THE

ELECTRICAL EXPERIMENTER

The Electrical Experimenter

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Sayville

SAYVILLE and Tuckerton are at present the only links connecting the American Continent directly with the German Empire. Both stations can now receive and transmit wireless messages to and from Germany, without any relaying means, at any given hour of the day.

First Tuckerton and now Sayville have been taken over by our watchful Government with the evident intention of preventing the two stations from committing an unneutral act, in conformity with international law practice.

The layman will immediately ask, that if the United States Government takes over the wireless plants, why does it not also take over the various transoceanic cable stations? He furthermore cannot see what harm the wireless stations can do, because they have been required for some time to use plain English or plain German, no code messages having been allowed since the outbreak of the war.

The answer is simple enough. A cable message during the time of its dispatch stays on the cable. It has only one destination; no one can "tap" the message without serious difficulties. Not so with the "wireless." Its waves being propagated in every direction, a thousand stations, or more, if properly equipped, can catch the message anywhere within the receiving radius of the sending station.

No doubt the far-seeing shrewd German Government long ago foresaw the possibility of a war with England and the inevitable isolation of the empire which would result in consequence thereof. It clearly foresaw the cutting of its cables by the enemy and it acted accordingly. Sayville and Tuckerton was the answer. Thus when England actually did cut the German cables early in August, 1914, Germany was by no means isolated telegraphically. Thanks to the wireless, which a wise government had long before planted on foreign soil, telegraphic traffic between America and Germany goes on the same as before, with the difference that the messages now travel over the very heads of Germany's enemies. With the inauguration of the German submarine warfare, the German Admiralty doubtless found a powerful weapon in the shape of the Sayville and Tuckerton wireless stations. The two stations being controlled almost entirely by German capital, it was reasonable to expect that they would support the German navy and its submarines to the best of their ability. Before the United States Government took over the Sayville station, early in July of this year, we had been reading a lot of nonsense as to some new devices being employed at that station which were supposed to be used in sending out messages by means of a special time-spacing system between the dots and dashes, as well as by varying the length of the dots and dashes themselves, which latter make up the telegraphic alphabet. Such a thing is, of course, not impossible, but why should it be done if much simpler means are at our disposal?

Let us imagine the following: A German spy is located on the ocean liner *Adriatic*, headed for Liverpool. When the ship is two days out the spy learns that the ship, on account of submarine danger, will not dock at Liverpool but at Greenock (Scotland) instead. This is important information. Within ten minutes he has sent a wireless to a stockbroker in New York as follows:

H. P. Frye & Co.,
235 Wall Street, New York.
Sell at once 2,000 shares U. S. Steel at 58.
John Miller.

When Frye & Co. receive the message they consult their code book and find that it reads thus:

Adriatic will dock at Greenock.

Within twenty-five minutes after John Miller handed his message to the operator on the *Adriatic* Sayville has received and dispatched the following message to its Nauen (Germany) station:

F. S. Schneider & Co.,
Friedrichstrasse, Berlin.
Cannot dispose 2,000 shares U. S. Steel at 58. Are bid 55½. Advise. Frye & Co.

This message is promptly received by the German commander of the submarine U-69, bobbing up and down not far from the south coast of Ireland.

He also consults his code book and deciphers the harmless message thus:

Adriatic will dock at Greenock next Tuesday.

With this intelligence the German submarine commander is enabled to change his course in order to successfully hunt his quarry.

This is only one of the ways how the wireless stations at Sayville and Tuckerton can be used successfully to violate our neutrality; there are undoubtedly scores more.

In view of the above it is not quite clear how the United States Government, even by exercising the greatest care in censoring messages, can hope to prevent at all times the dispatch of unneutral wireless messages.

H. GERNSBACK

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Television, or The Projection of Pictures Over a Wire

By H. Winfield Secor

PROBABLY there is no more interesting, and as yet unperfected, branch of science than that of *Television*, or the process of transmitting and reproducing a scene or a person's likeness over a wire, such as a telephone circuit, so that, for instance, a person telephoning over a line can see on a screen in front of him the person to whom he is talking.

There have been many attempts made to solve this fascinating problem. Several European scientists, including the late E. Ruhmer, of Berlin, succeeded in constructing such an arrangement for the simultaneous transmission and reproduction of living pictures over a wire by utilizing a great number of selenium cells, mounted very compactly in a small flat area.

Selenium, as we know, changes its electrical resistance proportionately to the amount of light thrown on same. Therefore, as every picture is made up of light and dark shadows, it is evident that if such a picture is properly projected on a group of selenium cells that the different cells will change their electrical resistance proportionately to the amount of light projected on them and corresponding conjointly to the light and dark shadows of the view before the instrument. Simply explained, this system works as follows:

Each selenium cell on the transmitter would be connected up with its individual lamp (very small, of course), and thus it is perceived how, at the receiving station a picture or view could be reproduced in black and white and intermediate tones, for the reason that each selenium cell would allow a different amount of current to reach its individual lamp.

This may seem a little ambiguous or complicated to those not familiar with the subject, but what we are driving at may be the more readily perceived or understood by inspecting Fig. 3A. The portrait photographed, reproduced by the half-tone process, exhibited at Fig. 3A, is photographed onto the copper plate used in printing the reproduction on this page, through a finely ruled glass screen. This screen therefore causes the original photograph to be broken up into many small dots. The illustration here referred to, for instance, has about 140 dots to the inch. By looking in an ordinary manner at the photograph here reproduced, no distortion is noticeable, and the picture appears quite natural. Nevertheless, *it is made up entirely of dots*. You can convince yourself of this by inspecting our illustration with a good lens. This brings out the logic of the argument previously referred to, viz., that it is possible, theoretically and practically, to make a machine that will reproduce a picture by such an arrangement of dots or points; whether all of the dots necessary in building up the picture are simultaneously thrown on the screen of the Television apparatus, or whether these dots are successively or very rapidly thrown on the screen, one after the other.

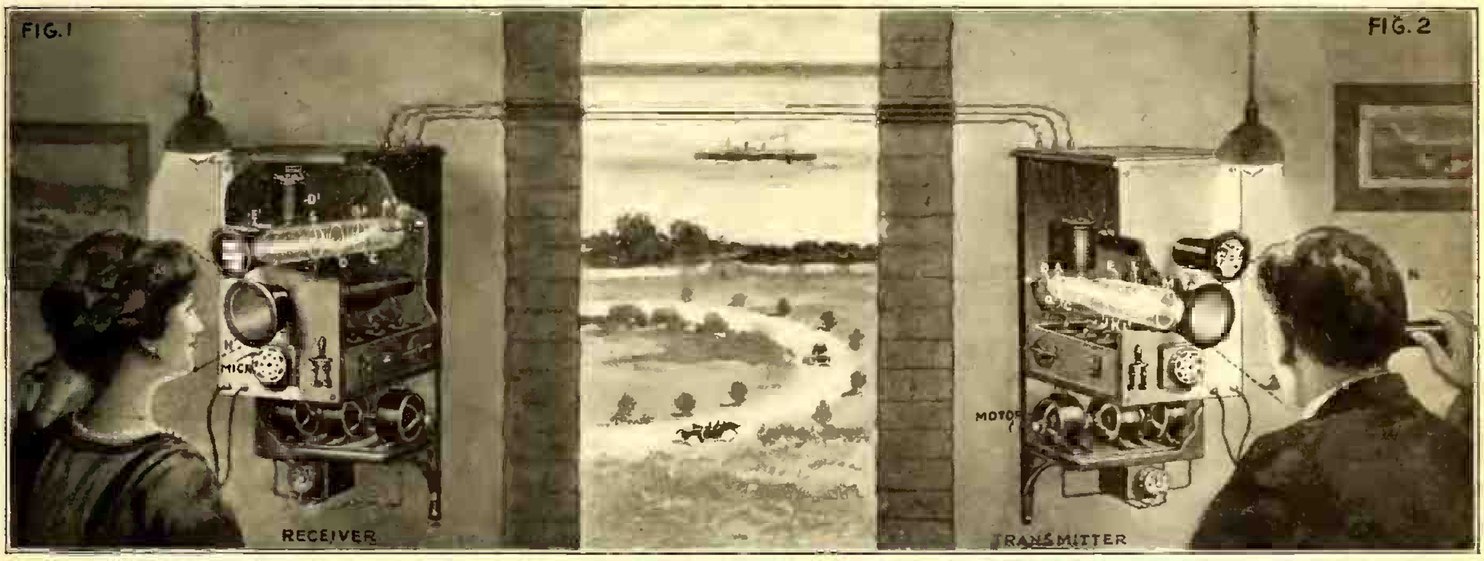

Fig. 1, at Left, Shows Image of Man at Right Being Transmitted and Reproduced on Screen in Front of Lady. Her Face is Transmitted and Reproduced at Fig. 2 (Right) Before Man. Mr. A. A. Campbell-Swinton's Scheme.

The second view, at Fig. 3B, shows a largely magnified portion of the (marked) eye on the face of the half-tone cut. This shows how the reproduction of the face is made up of small dots, and by closely looking at any newspaper illustration, which is usually photographed through a coarse screen, this *dot make-up* of the picture will be very evident. Some illustrations in magazines and books, which are reproduced on highly polished and specially coated paper, are photographed through such a fine screen that the keenest eye cannot perceive any break-up or dot formation.

As aforementioned, a number of work-

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ers have endeavored to solve this problem of "seeing over a wire," as it is commonly referred to, and one of the best methods tried in a laboratory, on a crude scale, is that of making use of a large number of selenium cells.

However, there are several drawbacks to this solution of the problem, some of them being enumerated below.

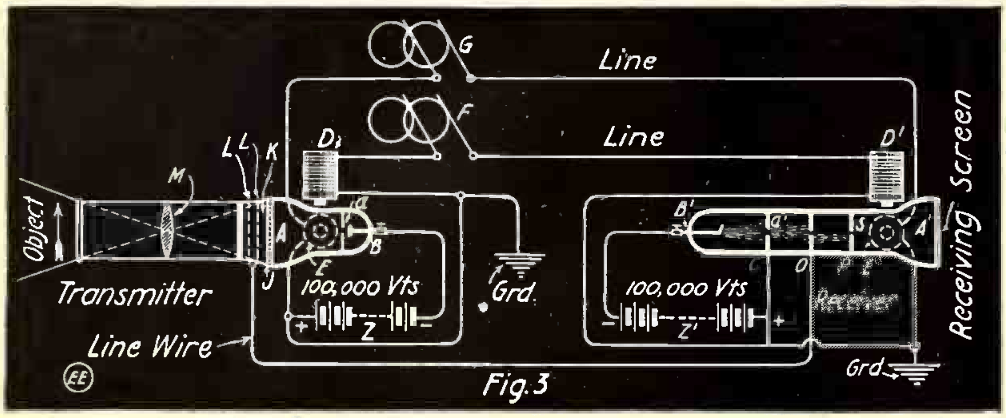


Fig. 3. Diagram of Proposed "Television" Scheme.

Selenium cells manifest a quality known as "time lag" in their electrical operation or action, and this means that it is difficult to build any such apparatus, as we now have under consideration, to act in an anywhere near perfect manner, when the selenium cells will show varying degrees of "time lag," or, in other words, when they tend to be sluggish in their action of changing from high to low resistance, etc. This lag is small, of course, and it must be understood that in considering the basis of this whole process that with the dot formation, even though made up of a vast number of small lamps, compactly grouped at the receiver end of the line, that the changes in the lamps' intensity, which is of course primarily dependent upon the action of the selenium cells on the transmitter, must be quite rapid, and this may be more readily understood when it is known that in the ordinary motion picture, with which we are all familiar, there

Fig. 3A. This Picture Is Made of Many Small Dots, Although You Wouldn't Think so. Note Marked Eye in Fig. 3B.

are from 16 to 20 different pictures projected on the screen per second. This has been found to give us a fairly steady picture owing to the "lag" of the human eye in perceiving an object in motion. That is to say, the eye does not loose its impression simultaneously, but the object's impression on the retina of the eye remains for a fraction of a second, and this explains how motion pictures are made possible by the present methods in vogue.

It has been estimated by a well-known English authority and scientist, who has worked along the line of Television, that if the selenium cell process was to be used to give good close-grained results on a surface only two inches square, there would be required 150,000 wires, 150,000 selenium cells, 150,000 lamps. While even to obtain an effect no better than that used in the coarsest process blocks, as used by ordinary daily newspapers, there would be required at least one-tenth that number of selenium cells, lamps and wires.

Working on this basis, but reducing the number of cells, etc., to be used, to a figure of 90,000, this scientist calculated that the cost for a 100-mile transmission circuit, including apparatus at both ends, would amount to the staggering sum of $6,250,000. This considers simply a monochrome reproduction in black and white only of the view or object over the circuit. If the apparatus in question should have to be triplicated, so as to give a colored picture, by the well-known three-color process, then the cost would naturally rise to three times the amount stated.

