current flowing in the side (*b*) will be in the opposite direction.

Referring to Fig. 2, a simple form of the invention is shown, in which M is a magnetic circuit energized by the coils *e*—*e'* N—S are pole pieces of the magnetic circuit M. *g* is an air-gap in the magnetic circuit M. In order to produce an intense magnetic field the magnetic circuit is energized by a strong constant current and the air-gap *g* is made very narrow. Within this air-gap *g* is disposed a side *b* of the frame C so that the conductors cut transversely the lines of the force of the field. The position of the frame C carrying the conductor is such that the lines of force in the air-gap *g* cut the side *b* at right angles to its length and also at right angles to the plane of the winding. It is to be noted that the conductor wound upon the frame C is the sole conducting path within the air-gap, it is free to move within the air-gap and is connected to the telephone circuit by means of flexible leads through the terminals T—T'. The frame C carrying the conductor is held in position and attached to a diaphragm D inclosed in sound box B by a rigid connection *r*. It will be seen by what has gone before, that when current flows through the conductor a force will be developed due to the reaction of the lines of force around the conductor with the lines of force in the air-gap *g* which will tend to move the conductor in reference to the lines of force of the field existing in *g*. Since the conductor is firmly attached to the frame C, which in turn is connected to the diaphragm D by the rod *r*, any force acting on the conductor is transmitted to the diaphragm D. The advantages of this construction are that a very powerful magnetic field may be maintained in the air-gap *g*, a large amount of active conductor may be disposed in the field, so that the weak varying currents representing the speech variations are utilized to a very high degree. Also that the speech reproduction is free from the effects of magnetic hysteresis, which has a detrimental effect in the ordinary receiver.

Referring to Fig. 3, a vertical view of Fig. 2 is shown. In this view the supports for the sound box B are shown."

PATENT NO. 1,050,239, FOR ELECTRICALLY OPERATED SOUND PRODUCER, HAS BEEN GRANTED TO CARL J. SCHWARZE, OF ADRIAN, MICH.

The invention relates to electrically operated sound producers, being more particularly designed for use as an alarm device on vehicles and automobiles.

It is the object of the invention to obtain an efficient and compact arrangement of the operating parts and one which may be readily manufactured and assembled at low cost of construction.

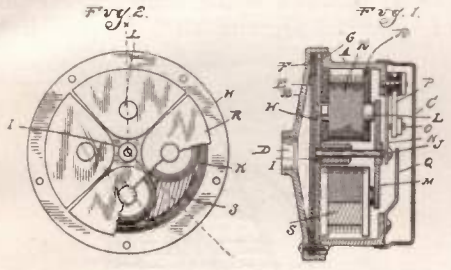
This sound producer which gives quite a loud sound by using a very small apparatus is interesting chiefly because of its simplicity.

We quote herewith an extract from the patent, using the language of the inventor:

"My improved apparatus is completely housed in a suitable casing preferably comprising the portions A, B and C. The portion A is of cylindrical form and of magnetic metal, being arranged around the electromagnet coils and coöperating therewith. The portion B is a cap slightly coned and provided at its center with a nipple D for attachment to the horn or megaphone. The portion C is a cap for the opposite end of the case and incloses such parts as are outside of the cylindrical portion A.

Within the case is arranged the sound producer which comprises essentially a diaphragm E arranged across the case adjacent

to the cap B and clamped thereby between washers or rings F and G against the case portion A. Adjacent to this diaphragm is a plate H of magnetic metal which is also clamped by the cap B to the case portion A. The plate H is centrally apertured and is provided with a correspondingly apertured bearing I preferably formed of non-magnetic metal and in which is slidingly located a striker rod J. Arranged concentrically around this striker rod are a plurality of magnet coils K having pole pieces L which exert a balanced pull upon a disk armature M mounted upon the striker J. The striker J is also connected to the vibrator spring N of the make and break circuit closing device in which O is the coöperating adjustable con-



tact secured to the arm P having an insulated support on the frame.

Q is a spring arm or buffer arranged in the path of the striker J at the opposite end from the diaphragm P.

With the construction as thus far described the passage of the electric current through the circuit interrupter and the coils of the magnet will cause a vibratory movement of the armature which is transmitted to the striker J and will cause the latter to impinge upon the diaphragm E. The resiliency of this diaphragm will return the striker and the buffer Q will operate in conjunction with the magnetic pull to increase the force of the blow.

To facilitate the construction of the magnet the several coils which surround the core or pole pieces L are individually wound and are then attached to the plate H. Each coil is wound between the insulator flanges R which are fashioned to form complementary parts of a circular disk concentric with the axis of the casing. Thus when all of the segments are assembled they together form peripheral flanges leaving a groove in which a condenser may be located. This condenser is preferably formed of a pair of wires wound together around the magnets in the groove between the peripheral flanges and to form a circular body on which these windings may be placed, filler blocks S are arranged in the spaces between the coils K. The arrangement is one which utilizes practically all of the space within the casing A and at the same time it is a construction which may be easily manufactured and the parts of which can be quickly assembled."

MAX NEMMERT AND GEORGE SCHNABEL, OF HAMILTON, ONTARIO, CANADA, HAVE BEEN GRANTED PATENT NO. 1,049,516, FOR ELECTRICAL THERMOSTAT.

This is a new thermostat and although it seems to be a rather delicate apparatus, it presents some good points which will be apparent by perusing the patent specification which we give below:

"According to the form of our invention

Fig. 1

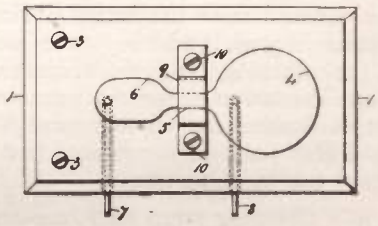


Fig. 2

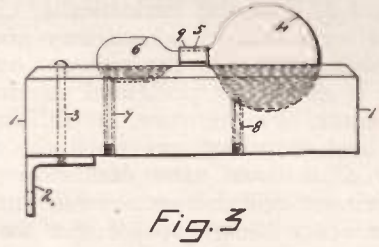
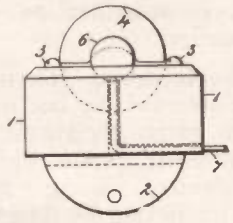


Fig. 3



illustrated, 1, is a base or block of insulating material—porcelain for example—having secured thereunder an angular wall bracket 2, by means of screws 3, 3. Formed in the upper face of the aforesaid block 1, are suitable recesses in which is seated a hermetically sealed vessel or glass container consisting of a large globular portion 4, a restricted or horizontal capillary neck portion 5, and a smaller cylindrical portion 6, having semi-spherical ends.

Either or both portions 4 and 6, may be partially filled with mercury to a level normally below the horizontal neck portion 5, and the rest of the space is charged with an effective gas adapted to absorb heat such as water gas. Upon the temperature rising to a predetermined degree the heat absorbing gas instantly condenses and the two portions of mercury in the parts 4, and 6, expand and

coalesce in the neck portion 5, or approximate sufficiently to close the electrical circuit and allow the current to pass.

Obviously the quantity of mercury contained in each part 4, and 6, will be dependent upon the temperature degree at which it is desired that the heat expansion will cause union through the neck portion 5.

7, and 8, are the leading in wires which connect with the alarm device or automatic signal, and they are sealed into the parts 4, and 6, respectively, without insulation. For the purpose of this specification the wires 7, and 8, are termed the stationary contacts and the mercury the movable one.

9, is a clamping strap held in place by screws, 10, 10, for holding the sealed vessel *in situ* on the block, 1.

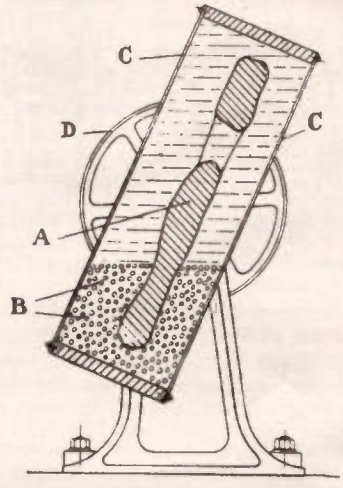
By sealing the naked end of the wires 7, and 8, into the hermetically closed vessel or container where they are always covered with the mercury oxidation is effectively prevented, as no air can enter. Furthermore, the shifting of the heat absorbing gas when the mercury cools down after each closing of the circuit will insure a fresh surface of mercury being exposed and thereby nullify any volatilization when the "break" occurs.

From the foregoing description it will be readily seen that by our invention we provide an extremely simple and effective thermostatic device, while the connecting element, being hermetically sealed, is unaffected by damp or the ravages of vermin and remains absolutely unaffected by exterior influences other than the predetermined degree of heat. Finally, we find by experiment that our improved thermostat is instantaneous in action, whereas devices heretofore constructed have all necessitated some seconds to close the circuit after the "critical" temperature has been reached.

Slight changes might be made in the general shape and disposition of the parts shown and described without departing from our invention, and we do not restrict ourselves to the precise form set forth, others being possible that fairly fall within the scope of the appended claim."

Patent No. 1,051,556 to Stefano Consigliere, of Genoa, Italy, relates to improvements in electroplating whereby metallic bodies of compact and non-porous metal deposit may be directly obtained by means of the electro-deposition process, which metallic bodies may be of any desired shape, solid or hollow, and capable of supporting high interior or exterior pressures, and without its being necessary that the surface of the proposed bodies be a regular one or one having a revolving surface.

The leading feature of the invention is the employment of a suitable number of movable small bodies, preferably of spherical or rounded form, and hard,

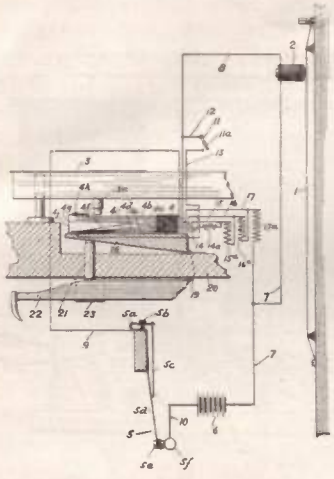


electrically non-conductors, and of suitable size and appreciable weight, such as glass or porcelain balls, ordinary pebbles, or the like, said bodies being put in continuous or inter-mittent movement inside the liquid of the bath, so as to beat and roll on the surface of the mold on which the metallic layer is being deposited or has already been deposited, and all this with or without interruption of the electrical current. The movement of said hard, relatively heavy bodies on the surface of the mold may be obtained in different ways, by means of rotation or oscillation, or a combination of rotation and oscillation of the vessel or drum containing the electrolytic bath.

In the illustration which represents a vertical sectional view of the apparatus, A is the mold on the surface of which the metallic coating is to be applied. B are the hard, relatively heavy bodies, for contacting with the mold; C, C, are

the anodes, and D is a belt pulley for effecting the rotation of the drum.

Patent No. 1,051,675, issued to George Breed, of Philadelphia, Pa., assignor to the Lyrachord Co., of New York, N. Y., a corporation, comprises a method of and mechanism for pro-

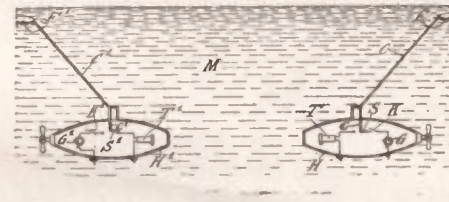


ducing musical sounds whereby sonorous members are vibrated electromagnetically by a pulsating current under control of the performer so that the electro-magnetic action and the volume of sound can be varied at will, the primary object effected being the provision of an instrument, and particularly a piano, in which the current is automatically regulated to a substantially constant effective value, any desired part of such current value utilized in effecting the electro-magnetic action, the tones sustained indefinitely, and their volumes varied (swelled or diminished) gradually or abruptly at the will of the performer by means of the usual keys.

The means embodying the invention, as shown in the drawing, comprise primarily, the piano string, 1, the electro-magnet, 2, disposed so that when excited it will attract the string, the piano key, 3, having thereon the boss, 3a, the compound switch, 4, disposed so that it can be operated by means of the boss, the pulsator, 5, for regulating and pulsating the current which excites the electro-magnet, and the battery, 6, which supplies the current. The current flows from the battery, 6, through the conductor, 10, to the pulsator, 5, thence through the conductor, 9, to the switch, 4, thence through the conductor, 8, to the electro-magnet, 2, and thence by the conductor, 7, back to the battery.

Patent No. 1,051,443 to Greenleaf W. Pickard, of Amesbury, Mass., assignor to Wireless Specialty Apparatus Co., of New York, N. Y., a corporation, relates to an improved method of setting up electrical stream lines and receiving electrical energy therefrom for communication between stations located in such conductor, the illustration representing a vertical section of the ocean with two submarines equipped with the invention.

Heretofore, according to the inventor, communication by means of electrical conduction, or current flow in the earth or water, has been dependent upon horizontally disposed base lines at each station, and the use of intermittent or alternating current of so low frequency that the stream lines of electrical current were enabled to spread out in all three dimensions. These prior methods were defective, both in that with horizontal base lines neutral positions could be found in which the receiving base line bridged or shunted



portions of the conductor which were equipotential, thereby precluding signaling, and also in that as the stream lines from the transmitting base line spread out in three dimensions, much in the manner of the magnetic lines of force about a bar magnet, their intensity diminished approximately as the inverse cube of the distance, rendering long distance signaling impossible without the employment of prohibitive amounts of energy.

This present method depends upon the establishment of alternating electrical currents on and in the conducting medium, these currents only pene-

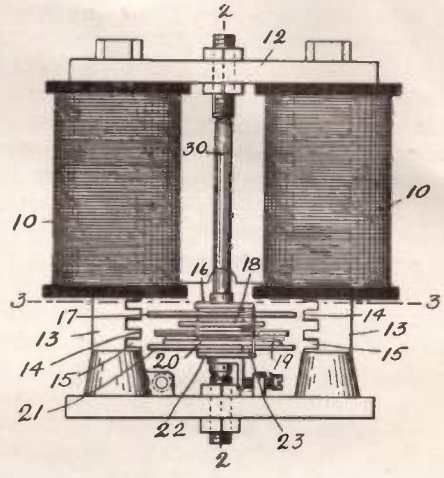
trating the medium to a depth sufficient to reach the receiving base line, and being, therefore, more nearly two-dimensional than three-dimensional in their extent. As a result, the intensity of the lines of current flow decreases approximately inversely as the square (instead of the cube) of the distance from the transmitting station, permitting long distance signaling without the use of excessive amounts of energy, as contrasted with the prior use of low frequencies and three-dimensional fields of stream lines.

Two boats are shown, each completely and alike equipped for both sending and receiving, the equipment of the boat at the left being lettered similarly to that at the right, but with prime exponents. Of that at the right, hereinafter described as sending (and that at the left as receiving) F, is a conducting float, not insulated from conducting medium, M, trailing behind and above the submarine boat at the end of a conductor, C, insulated (as indicated by its solid black line) from conducting medium, M, and connected to F and S, all constituting a base line having a substantial vertical component. This conductor is connected, by means of a switch, S, either with an alternating current generator, G, and make-and-break key, K, or, as desired alternately, with a low-resistance telephone, T, the circuit being completed in either case through the metal hull, H, of the submarine boat. The functions of float, F, are to maintain the difference in level of the top and bottom of conductor, C, and to hold it in its inclined position, and also when desired, to provide a large conducting surface in contact with medium, M, to more effectively use the stream lines, in co-operation with the metal surface, H, of the boat.