From this figure it is to be seen that evidently such a solution of the problem is far beyond us and not capable of industrial or practical applications, in the strict sense of the word.

Some workers in this field have also devised or advocated at different times very clever and ingenious methods, which seem quite good theoretically, for using a less number of selenium cells, lamps, etc., but to gain the same effect as if a large number of cells were used, by suitably moving a beam of light over the various cells successively at very high speed, and some similar arrangement being used at the *lamp* end of the circuit, where the picture is to be reproduced. This would act upon the principle of the retina retention of impression, as previously mentioned, and such ideas are based upon the theory that with proper apparatus, which unhappily is nearly impossible to construct from a mechanical standpoint, that each cell could be used for a fraction of a second.

One of the latest and most promising (theoretical) systems of Television—the *Telephot*—or the instrument for "seeing over a wire," makes use of a stream of cathode rays, which can be deflected and changed in their direction of production very rapidly, and moreover, these rays possess an infinitesimal amount of momentum or mass. This method has been brought forth by an Englishman, Mr. A. A. Campbell-Swinton, president of the Röentgen Ray Society, of London.

The apparatus based on his descriptions and ideas are shown in the illustration at Figs. 1 and 2. In this picture detailed apparatus only is shown for transmitting pictures one way, or, in this case, from right to left; the detailed receiving apparatus being then at the left of the picture and the transmitting apparatus with high frequency A. C. generators, etc., being shown at the right. Both transmitting and receiving tube openings are shown, however. It is evident that one can easily, and without any awkward motions, glance slightly upward to view the reproduced face in the smaller upper screen, which is shown placed at a small angle. A dictagraph or super-sensitive telephone transmitter is probably best for such instruments and is observed under the *television screens.* Six wires are required to transmit pictures both ways.

We may now briefly consider the operation of this apparatus advocated by Mr. Campbell-Swinton, and which has been favorably received by the scientific world, *although as yet not practically demonstrated.* The schematic diagram, Fig. 3, will help the reader to understand the diagnosis of its operation. Three line wires are necessary between the apparatus, as observed from the illustrations at Figs. 1 and 3. At the *transmitter* end of the line there is used a focusing lens barrel "X." The object whose reproduction is to be electrically transmitted over the line is arranged at the tube opening, as at "N." A Crooke's vacuum tube is used at "A" and at "B" is the cathode electrode of the tube, from which the cathode rays are shot forth at an incredible velocity and which have

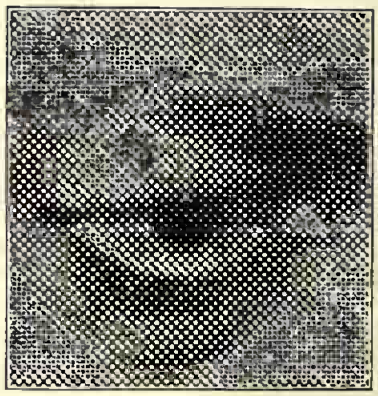


Fig. 3B. Hold This 18 Inches From You and the Effect Will Be Seen to Give the Facial Features Noted Inside the Marked Square on the Face at Fig. 3A.

practically no mass or momentum. An anode "C" of circular form is placed in the tube, which has at its center a small aperture or opening "a." Through this opening a small stream of cathode rays may pass; these rays being produced by a high potential *continuous current* from a source "Z," giving in the neighborhood of, say, 100,000 volts. Placed at right angles about the tube "A" are two electro-magnets "D" and "E," and these are energized by alternating currents from the A. C. generators or dynamos "G" and "F." These magnets allow of readily controlling or deflecting the cathode rays stream in a vertical and horizontal direction, respectively.

At "J" in the transmitter tube is placed a special screen, the whole surface of which is searched out by the stream of cathode rays, every tenth of a second, under the combined action of the A. C. electro-magnets "D" and "E." It should be mentioned here that the dynamos "G" and "F" produce *widely different* frequencies of alternating current; one of them producing, say, 1,000 complete positive and negative alternations per second, and the other 10 such complete alternations per second. The special screen "J" is proposed to be a gas-

(*Continued on page* 172.)

Submarine "Wireless" Signaling

THE subject of safety of submarines at sea is of vital importance, especially in the present submarine warfare, in which many of these under-sea fighters are participating.

It is well known that wireless telegraphy is now the most important factor of communication on our present ocean steamers and battleships, which aids their navigation and safety at sea; but when we come to the submarines, the wireless used on these craft cannot now be directly adapted to the under-sea fighters, as the etheric waves produced by the ordinary wireless apparatus cannot travel very far in water, and therefore other means of signaling becomes necessary. Many forms of apparatus were invented and used with considerable success, such as the submarine bell, which is still in service; but the distance traveled by the sound is so small that it is practically useless.

These methods were rarely used, however, until finally an Austro-Hungarian physicist, H. Christian Berger, who realized the necessity for an efficient means of submarine signaling between moving undersea vessels, devoted his talents to the solution of the problem. He finally solved the problem by using the principle of longitudinal vibrations in a steel wire or strip set into vibration by frictional means.

His first transmitter consisted of a piano wire, as at A in Fig. 1, which is here shown a ribbon of only 2 millimeters diameter, set into longitudinal vibration by a hand-driven silk wheel B moistened with alcohol; D is a sounding chamber, which is immersed in the water. With this apparatus Morse dot and dash signals were clearly heard for 3 kilometers (1.86 miles). The sound had the qualities of the ordinary etheric wireless, and it has therefore been called submarine wireless.

These experiments were conducted on the United States submarine E-1, and were so successful that the United States officials were encouraged to build a large apparatus, using a ½-horsepower electric motor C, Fig. 2, to drive the exciter, and also the wire was substituted by a flat metallic ribbon having a thickness of 1/16 inch and a width of ½ inch.

The complete apparatus is shown in Fig. 2. A commercial type Morse key, Fig. 3, operates a magnetic clutch D on the shaft by pressing the key, thus supplying current to the electromagnets in the clutch and connecting the worm gear in case E, which is connected in turn to the felt-edged wheel A. This wheel contains a reservoir inside it, in which alcohol is placed in order to feed the felt continuously.

The operation of same is as follows: The clutch is connected and the steel ribbon is next stretched and placed near the felt wheel so it touches same. The motor is next started by pressing the Morse key. The felt wheel is set in motion, according to the current sent through the magnetic clutch, which is operated by the key and consequently produces friction on the ribbon, which is caused to rapidly vibrate. These vibrations are sent out on air waves and cause the hull of the boat to vibrate, and finally are communicated to the water. The water is thus also set into vibration and these vibratory tones are received by another vessel containing the proper receiving apparatus. The distance that these waves travel depends entirely upon the number of vibrations which the steel wire or ribbon emits.

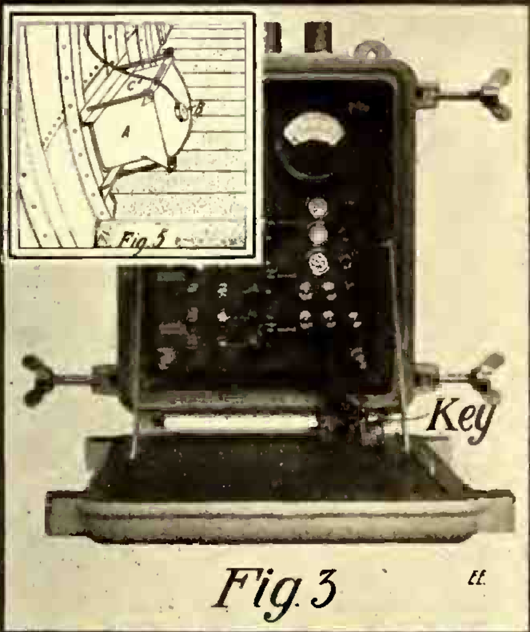
The receiving apparatus consists of a receiving tank, super-sensitive microphone, telephone receiver and battery. The receiving tank is placed on the hull of the boat as shown in Fig. 5 at A, and it is filled with water. The microphone transmitter B, Fig. 5, is placed in firm contact with the receiving tank and connected in series with a telephone receiver and battery by waterproof copper wires. The transmitter is then covered with a thick steel plate A. See Fig. 4.

The incoming waves or vibrations caused by the transmitter are caught by the receiving tank, and the microphone intercepts these faint vibrations, which vary the resistance in the telephone circuit, thereby giving the exact sounds as produced at the transmitting station. The water in the tank acts as a conducting medium between the hull of the submarine and the sensitive microphone transmitter, just as the ether acts as a conducting medium in aerial wireless telegraphy.

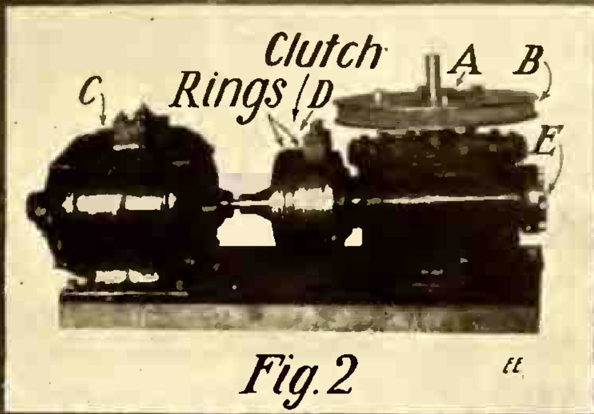
With this system signals were audibly read at a distance of 10 knots. The secret of the extraordinary efficiency of this system lies in the fact that the vibrations used are longitudinal and the stresses set up molecular. Unlike a plucked violin string, where the pitch depends on the tension, the pitch in longitudinal vibrations is independent of its tension.

As friction is always rhythmic, the exciter or felt wheel throws the wire into intense longitudinal oscillations, and a clear and absolutely uniform musical note is produced in the water. In order to produce a note of 1,000 vibrations per second, most suitable for microphones, the wire is cut for one-half a wave length. As the velocity of sound in steel is about 16,000 feet per second, the wire would be 1/2,000, or about 8 feet in length, and this would generate a sound wave of about 4.7 feet in water. So it must be quite evident that to transmit these vibrations for eight or 10 miles a longer wire must be used, or else a shorter wire having a greater tension. Therefore more power is required to set this wire in vibration.

This method of signaling has been approved by marine officials, and many of these apparatus are being used by Uncle Sam's submarines, with good success.



Above (Fig. 5) Receiving Microphone Installed on Shell of Submarine. Fig. 3 Shows Morse Telegraph Key and Switchboard for Transmitter.



One-Half H. P. Magnetic Clutch and Molecular Friction Wheel With Oil Immersed Worm Drive for Transmitter.

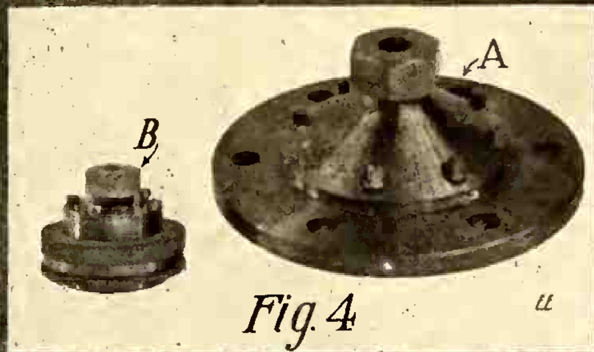
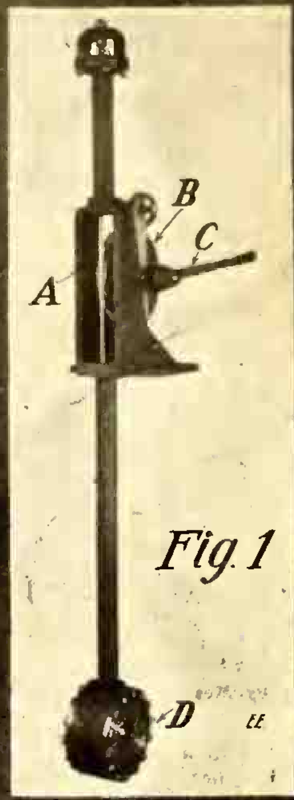


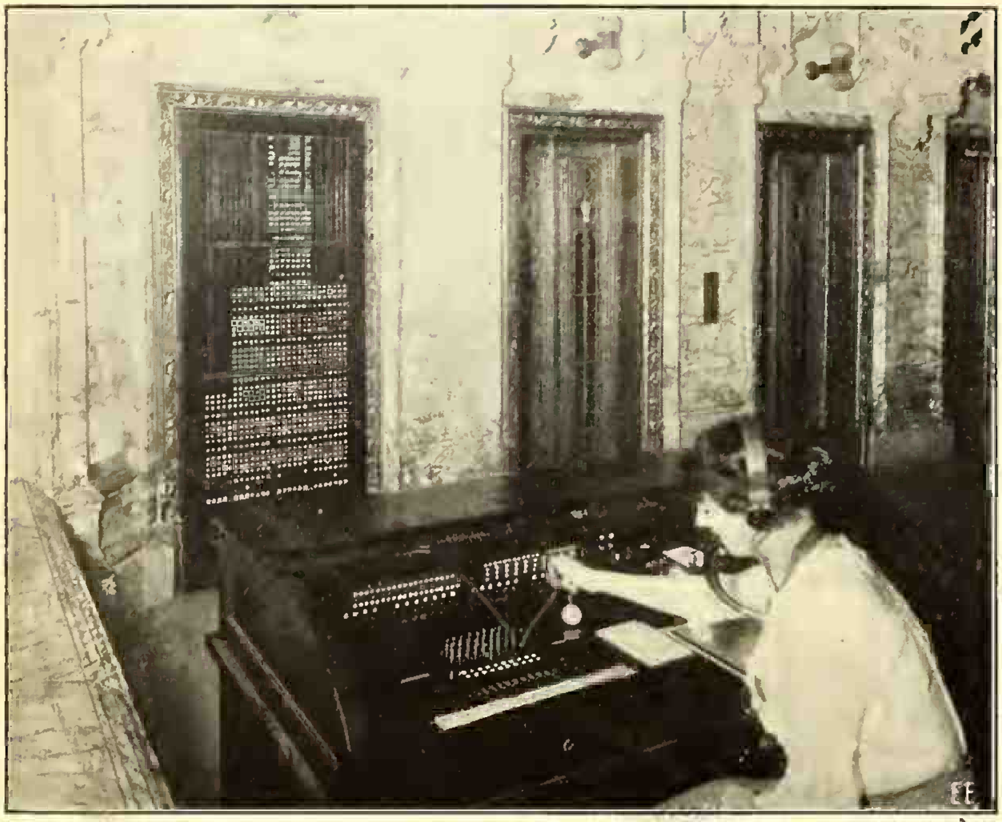
Fig. 4. One Type of Super-Sensitive Microphone Used to Pick Up Vibrations Transmitted through the Water.



Hand-Driven Form of Submarine Transmitter.

ELECTRIC ELEVATOR CONTROL AT THE WOOLWORTH BUILDING.

One of the most striking objects at the Woolworth Building, in New York City, is the automatic elevator control, which is depicted in the accompanying photograph. The switchboard here seen is not a control board, similiar to that in an ordinary power house, but entirely new. It contains many small electric lamps, placed in a number of vertical rows, each row corresponding to an elevator, and the number of lamps in a row corresponding to the number of floors which that particular "car" covers. In this way the operator can readily see just where any of the 27 cars are located in all sections of the building. There are also a number of jack switches on the desk connected to telephones installed in each car, by means of which communication with any particular motorman is easily effected.



This Girl, by Means of a Lamp Signal Board as Shown, Has Complete Control of the 27 Elevators in the Woolworth Building, New York City.

This system is very simple and works splendidly in large buildings where many elevators are in operation. Elevator dispatching is thus reduced to a science in the modern skyscraper.

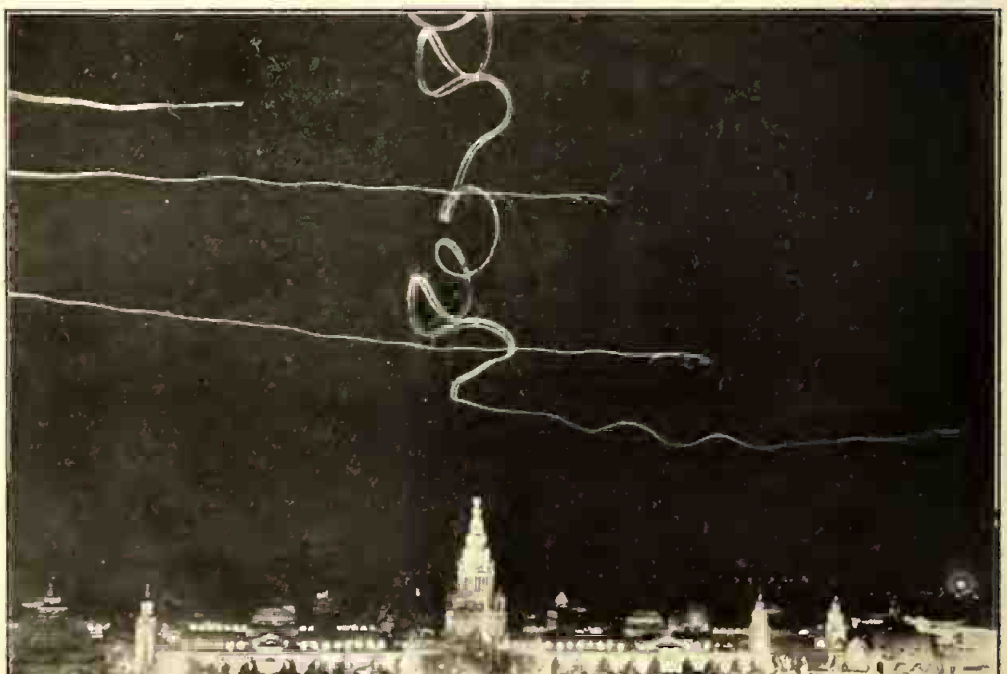
ILLUMINATED AEROPLANE GIVES SPECTACULAR EFFECT.

This is a bona fide negative taken of an illuminated aeroplane flight made by Art Smith, the "Upside Down Aviator," flying at night over the Panama-Pacific International Exposition in San Francisco. The picture was made from a single timed exposure on the night of May 27, and is now published for the first time. The shutter was exposed during the period of the flight.

The picture is unique, as it is the first photographic record of an aeroplane's course ever made on a single negative. While the course of an aeroplane may be recorded by a cinematograph film, a night exposure obviously is the only one capable of recording the course of an aeroplane on a single plate. A daylight exposure would show the aeroplane at but one point.

Owing to the high speed of the aviator's flight and the fact that only a portion of the aeroplane was illuminated the course of the flight only is marked on the negative, the aeroplane itself having escaped the camera. The parallel lines were made as Art Smith flew back and forth over the exposition grounds while gaining a height from which to loop the loop and turn the side spirals of which he is a master. These parallel lines apparently start or end in the dark, as from time to time the aviator shuts off the light from his aeroplane. The trail of light is caused by the flow of brilliantly illuminated white smoke and a discharge of white fireworks from a non-explosive smoke pot at the back of the aeroplane.

The lines above the Tower of Jewels, in the center of the picture, were taken as the boy aviator, with his aeroplane fully illuminated so that the thousands below might observe his flight, looped toward the earth. These lines show four distinct loops, in which the aviator turned complete circles in courses vertical to the earth and one back "upside down" loop.



Illuminated Aeroplane Describes Wonderful Effects Against Night Sky of 'Frisco Exposition.

HOW ELECTRICITY KILLS.

Ever since electricity was first used it has been known that under certain circumstances it was deadly, but just what these circumstances were and how electricity kills took almost endless experimenting to find out. The mystery of electricity's deadly power seemed to be one of those unanswerable problems which deal with the question of life and death, but now, thanks to the tireless energy of many scientists, the various results of their observations have brought the answer.

In the case of an electric shock severe enough to kill, death usually results from one of two causes—either from paralysis of the respiratory organs or from contraction of the muscular fibers of the heart. In the former case, the victim may occasionally be literally brought back to life by artificial respiration, but there is no known remedy in the latter case.

The effect of direct and alternating currents vary with the current strength, the duration of contact and the path through the body.

Lower animals are much more susceptible to electric shock than mankind, dogs being frequently killed by a direct current as low as 70 volts. The average man can take a direct current of 100 volts and scarcely notice it; 200 to 400 volts give rise to muscular cramp, while respiration is suddenly stopped at 550 volts. At 600 volts both contraction of the heart and respiratory paralysis begin, but at 2,300 to 4,800 volts the effect is usually confined to the respiratory organs. The electrocution records of various American penitentiaries show that two to seven amperes at 1,500 volts, 15 to 50 cycles per second, always stops the heart when continued 45 or 50 seconds.

A NOVEL DENTISTS' SIGN.

A clever advertising sign was recently made for an Eastern dental parlor. It is indeed unique and never fails to arrest the attention of the passing crowds.

This sign is an electrically operated *human jaw*, as seen in the photograph Fig. 1, and it consists of two parts, namely; the lower and upper jaws. They are constantly opening and closing. This is done by means of a one-eighth horsepower electric motor connected to a suitable gear which is linked up to the lower jaw frame. A large number of incandescent electric lamps encircle tis sign, which are lighted at night. Fig. 2 shows the sign when the jaws are open.

The size of the sign is 30 inches high, five feet wide and five feet deep, and the distance between the jaws when they are fully opened twenty inches. It weighs 400

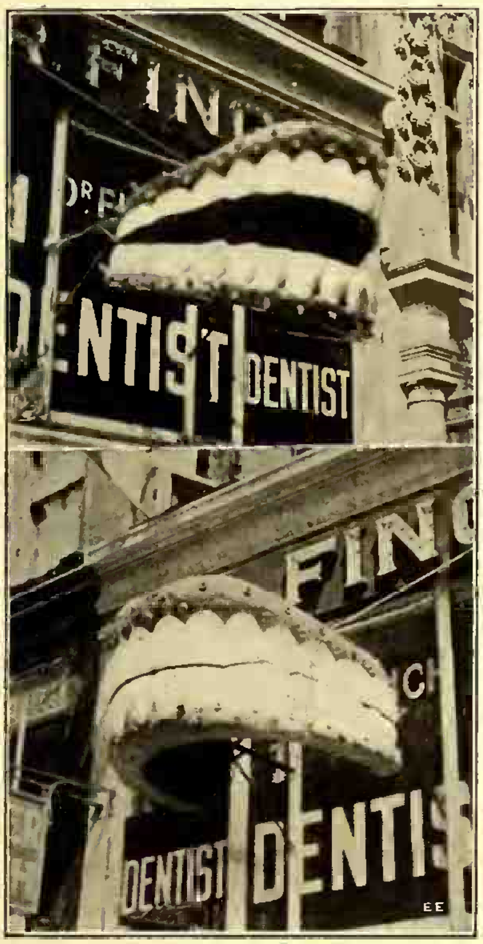


Fig. 2 (Above) Shows New Electric Dental Sign With Jaws Opened. They Open and Close Repeatedly; Fig. 1 (Below) Showing Them Shut.

pounds. Photos by courtesy of the Federal Sign System.

Edison 3,000,000 C. P. Storage Battery Searchlight

Profiting by an experience of firemen in fighting the $3,000,000 fire at the Edison Works at West Orange, N. J., on Dec. 9, 1914, Thomas A. Edison has perfected another invention which he took to his home in Llewellyn Park recently to try out.

A few minutes after Charles Edison began operating the device for the edification of his father, people living in the valley east of Llewellyn Park telephoned Police Headquarters and asked, "What is that terrible light shooting out of the park?"

A policeman found Mr. Edison and his family enjoying the wonders produced by a new 3,000,000-candle-power searchlight, capable of throwing a ray several miles, the most powerful portable searchlight yet invented. It is very small and the power is supplied by storage batteries.

In the fire at the Edison plant the yards were thrown in darkness when the power was shut off. Mr. Edison conceived the idea of a portable searchlight, and two days after the blaze he had designed a working model. Now he announces the perfection of his idea.

It was said at the Edison laboratory that the lamp will be very useful in mine rescue work, at fires, and on ships, aeroplanes and locomotives. It can produce light in any volume desired, involving a new principle and making it of marvelous efficiency. A specially made incandescent lamp of high candle power is used in it.

(C) By International News Service.

Thomas A. Edison Inspecting His New 3,000,000 C. P. Storage Battery Search Light.

CORRECTION ON TALKING PICTURE ARTICLE.

With reference to the article entitled "Talking Motion Pictures and Selenium," published in the June, 1915, issue of *The Electrical Experimenter,* we are informed by Ignatius H. McCarty, of San Francisco, a well-known wireless and electrical engineer, that he has done similar work to that mentioned by S. Wein in his treatment of the subject, and also he suggests that many details not mentioned in the article have been worked out by himself and his associates, necessary to the successful commercial application and adaptation of this ingenious scientific idea.

Mr. McCarty has been granted a basic patent on this method in France on September 26, 1912, the number of the patent being 448,757, and his United States basic patent bears application serial No. 701,219.

It is also stated in his communication that, in the apparatus used in his system, the speech accompanying the motion pictures is so perfect that it does not at all resemble a phonograph, and does not possess that "tin-canny" effect always so noticeable when the usual phonograph is used with a horn on same, or even when a number of horns are used. Also, this inventor claims to have invented a telephonic transmitter suitable for wireless and other work, which does not use any carbon, but instead a compounded product developed by himself, and which substitute is pronounced absolutely free from carbon, after chemical analysis. It is said to be far superior to the ordinary carbon transmitter, and is shortly to be tested out over the New York to San Francisco long-distance telephone circuit. It has also been tested with wonderful results over circuits 75 to 100 miles long, and works better in every way than the common carbon-grain transmitter.

MAKING TELEGRAPH RELAYS ACT AS SOUNDERS.