Patent No. 1,053,340, issued to Alfred A. Zeigler, of Boston, Mass., relates to electro-magnets, and has for its object to improve the construction of the same, to the end that the armature may be given a complete quarter turn and during each unit or part of its movement will exert a powerful pull.

The electro-magnet may be used to operate a semaphore or other device, but is especially useful in cases where an armature having a wide range of motion is required. The Figure is a front elevation of an electro-magnet embodying this invention, the armature being in its retracted position.

10,10, represent a pair of magnet-coils arranged on cores connected together by a heel-piece, 12, the forward

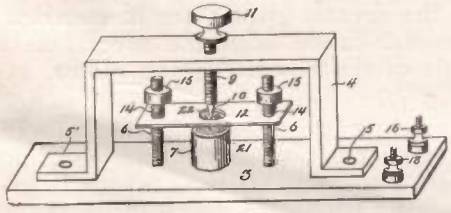


ends of the cores being extended or prolonged, as at 13, to form the poles, The poles, 13, are formed with opposing curved pole faces, 14, and said pole faces are formed with transverse interdental spaces or grooves, 15, each pole face having several such interdental spaces or grooves. An advantage of forming the pole faces with interdental spaces or grooves is the production of a large magnetic surface; they also enable the employment of an armature having portions of different leverage.

The armature shown is especially designed to be used with the electro-magnet when operated by an alternating current, and said armature is made S-shaped, and is composed of a pile of superimposed iron plates, partially insulated from each other and rigidly secured together. As here shown, seven S-shaped plates are employed, as 16, 17, 18, 19, 20, 21 and 22, and between the several plates, or most of them, separating plates, 23, are provided. Some of the plates are made longer than others, as for instance, the plates 16, 18, 20 and 22 are made longer than the plates 17, 19 and 21, and when said plates are rigidly secured together and to a center-shaft, 30, the longer

plates will project beyond the ends of the shorter plates, so that the outer faces or ends of the armature will be complementary with the opposing indented or grooved pole faces. The feet of the several plates, or most of them, are made of different length, but their heels are arranged in the same vertical plane, hence their toes terminate different distances from the back side of the armature. This admits of the different plates entering the magnetic-field successfully and of the magnetic force acting increasingly to pull the armature in order that a full quarter turn may be given it, and also to hold the armature in its full attracted position.

Patent No. 1,052,355, issued to Thomas L. Manning, Jr., of Warren, Ohio, relates to detectors adapted for use in wireless telegraphy, the object being the production of a simple apparatus by which the degree of pressure on the granular material may be conveniently regulated while making experiments,— the accompanying view representing the device in perspective, in which 3 is a base of suitable non-conducting material carrying the frame, 4,

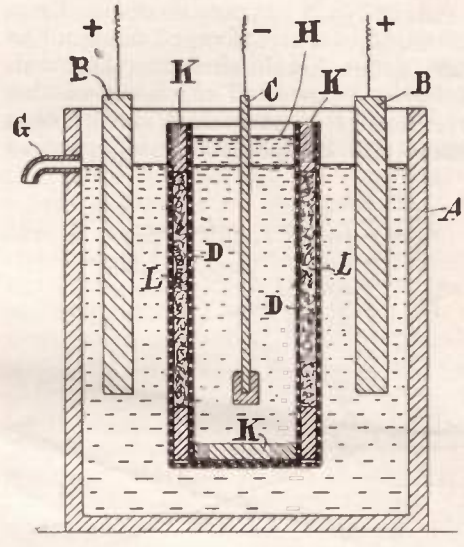


secured to said base by the screws, 5,5. Screw-threaded posts, 6,6, rise from said base. 7 represents a container or cup, which may be lined with silver or other good conductor, and is filled with silicon, metallic filings or other materials usually employed in detectors of this nature. The cup is secured to the base, 3, and has an extension through said base, where it is connected by a wire with the post, 16. A screw-threaded rod, 9, extends through the frame, 4, and is provided with a pointed tip, 10, adapted to costact with the granular or other material, contained in the cup, 7. The said tip may be moved up and down by turning the screw through the member, 11. Above the cup, 7, a plate, 12, is provided, through which the screw rods, 6,6, pass. Surrounding these rods or posts, above the plate, 12, are the spiral springs, 14, and above the springs are the nuts, 15.

16 represents a binding post connected by a wire underneath to the screw, 5, and 18 represents a similar post connected by the wire, 19, to the cup member, 8, of the cup, 7.

It will be seen that the device provides a simple and ready means through the screw, 9, of adjusting the sensitiveness of the detector, while the nuts, 15, springs, 14, and plate provide a means of varying the pressure on the granular material, and the perforation provides a ready means of adding additional material without disturbing the other parts. Further, various materials may be conveniently experimented with or tried out in the cup, 7, with a minimum loss of time.

Patent No. 1,052,256, issued to Noak Victor Hybinette, of Kristiansand,



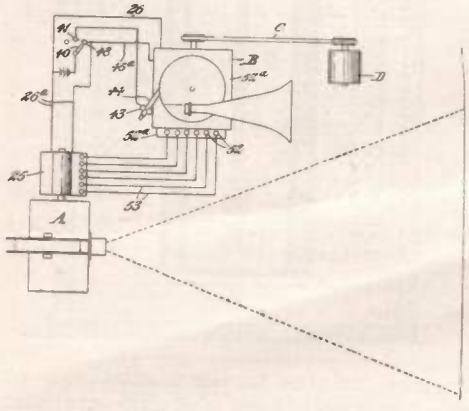
Norway, relates to the electrolysis of metal salt solutions, the characteristic feature being the use of a diaphragm that is made up of a fibrous filtering material, such as asbestos or the like, which is filled in between perforated frames, preferably of lead.

A is the cell or tank generally made from wood and leadlined. In this tank are suspended the anodes, B, and cathode, C. D is a screen made from lead, perforated and being held in

shape by the structure, K, generally made from wood or iron covered with lead and of which the upper horizontal part is made deep enough to prevent any filtering, except in the submerged part of the screen. The space, L, between the lead screens is filled with loose asbestos or other suitable filtering material. It is remarkable that the use of metallic lead should be possible in a construction interposed between anode and cathode. It would seem that such screen should be covered over with a plating of metallic copper; such plating does not take place, at least not to such an extent as to cause any annoyance.

It will be noticed from the above description of the diaphragm that it has more the character of a filter or screen than of a diaphragm proper. It has the advantage of offering a lower resistance to the electric current than an ordinary diaphragm.

Patent No. 1,053,946, issued to Leon Gaumont, of Paris, France, assignor to Societe des Establishments Gaumont, of Paris, France. The object of this invention is to provide a device of a simple and comparatively inexpensive



nature, which shall permit of maintaining a substantially synchronous or timed relation between a phonograph and a kinematograph, so that the same may be synchronously operated in a substantially automatic manner, permitting music, singing, speaking or other sounds to be reproduced from the phonograph in accurate relation to a moving picture exhibition given from the kinematograph, without requiring any particular care or attention upon the part of the attendant.

The view illustrates diagraphically an arrangement for maintaining a synchronous relation between a kinematograph, A, and a phonograph, B, and wherein the kinematograph motor is adapted to be controlled directly from the movement of the phonograph motor, or from the phonograph actuated therefrom. In this formation of the device, the kinematograph motor, 25, is arranged to operate at four times the speed of the phonograph motor, and is provided with six poles, the coils of which are connected by means of conductors, 53, with binding posts, 52, carried upon a circular part, 52a, adjacent either to a rotative part of the phonograph, or to some member turning in unison therewith. The part, 52a, carries an annular series of contact plates, arranged in four groups, each group comprising six each such plates, the corresponding plate of the several groups being electrically connected with each other by means of conductors, and being also connected with the binding posts, 52, by means of conductors, whereby the corresponding plates of the several groups are in electrical communication with the several field coils of the kinematograph motor, 25.

40 represents a controlling switch having its lever adapted, when moved in one position, for communication with a contact, 41, from which is extended a conductor which includes the windings of an electro-magnet, 43, and is so connected in the field circuit, 26, of motor, 25, as to short circuit the conductor together with the field coils of said motor and the intercommunicating parts when the switch is adjusted to include said conductor in said field circuit.

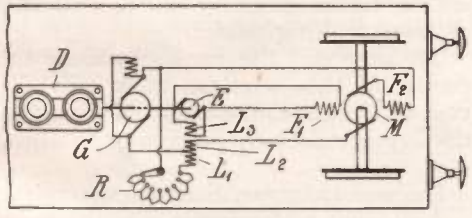
44 represents a detent lever having a spring, the tension of which is normally exerted to move said lever in the path of a projection carried by a moving part of the phonograph in such a way as normally to prevent the operation of the phonograph. The lever, 44, is arranged as the armature lever of the electro-magnet, 43, whereby it will be seen that when the switch, 40, is moved to connect the windings of

said magnet in the motor field circuit, 26, and thereby to energize said magnet, the lever, 44, is moved against the tension of its spring and is thereby disengaged from the projection upon the moving part of the phonograph. The phonograph is driven by a band, C, or the like frictional driving connection from a motor, D.

This patent should prove interesting to our readers, coming as it does just as Mr. Edison announces the perfection of a device which accomplishes this and is putting it out before the public.

Patent No. 1,052,263, issued to Frans G. Liljenroth, of Vesteras, Sweden, is for certain improvements in electrically propelled motor cars.

It is well known that we can propel motor cars by means of an internal combustion motor in such manner that



an electric power transmission consisting of a continuous current generator and a continuous current motor is arranged between the internal combustion motor and the wheels of the car. The advantage of such propulsion system lies essentially in that the internal combustion motor may run at constant speed and torque while the necessary variations of the speed and tractive power of the car may be accomplished by regulating the electric power transmission. For the purpose of obtaining small dimensions of the electric machines and small losses in the electric power transmission the variations of the torque of the electric motor should be controlled in such manner that the voltage and the intensity of the electric main current vary as little as possible. The object of the invention is to obtain such an effect by exciting the field of the electric motor in such manner that great variations of the field strength of the motor are effected when the intensity of the main current varies slightly.

The invention consists, in the combination with an electric power transmitting system for electrically propelled cars, of an exciter for the driving motor having three field windings, one of which is shunted to the armature of the generator, and the second of which is connected in series with the armature of the generator and the driving motor and so arranged that it counteracts the first mentioned winding, while the third winding is connected to the armature of the exciter itself.

In the cut, D, is an internal combustion engine, for instance a Diesel motor, to which is directly coupled a continuous current electric generator, G. To the generator, G, is electrically connected a motor, M, the armature of which is coupled to the driving wheels of the car. The motor, M, is provided with two magnetizing windings, F1 and F2, respectively. The winding, F2, is connected in series with the armature of the motor, M. The winding, F1, is connected to the armature of an exciter, E, which may be driven by the internal combustion engine, D. The exciter, E, has three field windings, L1, L2 and L3, respectively. The winding, L1, is shunted to the armature of the generator, G, and its circuit may contain a suitable rheostat, R. The winding, L2, is connected in series with the armatures of the generator, G, and the motor, M, in such manner that it counteracts the winding, L1. The winding, L3, is shunted to the armature of the exciter itself. The winding, L3, has such a large resistance that the machine cannot excite itself by means of said winding alone. The windings, L1 and L2, are so proportioned in relation to each other that they at normal voltage and intensity of the current delivered by the generator, G, compensate each other, the voltage of the exciter, E, being accordingly nil under such circumstances.

WIRELESS IN SIBERIA

The extreme northeastern corner of Siberia will soon be in wireless touch with Vladivostok.

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The Wireless Screech

OUR MOTTO . . —— . . . . ——— .

THE ETHER: JAMMY

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The Wireless Screech

A screech howl, saturated with wireless inflammation, insensate insanity, incoherent coherers, scintillating oscillators, reflex reflectors, seductive inductions and other technical invertebrata.

Mohammed Ulysses Socrates Fips, Idiotor-n-chef.

(N. B.: The idiotor is no lady, and objects to being called "Miss Fits." Such nicknames as "Ham" for "Mohammed," and "Old Socks" for "Socrates" are prohibited by the Law of Gravity.)

Mr. Fips is pre-eminently qualified to hold down this job, having taken the highest degree in Lunacy at the Matte-

wan Nut College, afterwards being appointed to the Electric Chair, University of Sing Song.

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Vol. . . . . APE-RILE FOOL 1. No. . . . . .

Idiotorial

It is a great and noble thing to be an idiotor for a magnolius magazine like the *Screech*.

It is astonishingly astounding that the human brain is capable of holding such a world of information regarding the wireless as is crammed into the cerebrum, the cerebellum and the medulla oblongata of a certain party whose name modesty alone prevents us from making public.

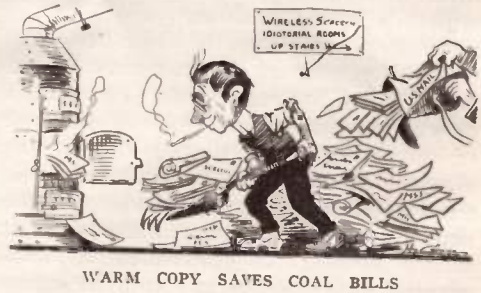
To keep out the rank outsiders the pastor of this wireless flock will slip you, in the code, the name of this electrically intellectual phenomenon:

. — . .. .

Do you twig me, Stephen?

And what a blessing it is to the great unwashed that he is allowed to be at large and disseminate his knowledge to the intellectually halt, lame and blind. To illustrate, let us take a recent experience.

When your Idiotor finished reading the *Garden of Allah*, he was seized with a wild desire to see a great desert



WARM COPY SAVES COAL BILLS

like the Sahara in all its solitude and grandeur. So a friend advised me to take a ride on the Market Street Elevated through West Philadelphia.

I'll never forget that trip above the level of that vast desert of two story

roofs. The Sahara, Arabian or Gobi deserts have nothing on this section, which is ideal for the study of monotony is all its branches.

But one thing broke the unvarying sameness of the sea of red tin. Nearly every square contained one or more wireless aerials, mounted on the roofs. That they were all the work of amateurs was quite evident. Here was something that aroused me from my slumbers. I set my ears for the crash of the spark, and my nose for the scent of ozone.

"Say, sport, what's all that riggin' on them houses?"

The voice came from a big shouldered bull what sat alongside—at least he had the appearance of a bull, or a detector—er, I should say detective.

"Wireless aerials," I replied genially.

"Come again, I don't get yuh," said he.

"Terminal apparatus for disseminating electromagnetic Hertzian waves through the universal ether."

"Sorry, pal, but I can't spiel nothin' but English. I'm wise to that "ether" stuff though, fer I've done my turn in the hospital when I had me appendicitis pulled."

"H'm! Well, I'll proceed to elucidate," said I, as my companion eyed me narrowly, and fumbled with a pair of bull bracelets—a style of jewelry very unpopular with crooks. "Those masts are constructed for the purpose of holding aloft the antennas of the apparatus for sending macaroni-grams into the circumambient atmosphere and——"

"Are they good to eat?"

"Huh! What?"

"Macaroni-grams."

"Rubbish! They merely aid in the condensation of fluxes toward the equatorial zone, in contradistinction to the electrolytic detectives which are attached to the high-frequency galvanometers in order that the wave-measuring helix may not become plane-polarized by the congealing of the vertical oscillator, which would set up a high tension thermo electric induction in the silicon and put the coherer on the fritz!"

"Gee! There must have been a terrible loss of life! How did it all happen, pard?"

"Say, what are you talking about?"

"Sign those papers, or I'll bring back the child!"