This is an age of improvement; new inventions for the betterment of the conditions of mankind and for his convenience are of almost daily occurrence.

Until quite recently, however, they have seemed to labor under the impression that the electric sounder had reached the perfect stage—that the local battery was a permanent fixture.

The new diaphragm telegraph sounder does away with both electric sounder and local battery. It is attached to the relay, and works from the main line battery.

Many devices have been employed with a view of making the relay loud enough to read without a sounder, but the device here pictured is claimed to be the only instrument that actually creates additional sound and intensifies it to practically any degree desired.

The concussion takes place within the air-tight diaphragm starting the vibration through the intensifier similar to the reproduction of the human voice by the phonograph. It has a strong, easily read, non-metallic tone that can be read with accuracy at a distance of a city block, and the adjustments may be so varied that no two instruments need sound alike.

New Amplifone Horn Converts Any Telegraph Relay Into Sounder.

Baron Münchhausen's New Scientific Adventures

By Hugo Gernsback

The Earth as Viewed from the Moon

I am in receipt of the following letter, postmarked Red Dog, N. M. It runs as follows:

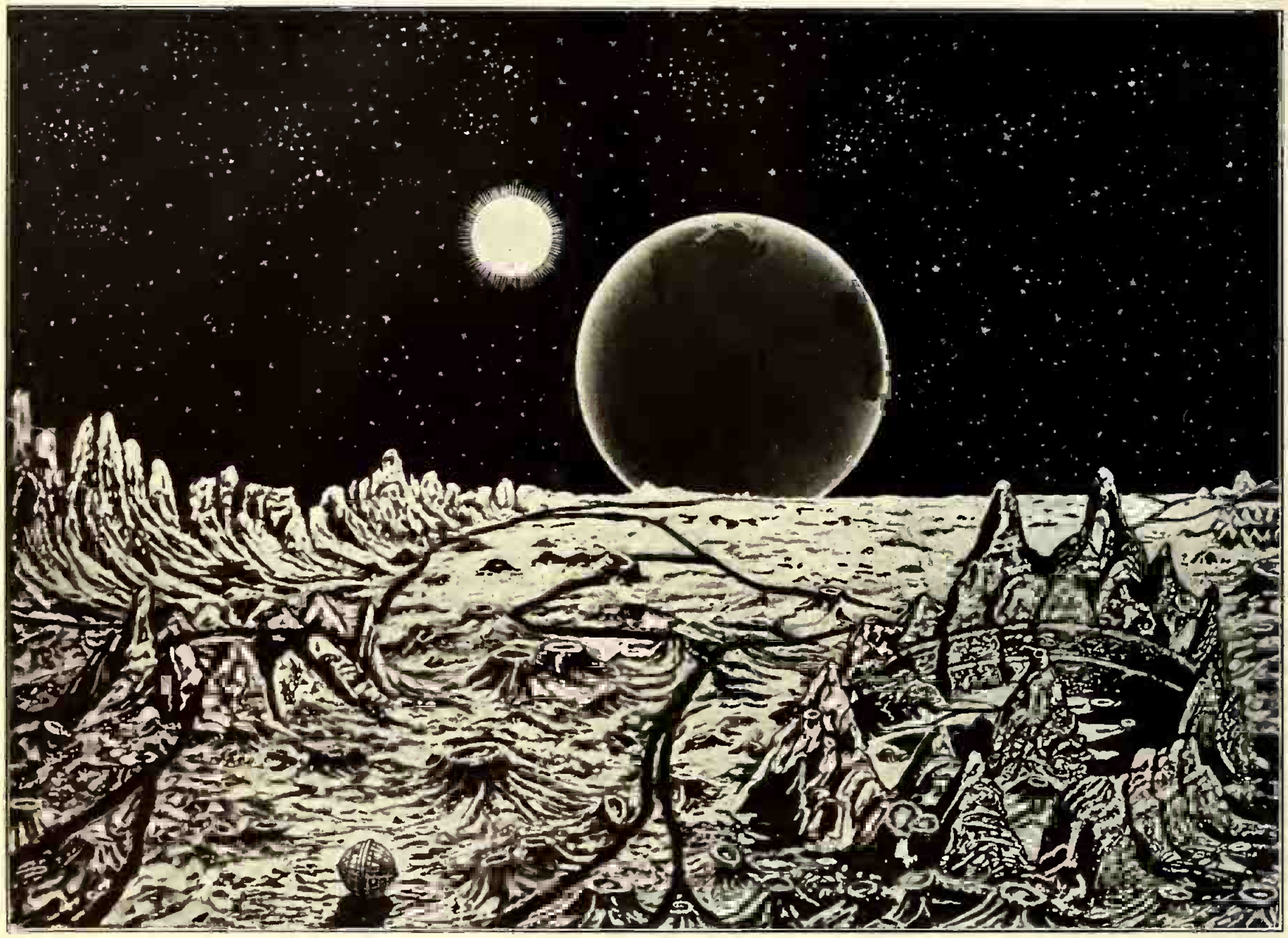
deer (?) *mister i. m. alier,*

i am onely a uneducatet cowboy & perhaps i aint much sens but hear i have been reeding those gosh-darned münchenhaus storys of yourn & i am all het up about em i an my pal mike cokkleberry has tryed making hed or tale out of em but it aint no use

the first storys werent kwite so bad but they getting fierse as you rite more of em but you kapped the klimaks as mike sais when you rave about this graviti busness an try to mak us believ that a objeck between here and the moon weihs nothin at all a pound is a pound isnt it anywere? an mike sais that he lernt in scool that a lb of lead weihs as much as a lb of fethers, so mike figgered if that is true well then how coud you weih 28 lb on the moon if you weih 170 lb on the erth a lb is a lb isn't it? gosh darn nonsens it is thats what i sais it is an you now it is we may be igorant out hear in the wooly west but we aint that kracked yet by a darnsite that aint all, when mike & i red about that münchenheimer of yourn shoting rocksalt at them germins so they had to skratch themselfs which made them throw up their hants we sure thoght that it was a grate trik an we tryed it on bad man rogers when we sees him last weak we didnt wish to kill him ded just wanted to hav some fun & watch him skratch hisself when the rocksalt got under his skinn

so we lays for rogers near bulfinsh crik when he koms riding that there evening on his way to ed sweezys place sos he woudnt now from where we ambushd him we had fixt a maksim silenser on our rifels an insted of bulets we use your rocksalt to shoot at him well everything goes loveli he koms all stuck up as usal on that fool hoss of hisn an when he is jest bi we pot at em mike at his leg i at his bak the guns go fss-sst—fss-sst and thats all but he must have herd the klik of our guns and he weels around in his sadel but instead of skratchin hisself in a agoni as he should he sneeses and sneeses and sneeses fack is he almost sneest his fool hed of after a wile when his sneesing gets weeker an his swaring louder he looks around suspishes like but he dont see us an so he rides on after awhile

mike an i looks at each other



. . . . At This Minute It Is NEW EARTH For Us On The Moon . . . . (C) E. P. Co.

flabergastet like and mike sais sais he, i had my suspishen of that feller alier now i now he is a fake darn his hide i thoght so to so we tryd it again & shot the salt again our windo pane when we git home wel would you believ it the salt never even touched the pane at all but when mike goes to inspeck the windo he almos sneeses his hed of that put us wise to it that when you shoot rocksalt from a gun it pulverises instinktly and the fine salt hangs in the aire around like a cloude of snees powder an when you git near it it gits in your nose an then you snees till the cows come home.

well maibe our salt wasnt as good as your frenchy kind & maibe we shoudnt of used a silenser on our guns but jest the same as a frend i adwise you never to kom out here to red dog for mike an i wont try rocksalt on you we'll use *reel* rocks

yours in disgusd
Bill snikeltree

HAS it ever occured to you how the earth would look to you if viewed from the moon? Did you know that it is *new earth* on the moon when it is full moon on earth? If you don't know these things—and you certainly should know them—let Münchhausen tell you.

In this instalment he gives you true scientific facts in plain English. The story makes twenty minutes of pleasant as well as instructive reading.

s.p. mike sais your name ougt to be U.R. alier not i. m. alier.

* * *

When I had established my wireless connection with Baron Münchhausen that evening I immediately read the above letter to him and demanded an explanation. The Baron merely chuckled softly and said:

"My dear Alier, you ought to know better by this time than to doubt my word. I am always glad to give details of any general statement I might make at any time. In this instance let me state that your correspondent, who seems to have but a limited education, is, of course, right as far as he goes. My first experiments with shooting rocksalt were exactly as stated by your cowboy friend: the salt *does* pulverize before reaching the enemy—that is, *ordinary* rocksalt does. Not the kind, however, that I used for the French and English Allies. For when I found out that ordinary salt went up in dust when shot from a gun I promptly set out to remedy this defect. I simply ground up the rocksalt and by means of a chemical binder I formed a stiff paste; this was then compressed hydraulically in dies under an enormous pressure into little sharp-pointed bullets about ½ inch long. After drying, the bullets were ready to be used by our soldiers. These compressed rocksalt bullets did not pulverize, and while they had not the great penetrative power of an ordinary bullet, they accomplished the purpose for which they were intended very well indeed. I hope I have satisfied you and your correspondent's curiosity."

I apologized meekly to the Baron for having doubted his word, after which I added:

"The public down here, Your Excellency, has been very much impressed with your recent adventures on the moon. I am daily in receipt of correspondence from people from all parts of the world desiring particularly to know what the appearance of the earth is as seen from the moon. Many wish to know if large cities and rivers can be seen, and some even go as far as to ask if you can see trains and people move about the surface of the earth. Large bets are being made by people on the above subjects and the newspapers are being besieged for information day and night. They all have now put it up to me to procure first hand official information from you, and I trust you will be good enough in helping me to relieve the abnormal tension."

I heard Münchhausen laugh softly before he replied:

"Well, well! I would never have believed that people take such an interest in astronomy, but it certainly shows signs of progress by the human race and it is worth encouraging.

Without desiring to deliver a dry, astronomical lecture, I think it best to state a few fundamental facts in order that I can make myself better understood. Anyhow most people's astronomical knowledge is rusty nowadays. Therefore I hope I shall not bore you unduly.*

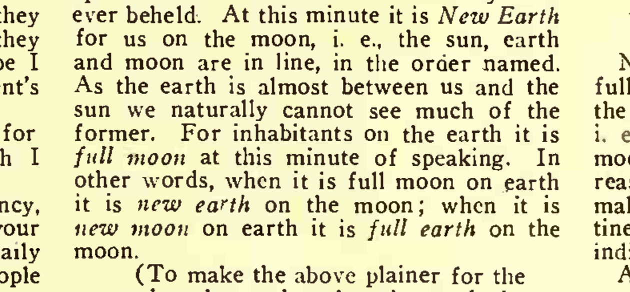
The moon is about 240,000 miles distant from its primary, the earth. It revolves about the latter in 27¼ days, always turning one side to the earth. For this reason the inhabitants of the earth can never see more than one of the moon's hemispheres. Thus the moon revolving around the earth in 27¼ days turns just once around its axis during this time. Consequently the length of the moon's full day is 27¼ terrestrial days, which gives it a night of almost two of our weeks, as well as a day of like duration.

Now let us turn our attention toward the physical aspect of the earth as viewed from the moon. I am now sitting at the foot of a precipitous mountain close to the bulwark *Ptolemäus,* which is near the moon's equator. When I lift my eyes earthward I am presented a wonderful spectacle such as no other human eye has ever beheld. At this minute it is *New Earth* for us on the moon, i. e., the sun, earth and moon are in line, in the order named. As the earth is almost between us and the sun we naturally cannot see much of the former. For inhabitants on the earth it is *full moon* at this minute of speaking. In other words, when it is full moon on earth it is *new earth* on the moon; when it is *new moon* on earth it is *full earth* on the moon.

(To make the above plainer for the reader the author has inserted the accompanying diagram and the following explanation:

The plain line represents the orbit of the Earth; the dotted line represents that of the Moon.

*The balance of this instalment is based upon actual facts, according to the latest lunar researches.—AUTHOR.



Explaining the Phases of the Moon and the Earth.

At point A the Moon crosses a point of the Earth's orbit which the Earth has already passed. At the expiration of about one-fourth of a lunation she arrives at B, at which time the Earth is between the Moon and the Sun, consequently it is *full* moon; pursuing her course she is now in advance of the Earth and crosses her orbit again at C. From C she continues on her course till at D she is between the Earth and the Sun, consequently it is *new* moon; from D she approaches near and nearer to the orbit of the Earth till at G she again crosses it 240,000 miles behind the Earth. This completes one lunation or revolution of the Moon around the Earth.

In order to show how the Earth and the Moon are lighted up by the Sun the zig-zag lines around part of the Earth and the Moon in the diagram represent the portions which are lighted. Thus it will be readily seen that at A the Moon is in its *first* quarter as respects to the Earth, while the Earth is in its *last* quarter as seen from the Moon. At C this order is reversed.

Again at F we see a duplication of the phases exactly as occurred when the Earth and the Moon were in the position as shown at A.)

Now, then, as the sun shines on our full moon the sunlight is reflected down to the earth, half of which naturally is dark, i. e., night. It is now night for you, the moon lighting up your landscape. For this reason it is possible for me to *just faintly* make out the outlines of the American continents. But it is mostly blurred and very indistinct.

A little to the left of the earth I see the sun—a wondrous sight. As there is practically no atmosphere on the moon the earth as well as the sun sail in a pitchblack sky. For the sky on earth is blue only due to the terrestrial atmosphere and its diffused sunlight. On the moon there being practically no diffusion our sky is naturally black all of the time. The sun, as well as all the stars, shine with a tremendous brilliancy never seen on earth, for our little atmosphere cannot soften the penetrating glare of the heavenly bodies as does the earth's thick atmosphere. Neither do the stars flicker as seen from here, for the "twinkling" is not of the star's making, it is but a product of the earth's air which brings about this phenomenon.

Again gazing earthward this is what I see:

A big almost black disc appearing to me about 14 times as large as does the full moon on earth; old mother earth assuredly is an imposing sight. Around the circumference of the dark disc I see a wondrous pink fringe—it is the earth's atmosphere illuminated from behind by the sun's rays. It (*Continued on page* 170.)

How Telephone Men Are Trained

TO the layman a telephone instrument is a rather mysterious contrivance. He knows that he has merely to signal the operator in order to talk into the transmitter and send his voice over the wires thousands of miles and through the receiver listen to another voice from many miles away. But the operation of the telephone system is not like that of a locomotive or street car, for example, because we can't see the wheels go round.

So when a telephone man comes to our office or residence to install a telephone or inspect and repair one which may be out of order, we may be pardoned for exhibiting a little curiosity as he deftly does his work. It all seems quite simple to him, however, because he has been carefully trained for this work, and every step has been taught him in a systematic and practical way.

The New York Telephone Co. maintains a plant school at 30 Gold street, New York City, where employees of the plant department are instructed in the work of installing and maintaining telephone instruments and the various methods of wiring, etc. It has been in operation since 1903, when it began in a small way as more or less of an experiment. It has grown steadily and taken its place as an important part of the company's organization, and many telephone men have received their first instructions in the principles of telephone practise here.

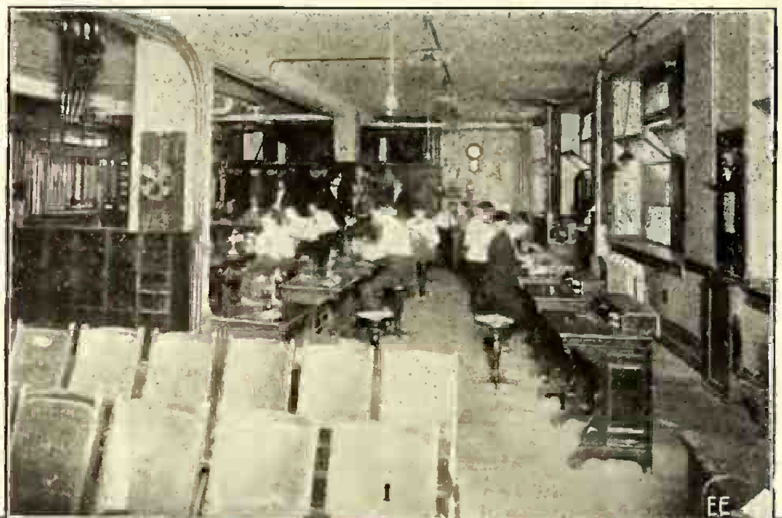
The object of the school is to interest and instruct the employees of the plant department in the telephone business, develop their ability to learn circuits and provide them with a suitable foundation upon which to build their knowledge of telephone practise as they gain experience in the field.

The period of instruction covers from 10 to 12 weeks, four weeks being spent in the school. The capacity of the school is sufficient for 50 students.

Three views of the highly developed plant training school maintained by the New York Telephone Co. are shown herewith. The illustration at Fig. 1 shows a general view of the school. Each student sits before a small switchboard with the proper devices on same specially arranged to teach him in the shortest time how telephone switchboards work, and also it is possible for the instructors in charge to throw a multitude of "faults" or troubles on the boards, and the time is then checked carefully which it takes the student to "clear up" all of these troubles. In some cases several hundred "faults," such as short-circuits between wires, grounded wires or cables, bell troubles, relay troubles, etc., can be simultaneously thrown on such a board, and the student is required to quickly clear up these artificially made "faults."

A closer view of students performing this testing and *trouble shooting* on switchboards is seen at Fig. 2. The students, as will be observed, are given personal instruction, and this of course conduces to their rapid education and training. A corps of telephone experts are in charge of the school who are men of wide experience in such matters.

In the illustration at Fig. 3 several students may be observed wiring telephone branch exchange circuits, this being *third grade work,* as it is termed in the school. This is very important work and must be learned exactly and the student must show considerable skill in handling the soldering iron, as many hundred small joints between wires and connecting studs are to be soldered in a very neat and workmanlike manner; or, in other words, the job must be done perfectly from a mechanical and electrical standpoint. A loose joint, caused by improper soldering, can cause a telephone circuit to be worthless for transmitting speech over. Hence, the great importance of training these men to do their work as perfectly as possible. They must know the why and the wherefore of everything.



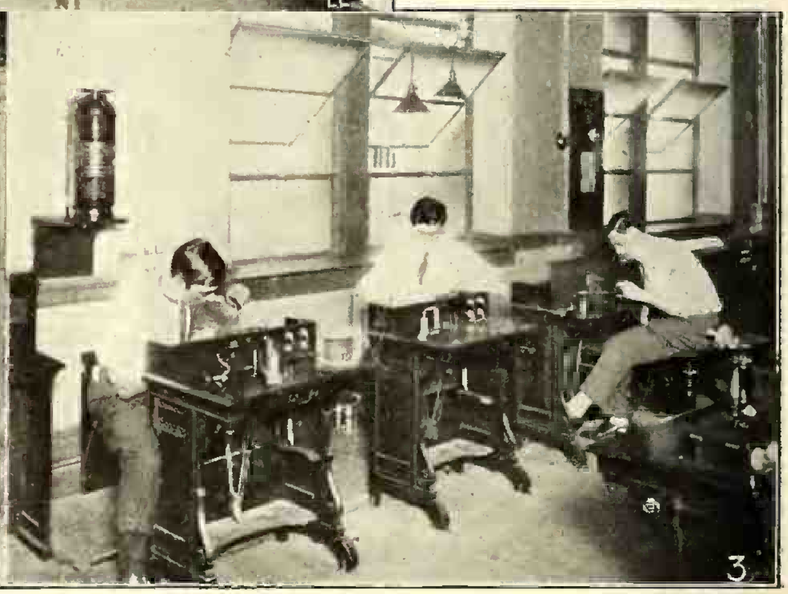


Illustration Fig. 1. Shows General View of the New York Telephone Co.'s Plant School. Fig. 2. Students Testing Sub-Station Instruments For Trouble—Second Grade Work. Fig. 3. Learning How to Wire Up Branch Exchange Circuits—Third Grade Work.

TO HONOR WIRELESS HEROES.

The dedication of the Jack Philips *Titanic* memorial fountain at the base of the tower of the United States Barge Office, New York City, took place last May.

President McAneny, of the Board of Aldermen, received the memorial on behalf of the city. It consists of a cenotaph shaft 8 feet high with seats on each side and a fountain in the center, all of granite, and a background of cypress trees.

The funds to erect the Philips Memorial were collected by the wireless operators on Atlantic and coastwise steamships on both oceans and amounted to more than $3,000. It is intended to have the names of all operators who have lost their lives while on duty inscribed on the cenotaph as a record of their bravery and to inspire others to emulate their example in the time of danger. The names on the memorial are:

George C. Eccels, s.s. Ohio, Aug. 26, 1909; Pacific Coast.

Stephen F. Sczepanek, s.s. Pere Marquette, Sept. 9, 1910; Lake Michigan.

Jack Philips, s.s. Titanic, April 15, 1912; Atlantic Coast.

Lawrence Prudhunt, s.s. Rosecrans, Jan. 17, 1913; Pacific Coast.

Donald Campbell Perkins, s.s. State of California, Aug. 18, 1913; Pacific Coast.

Clifton J. Fleming and Harry Fred Otto, s.s. Francis H. Leggett, Sept. 18, 1914; Pacific Coast.

Adolph J. Svenson, s.s. Hanalel, Nov. 23, 1914; Pacific Coast.

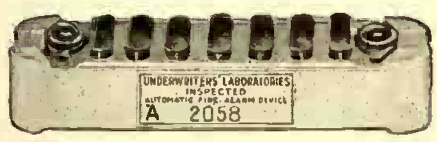
Ferdinand Kuehn, s.s. Monroe, Jan. 30, 1914; Atlantic Coast.

Walter E. Reker, s.s. Admiral Sampson, Aug. 25, 1914; Puget Sound.

Space is left for the addition of other names in the future.

NEW THERMOPILE FIRE DETECTOR.

A fire alarm system consisting of a number of thermopiles which are distributed throughout the building to be protected and which are connected in series to a galvanometer cabinet has recently been placed on the market. Connections are also made from the cabinet to fire alarm bells and to a trouble buzzer. The cabinet contains, in addition to the test resistors, the special galvanometer which is connected to the thermopiles. A break in the circuit, a drop in battery voltage or a total failure of the



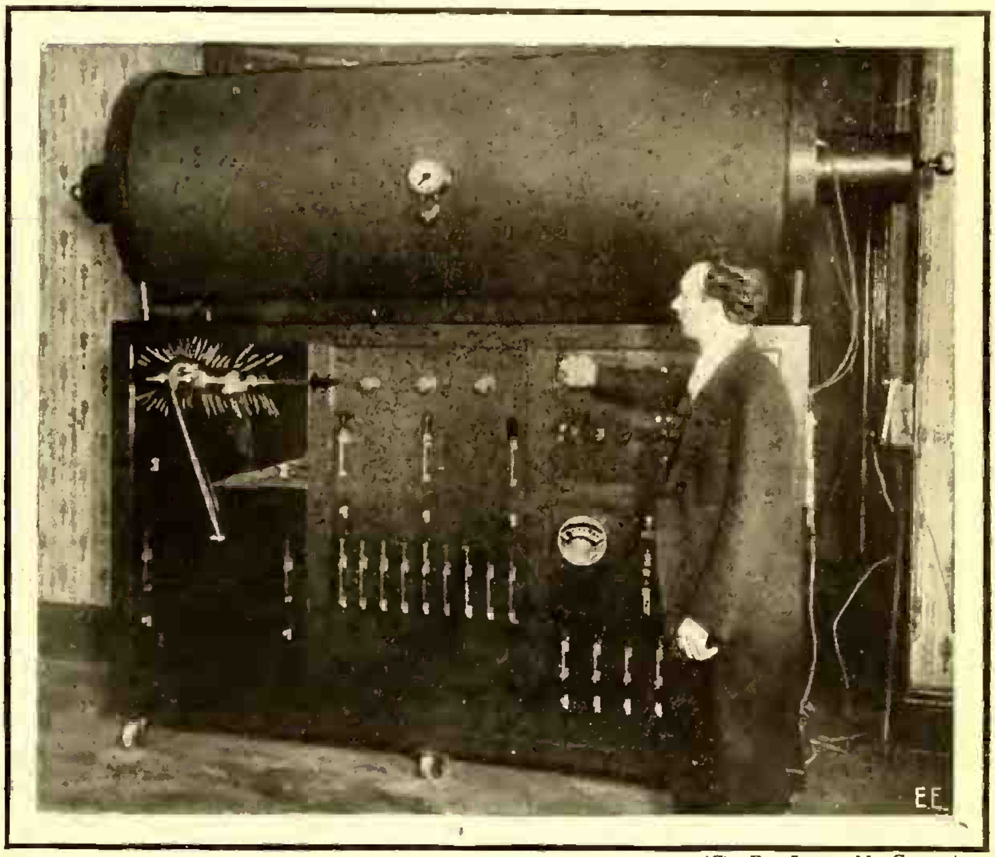
New Thermopile Fire Alarm.

battery will cause the operation of a trouble alarm, which continues until the trouble is remedied. The deflecting pointer of the galvanometer is held in its normal position by the test current in the thermopile circuit. When suddenly energized by current from the thermopiles the pointer is moved into contact, sending in a fire alarm, and when de-energized the pointer is moved into contact for the trouble alarm. The thermopiles consist of cubes of dissimilar metal connected in couples and mounted in porcelain. The joined ends of the couples are exposed, while the other ends are concealed in the base. According to the manufacturer, a temperature rise need not be more than 10 degrees Fahrenheit, but must take place within 60 seconds in order to operate the fire alarm. The alarm will be operated just as quickly whether the temperature of the room at the time of the fire is at zero or at any higher temperature. A single thermopile is designed to operate throughout a maximum floor area of 400 square feet. The maximum distance between centers of thermopiles in general is recommended to be about 25 feet, and in corridors 40 feet.