I was worried. I said:

"My good man, you seem to converse with the intelligence of a prune. Have you been that way long?"

"Naw," he snorted, "I'm ketchin' the habit from you. But go on. We have only three more squares to go. Shoot!"

"Well, as I was saying, when the sending key becomes surcharged with juice, it leaps the gap across the mica diaphragm receiver, gives a wireless screech, generates four barrels of ozone——"

"Ah, here we are! See that pretty park down below? Wouldn't you like to get out at the next station and take a walk through it with me? I'll see that the squirrels don't get you. Come on."

The gentleman was very kind. Though his order of intelligence was only a couple of jumps ahead of the chimpanzee, he seemed to wish to do me honor in his crude way, so I accepted his invite.

The park was surrounded by a high stone wall. At the gate my guide stopped to converse with a man in uniform.

"Did yuh git him?" I heard the man ask.

"Sure, that's him. The description says, 'electrical bug—daffy over wirelesss telegraphy, etc.' Yuh oughter hear him spout that stuff off."

We were admitted, and the big iron gate closed behind us with a bang.

"Well, I landed yuh at last," said my guide with a chuckle. "Been on yer trail fer two weeks, and jest to think, I found you by accident in the 'L!'"

Then I looked back and saw inscribed over the stone arched gateway:

KIRKBRIDE'S ASYLUM FOR THE INSANE

OUR TABLOID DRAMMER WAR, WIRELESS AND I SHOULD WORRY!

Cast of Characters

Gen. Noosantz, Commander Mexican Federal Camp.

Cutie Sparkgap, operator field wireless station.

Macaroni Ampere, operator wireless station, City of Mexico.

Members of Gen. Noosantz's Staff (male), sentry, and chorus of soldiers, camp followers, Mexican hairless dogs, padres, tamales, matadores, frijoles, picadores, cuspidores, etc.

The scene is laid in the Chili con Carne Mountains, where large force of Mexican troops are hemmed in by rebels. Their only hope of rescue is through calls for reinforcements by wireless. Interior of wireless operator's tent. Cutie Sparkgap is discovered shooting crashing sparks into ether, making desperate effort to raise Macaroni Ampere, her lover, on the Mexico station.

SOMEBODY HAS CUT THE WIRELESS

Enter Gen. Noosantz and staff.

The Spark: . . . . . Help! Succor! Assistance!

Gen. Noosantz (with ingrowing excitement): No answer yet?

Cutie Sparkgap: Nothing doing. Couple of amateurs butting in—that's all.

General: Carramba! Santissima! We must raise headquarters at once or all is lost. The rebels are closing in and there is no escape! Try again.

The Spark: . . . . . (mx) Mexico! Help! For the love of frijoles, why don't you answer, Mac?

Cutie (turning switch and putting phones to ears): H'm! Not a flicker, General. Wait!

General: Got 'em?

Cutie: Shucks! Nothing but a tramp steamer reporting off Vera Cruz! Our spark is too weak, I'm afraid, or someone has CUT THE WIRELESS!

General: Keep calling. Try again. Madre de Dios! We must get 'em!

The Spark: . . . . . (repeated many times).

General: Now! Now! The phones!

Cutie (listening): Yee, I got 'em! Sh-h! Yes, it's my friend Macaroni!

General: Quick! Tell him we're bottled up! Rebel general's got us. Send help at once or it will be too late!

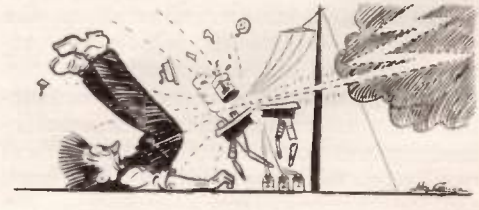
The Grattle

Remember that old saying, "A fool and his questions are soon started?" Well, get your fool questions started our way and we will be fool enough to try and answer them in this department. This service is absolutely free to our readers, although we do make a nominal charge of $2.98 per kilowatt for brain power consumed in the struggle, or in case a brain storm is produced, sender must settle for our hospital expenses.

Mr. Ama Chewer, Delaware Spark Gap, Pa., writes:

All winter I have been working on a device for storing electric energy of lightning. I have my storage batteries, aerials, and wireless accumulators in good working order, and ready to try out, but have been waiting for months for a thunder shower. Can I get a patent on my apparatus before actually trying it out with lightning, or must I keep on waiting, watching and praying for lightning?

Ans. Notify the Weather Bureau at Washington that you require a first-class, A No. 1 thunder storm. If they have any in stock they will mail same to you at once by parcels post.



(Note: Just as we go to press a letter came from Mr. Ama Chewer saying his apparatus was struck by lightning and searchers had been unable to find more than eight molecules, fourteen atoms and seven ions of the original device.—Ed.)

Wireless Club Notes

TRI-STATE WIRELESS ASSOCIATION

At a recent meeting the following officers were elected: C. B. DeLa Hunt, president; O. F. Lyons, vice-president and consulting engineer; J. Marchisio, second vice-president; C. J. Cowan, recording secretary; Miss N. L. Dacus, corresponding secretary; J. Williams, treasurer; H. B. Horn, sergeant-at-arms; E. Bailey, chief operator, and H. Wilson, librarian.

THE OKLAHOMA STATE WIRELESS ASSOCIATION

At a meeting of the above club, held February 4, the following officers were elected: Ralph Jones, president; Harold Rorshach, vice-president; George O. Sutton, secretary and treasurer; Tom Reed, technical adviser and chief operator. All amateurs in the State of Oklahoma are invited to send in their correct address, call letters and other information for membership to the secretary, Box 627, Tahlequah, Okla.

THE AMATEUR WIRELESS ASSOCIATION OF SCHENECTADY

At the last meeting of the Amateur Wireless Association of Schenectady, N. Y., the following officers were elected for the present year: C. Wright, president; G. Birch, vice-president; L. Pohlman, treasurer, and A. R. Toft, secretary.

MURRAY HILL WIRELESS ASSOCIATION

The Murray Hill Wireless Association has been organized and has elected the following officers: Carl Jamer, president; William Bauschlicher, vice-president; Benjamin Ritch, secretary, and Arnold Zelvin, treasurer.

All communications should be addressed to the secretary, 334 East 34th street, New York City.

NORTHWESTERN WIRELESS ASSOCIATION

The members of the Northwestern Wireless Association have agreed upon branching their association out all over the United States to make all amateurs acquainted with one another and would like to hear from amateurs all over the country.

A small fee is charged to cover expenses for membership cards and certificates. Any question pertaining to wireless construction and Government wireless operating rules will be gladly answered to members of different States if return postage is enclosed.

For data please write the corresponding secretary, Edward G. Egloff, 2729 Noble avenue, Chicago, Ill. A 1 kw. central station is located in Chicago and operated by members of that city.

EAST SIDE Y. M. C. A. RADIO CLUB

This club was formed for the purpose of discussing wireless telegraphy and to assist the members in any manner necessary to improve their efficiency in operating.

The following officers were elected: Harold Sache, president; Alex. Schneider, vice-president; Paul C. Elliott, 162 East 66th street, New York City, secretary and treasurer, and Ernest Cyriax, chief operator.

Meetings are held semi-monthly, on Sunday evenings, at various members' houses and the dues are 25 cents per month. Every member must possess a sending and receiving station and must be able to operate in either Morse or Continental at not less than 15 words per minute on examination given by the chief operator. Members must not be under 16 years of age and must possess a Government amateur or commercial license.

AMATEUR COMMUNICATION FROM NEW YORK TO BUFFALO

The following clubs have been united in an effort to establish a relay between New York and Buffalo: The Amateur Wireless Association of Schenectady, Chester Hill Wireless Club, Frontier Wireless Club, Gramery Wireless Club and the Rockland County Radio Wireless Association.

All amateurs in the State of New York who have either sending or receiving stations are invited to forward their names and addresses, stating call letters and power, to John F. Diehl, 207 East 25th street, New York City.

THE WIRELESS CLUB OF NEWTONVILLE

The Wireless Club, of Newtonville, Mass., was recently organized.

The following are the officers: Howland Lord, president; John B. Starkweather, treasurer, and Albert Hunt, chief operator.

DETROIT Y. M. C. A. RADIO CLUB

There has been formed in the interest of the wireless amateur of Detroit and vicinity the Detroit Y. M. C. A. Radio Club. Twenty-six amateurs have become members in it since it was formed a few weeks ago. A complete 1 kw. Standard Radio Company's set is installed and stations within a 75-mile radius are invited to call DAB. Correspondence with other clubs is also solicited. Edmund Hansen is chief engineer and leader.

MASSACHUSETTS WIRELESS ASSOCIATION

The Massachusetts Wireless Association has been organized with general offices and clubrooms located at 245 Commonwealth avenue, Boston, Mass.

Officers of the club are: Whitman S. Chapin, president; George F. Brown, vice-president, and Harold E. Vining, secretary and treasurer. They have a membership enrollment of two hundred and seventy-five members, all amateurs. Plans are now being made by them to erect a powerful wireless station on Mt. Tom, Holyoke, Mass.

PITTSBURGH WIRELESS ASSOCIATION

There has recently been organized in Pittsburgh a new wireless association, which promises to become an institution of the greatest influence and value among the amateurs in and around Pittsburgh. This association has, since its inception a few months ago, a steadily growing membership and attendance. Interesting programmes of value are being provided by the members which prove of great value to the club in general.

All who are interested in the art of wireless communication and who reside in Pittsburgh and vicinity, and desiring to become members, should have their applications for membership forwarded to the club's rooms, located at 6031 Kirkwood street, Pittsburgh, Pa.

The following are the club's officers: H. F. Shaw, president; E. L. Teyh, vice-president; Wm. E. Menges, secretary and treasurer; Willard Ela, 1320 Woodland avenue, North Side, Pittsburgh, Pa., corresponding secretary.

Any person wishing further information should communicate with the corresponding secretary.

ARKANSAS WIRELESS ASSOCIATION

All interested in wireless telegraphy and telephony, living in Arkansas, are requested to communicate with the secretary for particulars and enrollment for membership in the Association. No dues. Address the secretary at 216 W. 20th street, Little Rock, Ark.

LANE RADIO ASSOCIATION

The Lane Radio Association of the Lane Technical School, of Chicago, has elected the following officers for the year: B. C. Lizenby, president; C. I. Gingrich, vice-president; J. Simon, recording secretary; C. H. Stone, treasurer; E. T. Weart, radio engineer; C. H. Stone, radio operator; R. Traub, corresponding secretary, 2147 Lincoln place, Chicago.

RADIO INTERCOMMUNICATION CLUB, SPRINGFIELD, MASS.

Our officers are: R. S. Hall, president; O. C. Grant, vice-president; C. W. Sias, secretary-treasurer; W. C. Sloat, technical adviser.

We have eight members so far and hope to get more shortly. Any out of town member wishing to join may do so by sending in for application blanks.

Address all letters to the secretary, 25 Terrence street, Springfield, Mass.

Our Wireless Station and our Laboratory Contest will be continued every month until further notice. The best photograph for each contest is awarded a monthly prize of Three (3) Dollars. If you have a good, clear photograph send it at once; you are doing yourself an injustice if you don't. If you have a wireless station or laboratory (no matter how small) have a photograph taken of it by all means. Photographs not used will be returned in 30 days.

PLEASE NOTE THAT THE DESCRIPTION OF THE STATION MUST NOT BE LONGER THAN 250 WORDS, AND THAT IT IS ESSENTIAL THAT ONLY ONE SIDE OF THE SHEET IS WRITTEN UPON. SHEET MUST BE TYPEWRITTEN OR WRITTEN BY PEN. DO NOT USE PENCIL. NO DESCRIPTION WILL BE ENTERED IN THE CONTEST UNLESS THESE RULES ARE CLOSELY ADHERED TO.

It is also advisable to send two prints of the photograph (one toned dark and one light) so we can have the choice of the one best suited for reproduction.

This competition is open freely to all who may desire to compete, without charge or consideration of any kind. Prospective contestants need not be subscribers for (the publication) in order to be entitled to compete for the prizes offered.

FIRST PRIZE, THREE DOLLARS

The accompanying illustration shows a view of my wireless station.

For sending I employ two ignition coils with one mercury and two vibrating interrupters, the latter giving a high pitch note to the spark produced by the coils—

HUDSON STATION

two 4-volt, 40 ampere-hour storage batteries, fuses, voltmeter, rheostat, large helix, oscillation transformer, glass plate condenser, zinc spark gap and heavy key.

The receiving set comprises a loose-coupler, double-slide tuner, loading coil, two fixed and one variable condenser with double pole switch for long or short wave-lengths, silicon and galena detectors with shorting switch, 1,000 and 500 ohm telephones, buzzer with key and battery, as well as a relay and anchor gap for the break-in system.

The telephone set shown in the illustration is connected to a short private line. Most of the above-mentioned instruments are home-made, thanks to the help received from *Modern Electrics*.

My aerial consists of four aluminum wires 80 feet long, fastened on 11 foot spreaders, and is 60 feet high at one end and 35 feet at the other. My sending range is about ten miles in daytime, while my receiving range is approximately 1,000 miles. My call is XBO.—*W. H. Hudson, Australia.*

HONORABLE MENTION

I am submitting for the contest a photograph of my portable wireless set.

HIERONYMUS STATION

It was taken while the set was in actual operation at the K. C. Boy Scout camp last year.

For sending I use a 1-inch spark-coil, spark gap, plate condenser, key and battery, consisting of seven dry cells in the bottom of the box.

For receiving I use 2,000 ohm 'phones, fixed condenser, silicon detector and double slide tuner. I can take the tuner and detector out of the box and place them in another box, like that shown in the illustration, so that they can be used elsewhere if desired. My helix is collapsible in order to make room for the tuner and detector.

The aerial is composed of four aluminum wires, 30 feet long, connected together at the top of a tower made of six-foot poles jointed together. With five assistants I can erect my aerial, send and receive a message and take down and put away the aerial and get ready to start in about five or six minutes. I used it last year at the Boy Scout camp to send and receive messages up to about one mile. I am quite certain I could have done even better.

I am a constant reader of *Modern Electrics* and I would not give up what I have learned from it for anything in the world. I belong to the Wireless Association of America and have applied for my licenses.—*Galen Hieronymus, Missouri.*

HONORABLE MENTION

In the illustration may be seen my entire wireless station.

The receiving set comprises a set of 2,000 ohm Western Electric telephones, Murdock loose-coupler, variable and

DANE STATION

fixed condensers, silicon detector and D. P. D. T. switch.

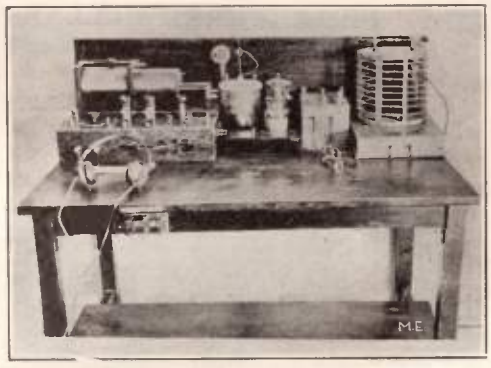
For transmitting I employ an electrolytic interrupter, used with a one-inch coil; zinc spark gap, wireless key, helix wound with 45 turns of copper ribbon, ¼-inch in width, and Murdock sending condenser.

My aerial is 100 feet long, 75 feet at one end and 45 feet at the other, containing four strands spaced four feet apart.