New Harmless Ray To Do X-Ray's Work.

Every person who has had experience with X-ray work knows of the severe burns which the ordinary X-rays give when worked with constantly. These defects are now overcome by the discovery of a new *ray* by Charles H. Stanley, of New York City. This new ray can be put to the same uses as the X-ray and more, and produces very satisfactory results. It is harmless and does not necessitate the operator "screening" himself in order to perform his work safely, as is the case with the old and dangerous X-ray.

Fourteen years of experimentation and research were expended before this new and harmless ray was perfected. The photograph herewith presented shows Mr. Stanley, the inventor, standing near his apparatus, which consists of a specially designed high frequency coil, producing a tension of one million volts and a discharge between two terminals, which can be separated 39 *feet apart*. This coil is so made that several different frequencies are sent to the X-ray tube, so that the production of the X-rays in the evacuated tube is constant and not flickering, as in the old tubes, using ordinary coils or high frequency machines. Note the immense size of the apparatus. This new ray cannot be developed with smaller apparatus, it is stated. Various kinds of current, such as Tesla, high tension, static, Oudin, etc., can be produced by this machine just by changing the switches, shown on the front of the apparatus.



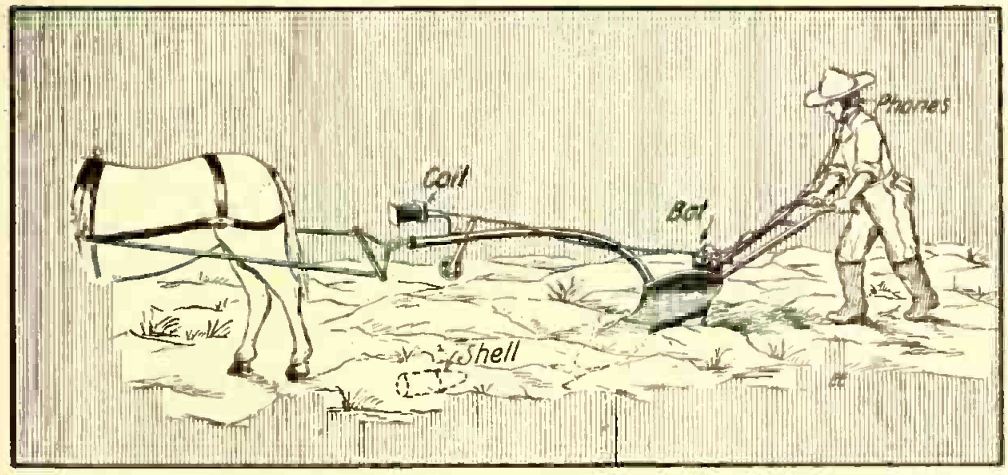
(C) By Janet M. Cummings.

Marvelous New X-Ray Machine Capable of Producing Sparks 39 Feet in Length. Its Inventor, Charles H. Stanley, is Shown in the Picture.

So powerful is this ray that X-ray pictures can be readily taken 35 feet from the tube and strong effects are also produced on a fluoroscope. It has also a great healing effect on cancer, tumors and similar diseases which the ordinary X-ray has not, or at most to a very small extent. Therefore, this new invention may prove a wonderful remedy for the now incurable diseases. It is called the "Stanley Ray," after its inventor.

FINDING UNEXPLODED BOMBS ON EUROPEAN BATTLEFIELDS BY ELECTRICITY.

One of the most dangerous propositions the European tillers of the soil have to contend with under the present war conditions is that of running their plow into an unexploded shell. Most of these shells are exploded, as is well known, by coming in sudden contact with some other body, and, of course, a moving plow forms an ideal means by which to explode such shells, which may have buried themselves several inches in the soil.

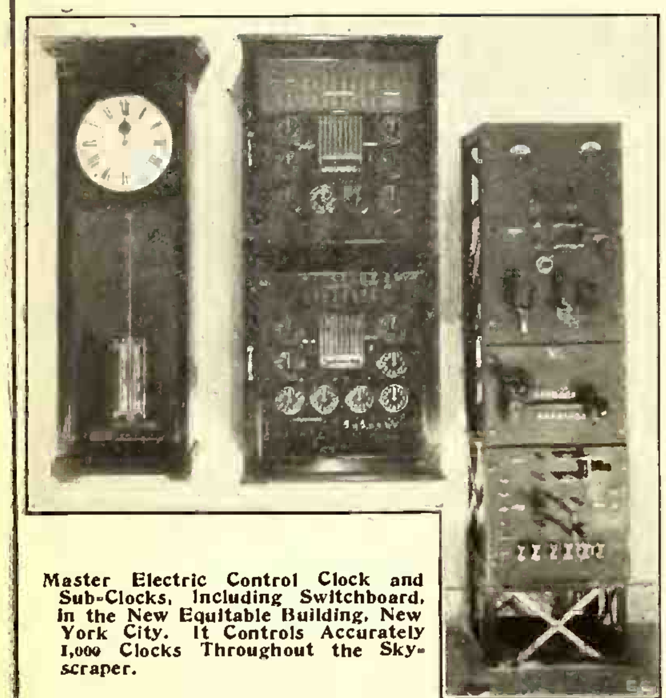


The Plowman on European Battlefields Uses An Exploring Coil, Attached to the Plow, to Determine the Presence of Unexploded Shells.

To obviate this, there is now being used in France an electrical exploring coil, arranged to extend two or three yards ahead of the plow by being suitably supported on a small arm mounted in front of the plow, the coil being properly excited by a buzzer interrupted current from a battery carried on the plow frame. The man doing the plowing wears a set of sensitive telephone receivers on his ears, and whenever the coil, and conjointly the plow, comes within a couple of yards or so of such unexploded shells (which are made, of course, with a magnetic or steel jacket) a difference in the tone of the interrupted current in the head phones is perceived. He then knows that he should examine the ground carefully.

NEW ELECTRIC CLOCK SYSTEMS OF THE EQUITABLE BUILDING.

The most difficult problem of to-day in modern office buildings is the regulation of the clock system. The photograph here presented shows the complete mechanism for controlling one thousand electric clocks in the new Equitable building, New York City.



Master Electric Control Clock and Sub-Clocks, Including Switchboard, in the New Equitable Building, New York City. It Controls Accurately 1,000 Clocks Throughout the Sky-scraper.

The master clock is shown at the left, which is connected to two sets of relays mounted on a panel shown in the center of the picture. These relays are connected electrically to 16 different lines in the building to which all the secondary clocks in the separate offices are connected. The 16 secondary controlling clocks herewith shown in the panel are connected in parallel with each line. This is done to indicate to the operator the condition of the line. If any one of them stops he can readily see which line is out of order and thereby save time in finding the trouble. Each line has a set of fuses, and also the master clock circuit is properly protected by circuit-breakers on the main panel seen at the right of the photo.

The current used for this system is supplied by a storage battery of 24 to 30 volts, controlled by a switchboard seen at the extreme right. An end cell switch is provided for regulating the battery voltage. The clocks are electrically wound and synchronized by means of a step by step magnetic method. This clock system represents one of the finest and most accurate ever installed in this country. Compare this masterpiece of an "automatic electric time-keeper" with her 1,000 wards to the accuracy attainable if the old-time clockman regulated each of the 1,000 clocks by hand. —Photo by courtesy of *Architecture and Building.*

INSTITUTE OF RADIO ENGINEERS MEETING.

At the last meeting of the Institute of Radio Engineers before closing for the summer holidays and held on June 9 at Columbia University, New York City, two excellent papers were read as follows:

"Engineering Precautions in Radio Installations," by Mr. Robert H. Marriott. B. Sc., and the second paper was entitled "Static Elimination—Some Suggested Methods," by Prof. Dr. Alfred Norton Goldsmith, of the College of the City of New York Radio Laboratory.

Both of these papers were well received and contained some new and vitally interesting points on radio matters.

Mr. Marriott's paper dealt at length with the proper installation of all wiring on shipboard for radio sets, such as grounding or iron pipes containing wires and the grounding of all auxiliary metal parts in some cases. It was recommended that all metal members on the vessel be grounded, especially when powder or highly combustible or inflammable materials were to be carried. He explained at length that practical tests had shown that sparks would be produced between various metal parts on the ship and other metal parts, which latter might be grounded, or even between two insulated metal parts. In some cases even the rails around the decks have become charged by induced radio currents, and therefore all metal fittings should be well grounded to the metallic hull of the ship.

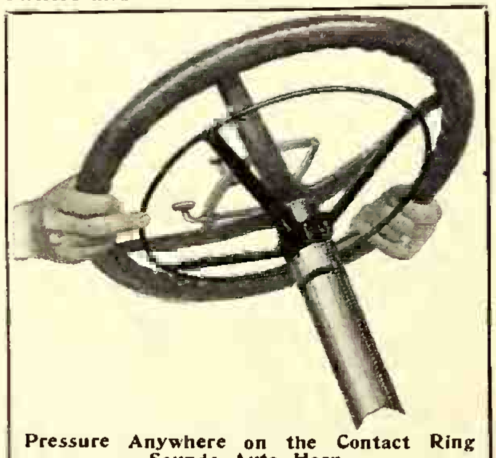
Prof. Goldsmith's discourse was rather hyper-scientific and quite difficult of practical demonstration or adaptation. It related to shielded aerial wires, etc.

Some interesting discussion was indulged in by those present, and Prof. Ferdinand Braun, of Germany, the famous radio authority, took an active part in same, as did also Mr. Weigant, designing engineer of the Marconi company.

IMPROVED SIGNAL-HORN SWITCH FOR AUTOS.

The new Seng switch recently developed for operating electric signal horns on automobiles, and shown in our illustration, possesses considerable merit, it seems, as no matter at what point of the steering wheel the hands grip same, it is always possible to operate the electric horn by just touching the "complete" contacting ring, which is shown mounted below the steering wheel proper.

German silver contacts are used in the make-up of this special switch and it should find a wide application among motor car owners and drivers of same.



Pressure Anywhere on the Contact Ring Sounds Auto Horn.

The switch is so made that it can be attached in a few moments' time to any steering wheel head, and it is provided with a length of flexible conductor with substantial insulated covering on same.

ELECTRIC HOUSE WIRING TROUBLES.

By W. F. Bennington.

PROPERLY installed electrical apparatus is the safest and healthiest means of providing heating and illumination. If improperly installed, however, it often becomes a source of extreme danger. The rules which govern the installation of electrical apparatus in this country are issued by the National Board of Fire Underwriters and are exceedingly rigid. To the average man they seem extreme. The matter of safety depends to a great extent on the honesty of the electrical contractor in properly installing the wiring and apparatus in accordance with rules of the above board. To receive the approval of the National Board of Fire Underwriters any electrical apparatus must pass a series of rigid tests before the approval is granted to the manufacturer. Wire is put through an exceptionally rigid test for insulating properties. Although the use of "approved" apparatus and wire may help to prevent trouble, the greatest source of danger lies with the electrical contractor and the help that he employs. A carelessly installed wiring system will sooner or later cause trouble and necessitate endless repairs and annoyance.

Perhaps the greatest source of trouble is *loose connections,* which cause heating and eventually the destruction of the connection itself. The heat from a loose connection will start any woodwork smouldering that is in contact with it. As a general rule these connections are out of sight and the trouble may continue for weeks without giving any warning. Suddenly there is one of those fires that seem to start from nowhere and are due to the fact that some careless workman neglected to tighten a screw or left a joint poorly soldered. Very often, however, a loose connection will give evidence of its existence by the flickering of the lights. This should have immediate attention, as it is sure to mean that something is the matter. As a general rule people blame the lighting company and talk about "inefficient service." Sometimes this is the cause, but don't take chances—find out. Turn on all the lights in the room and see if they flicker. If they do turn on all in the house and see if they are affected in the same way. If you find that one room alone is affected go to the distribution box and see if the fuses that control that room or part of the house are loose and tighten them up if necessary.

Loose fuses are often the cause of flickering lights. Should you find that all lights in the house are flickering and that the connections to the service are all tight, then call up the lighting company and tell them about it. If the trouble seems to affect only one room or part of the house and you cannot locate any loose connections or fuses, call in an experienced electrician and your troubles will soon be past. Make yourself familiar with your lighting system and know just where the fuses for each part of the house are situated and also keep a supply of spare fuses handy. This will save you a large amount of trouble and inconvenience, as it is unnecessary to call in an electrician every time there is a fuse blown. A few moments' explanation by a man familiar with house wiring and you can install your own fuses.

Don't overfuse your circuits. If a circuit is intended to carry a current of 10 amperes, don't put 30-ampere fuses in. The fuse is similar to the safety valve on a steam boiler, and putting 30-ampere fuses where 10-ampere should be is exactly the same as setting the safety valve of a boiler at three times the pressure that the boiler will safely carry. By putting in fuses of a higher capacity than the circuit is wired for you stand an excellent chance of causing trouble that will be expensive to repair.