I am a constant reader of *Modern Electrics* and believe it one of the best magazines printed. My call is KWD and I would be glad to hear from anyone within my range.—*Joseph Dane, Jr., Maine.*

HONORABLE MENTION

The accompanying photograph is a flashlight view of my wireless station, the greater part of which I have made from raw material.



HEYMAN STATION

For receiving I use a loose-coupler wound to 900 meters; three detectors of the ferron, galena and electrolytic types, potentiometer, variable condenser and a 2,000 ohm set of head receivers. The aforesaid instruments, with the exception of telephones, are all mounted on a quartered oak box constructed by myself.

For transmitting I use a ½ kilowatt transformer coil connected to a 110 volt A. C. power circuit through an electrolytic interrupter, a zinc spark gap mounted upon a helix which is wound with 30 feet of No. 4 aluminum wire, a large copper plate condenser, which has proven very efficient, a wireless key and two leyden jars. The entire transmitting set is mounted on a mahogany table.

My aerial consists of five strands of aluminum wire on 12-foot spreaders, 60

feet high on one end and 75 feet at the other. The entire aerial is approximately 100 feet in length.

The set has proven very efficient. I have succeeded in picking up stations with my receiving apparatus as far as Cape Cod and North Carolina. I am able to transmit up to 20-25 miles with the transmitter and often communicate with a friend of mine ten miles away.

I wish to thank *Modern Electrics* for the many helpful suggestions I have obtained from it. My call letter is IX and I shall be glad to communicate with anyone within my range.—*Horace W. Heyman, New Jersey.*

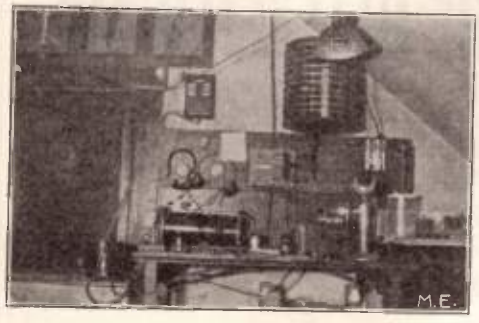
HONORABLE MENTION

Here is a flashlight photograph of my wireless outfit.

The aerial is composed of four wires 130 feet long and 50 feet high at both ends.

The transmitting apparatus consists of a one-half kw. transformer coil and interrupter, home made helix and large glass plate condenser, heavy spark gap and wireless key.

The receiving set comprises a large double-slide tuning coil, potentiometer,



HOOD STATION

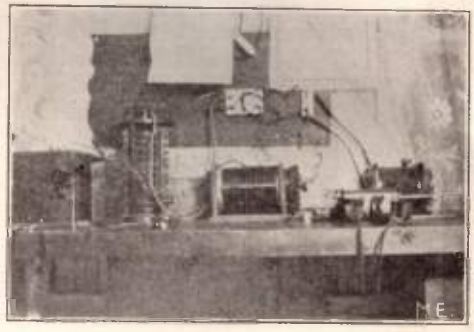
one fixed and two variable condensers, one silicon and one peroxide of lead detector, and one 2,000 ohm double and one 500 ohm single headband; also all necessary switches for aerial and ground, etc. I am connected by a private telephone and telegraph line, which runs to five of my boy friends' homes, three of whom have wireless stations.

I am a constant reader of *Modern Electrics,* from which I have received many useful hints, and highly recommend it to anyone who does not read it at present.—*Kuper Hood, Jr., Kentucky.*

HONORABLE MENTION

Herewith is a photograph of my wireless telegraph outfit, one-half of which I have constructed myself.

The sending set uses a four-inch coil employed as an open core transformer operated on 110 volts A. C. with a choke coil and rotary spark gap which is not shown in the illustration. A Mesco helix and a moulded Murdock conden-



MULFORD STATION

ser for the transformer complete the set.

The receiving outfit comprises two loose-couplers, two variable condensers, one fixed condenser, a perikon and silicon detector and a pair of 3,000 ohm telephones.

My aerial consists of six wires spaced 1½ feet apart, 100 feet in length and 60 feet high at one end and 50 feet at the other on 8-foot spreaders.

With this outfit I have obtained excellent results. I can communicate with another amateur one-half mile away from me and another 30 miles. I have been an experimenter for four years. I recommend *Modern Electrics* for all amateurs.—*Harold C. Mulford, New York.*

HONORABLE MENTION

Herewith will be seen a flashlight photograph of my wireless station.

The transmitting apparatus consists of two ½-inch spark coils, a helix of my own make, a 15-plate oil condenser, and a Mesco spark gap. I use a step-down transformer to reduce the current from 110 volts to 8 volts.

The receiving set comprises a loose-coupler, fixed and 21-plate variable condensers, and two detectors of the silicon and perikon types. I have a pair of 2000 ohm telephones, and all the neces-

sary switches, which are mounted on the switchboard.

The aerial is 75 feet long, 58 feet high at one end and 40 feet at the other.

GOODING STATION

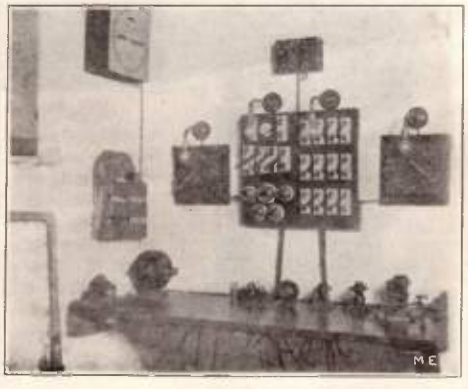
It is composed of seven strands of No. 18 bare copper wire, which are fastened on 10-foot spreaders.

I am a reader of *Modern Electrics,* which I consider a very good magazine, and recommend it to every person interested in electricity.—*Frederick R. Gooding, Delaware.*

HONORABLE MENTION

Herewith are photos of my electrical apparatus and also one of my lathe with tools for small mechanical work.

The two switchboards "A" and "B." "A" contains a voltmeter, main switch,



LOHR EXPERIMENTAL APPARATUS

six knife switches and five snap switches. "B" has 12 knife switches. Beside the switchboards are two rheostats, one connected with each board. Above the switchboard is a circuit breaker, made for a 6-60 storage battery.

I also have a voltamp six-volt dynamo, run by water power.

My switchboards are connected with motors of different types, some of them home made, miniature lights and other things electrical. I can either use the dynamo or storage cell.

On my lathe, which is equally good for metal or wood, and run by foot power at present, I do most any kind of light machine work. I have necessary tools for both wood and metal working, and also screw cutting tools.

I spend most of my spare time in

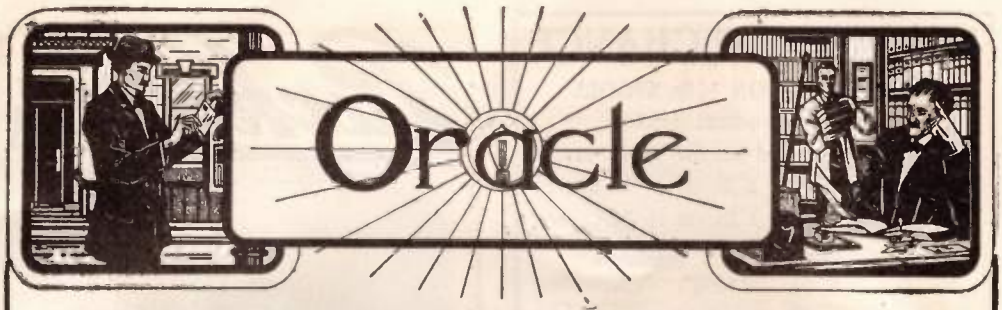
LOHR WORKSHOP

"My Workshop" doing all kinds of experimental work.—*Allen W. Lohr, District of Columbia.*

WIRELESS ASSOCIATION OF CENTRAL PENNSYLVANIA

The Wireless Association of Central Pennsylvania was formed December 1, 1912. The officers are Morton Kay, president; Charles Kutz, vice-president; Daniel Zorger, secretary, 409 Kelker street, Harrisburg, Pa.; Jesse K. Howe (operator of P. R. R. station at Harrisburg), chief operator.

All amateurs in this part of the State wishing to join the association will please communicate with the secretary at once. If all the amateurs in this part of the State join, the association would have a membership of over 100. This association has two 1-kw. stations and three ½-kw. stations. There are no dues.



Queries and questions pertaining to the electrical arts, addressed to this department, will be published free of charge. Only answers to inquiries of general interest will be published here for the benefit of all readers.

On account of the large amount of inquiries received, it may not be possible to print all the answers in any one issue, as each has to take its turn. Correspondents should bear this in mind when writing.

Common questions will be answered by mail if 10 cents to cover expenses have been enclosed for each question. This class of correspondence has grown to such proportions that we can no longer answer questions by mail free of charge.

Owing to the additional labor required in the gradual advance of the date of publication of this magazine, there will be more or less delay necessary in answering questions and we therefore cannot undertake to furnish quick replies, for the next few months at least.

Special information requiring a large amount of calculation and labor cannot be furnished without remuneration. THE ORACLE has no fixed rate for such work, but will inform the correspondent promptly as to the charges involved.

NAME AND ADDRESS MUST ALWAYS BE GIVEN IN ALL LETTERS. WHEN WRITING ONLY ONE SIDE OF QUESTION SHEET MUST BE USED; DIAGRAMS AND DRAWINGS MUST INVARIABLY BE ON A SEPARATE SHEET. NOT MORE THAN THREE QUESTIONS MUST BE ASKED, NOR SHALL THE ORACLE ANSWER MORE THAN THIS NUMBER. NO ATTENTION PAID TO LETTERS NOT OBSERVING ABOVE RULES.

WE CANNOT ANSWER QUESTIONS REGARDING SENDING AND RECEIVING RANGES.

PLEASE NOTE

We frequently receive questions for the Oracle accompanied by the request, Please do not refer me to back numbers as I have only a few. In order to comply with requests of this sort, it would be necessary to repeat over and over again in this column information that had already appeared either here or in the body of the magazine, and this the Oracle has no intention of doing. If you do not happen to have a back number referred to you can probably borrow it from a friend or in the event that you cannot get hold of it in any other way, we can probably supply you with a copy.

MOTOR FOR SPARK GAP AND INTERRUPTER

(2357) Robert F. Adams, Texas, writes:

Q. In reading over the January, 1913, issue of *Modern Electrics,* I came across an article in the Experimental Department, entitled, "A Method of Using the Rotary Spark Gap with an Ordinary Spark Coil," and beg to ask you a few questions about same, as follows: Is a Knapp Type "S" motor sufficiently powerful to drive the spark gap and converter of the above arrangement?

A. Yes. This motor should operate the device satisfactorily.

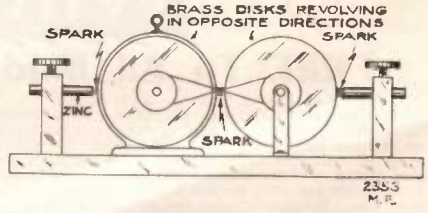
AERIAL. ROTARY SPARK GAP

(2358) A. Plausics, New York, asks:

Q. 1. What is the wave length of my aerial, which consists of four wires 1 foot apart and 45 feet long with a 50-foot lead-in taken from the middle of the aerial? The aerial proper is of No. 12 bare aluminum wire. The lead-in is made of two aluminum wires, stranded, and the ground of 4.

A. 1. One hundred and ten metres.

Q. 2. Is the rotary spark gap shown in sketch good? As the vibrations of a spark coil are irregular, it will use every spark, not leave some waste, as in the usual rotary. The gap also keeps cool. If not good, why not?



A. 2. This looks to us to be a very good form of spark gap for use with spark coils.

Q. 3. If a storage battery is run down, is it reliable to test it by connecting it up with a motor and noticing the speed? If not, why not?

A. 3. There is no objection to this, provided the battery is immediately recharged afterward, otherwise it is not advisable to test the battery in this way, for the reason that when the battery is in a discharged condition any great amount of current drawn from it simply makes its condition so much the worse.

LICENSE. SINGLE OR DOUBLE RECEIVERS

(2359) William O'Brien, New York, inquires:

Q. 1. Which is the more efficient, a tuning transformer and a single 1000-ohm head 'phone or a double-slide tuning coil and a 2000-ohm head set? Both are used in con-

nection with a ferron detector, variable and fixed condensers.

A. 1. This is a matter of personal preference, and it is hard to say which would be the most efficient combination. A good many operators use one receiver satisfactorily, but most operators find the double receiver to be much more satisfactory.

Q. 2. To what department in Washington should I write in order to obtain an amateur wireless license? Also what information must I send?

A. 2. It is not necessary to write to Washington. Write to W. D. Terrell, Radio Inspector, Custom House, New York, N. Y. See the article on the Wireless Amateur and the Wireless Law in the December and January issues of *Modern Electrics*.

Q. 3. Under what condition of the new law will amateurs be allowed to use an ordinary spark gap, helix, etc.?

A. 3. See answer to No. 2342 in the March issue.

INSTRUMENT CONSTRUCTION. GROUND. INSULATION

(2360) Henry L. Dillon, Rhode Island, wants to know:

Q. 1. Is dry yellow locust wood suitable for making bases for wireless instruments? Would it do instead of hard rubber for the top and bottom of a rotary variable condenser? If not, will a ½-inch square of hard rubber glued in the center of wood and drilled for the shaft that the movable plates are on go through it, as the wood takes a very fine polish and is very smooth without varnish.

A. 1. Locust wood would probably be all right with the hard rubber inserted as mentioned.

Q. 2. Would 18 square feet of No. 9 steel woven fence wire with copper wire soldered to it make a good ground for wireless telegraphy?

A. 2. This would make a fairly good ground, but the more of this wire you use the better will be the ground.

Q. 3. Will porcelain cleats do for insulation on receiving aerials? If so, how many will it take?

A. 3. Yes. Porcelain cleats do very well for insulating receiving aerials. Use one at each end of each of the aerial wires.

TRANSFORMER SECONDARIES. ROTARY GAP

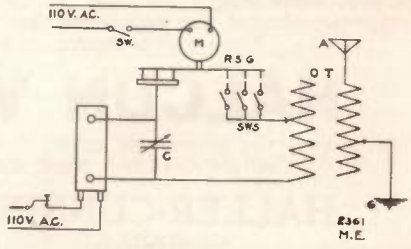
(2361) Ralph O. Terrey, Illinois, writes:

Q. 1. When examining a transformer of a well-known make recently, I noted the extreme smallness of the secondary winding. The outside dimensions were 2½ inches by 2½ inches cross section, with the maximum diameter nearly 6 inches. The transformer is rated at ½ kw. when drawing 7 A. from the 110-v. line. Now, I have seen in your column the specifications of ½-kw. transformers, and each time they call for over 5 pounds of enameled wire (as having the least amount of insulation), and I do not see how the manufacturer can put out a transformer lacking in one detail without having it lacking in some other particular. Perhaps you can explain?

A. 1. You cannot tell how much wire there is in the secondary simply by looking at it. Probably the transformer has wire enough, if of a reliable make.

Q. 2. I have a disk for a rotary gap which is on the shaft of a 3400-r.p.m. motor. There are 9 concentric circles of points on the face, having, respectively 10, 12, 14, 16, 18, 20, 22, 24, 26 points. There are 9 stationary electrodes, insulated from each other, as are the circles of plugs, and one straight electrode that takes care of all the plugs, and which is always used, no matter which circle of plugs is used. Now, the wiring plan I use would not work, and so I ask for a system which would control both the secondary and primary current, using if possible a magnetic key?

A. 2. Connect the 9 single electrodes to separate single pole switches as per sketch herewith (the sketch shows only three rows, the rest of the hook-up should be as per the sketch) and the condenser should be vari-



able for the reason that the greater the number of sparks per second the smaller should be the condenser. The condenser does not need to be continuously variable as in the receiving set, but should be capable of adjustment by adding or removing plates as required.

TELLURIUM. TESTING TRANSMITTER

(2362) Bryan G. Barker, Minnesota, inquires:

Q. 1. Where may the substance tellurium used with galena in detectors be obtained?

A. 1. This can probably be obtained from Eimer and Amend, 205 Third Ave., New York, N. Y., or any other chemical supply house.

Q. 2. What would be the wave length of the following aerials: (A) four wires, 55 feet long and 35 feet from aerial to spark gap, ground lead, 10 feet; (B) two wire, 120 feet long and 15 feet from wire to spark gap, ground lead 25 feet?

A. 2. (A) 130 metres, (B) 200 metres.

Q. 3. How may an amateur be absolutely certain that his station complies with the law, if he has not the proper instruments to make the various measurements necessary? How can he tell if he is sending out a pure wave or an absolutely sharp tuned wave?

A. 3. You cannot be absolutely sure. For testing the pureness and the sharpness of tuning of the sending wave use your receiving set for a wave meter as described on page 735 in the October, 1912, issue of *Modern Electrics*.

RESISTANCE WIRE. TRANSFORMER DESIGN

(2363—William W. Stacey, Canada, asks:

Q. 1. Where can I procure some good resistance wire, such as they use in electric sad irons and heaters?

A. 1. Herman Boker & Co., 101 Duane street, New York, N. Y., or the Driver-Harris Wire Co., Harrison, N. J. German silver wire can be obtained from most any electrical supply house advertised in our magazine, but is not as good as heater wire.

Q. 2. Will you please give me the size of the core and wire for transformer to transform from 80 volts at 10 to 15 amperes, up to 110 volts A. C.?

A. 2. You can easily figure this out for yourself by following the method outlined in the article on page 1140 of the February issue of *Modern Electrics*.

SPARK TROUBLE. BUZZER TEST

(2364) P. Murawski, New York, writes:

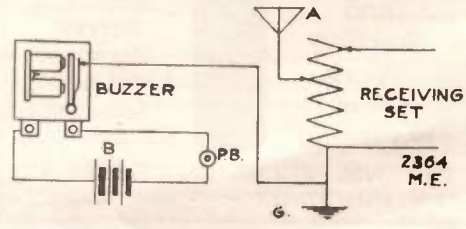
Q. 1.—I get an arc in my spark gap instead of a snappy spark. What is the trouble and how can I remedy it?

A. 1.—Your trouble is due to insufficient capacity in the condenser. Increase the size of your condenser and the arc will be replaced by a snappy spark.

Q. 2.—How can I connect a buzzer to detect faults in telephones, detectors, etc.?

A. 2.—Your question is not clear. Perhaps you refer to the conventional buzzer, and if such is the case you will find your answer below.

Q. 3.—How can I connect a buzzer to show that the receiver is in working order?



A. 3.—You will find the connections

for a buzzer test in the accompanying diagram.

GROUND CONNECTIONS. DYNAMO AND TRANSFORMER RATING

(2365) Wm. Matern, New York, inquires:

Q. 1.—Would a piece of 1½ inch water pipe driven 12 feet into the ground be suitable for a lightning ground? If not, what would?

A. 1.—It would be suitable for a ground provided that the surrounding earth is moistened at all times. A most suitable ground consists of a number of stout, galvanized wires, or, still better, copper wires, spreading under the ground in all directions radially. In the instance of the iron pipe, it would be preferable to surround it with coke, which would enable the making of a better contact with the soil if constantly supplied with water.

Q. 2.—What rating would a coil with a core 11 by 7 by 1 inch, made of strips of stove pipe iron, secondary made of two ½ kw. coil secondaries, and primary comprising three pounds of No. 14 B. & S. wire in three layers, have?

A. 2.—With all the work properly done, we believe that the rating would be between one-eighth and one-quarter kilowatt on 60-cycle current.

Q. 3.—I have a dynamo-motor, type ⅛, No. 3220, manufactured by the C & C Electric Motor Co. of New York. Its speed is rated at 2,200 R.P.M., and its output at 9.5 amperes. What is the voltage it will deliver?

A. 3.—The makers have no record as to the voltage of this machine. It is probably a battery motor designed to run on about 12 to 15 volts. However, it should not give this voltage as a dynamo unless run considerably above its normal speed.

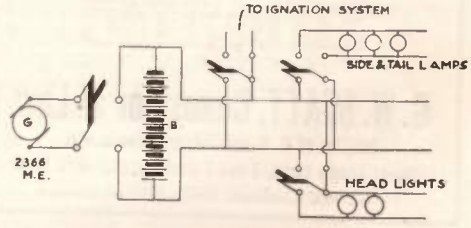
AUTO TRUCK LIGHTING

(2366) D. B. Van Tassel, Ohio, writes:

Q. 1.—We have an auto truck and wish to connect a dynamo to the engine flywheel to charge a storage battery, and we desire to have the battery furnish ignition to the engine as well as operate two 20 c. p. headlights, two 6 c. p. sidelights and one 4 c. p. tail-light. Please advise what type of

dynamo, battery, lights and wire to employ?

A. 1.—You would require a 75-watt or a 100-watt generator equipped with a friction pulley to operate against the face of the flywheel. These generators are made by a number of concerns, and we would refer you to our advertising columns. The generator should be wound for either six or eight volts and tungsten lamps should be employed. Any reliable make of storage battery with a capacity of 60 ampere-hours, 6 volts, may be employed. Heavy lamp cord would be perhaps the most suitable at the price, but if you desire to have a high-grade installation, you might use armored lamp cord, obtainable at any large electrical supply house. We are appending herewith a diagram showing the necessary switches.



SPARK COIL CONDENSERS. POLARITY OF SPARK COIL SECONDARY. WIRELESS TELEPHONES

(2367) Carl Challman, New York, asks:

Q. 1.—How many square inches of tin foil necessary to construct a condenser for a one-inch coil?

A. 1.—You fail to mention whether for a primary or secondary condenser. For a primary condenser there should be 800 square inches of tin foil used with paraffined paper, shunted across the interrupter contacts. For the secondary a suitable condenser may be made with five sheets of .05 inch glass measuring 8 by 10 inches, coated with tin foil on both sides measuring 6 by 8 inches.

Q. 2.—I often read of the terminals (secondary) of a spark coil described as positive and negative. Kindly tell me how to determine which is positive and which is negative?

A. 2.—The polarity of secondary terminals may be readily determined. If two iron wires about No. 24 B&S are

connected to the secondary terminals and separated by a small gap so that an arc forms when the coil is operated, it will be noticed that after a few seconds one of the wires will become heated and finally fuse. This is the positive pole of the secondary winding.

Q. 3.—Are there any wireless telephone stations in or around New York City?

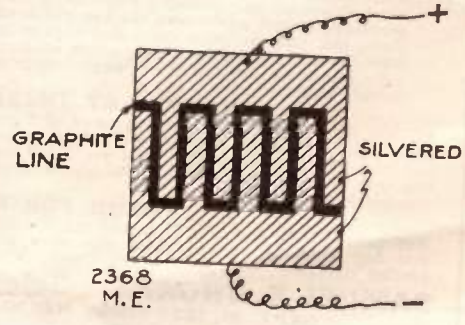
A. 3.—To our knowledge there are no wireless telephone stations in regular service, but we understand that there are a number of amateurs and experimenters working upon sets, which are heard from time to time.

RADIOPHONE. PLATINUM LEADS IN ELECTRIC LAMPS. STATIC MACHINE DISCS

(2368) Ralph Batcher, Iowa, states:

Q. 1.—In the book, *Fireside University*, there is a description of Bell's radiophone using a selenium cell. It states in the description that lamp black may be used and the results will be equal to those obtained when using selenium. Therefore, can lamp black be employed in other places where selenium is now used?

A. 1.—Probably the book mentioned does not explain sufficiently the use of lamp black in connection with the radiophone. Following the experiments of Bell with his instruments employing selenium it was found that the transmission of sound was possible without the use of selenium or batteries, and that non-luminous heat rays were capable of producing sound. A thin plate of any material serves as a receiver in the radiophone, the sounds produced by this plate being transmitted by means of a tube to the ear. Very good results are obtained by using plates the surfaces of which are cov-



ered with Indian ink, platinum black or soot. These plates, which absorb,

When writing, please mention "Modern Electrics."

but do not reflect the light, are the most effective. It will thus be seen that selenium and electricity no longer are necessary for the radiophone made in this manner. However, the great sensitiveness of surfaces coated with soot caused early experimenters to form the idea of substituting soot for selenium in a selenium cell. For this purpose silver is precipitated upon a glass plate and portions of this coating are removed so that the places free from silver form a zigzag-shaped line. This line, which divides the silver coating into two portions which are connected to a battery and telephone receiver, is filled with soot. When the intermitted rays of light strike upon the face of such a cell, loud sounds are produced in the telephone. It is safe to assume that with more elaborate arrangements the soot cell might be employed in connection with relays for other purposes where selenium is employed.

Q. 2.—In the same book is a description of how incandescent lamps are made. Are platinum wire leads from the filament to the socket still used? If not, how is the difficulty overcome?

A. 2.—Platinnum wire leads are still employed, but only at the point where the leads pass through the glass support at the bottom of the bulb, the rest of the leads being copper. The reason for the use of platinum is in the fact that this metal expands and contracts in the same proportion as glass, with the result that a tight-fitting contact is always maintained between both. If copper or other metal were used, the glass would either crack or the wire would become loose through the unequal expansion of the glass and metal.

Q. 3.—Can fibre sheeting 1/16 inch thick be used for a static machine?

A. 3.—We would hardly recommend fibre for this purpose. Either use glass plates, hard rubber or special composition discs sold by experimental supply houses. Flat talking machine discs are said to give fairly satisfactory results.

SPARK COIL OUTPUT

(2369) William C. Duckham, New Jersey, asks:

Q. 1.—What is the output in kw. of a 1½ inch coil when operated in con-

nection with an electrolytic interrupter?

A. 1.—There is no available data regarding the output spark coils, but manufacturers inform us that the primary winding of such a coil takes from 4 to 5 amperes when operating on 110 volts with a choke coil in series with the interrupter.

SENSITIVENESS OF RECEIVERS. HOOK-UP

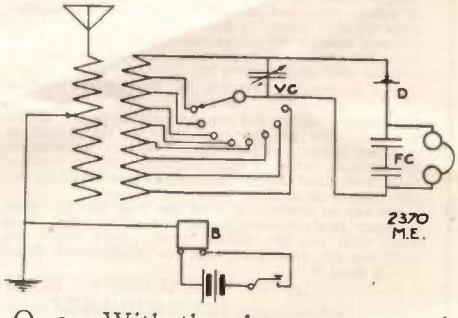
(2370) Clarence L. Brown, Indiana, states:

Q. 1.—I have a friend who has a 500 ohm Manhattan receiver and head band. I have a pair of 3,000 ohm 'phones. Why is it that he can get a station about six miles away as loud and as plain as I can, both hooked in on the same set?

A. 1.—The reason for the results which you mention is due to the fact that low resistance receivers work equally well, if not better, than high resistance receivers for short distances. For local stations they will enable the stations to be heard much louder than with the high resistance 'phones, but the latter prove their efficiency only on faint signals, which will not be audible in the lower resistance type.

Q. 2.—Please give hook-up for the following: Loose-coupler with one slide on primary and eight points on secondary detector, two fixed condensers, one variable condenser, 3,000 ohm head set and buzzer test.

A. 2.—Herewith is your diagram.



Q. 3.—With the above set properly connected and with an aerial 72 feet high and 35 feet at the other, consisting of five No. 14 aluminum wires, 65 feet long, how far should I be able to receive?

A. 3.—If you will refer to the back numbers of *Modern Electrics* you will learn that we have always discouraged

Health and Deep Breathing

By D. O. Harrell, M. D.

DID you ever stop to think that the one most important thing in the world to you, and to every other human being—is air? You could live without food or water or clothing for some time; you could not exist five minutes without air.

Although everyone knows that one must have air to live, few people understand the vital connection between their general health and the quantity and quality of the air they breathe. Physicians find that not one person in twenty (possibly not one in a hundred), habitually breathes deeply. We are able to trace directly to that fact a large proportion of the cases of anæmia, nervous breakdown and general ill health which come to us for treatment.

A little knowledge of the functions of the lungs and the part they play in maintaining health and vigor in the human body will show the great advantages gained by using one's breathing power to its fullest capacity. Every time your heart beats, a current of bright, red, *purified* blood is sent coursing through your arteries to every part of your body, renewing the wornout tissues with life-giving oxygen and gathering up the waste in the system. Then back through the veins to the heart again where it is pumped into the lungs, which rid it of its poisonous matter and give it a fresh supply of oxygen. In the course of forty or fifty heart beats, every drop of blood in your body passes in this way through your heart and lungs.

If your supply of air is shut off, the heart goes on pumping just the same, and the blood, laden with impurities, is forced through the arteries and veins again and again, becoming fouler with every circuit. In two or three minutes the brain is clogged—you become unconscious—in a few minutes more the heart itself is unable to go on, and death results. That is what happens when the supply of air is entirely cut off, as in the case of strangling or drowning. *The same thing, to a lesser degree, happens when one habitually breathes in a shallow manner, using only a small portion of the available lung surface.*

In order to secure and maintain vigorous health of mind and body, the first thing necessary is to make sure that the lungs have an abundant supply of oxygen to thoroughly perform their function of eliminating the poisonous matter which is constantly being deposited in the system through the waste of muscular and nervous tissue. The only sure way to do this is to train oneself to breathe deeply.

Many men and women, who have never known from childhood what it is to feel fresh and vigorous as they start for their day's work, who are tired out at noon and completely "done up" before they get home at night, would feel themselves different persons after a few weeks of systematic deep breathing.

There are a number of publications on this subject which give valuable information to anyone wishing to learn how to breathe deeply. One of the best I have seen is a neat little booklet, published by Paul von Boeckmann, R. S., of 1750 Terminal Building, 103 Park Avenue, New York City, which may be obtained of the author for ten cents in coin or stamps. It is illustrated with diagrams and written in a pleasing, non-technical style, easily understood by one not a member of the medical profession. Dr. von Boeckmann explains in it several simple breathing exercises worth many dollars to anyone suffering from the ills caused by insufficient shallow breathing.—*Advertisement.*

the asking of questions relating to range of wireless stations. At the best such estimates can only be guesses, for the reason that so many factors enter into the actual distance that can be covered.

FERRON DETECTOR. CLIMAX WIRE. WIRELESS BOOKS

(2371) Joseph Mason, Ohio, asks:

Q. 1.—What kind of a contact do you use on a ferron detector?

A. 1.—Many experimenters prefer an iron point to any other in connection with a ferron detector. However, a brass point will give satisfactory results and is most commonly employed.

Q. 2.—Would you kindly inform me as to where I could purchase Climax wire?

A. 2.—Climax wire is a trade name for a grade of resistance wire which can be purchased in almost any well-stocked electrical supply house, or from the Driver-Harris Wire Co., Harrison, N. J.

Q. 3.—What are a few books on wireless and electrical subjects that fully explain the questions listed as asked commercial and amateur operators in the February, 1913, issue?