We come now to one of the most common troubles and one that is little understood by those not familiar with electricity. A copper wire will carry only a limited amount of current with safety. Should you exceed this amount the wire will begin to warm up, and the more current you cause it to carry the greater the rise in temperature, until finally it will come to the melting point and "blow out." Overloaded wires are the cause of many fires that "cannot be accounted for." The permissible amount of current for a wire of any size is determined by the regulations of the National Board of Fire Underwriters and should never be exceeded without special permission. This is a subject for the electrician to determine. The capacity of your wiring should be sufficient to carry all that you would be likely to use and also to allow for any future additions that you might wish to add. The trouble comes when Mrs. Smith or Mrs. Jones buys some of the modern electric heating devices, such as flat irons, toasters, percolators, etc., brings them home and screws them on the socket. If the circuit is fused just enough to carry the lighting circuit of that room the addition of the new device will blow out the fuse if the current it takes is in excess of the fuse capacity. Perhaps the fuse capacity is too large, and then she may add one thing after another until the wires are carrying more than they can stand and then they will "blow open" or overheat and cause a fire. The best way is not to take chances, but when you wish to install some of the new heating devices call up the electric company and have them look the circuit over.

And now a few words regarding "shocks." The average lighting circuit is about 110 volts, and one might almost say harmless as far as injury from a shock is concerned. All apparatus made to-day for home use is carefully insulated and the danger of receiving a shock slight, but this does not mean that little Willie can take a screwdriver and try to dissect the anatomy of your table lamp. He will not be injured by the shock, but it is almost certain that he will give himself a nice burn and in all probability spoil the lamp, if not the fittings to which it is attached. This applies not only to lamps and sockets, but to electrical apparatus in general.

My advice to any man who does not understand his lighting system is to let it alone. Your effort to avoid a bill from the electrician may result in burned fingers and spoiled apparatus. Call the man who knows just what he is doing, and the chances are that the trouble is small if your house has been properly wired. Let it alone—it pays.

Porcelain sockets should be used in any place where there is a chance of moisture, or where people are likely to get into contact with the ground. The "ground" means water or steam pipes or any metal that is connected to the earth. Bathrooms and cellars are places where porcelain sockets should be used—the bathroom especially, as there people often stand in their bare feet, with wet hands, and water is an excellent conductor. Death has been known to result from turning on an electric light while in the bath, though deaths from the average lighting circuit are very rare indeed.

Familiarize yourself with your lighting circuit, observe the above suggestions and you are sure to save time, trouble and expense. There is no mystery about house wiring or apparatus. Spend an hour or so with your electrician, let him explain to you how it works and you will find it an excellent investment. Remember! Safety first.

ELECTRIC CHART TELLS PERCENTAGE OF DEATHS IN NEW YORK CITY.

It is pointed out that of every hundred children born in New York City 11 die within a year, in a recent number of the *Edison Monthly* magazine, and only one attains the age of 90. The city no longer produces centenarians.

A short time ago the Department of Health conducted a statistical study of the ages of the persons dying in New York. This detailed study covered a period of 13 years and involved 225,000 deaths, the figures here quoted being based on this record.

In the illustration is seen the novel method employed to graphically show the rise and decline of the population in the city. This electrical lamp-board is exhibited at the department's museum on Centre street, in the metropolis. In all, there are 100 incandescent electric lamps mounted on the lamp-board, in rows of 10. A specially arranged automatic flasher lights all of the lamps first; then at intervals of several seconds the flasher extinguishes the lights, until the chart, in a very striking manner, shows that all have died before reaching the age of 94.

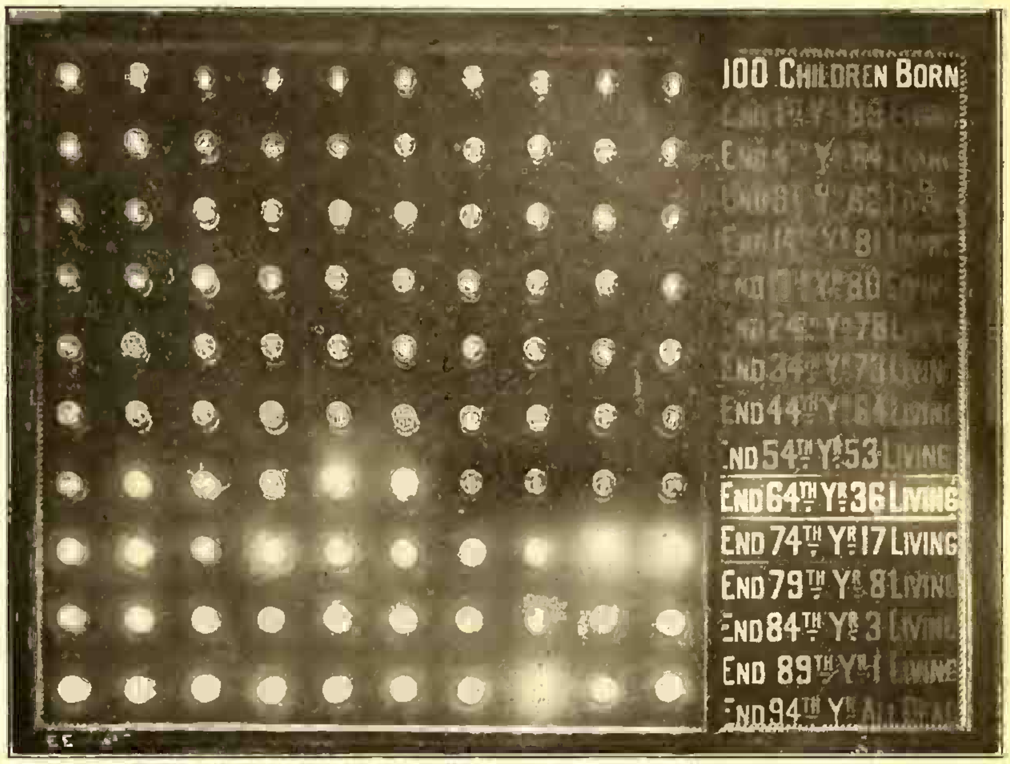


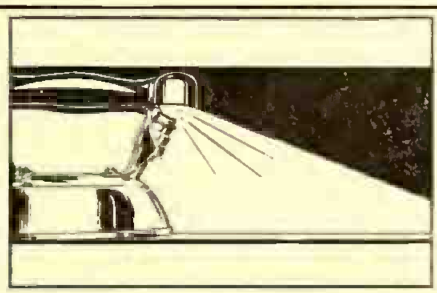
Photo Courtesy of New York Edison Co.

Electric Lamp Chart Depicts in Graphic Manner Mortality of a Great City.

This idea can very well be applied to many other branches of city departments, or also in many industrial corporation offices where records are to be studied by a number of interested people simultaneously. Besides, this method has a very striking effect, not made posible by any other means of indication.

ELECTRIC IRON CARRIES HEAD-LIGHT.

An electric iron with a feature that is entirely new has recently been developed by a Pittsburgh concern. This feature is a small *Mazda* lamp attached to the iron in front of the handle. On account of the presence of this lamp, the iron has been named the "Hedlite Iron." Due to the fact that the lamp is only a few inches above the surface to be lighted, it gives more light upon the ironing board than would be obtained from several large lamps located in a ceiling fixture.



Electric Sad-Iron Carries a Head Light.

The lamp is provided with a metal reflector, which has a shield to keep the light from striking the eyes of the operator, both when ironing and when the iron is at rest in a vertical position. The lamp socket is supported by the front handle bracket and the supply wires from the lamp are carried through a metal tube to the interior of the iron.

The lamp burns whenever the current flows through the iron and thus acts as a warning signal if the current has been left on by mistake. The current consumption of the lamp and iron is 500 watts. The iron is made in both tilting and stand types. The lamp is especially desirable and efficacious where there is only one outlet, as is frequently the case in apartments and small dwellings.

LIGHTNING RODS REDUCE PROPERTY DAMAGE.

In the annual report of W. E. Longley, State Fire Marshal of Indiana, attention is called to the fact that, as a result of the increasing use of lightning rods on farm buildings, only 453 cases of lightning damage were reported in Indiana during 1914, compared with 1,006 during the preceding year. "Lightning rods properly placed afford certain protection," declares the fire marshal, "for only seven buildings equipped with rods were struck during 1914. In these seven instances investigation showed that the rods either had gone a long time without proper attention or were not properly grounded."

Some Famous Electrical Laboratories.

PROBABLY there is no electrical concern who maintain a finer or greater variety of testing and research laboratories of every description than those of the General Electric Co., whose main plant is at Schenectady, N. Y., and who also maintain extensive plants at East Lynn, Mass., and several other cities.

The views shown herewith are those taken of some of the principal laboratories of this company at Schenectady. The portrait in the center of the group is a likeness of Dr. Charles P. Steinmetz, chief engineer of the General Electric Co.

eventually reach some satisfactory solution of their multifarious problems, thanks to the brilliant staff of specialists they maintain and also to the extremely fine laboratory facilities afforded.

In Fig. 1 of the illustrations here presented is seen a section of the chemical laboratory, where all kinds of acids, salts, rare metals and oxides, etc., are kept ready for any kind of research work encountered. In the illustration at Fig. 2 is seen a corner of the special research laboratory, where various kinds of new lamps, vacuum bulbs, etc., are electrically tested out. A desk fan may be observed mounted on a portable stool and blowing a draught of air on a special electric tube, noticeable just to the left of the "danger sign." A second tube of this type is also shown, illuminated, toward the left of the picture.

Several Views of the Wonderful Research Laboratories Maintained by the General Electric Co., at Schenectady. Center: Chief Engineer Dr. Charles P. Steinmetz.

This renowned engineer and scientist has associated with him some of the leading scientists and research workers of this country, and in this brilliant array appear the names of Irving Langmuir, Sol Dushman, Coolidge, and many others of whom perhaps we have not heard much in a popular way, but who are hard at work solving the many problems confronting such a vast corporation as this. Every imaginable kind of research work is done in these laboratories, including the fields of physics, mechanics, optics, all branches of electrical science, X-ray and incandescent lamps, chemistry, etc., ad infinitum. This will be the more impressed upon the reader's mind when it is said that the General Electric Co. never attempts to do a thing half way, but always goes to the bottom of any problem tackled. Also they, in most every case,

In Fig. 3 is depicted a section of the high voltage testing laboratory. Here extra high voltage insulators and insulating materials, etc., are tested for break-down strain or electrical resisting strength. Great care must be observed by those working in these high voltage laboratories and danger signs are kept posted, marked with proper warnings. X-ray tubes are tested out in this laboratory also. High voltage alternating and direct current is available for this class of work, and practically any voltage desired for tests here conducted is available at any frequency desired from 60 cycles up to half a million cycles per second or more.

Another view of one of the chemical laboratories is shown at Fig. 4, and here is observed also a set of electric ovens used for heating and other purposes. These electric ovens have rheostats located on the bench beneath them, so that the heat may be very finely regulated to any required temperature desired by the chemists.

Every modern appliance is at hand in these wonderful laboratories and they are probably the best equipped in the country to-day, if not in the world. No problem is given up until all of the research staff have had a try at it, and many marvelous inventions have been developed in these always busy "think factories."

TO LIGHT NIAGARA WITH SAN FRANCISCO EXPOSITION SCINTILLATORS.

A movement has been organized in the sister cities of Niagara Falls, N. Y., and Niagara Falls, Ont., to acquire the battery of electric searchlamps now being used for the scintillator illumination at the Panama-Pacific Exposition at San Francisco, and to provide for the electrical illumination of the Falls during a number of months of each year.

Are you a subscriber? Better decide now so you will not miss the many good things in the forthcoming September issue, 64 pp.

How Telephone Transmitters and Receivers Are Made

Do you know of the vast research work back of the telephone instrument you use daily? Telephony has grown to be one of the most highly specialized of applied sciences. How the separate parts of every instrument are exhaustively tested is explained in this article.

LITTLE does the average person, using the modest-looking telephone of to-day in its neat black dress, dream of the stupendous amount of money and engineering end of the game. We shall in this brief discourse endeavor to look into some of the more interesting aspects of the making of the telephone instruments. The wonderful history of its inception and perfection have been well cared for in the extensive literature of the day and we will not take up the reader's time with such matters here, as space does not permit. Those interested would indeed do well to read Herbert N. Casson's wonderfully interesting treatise, "The Romance of the Telephone."

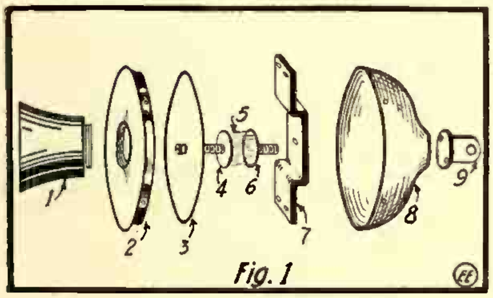


Fig. 1. Parts Making Up the Telephone Transmitter.