A. 3.—We would recommend you to the publications that have been advertised from time to time by our Book Department. A good book on wireless telegraphy and another on the principles of electricity would be all that you should require.

ARC BURNING IN ALCOHOL FLAME

(2372) Chas. M. Gardner, California, writes:

Q. 1.—Please explain just how the arc of a wireless telephone is burned in the flame of an alcohol lamp and are the small spirit lamps sold by various firms in connection with pyrography outfits suitable?

A. 1.—The flame of the alcohol lamp is placed underneath the arc in order to supply it with a constant supply of hydrogen gas, which has been found to increase the efficiency of the arc for producing high frequency current. In some instances the arc is enclosed within a metal chamber containing vent holes, and in which the alcohol lamp flame supplies the hydrogen gas. This spirit lamp, or any other similar type, is satisfactory for this purpose for a small arc.

Q. 2.—Will an ordinary transmitter carry 10 to 15 volts without baking?

A. 2.—If it is of a practical design, such as those employed for regular commercial work, it will probably handle the potential mentioned without baking. In most of the city systems in this country the potential is 24 volts.

WIRELESS CONTROL SYSTEMS

(2372) Ralph S. Hull, Pennsylvania, requests:

Q. 1.—Will you kindly tell me how a locomotive or a steamboat may be controlled by wireless?

A. 1.—There have been a number of systems invented for wireless control. Most of these operate with a coherer receiver and a special control relay carrying a large number of contacts for closing different circuits upon the receiving of certain combinations of dots and dashes. A very interesting system of wireless control is published in the November, 1911, issue of *Modern Electrics* on page 490.

THE EXPERIMENTAL CLUB OF CINCINNATI

The Experimental Club of Cincinnati held the largest meeting since its organization, a year ago. They discussed the new wireless law. It was suggested that other clubs in Ohio, Indiana and Kentucky work in co-operation and form a relay club. Amateurs in the States named who do not belong to a club are requested to write to the secretary, William G. Finch, for particulars. This club will publish a directory, giving the name, power, call letters and location of the members and different wireless clubs who will work in co-operation with each other. This will be published one month after this notice appears in *Modern Electrics*. The officers are: C. Fender, president; W. Moore, vice-president; W. G. Finch, secretary and treasurer. All correspondence should be addressed to the secretary, 1214 Jackson street, Cincinnati, Ohio.

Apparatus Exchange Department

This department is for the free use of our subscribers and readers, to enable them to exchange technical articles for which they have no further use for other articles or apparatus which they need.

Advertisements under this heading containing more than fifty words cannot be accepted; the right is also reserved to rewrite or reject any advertisement which will not be for the best interests of our readers. Advertisements under this heading will be inserted one time only free of charge.

Advertisements of articles intended for sale cannot be accepted as a regular classified department is conducted for advertising of this character at a cost of 5c per word.

Advertisements should be addressed to "Apparatus Exchange Department," care *Modern Electrics*, 231 Fulton St., New York.

WILL EXCHANGE A 4-MAGNET, 110-VOLT telephone magneto, good condition, cost $6 new, for a static machine, 1-inch coil or other wireless apparatus of equal value. Russ Simonton, 1709 F St., Bellingham, Wash.

WILL EXCHANGE ¼-INCH SPARK COIL FOR Young American revolver. Write R. A. Mitchell, 11 Percy St., Ottawa, Canada.

I WILL EXCHANGE 4 EDISON PRIMARY batteries, 1 omnigraph No. 1 with records, 1 loose coupler, single slide on primary, 6-point switch on sec., 175 ohm receiver and head band, 110-volt fan motor. Would like 6-volt, 60-a.h. storage battery, silicon detector, double slide tuner. Write or call, E. Littlefield, East 24th St., Sheepshead Bay, N. Y.

WILL EXCHANGE, A NEW POCKET VOLT-ammeter, 12-v., 30-a.; a 3-slide tuner, 12-in. long; a $2.50 slide-plate, variable condenser, and a hydrometer on H. R. base, for a $3 Murdock rotary rec. condenser. Charles Krebs, 446 West 28th Place, Chicago, Ill.

FOR EXCHANGE — ABOUT 45 COPIES OF American Boys' Magazine; a few of them have the covers torn off; for something in the wireless line; magazines cost $4.50. Glen Decker, 230 Pigeon St., Ligonier, Ind.

FOR EXCHANGE—ONE ALMOST NEW "FOTO-Scope"; price, $5; for a 1-in. spark coil or rotary variable condenser. Frederick S. Kriger, 32 E. Third St., Corning, N. Y.

WANTED—A NO. 2 OR NO. 2, JUNIOR, OM-nigraph, in exchange for any of the following wireless apparatus: ¼-kw. closed core transformer (home-made), loose coupler, 1-in. spark coil, ½-kw. tran'-voil with interrupter, 1000 ohm single head set, Murdock. B. B. Bignall, 305 Lincoln Ave., Freeport, Ill.

WILL EXCHANGE ACETYLENE GAS BICYCLE lamp for small dynamo or hand generator. Write Edward French, Peekskill, N. Y.

WILL EXCHANE ELECTROLYTIC DETECTOR without Wolaston wire and Standard 2-volt, 10-ampere hour storage battery for electrolytic interrupter. Both instruments used very little. John Sinclaire, 14 E. Fifth St., Corning, N. Y.

STORAGE BATTERIES—HAVE TWO 6-VOLT, 60-ampere-hour, to exchange for camera or bicycle; have boy's bicycle to exchange for camera or ¼-h.p. A. C. motor; have two ½-inch spark coils with vibrators for best offer. C. C. Hollenback, Columbus, Ohio.

WILL EXCHANGE STATIC MACHINE, IN EX-cellent condition, for a good wireless course; must be in good condition. Geo. C. Drake, Russell, Iowa.

HAVE TWO DETECTORS, CAT-WHISKER silicon and universal, both in excellent condition, and hold adjustment; would like a Brandes 1000-ohm Superior phone or German silver split head band, in good condition. Write Nelson Lockwood, 237 Prospect St., East Orange, N. J.

WILL EXCHANGE PORTABLE WIRELESS sending and receiving set, complete, in case, and in fine working order; range, sending, 15 miles; receiving, 800 to 1,200 miles; ready to work; for a small motorcycle engine or marine engine, in running order, or good gun, camera; first offer gets bargain. Wriet, stating what you have. G. A. Hackworth, Antlers, Okla., Box 344.

HAVE A 1-INCH AND ¼-INCH COIL, FINE for wireless work; also two telegraph resonators; want electrolytic interrupter, rotary spark gap, or what have you? Write me, care W. U. Telegraph Co., Pontiac, Mich., Bernard D. Fellows.

WILL EXCHANGE A PAIR OF 2000-OHM phones for either a Murdock variable condenser, a good "T" aerial switch, a motor to run 110-v. A. C., or a 1-inch spark coil with key. Philip Cowles, 201 Christian St., Wallingford, Conn.

WHAT HAVE YOU TO OFFER FOR A PAIR of 2000-ohm Clapp-Eastham phones? I need a good rotary condenser, aerial wire and a variable sending condenser, or what have you? I have other things. Write me. F. B. Southwick, 271 Franklin St., Boston, Mass.

LOOSE COUPLED AND CLOSE COUPLED helix (transmitting), load coil (receiving); instruments well finished and are in perfect condition; also have loose coupler, taps on primary and secondary; prefer rotory condensers or Brandes phones; other apparatus for exchange. Let me know what you want and what you have. Henry Lesher, 7 Myrtle ave., Newark, N. J.

HAVE A 7x9, 8 OUNCE, WALL TENT, WITH fly. Will exchange for wireless or experimental apparatus, also Electrical Boiks. Milton P. Guswold, 849 Mich. Ave., Wilmette, Ill.

ELECTROLYTIC INTERRUPTER, COST $2.25, in exchange for wireless key of nearly equal value. John Starrett, 204 South St., Plymouth, Wis.,

FOR EXCHANGE—WIRELESS KEY, ½-INCH spark coil, sending condenser, large spark gap, small spark gap, Murdock "AM" detector, fixed receiving condenser, motor, perikon detector, two sounders, and a 75-ohm receiver. What have you? Write R. Woodward, 51 Eppirt St., East Orange, N. J.

TO EXCHANGE—150-OHM RELAY, COST $6, for set 2000-ohm phones or loose coupler; 4-bar magneto, cost $4.75, for 1-inch coil, large tuner, or any article of equal value. Write, mentioning what you have, F. Grey Daly, Anamosa, Iowa.

TO EXCHANGE — PRINTING PRESS, GOOD condition, with type box, cleaner; also loose coupler, for two variable or ½-kw. open core transmitter. Kenneth Dryden, 2304 Sixth Ave., Kearney, Neb.

WILL EXCHANGE SEVERAL PARTS OF wireless set for electrical books, or anything electrical; state what you have. Leander J. Kleefuss, P. O. Box No. 731 Detroit, Mich.

FOR EXCHANGE FOR EQUAL VALUE IN wireless instruments, a 1¼-kw., 125-volt, 1650-r.p.m. Westinghouse D. C. generator, complete, with slide base and field regulator equipment, practically new, value $90; also a 5-h.p. throttle governor, Root-Vandervort gasoline engine, value $275; engine is complete, with muffler, motor and gasoline tanks. Address L. E. Miller, 315 N. Eighth St., Ft. Dodge, Iowa.

FOR EXCHANGE FOR EQUAL VALUE IN high-grade wireless instruments (Commercial preferred), one Columbia electric automobile, complete, without batteries, cost $1,600, trade value $1,000; would like 2-kw. transmitting set and a J. J. Duck Commercial receiving set (Type D, per Catalogue No. 6). Address E. B. Murry, 28 North 18th St., Ft. Dodge, Iowa.

A COMPLETE WIRELESS OUTFIT FOR GOOD printing press and supplies; sends 10 miles; receives 500 miles. Write Franklin Heath, Lendsborg, Kan.

WILL EXCHANGE ONE PAIR BRANDES "Transatlantic phones, double slide tuning coil, 1½-inch spark coil, for tent, Winchester rifle, camera or something of equal value; outfit cost me $19. A. H. Johnsen, 730 Milwaukee Ave., Chicago, Ill.

WHAT WILL YOU GIVE ME FOR SET OF drawing instruments (value when new, $2.50), two wooden triangles, 60, 30 and 45 degrees, and one 18-inch "T" square. Address C. Challman, 451 East 165th St., New York City.

FOR EXCHANGE—A 6-VOLT, 4-AMPERE DYnamo motor, in fine shape, and one rheostat regulator, in exchange for a 1-inch spark coil, or what have you got electrical? Leo F. Ravey, 203 E. Second St., Oil City, Pa.

FINE SET OF DRAWING INSTRUMENTS, nearly new; 2 triangles, 5 quires of paper; everything but board and T square; $15 value; also first nine books, Machine Drawing and Design Course, Am. School of Correspondence; will exchange for Type H1, Thordarson transformer, in good condition, or sending instruments of equal value to me; will also include Brownie Camera No. 2, or equal value instruments. Leroy Phillips, Jefferson, Iowa.

WILL EXCHANGE A HUNT & McCREE 3-slide tuning coil, fixed condenser, 1-inch spark coil; also a telegraph key; for Blitzen receiving transformer or other good receiving instruments of equal value. Warren Stanley, 62 Gloucester ave., Gloucester, Mass.

WILL EXCHANGE WINCHESTER BREECHlock cannon; shoots 10-gauge shells; for set of amateur phones with head band, or what have you? Jack H. Brody, 1514 57th St., Brooklyn, N. Y.

A FINE DARK OAK-FINISHED LOOSE coupler; 1¼-inch coil flat plate sending condenser, in fine oak case, and a home-made electrolytic interrupter, in exchange for four, not under 2-in. spark coil secondaries or the secondaries from an E. I. Co. ½-kw. transformer coil or a complete transformer coil, or what have you? Paul E. Diederich, 915 E. Grand Blvd., Detroit, Mich.

WANTED—A 115-VOLT D. C. MOTOR AND A 2-in. spark coil; I have for exchange a Premo, film pack post card size camera, 3¼ x 5½, almost new; also an acetylene post card reflector, in good shape; only used twice. L. B. Latto, Govan, Sask., Canada.

WILL EXCHANGE A $4 PRINTING PRESS, self-inking, and supplies, for anything electrical of equal value; I desire Geisler tubes, volt or ammeters, interrupter, etc. Fred Six, 1100 Lafayette Ave., Mattoon, Ill.

WILL EXCHANGE A $15 EDISON GEM phonograph, in good working condition for a loose coupler or a pair of Brandes 1000-ohm receivers with head band, or what have you? Chas. F. Metzler, 330 East 85th St., New York City.

WILL EXCHANGE ¼-INCH SPARK COIL, 4-inch Geisler tube (florescent), spark gap, 75-ohm receiver, for a good detector or head phones of 2000 ohms. William L. Harrison, Box 64, Lindsborg, Kan.

WILL EXCHANGE ONE "CARLYSLE-FINCH" hydro-generator, output 75-90 watts, almost new, for 1-3-in. spark coil, Blitzen receiving transformer (rotary type), ¼-kw. closed core transformer, or secondary wire for 1-kw. transformer; value of generator, $14. Louis C. Aldrich, 410 Ruggles St., Boston, Mass.

A 1-16 HORSEPOWER, 6-12 VOLT MOTOR, Porter type, cost $6, and is in good condition for a rotary variable condenser or a good water motor. R. Bautz, 414 Layton Blvd., Milwaukee, Wis.

$75 STAMP COLLECTION IN EXCHANGE for Brandes navy or transatlantic type phones and storage battery; also a small receiving outfit for exchange. R. Greer, 222 Henderson Ave., Ridley Park, Pa.

WILL EXCHANGE, POSTAL CARD PROJECtor, electric, $6 value, for ferron detector; also peroxide of lead detector, fixed condenser and potentio meter, and books, "Electricity for Young People" and "Operators' Wireless Telegraph and Telephone Hand Book," for what have you? John Starrett, Plymouth, Wis.

WILL EXCHANGE A COMPLETE 1-INCH sending set for good variable condenser of reliable make, or a good oil break key for a ¼-kw. transformer. Edward A. Parmele, 773 Tompkins Ave., Rosbank, N. Y.

WILL EXCHANGE PRINTING PRESS WITH 4 x 2½ inch frame, 8 sets of type, both plain and fancy, and all accessories necessary; also a 4-inch water motor; for a good typewriter, Omnigraph No. 2, or Junior or wireless instruments. A. S. Van Deusen, Jr., 1613 Wesley Ave., Evanston, Ill.

WILL EXCHANGE A GOOD PAIR OF UNION Hardware Co.'s $2 roller skates and a No. 1 Brownie Camera; both practically new; for wireless instruments. Address Byron Schonwald, 116 Nun St., Wilmington, N. C.

WILL EXCHANGE $15 MURDOCK SILICON detector, $5 rotary variable condenser, $6 revolver, $6 flexible flyer, $3.50 20-ohm telegraph set, $1.50 medical coil; everything practically new; for good typewriter or 4A Folding Kodak. Crocker Mann, Dover, Mass.

WILL EXCHANGE SET OF "HARPER'S ENcyclopedia of U. S. History," 40-watt undertype dynamo and other electrical apparatus for a "Burrowes Home Pool Table" or bicycle with coaster brake, in good condition. Harry Luckert, 915 Jackson Ave., New York City.

COMPLETE SENDING AND RECEIVING OUTfit, consisting of large loose coupler, detector, 2 variable condensers, fixed condenser, small aerial switch, 1000-ohm phone with head band, 1½-inch coil, series gap, helix, heavy key, 400 feet aerial wire, etc.; will exchange for small sail boat or canoe with sail. Ernest W. Sims, 453 Tremont St., Taunton, Mass.

WILL EXCHANGE A COMPLETE PRINTING outfit for a loose coupled receiving set, without phones. Send description of set to William C. Jamison, 244 W. Washington St., Sullivan, Ind.

HAVE A 10-VOLT DYNAMO MOTOR AND A new $3.50 Ever Ready volt ammeter, to exchange for a J. J. Duch $6.25 ½-kw. transformer coil or one of any other reliable make; also an interrupter with extra tube, for a J. J. Duck Standard wireless key; must be in good condition. Ralph De Rose, 69 S. Judson St., Gloversville, N. Y.

WILL EXCHANGE TWO LONG-DISTANCE wall type telephones, each mounted on heavy black box, having induction coils, condensers, bells and extra sensitive receiver; runs on two batteries; cost $12.50; for 2000-ohm head set or ¼-kw. transformer. Alfred Hoffenberg, 1543 West 12th St., Chicago, Ill.

LOVELL DIAMOND A1 BICYCLE, HAVE used in speed races; I want loose coupler and head phones in exchange; also have three detectors, one after plan of Ferron, one like Pickett's, still another of my own design; can use any kind of minerals in exchange for instruments. Sheldon Ross, 37 Blue Hill Ave., Roxbury, Mass.

WANTED — A 5-H.P. MARINE ENGINE, OR state what you have for a complete wireless station, sending 150 miles, receiving 1,000-2,000 miles; instruments are 1-kw. transformer, plate glass, condenser key, oscillating transformer, spark gap, loose coupler and 3-slide tuner, adjustable condenser, perikon detector and combination detector, 3 lbs. No. 32 enamel wire, one pair wireless receivers, 20 ft. BX for connecting transformer, junction boxes and switches for same, two 60-watt Mazda lamps and fixtures for same. Frederick Banker, 105 15th St., College Point, N. Y.

WILL EXCHANGE A HOME-MADE HELIX for 35 feet of copper or brass ribbon 1-32 x 1-2 inch; the frame is 10 x 12 inches, wound with ten turns of No. 8 aluminum; there are three binding posts for connections. Address Wm. H. Kibbe, 2070 Vyse Ave., Bronx, New York City.

WILL EXCHANGE 12 CONNECTIVE COPIES of "Modern Electrics," beginning March, 1912, for an electrical book or magazine or a good battery ammeter. Howard T. Scribner, Waterbury, Vt.

A GOOD OFFER—WILL EXCHANGE ¼-INCH coil, 1000-ohm phone, Mesco type, with head band, Vol. 5 of M. E. with part of Vol. 4, for good loose coupled tuner. Wireless Station, 486 Decatur St., Brooklyn, N. Y.

WILL EXCHANGE ONE COMPLETE W. U. 150-ohm telegraph outfit with key and two new batteries for one pair of 3000-ohm high-grade phones for my wireless outfit. John E. Wood, 1044 Lake Ave., S., Detroit, Minn.

A STARTING BOX, CUTLER-HAMMER 1-H.P., 2-amp., 500-v.; also 5-ohm telegraph sounder and key for a detector, a pair of phones, aluminum wire insulators or a potentiometer. R. D. Schlichter, Sellersville, Pa.

TO EXCHANGE—4 x 5 TO 8 x 10 KODAK enlarging camera, No. 2 folding pocket Brownie; books for boys (write for list); 1906 Indian rear wheel with tire in good condition; 1912 Indian front spring fork with wheel and tire, good condition; desire books on science, tools or miscellaneous. Frobisher, Englewood, N. J.

WILL EXCHANGE HIGH-CLASS WIRELESS instruments for good revolver or repeating rifle. C. W. Smith, 156 Harrison St., East Orange, N. J.

HAVE SEVEN COMPLETE INTERPHONES, in good condition, and one 110-volt direct current motor, about ¼ h.p.; will exchange for wireless instruments. Fred Lyon, 1710 Center St., Little Rock, Ark.

WILL EXCHANGE A "BUCKEYE" ELECTRIC A. C. magic lantern, used only a few times; in good condition and cost $12 when new, including two dozen photographic colored views; for Blitzen rotory variable or a pair of Brandes superior phones. H. E. Kelley, 1772 East 90th St., Cleveland, Ohio.

I HAVE A LARGE LOOSE COUPLER AND A ½-kw. electro transformer coil which I would like to exchange for a gun or instruments. For information, write R. W. Pierson, 18 Vernon Terrace, East Orange, N. J.

WILL EXCHANGE A GOOD MAGNETO, 6 volts, for a 110-volt 1-20 or 1-30 horsepower motor, A. C. Raymond J. Hoble, 5212 Prairie Ave., Chicago, Ill.

NEW "KELLOG" DESK PHONE SET, MECOgraph, omnigraph, electrically operated; sounder, relay and key, Apple dynamo, Powers M. P. arc lamp, selenium cell, 1000-ohm engine, 4-h.p. cycle engine, 10-h.p. auto engine, 2-cylinder; several small dynamos and motors; will exchange for large wireless transformer or other instruments. Joseph Lesmeister, Harvey, N. D.

WHAT HAVE YOU TO EXCHANGE FOR Columbia electric gramphone; cost $125; in perfect condition; also full set of handcuffs for release act, with instructions by Harry Houdini; cost $135. E. Ruth, 149 Oak St., Toronto, Canada.

NO. 50 BRASS CONDENSER PLATES, 6 x 6½ inches, No. 22 gauge; 1½-inch spark coil, used very little; telegraph key; series spark gap with three large zinc plugs; also rotary spark gap wheel, 3-inch diameter, ⅛ hole for shaft, 6 zinc plugs; prefer wireless supplies in exchange. Laurence Rice, New Durham, N. H.

A PEROXIDE OF LEAD DETECTOR WITH tablet, a 20-ohm sounder, two switches, a 4-point and 6-point, a slide plate variable condenser of 11 plates, finished in oak and cornet, worth $10, in good condition, for a ½-kw. close core transformer. M. H. Middlekauff, Box 114 Cornwallis, Ore.

WILL EXCHANGE SEPARATE INSTRUments, all new, for clarinet or snare drum, in good condition. Edwin Wolford, 51 East Eighth ave., Gloversville, N. Y.

WILL EXCHANGE AN "AMCO" RECEIVING transformer, worth $6; one pair Brandes superior receivers and a "Jove" wireless key, with extra heavy contacts, all in excellent condition, for instruments of equal value. M. L. Thompson, 1703 Third Ave., N., Fort Dodge, Iowa.

HAVE ONE GOOD LINEMAN'S TELEPHONE test outfit, learners' telegraph, one telephone key and voltmeter; will exchange for four telephones, small or other apparatus. J. Moore, 474 Revere St., Revere, Mass.

ONE HOME-MADE CIRCULAR POTENTIOmeter, four wet batteries, four Edison primary batteries and plates, and home-made case for an Exide 6-v., 100-a.h. storage battery, for a foot-power lathe with chuck. E. Freiwald, 1213 Helen Ave., Detroit, Mich.

WILL TRADE VARIABLE 17-PLATE CONdenser for a wireless key and some copies of "Modern Electrics" for some binding posts. Edward A. Walsh, 137 Kosciusko St., Brooklyn, N. Y.

WILL EXCHANGE 1-INCH NEW YORK SPARK coil, electrolytic interrupter, Bunnell sparkgap, Manhattan 2-slide tuning coil and wireless key; desire hot wire ammeter of reliable make and ¼-kw. Blitzen helix. Address D. H. Lapham, 54 Sunrise Terrace, Stapleton, Staten Island, N. Y.

WHAT HAVE YOU TO EXCHANGE FOR A 1-inch spark coil, spark gap, key, helix, phone, ferron detector, rheostat and tuning coil and D.T.D.P. switch? All mounted on hardwood base. Lester J. Miller, 3831 Windsor Pl., St. Louis, Mo.

1½-INCH SPARK COIL, FLAT PLATE CONdenser in fine oak case (twelve 4 x 5 photographic plates), and a home-made electrolytic, interrupter, in a fine working condition; will trade both for a good ¼ or ½ inch spark coil or a ball and socket double head band. Paul E. Diedrich, 915 E. Grand Blvd., Detroit, Mich.

WILL EXCHANGE 30 CLOTH-BOUND BOYS' book for a spark coil, 1 or 1½ inches or over preferred, or what have you in the wireless line? Write for list of books, stating condition of coil. Leslie Jones, Charleston, Ind.

1-KW. OPEN CORE TRANSFORMER AND ONE 9-plate variable rec. condenser, one potentiometer for a 3-in. spark coil and two Murdock rec. var. rotary condensers, or any other combination, including a 3-in. coil; reason for trade, have no current. C. H. Hild, 605 Sixth Ave., Brooklyn, N. Y.

WILL EXCHANGE MOVING PICTURE MAchine, complete, with films are acetylene generator, for a good loose-coupled receiving set; machine in first-class condition; cost $25; only used half dozen times. Joseph E. Hamilton, 16 W. Broadway, Port Chester, N. Y.

FINE STATIC MACHINE; BATTERY COMBInation volt and ammeter, watch size; 12-in. A. C. fan motor, 110 volt, 133 cycle; electrolytic interrupter; would like to exchange for something in the electrical or mechanical line. C. A. Babb, Abingdon, Ill.

WILL EXCHANGE 1 VOLTAMP DYNAMO, cost $5.50, for other apparatus; also 1 voltamp motor, cost $1.25; Vol. 4. "Modern Electrics," for Vol. 3. Hubert Bottorf, Johnsonburg, Pa.

FOR EXCHANGE, ONE LARGE SINGLEslide tuner, one small doughnut tuner, one pericon detector, one silicon detector; will exchange for phones or variable condenser. C. N. Seaman Oyster Bay, N. Y.

WILL TRADE WIRELESS SET, COMPLETE, H. C. 2000-ohm phones, loose coupler, variable and fixed condensers and ferron detector, Blitzen ¼-kw. transformer, oscilation transformer, sending key and condenser, for a good job press. Frank J. Taylor, 15 Orrin St., Cambridge, Mass.

FOR EXCHANGE—ONE 4-BAR MAGNET GENerator, with hand gear, height 5½ in., weight about 8 lbs.; in good condition; will exchange for 1-in. coil or Knapp Type S dynamo motor. Address L. R. Brown, R. R. 8, Hamilton, Ohio.

ONE LOOSE COUPLER, ONE SILICON DETECtor, one 75-ohm receiver an dhead band, one small battery motor, one 110-volt motor, in exchange for 8-volt, 60-a.h. storage cell. E. Littlefield, East 24th St., Sheepshead Bay, N. Y.

A COMPLETE OUTFIT OF JEWELER'S TOOLS, comprising one lathe, counter shaft, engine staking tools, K. & D. hair spring tools, glass cabinet and many other tools; tweezers, loops, etc.; none have been used one year; to exchange for wireless instruments or good view camera. Chas. A. Keams, 615 S. First, Arkansas City, Kan.

HAVE HOME-MADE AERIAL SWITCH ON marble base; rest of switch made of red fibre; also a Type K Knapp battery motor with 8-inch fan; to exchange for good static machine or tape recorder. William Dettmer, 11 Cliff Ave., East Port Chester, Conn.

WILL EXCHANGE—A BRAND-NEW 5-BRIDGE telephone magneto, hand geared; very powerful, weight 10 lbs.; also Mesco telegraph sounder and key, 20 ohms, in good condition, and other electrical apparatus; for 1½ or 2 inch spark coil, 2000-ohm head band wireless receivers or other instruments. Lee McCoy, P. O. Box 51, Beeville, Texas.

A D. C. DYNAMO MOTOR; RUNS ON 110 volts, D. C., and gives about 6 or 8 volts; also a Royal fire extinguisher; cost $12, and is just as good as new; to exchange for ¼-kw. rotory spark gap or other apparatus. Eugene T. Beynon, P. O. Box 124, Corpus Christie, Texas.

TWO A. C. MAGNETOS, IN NICE BOX, WITH ringer and switch hook, complete; each one worth $6; will exchange for standard set of 3000-ohm phones and one variable rotary condenser or loose coupler, or other electrical goods. C. O. Williams, White Plains, Ky.

AN EXPERIMENTAL LABORATORY WITH lathe, forge, blowpipe for glass blowing, number of coils, etc., including one 20-inch spark, moving picture camera, tools, X-ray tubes, etc.; exchange the use of these for services in acting as my assistant. Address by letter only, Herring, 435 West 119th St., New York.

A CORE AND PRIMARY WITH COIL HEADS of 50-watt step-down transformer, ¼-in. box spark coil, home-made, to operate with interrupter only; gives good spark; also key; to exchange for wireless instruments. Paul Brewer, 921 Wellington Ave., Chicago, Ill.

A GOOD 2-INCH SPARK COIL AND LOOSE coupler; would like to exchange them for Brandes superior phones and Blitzen rotary variable condenser. David E. Johnson, 25 Glen St., Worcester, Mass.

$24 KODAK; TAKES 5 x 3½ INCH PICTURES; in good condition; 100-ampere lightning switch; also four new I. C. S. books, Electrical Engineer's, Business Man's, Telephone and Telegraph Engineer's, Mariner's; will exchange for 1-inch coil, storage batteries, oscillation transformer, or loose coupler. H. M. Perkins, 367 Central St., Auburndale, Mass.

WILL EXCHANGE FOR GOOD MOTORCYCLE, sending and receiving sets; 2-slide tuner, 3 detceotrs, 3 condensers, 3000-ohm Western Electric phones, rheostat for detectors, ½-kw., with vibrator, 10-v., 50-a.h. storage battery, Leydon jars, helix, spark gap, voltmeter and desk watch; also some tools and 3-bar magneto (sets on oak board). Frank McGarrat, 2204 Seventh Ave., New York City.

HAVE 1-INCH COIL (MUSKEGON), ONE marble detector base with binding posts, one double-slide tuning coil and one nicely finished primary for Tesla coil, wound with 72 feet copper ribbon, coil 2 feet in diameter; base goes with it; exchange for small 110-volt, 25-cycle, single-phase motor. J. M. Day, M.D., Waynesfield, Ohio.

I HAVE ONE GENERATOR, WILLIAMS ELECtric Co. make, largest size; a good magneto; to exchange for one set good receivers for wireless telegraphy, or something in wireless. W. R. Hughes, Vernon, Tenn.

HAVE A LARGE CAPACITY SENDING CONdenser of 30 plates, 5 x 7 inches; also a dandy loose coupler, home-made; for a pair of Holtzer-Cabot receivers or a pair of Brandes $9 or $13 phones. Write for description of articles and other things, Roy Moynahan, 355 E. Warren Ave., Detroit, Mich.

AM OFFERING SEVERAL ELECTRICAL AND wireless instruments in exchange for others. Send for list, Howard S. Pyle, 3311 S. Thirty-seventh Ave., Seattle, Wash.

TO EXCHANGE—TWO G-50 GLADSTONE-LElande primary batteries, two wet carbon batteries, one automobile chain, one planetary automobile transmission for 40-volt, 10-ampere dynamo, 30-volt storage batteries, and switchboard to operate small lighting plant. Address James Tillery, 92 Bainbridge St., Dublin, Ga.

WILL EXCHANGE A RARE OLD COLLECTION of 1,200 stamps for a good dynamo. Reginald Penny, Dunnville, Ont.

WILL EXCHANGE TWO VARIABLE CONdensers, slide plate, Junior fixed condenser, one receiver, 1000-ohm D. S. home-made tuning coil, 1200 meter, and bare wire tuning coil, for Clapp-Eastham instruments. J. K. Adams, E. North St., Greenville, S. C.

WILL EXCHANGE A PULL-UP BLASTING MAchine No. 3; will fire from 20 to 30 holes; in good condition; for ½-kw. transformer, Blitzen make preferred. Philip Flaig, Jr., Niles ,Cal.

WILL EXCHANGE QUEEN & CO.'S. WHEATstone bridge and Weston portable voltmeter, 0-3, 0-150 D. C.; each in best condition; for high-grade camera with anastigmatic lens. F. L. Billingham, 161 Washington St., New York City.

A GOOD 1-INCH SPARK COIL, PURCHASED from Hunt & McCrea; two Crown telephones (never been used); will exchange for a rotary spark gap or a small 110-v., 60-cycle A. C. motor. L. P. Lennard, 201-3 Railway Ex. Bldg., Portland, Ore.

WISH TO EXCHANGE A PHOTOGRAPHIC print of each: Aerial and station of Chicago Commercial Station for corresponding prints of Government and commercial stations in all parts of the world. Send your pictures and I will send yours by return mail. Prints must be clear, and a "printing out" paper is preferred. Wireless, 1128 La Salle Ave., Chicago, Ill. Charles M. Walker, Jr.

PORTER MOTOR WITH FAN; ALSO 9-INCH battery motor fan and guard; small medical coil; magneto with pulley; want good 6-volt storage battery; will add cash for good one. John E. Irwin, 4318 Ave D, Brooklyn, N. Y.

A 75-WATT DYNAMO FIELD CASTING, COMpletely machined, with handwheel, in exchange for a 2-volt, 10-ampere-hour storage battery; field casting is suitable for armature 2¼d x 1½l inches. Stanley Geipel, 207 Townsend St., New Brunswick, N. J.

A CORNET IN GOOD CONDITION to exchange for a post card projector, camera or printing press and outfit; also a small motor for a voltmeter. Scott Hyde, Webster, S. D.

A 6-V., 60-A.h. EXIDE STORAGE BATTERY, A Fort Wayne 60-c., 110-v. motor, suitable for a rotary gap; a Norton 0-15 ammater, switchboard type; a Yost typewriter; a Bunnell wireless key, heavy contacts; a 0-60 Miles Jones speedometer (worth $20): all above guaranteed to be in good working order. Write and let me know what you have to exchange, W. C. Thompson, 33 Connecticut Blvd., East Hartford, Conn.

WILL EXCHANGE 2 LBS. OF ENAMELED No. 30 wire or wireless instruments for the following numbers of "Modern Electrics": May, July, August, September, 1911: Address Charles H. Faust, Long Prairie, Minn.

A GOOD B-FLAT POLISHED BRASS CORONET, in exchange for a 60-cycle A. C. motor, large enough to pull a rotary spark gap of a ½kw. Transformer: I also have a home-made loose coupler and a 5-bar telephone generator, in exchange. Clarence L. Brown, 1022 E. Tabor St., Indianapolis, Ind.

ANYBODY HAVING A SENDING OR RECEIVing set to trade or exchange will do well by sending a description of outfit to Willard Griffith, Bernardsville, N. J.

WILL EXCHANGE A LOT OF ELECTRICAL and wireless goods for wireless instruments; will trade a nearly new Oliver typewriter No. 3, visible writing, for high-class receiving and sending set. William Harrison, Box 64, Lindsborg, Kan.

WILL EXCHANGE THE FOLLOWING: A $5 mirroscope, will project post cards, photographs, etc., operated by gas, in perfect condition; $2 double slide tuner; $1 fixed condenser; 60c. spark gap; will exchange for articles of equal value, as a Tesla transformer, loose coupler, variable condenser. Write Charles Steck, 235 Third St., Union Hill, N. J.

A GOOD FERRON DETECTOR AND 1500-meter tuner of Clapp-Eastham construction to exchange either for a good $5 post card projector; I also have a W. E. head set of 2000 ohms; will exchange for anything of equal value. Vincent Freiermutt, 126 Second St., Watsonville, Cal.

WANTED—A 2000-OHM HEAD SET, IN GOOD condition, in exchange for battery motor, small wireless key, mineral detector, helix, 12 inches diameter, 10 inches high, 9 turns, No. 6 aluminum wire or a good receiving set, 3-slide tuning condenser, rotary, 150-ohm phones, fixed, 2 detectors. Jas. F. Lupton, 123 Central Ave., Greenport, N. Y.

WILL EXCHANGE A 1-INCH COIL, MAGNETO, bell ringer, an ohmnograph, with plates and several coil vibrators for anything useful in a wireless set or chemistry. W. Haynes, 102 N. Florence St., Springfield, Ohio.

WILL EXCHANGE 110-VOLT A. C. MOTOR, very powerful kodak or a lot of other articles for an efficient receiving set of good range, 1,000 miles and over; also have a stamp collection, very near every country represented, 1,800 different, in three albums. Scott's 19th and 20th century and a blank album; all for wireless instruments. Aime Asscherick, P. O. Box 95, Alexandria, La.

WILL EXCHANGE FINE MOUNTED SPECImens, birds and animals, brand new $8 camp stove, new 6-shot H. R. 6-in. barrel target revolver, 2-in. coil, 8-volt dynamo for ferron detector and loose coupler. Blitzen variable condenser, 1-in. bulldog coil. Edw. Fox, Plymouth, Wis.

WILL EXCHANGE ONE SET OF BOOKS ON how to run and repair automobiles for any electrical or wireless instrument amounting to $5. Write to Leonard Englert, Gloversville, N. Y.

ATWATER-KENT AUTO DASH COIL, VALUE $8, with rubber switch 3 x 4 inches on front, gives 2-inch flame on interrupter, for 110-v. A. C. motor, good variable condenser, loose coupler, hot wire meter or hard rubber sheeting; also have ½-inch auto coil without vibrator spring. H. N. Swain, 405 Franklin St., Hamilton, Ohio.

HAVE THE FOLLOWING FOR TRADE: 1-INCH coil, 2-inch coil, loose coupler, primary and secondary, two 6-volt, 60-ampere-hour storage batteries, $2 wireless key and D. P. D. T. switch; also a Blitzen tuner, Brandes navy phones and Brandes hot-wire meter; all brand new and in A1 condition. Wireless, 1128 La Salle Ave., Chicago, Ill.

TO EXCHANGE, 1 K. & D. NO. 9 GENERATOR; can also be used as a motor for film camera of post card size or thereabouts. Edward Erickson, 615 Custer Ave., Evanston, Ill.

WILL EXCHANGE A D. & W. 1-KW. OPEN core transformer with variable impedance for a Thordarson H2 or Clapp-Eastham ½-kw. or Blitzen ½-kw. or Thordarson plus $5 extra; transformer is in fine condition; one taken must be as good. Bayard H. Clark, 205 Augusta Ave., De Kalb, Ill.

WILL EXCHANGE ONE PAIR BRANDES navy type phones; have never been unpacked; for a small gasoline engine. R. D. Magann, 1117 Valmont St., New Orleans, La.

WIRELESS RECEIVING SET IN EXCHANGE for a twin Indian or Merkel. J. Frank Dwiggins, Box 11, Petersburg, Tenn.

I HAVE A McCOOL NO. 2 TYPEWRITER; would exchange for wireless outfit consisting of loose coupler, 2000-ohm head set, detector, 2 variable condensers, 3 lbs. aerial wire, tuner or other wireless instruments to the value of $18. Write for other offers on wireless, A. W. Black, Thorp Spring, Texas.

A 2-KW. EDGEWISE-WOUND COPPER RIBbon helix, on oak frame, open ends for loose coupling; heavy duty 2-kw. key; one set Murdock 3000-phase pro. type phones; one Murdock variable condenser, small; one high-grade microphone; loose coupler tuner; want Eastman 3A kodak or other high-grade camera, post card size. J. G. Klemgard, Long Beach, Cal.

6-VOLT, 60-AMPERE-HOUR STORAGE BATtery; 1-in. coil, with adjustable condenser and zinc spark gap; will exchange all for one Murdock or Duck receiving transformer costing $15. and not home-made; make me an offer. Harold Hursh, Box 368, Union, Ore.

I HAVE A BICYCLE, RANGER MAKE, IN good condition, except tires, to trade for 20-v., 4-a., 80-w. dynamo; also 1½ lbs. aluminum aerial wire, 5-bar magneto, 1000-ohm receiver, home-made head gear, and No. 2 Brownie kodak. Allie Black, Thorp Spring, Texas.

WILL EXCHANGE 1,000-SHOT DAISY AIR rifle for 1000-ohm phone or pair of 75-ohm phones; also silicon detector for galena, perikon or peroxide of lead detector, or for good fixed condenser. Chester Ulsh, 151 Mt. Vernon Ave., Marion, Ohio.

WILL EXCHANGE 75-OHM RECEIVER, 1913 World Encyclopedia, January and March "Modern Electrics," also "Popular Electricity," September, 1911, for anything in wireless. Harold Lee, 3133 N. 15th St., Philadelphia, Pa.

HAVE A SAVAGE 22-CAL. REPEATING rifle, an Eastman pocket folding kodak, one 500-ohm receiver, ¼-in. coil and all parts to a ¾-in.; large primary aand secondary of loose coupler; two little hustler motors; a home-made ferron detector; a 3-bar telephone magnet and a buzzer as described in "Modern Electrics" on page 1255, and an ammeter; I desire a rotory variable condenser or a ¼-kw. transformer with interrupter or a 2-in. coil or 2000-ohms phones. John Stadler, 210 Plymouth St., Toledo, Ohio.

TO EXCHANGE—BOOKS, PYOGRAPHY SET, midget kodak, panorama camera, desk telephone, lathe motor, fan motor, storage battery, three relays, wireless outfit; this is about one-fourth of it; want 1910-12 motorcycle. Write for list and particulars, Percy Davidson, Keosauqua, Iowa.

WILL EXCHANGE A FINE ASSORTMENT OF chemicals and glassware; cost me about $30; also chemical and electrical books for wireless apparatus; need phones and loose coupler; also a Murdock rotary variable condenser; send for list of my goods; I also have a lot of low-melting alloys for mounting crystals; also some pyron crystals, ¼ lb., to exchange. Chester J. Prosser, 1805 Jefferson Ave., St. Louis, Mo.

STAMP COLLECTION OF 800 OR MORE, many of China and Japan; coat-of-arms, flags and rulers of all nations; all mounted in "International Album"; all worth about $40; to exchange for transformer, phones or other wireless instruments; have also new Oliver typewriter to trade for other articles. Lee G. Koon, Gen. Del., Vancouver, Wash.

DYNAMO MOTOR FROM ARROW ELECTRIC Co., cost $5; registered 10 volts; rifle 22 calibre; Winchester 1904 model, value $5. Both in good condition. Motor practically new. Want kodak or head set. J. P. Camgroz, 1211 Inyo St., Fresno, Cal.

HAVE 2 TELEPHONE MAGNETO GENERAtors, 5 bar; one ¼-in. spark coil gives full ¼-in. spark; two ⅛-in. spark coils without vibrator or condenser; one is packed in wax; one 110 v. 32 c.p. lamp (new, never used); must be in good condition. Francis C. Harbert, 407 J St., Aurora, Neb.

DIAMOND SCARFPIN, COST $10, WILL EXchange for Edison wet batteries or X-ray tube and fluoroscope. Frank Copeman, 1253 Amsterdam Ave., New York City.

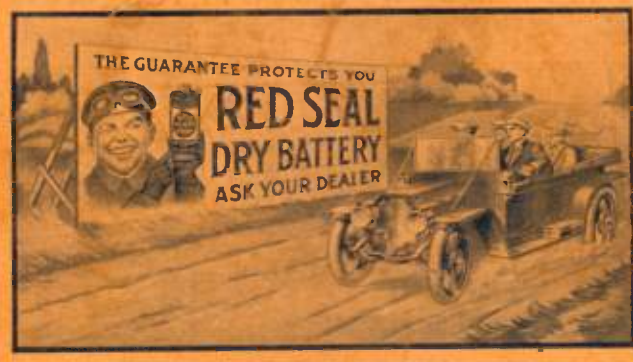
50-POP. ELECT. 50 ELECT. MECH. 40 M. E.; special transformer and detector, 4-20 storage battery, Murdock var. cond. 75 aluminum 5-in, cond. plates, 1-in. coil, 8 ozs. zincite and copper pyrites, ¼-in. Queen coil; write complete list material and apparatus. William L. Lewis, 405 County Line, Ardmore, Pa.

WILL EXCHANGE ⅛ H.P. MOTOR RUNS ON 110 volts A. C., 60 cycles; fine for a rotary spark gap, for a loose coupler or rotary variable condenser (not home-made); will exchange 2 keys, 1 sounder for circular potentiometer; will exchange ½ H.P. motor; dynamo weight 65 lbs., for a 4-in. to 6-in. spark coil. Harold Amtzen, La Junta, Col.

WILL EXCHANGE POST CARD PROJECTOR, value $25, equipped for electricity or carbide tank; voltmeter, value $2.50, for 1 kw. closed core transformer that runs on 110 volts, 60 cycle, or will exchange Ruhmkorff 1-in. spark coil, value $13, superior Brandes receivers, also volt meter; all articles are nearly new. W. A. Somers, 49 E. Corydon St., Bradford, Pa.

FOR EXCHANGE—ONE SET POWERS LENS, complete with jacket, 1912 model, cost $22.00, are almost new; only used 2 or 3 times; throws picture 18x15 feet about 80 feet for 2-inch spark coil; pair brands phones, omnigraph outfit or good coupler. Will consider any good electric goods. Morris Grubman, 1607 Carondelet street, New Orleans, La.

ROUND CASE



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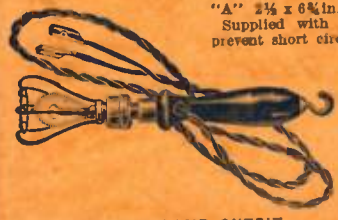
MADE IN THREE SIZES.

"A" 2½ x 6¾ in., $0.25; "B" 3 x 7½ in., $0.40; "C" 3¼ x 8½ in., $0.50. Supplied with either Round or Square Cartons. For convenience and to prevent short circuits we particularly recommend the Square carton.



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Has 12 ft. cord and a 4 c. p. 6 v. lamp. Can be operated by 4 Red Seal Dry Batteries. Useful where an open flame would be dangerous.

No. 1093 Trouble Lamp.....$1.25

RELIABLE SOUNDER.

A first-class instrument at a very low price.

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No. 144 20 ohms......95

RELIABLE KEY.

A high grade key, companion piece to Reliable Sounder, nickel plated Lever and brass frame.

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PONY DYNAMO AND MOTOR.

Made in 4, 6, 8 and 10 volts...$3.50

Will run as a motor or as a dynamo. As a dynamo will light a 6 c. p. lamp. Has a grooved pulley.

ELECTRIC CALL BELL OUTFIT.

Consists of:

One Iron Box Bell, 2½-inch gong.
One Cell Improved Mesco Dry Battery.
One Wooden Push Button.
Fifty Feet Insulated Wire.
Sufficient staples, and printed instructions which will aid any person to put the outfit in successful operation.

1762 Call Bell Outfit, complete.....$0.75

SNAPPER SOUNDER.

Makes a sharp "clicking" noise when spring is pressed, resembling a telegraph sounder. Used for signalling.

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