The Transmitter.

There are, of course, many different styles of telephones on the market, but as all are made up of essential parts, known as the *microphone*, into which we talk, and the *receiver*, which reproduces our speech, with more or less auxiliary attachments, we shall consider the most important parts, viz., the microphone and the receiver.

The "Bell" instruments used in this country are manufactured by the Western Electric Co., and as these have been simplified and standardized to a remarkable degree the greater part of the work here mentioned is that performed on "Bell" type sets.

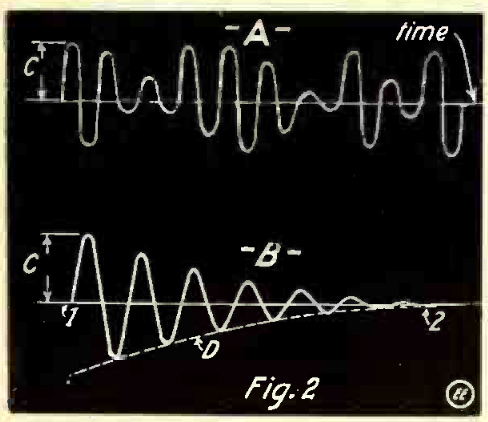


Fig. 2. At A, the Varying Voice Waves. At B, the Decay of Diafram Vibrations From Maximum Amplitude to Zero.

Take first the modern microphone, which picks up our spoken voice air waves and transforms them into undulating electrical currents, which are carried over the line to be retransformed into air or speech waves at the distant receiver. Its principal parts are observed in Fig. 1. The spoken voice sets up air waves which are projected into the mouthpiece and against a thin iron diaphragm 3, supported tightly all around its rubber-bound edge in the brass plate 2. The diaphragm 3 has secured at its center a small screw and nut, the inner end of the screw or stud carrying a polished carbon disc 4. A similar disc, carried by a metal bridge bar 7, forms the microphone chamber 5, which contains a small quantity of carbon grains. The transmitter parts being quite delicate, of course are contained in a strong punched-brass shell 8. A swivel or trunnion lug 9 is secured to the base of the shell, thus allowing it to swivel up or down in the manner we all know.

This will give a clear conception of the most important parts of the microphone, or transmitter, as it is termed. Each of the parts outlined and making up the complete instrument is the final result of vast technical research in the storehouse of Dame Nature.

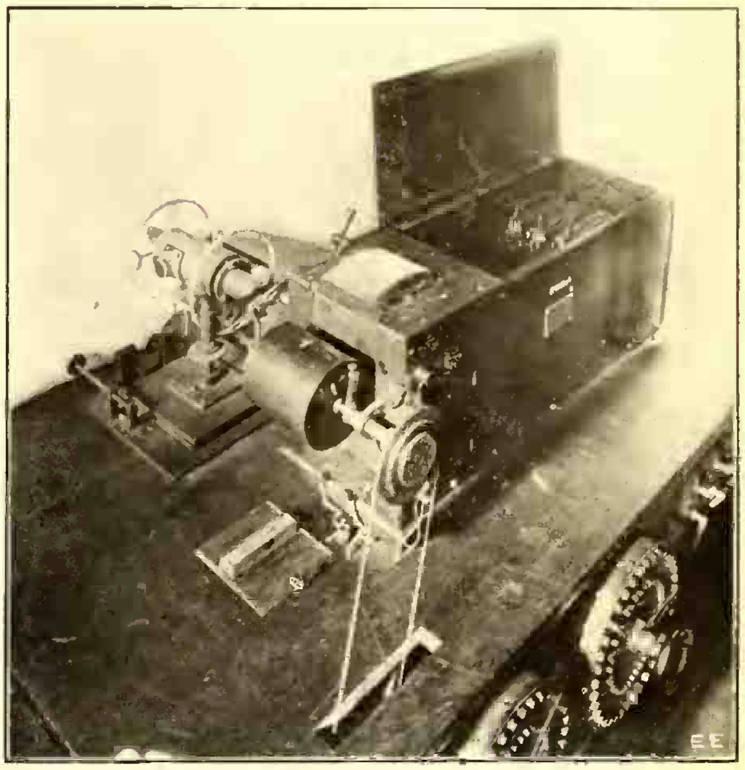


Fig. 2A. The Electrical Oscillograph Which Traces the Diafram's Vibrations on a Moving Strip of Film.

The mouthpiece No. 1, for instance, although it looks very simple, has a history of its own. In the first telephone the mouthpiece was simply a hollowed-out portion on the wood front of the cabinet. Later a wooden funnel was introduced. This progressed through various stages of fibrous and hard-rubber composition, and some of the latest tried out were of glass and porcelain. Glass is very sanitary, but extremely fragile. Porcelain is still going through the test stage. "Condensite" is one of the newer synthetic compositions being tried out for the mouthpiece and possesses many good qualities, notably strength. It may be dropped on the floor without breaking. The mouthpiece is an important part indeed, and its shape and "sound" qualities are always going through research tests to find something better. That, in truth, may be taken as the slogan of the telephone specialist: "Something better." The search is everlasting and constant.

Consider the front plate of the case, or part No. 2. For many years this was composed invariably of a cast-brass or alloy plate. Now it was found, by observation and exhaustive trials, that it was practically impossible to produce a cast plate for this purpose which could be polished and nickel-plated, that would show up absolutely smooth and free from blemishes due to air or "blow-holes" in the casting.

Hence a staff of technicians were started to work on this problem, with the result that the plate is now made of a special bronze or brass alloy, made to a specified chemical formula and rolled in sheet form. The discs are blanked out in massive punch presses, electrically operated, and after passing through several punching and bending stages, we have the finished part ready for nickel-plating. Only a certain alloy will permit of the many and intricate bending and forming operations necessary to give it the proper shape. Sometimes a whole "lot" of sheeting cannot be used, owing to a slight difference in its chemical make-up, etc., causing it to crack while being punched and formed. Even the nickel-plate on the surface of it is scientifically investigated and the heaviest plating ever used is applied to give maximum "wear resistance."

The diaphragm 3 is the part the average user of the telephone never sees, because it is hidden behind the plate 2 and perforated mouthpiece 1. This is one of the most closely studied parts in telephone science. Bell and Watson, in the early days, tried out all sizes and thicknesses of diaphragms, and the research in this direction has gone on ever since. The transmitter diaphragm need not be magnetic in character, and many different materials have been exhaustively experimented with, such as mica, gold-beaters' skin, fiber, brass, etc.

The present "Bell" diaphragm is made of a certain quality sheet iron, the thickness being specified in thousandths of an inch, as well as its chemical constitution. To prevent rusting, they are treated in various ways. Some of these methods consist of "Sherardizing," electro-deposits of zinc, coating with Japan enamel, etc.

This covers some of the physical sides of the problem. When the finished dia-

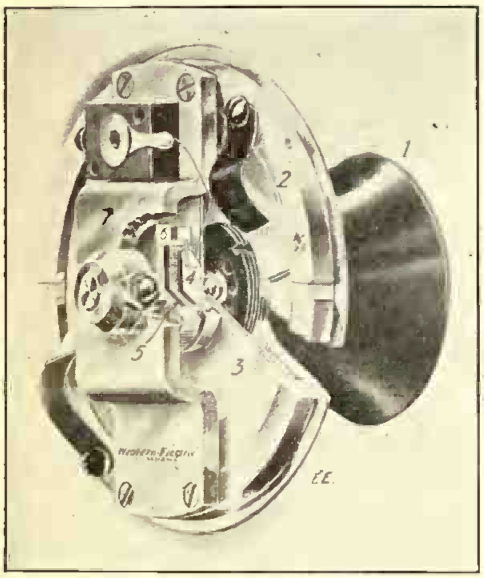


Fig. 3. Assembled View of Telephone Transmitter, Showing Carbon Grains, Etc.

phragm is ready for the electrical laboratory it undergoes a thorough and relentless test for various properties such as its elasticity and ability to follow faithfully the voice-wave undulations or vibrations. The voice waves are of many forms and frequencies and it is very important that a microphone diaphragm shall be able to pick up all the more important "speech-component" frequencies in the great numbers of complicated wave forms occurring in the average voice.

For the study of the diaphragm's vibrations an electrical oscillograph is utilized. This device records the vibration characteristics of the diaphragm when used for "speech" functions and also the time-period of its decay to a neutral or zero-vibration period after it has vibrated to maximum amplitude. Oscillograms of these vibrations are depicted at Fig. 2. The upper set of waves or ripples "A" are those of voice vibration, while the lower waves "B" show how the diaphragm's natural vibrations decrease from a state of maximum amplitude or vibration "C" at 1, to a zero vibration point at 2.

The balance of the microphone comprises, electrically, the carbon grains 5

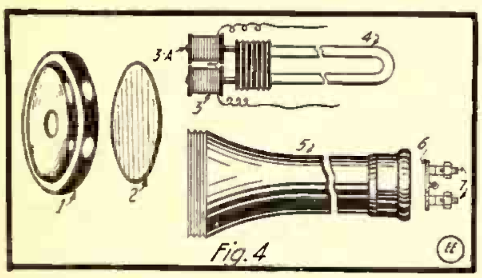


Fig. 4. Principal Parts Constituting the Speech Reproducer or Receiver.

(Fig. 1) and two carbon discs 4 and 6. The carbon used for this purpose is made in a special laboratory devoted to the purpose. Special furnaces are installed and all kinds of temperature and other measurements are taken while the grains and discs are being fired and annealed. The carbon mixture is the closest-grained product ever perfected and is susceptible of taking on a very high polish.

The grains are quite small, but regular in size and quality. The discs 4 and 6 are secured firmly to the brass sub-discs and supporting studs for attachment to the metal shell members. The carbon disc faces are polished like a mirror in specially designed rotary polishing machines driven by electric motors. Each machine will polish a great number of discs in a short time, owing to the unique arrangement of the machines. It may be remarked that mostly girls are employed in making up the parts, and especially in the assembly department.

The complete transmitter is illustrated at Fig. 3, and behind that innocent-looking little device is a battery of the foremost scientists in the electrical and mechanical realm, still banging away at the problem of "something better."

The Telephone Receiver.

The receiver on the telephone we use has, oddly enough, remained about the same as Alexander Graham Bell's original

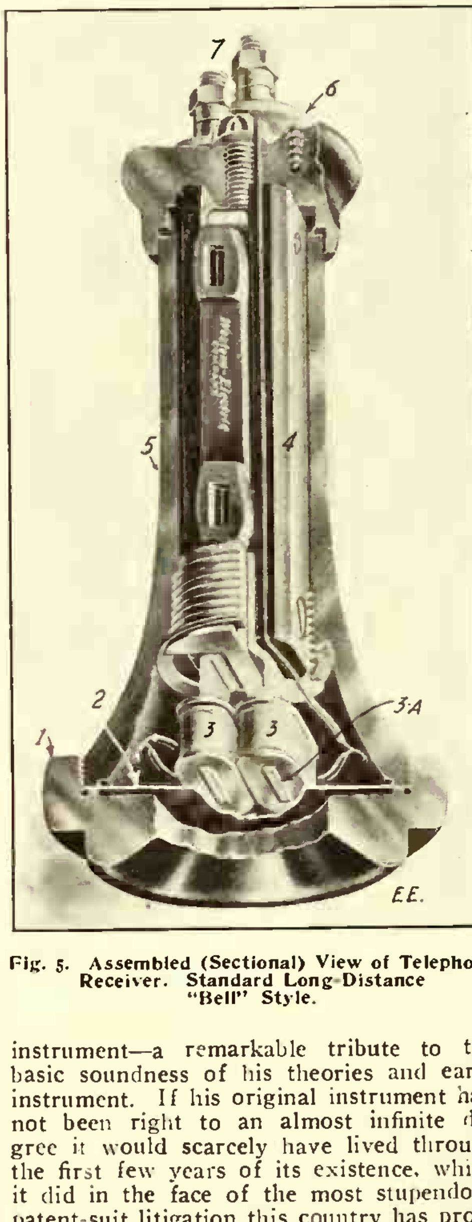


Fig. 5. Assembled (Sectional) View of Telephone Receiver. Standard Long-Distance "Bell" Style.

instrument—a remarkable tribute to the basic soundness of his theories and early instrument. If his original instrument had not been right to an almost infinite degree it would scarcely have lived through the first few years of its existence, which it did in the face of the most stupendous patent-suit litigation this country has probably ever witnessed. Inventors by the hundred sprang up, like mushrooms over night, claiming that they had prior patent rights on a speaking telephone similar or superior to Bell's patents. He finally won out in the highest court in the land, however, and the telephone got started on its way.

To proceed, the standard forms of the telephone receivers are the "Bell" commercial long type and the watch-case receiver, resembling a watch in size. The illustration (Fig. 4) shows the principal parts of the long receiver, and Fig. 5 shows the complete assembled receiver.

(To be concluded.)

OUR SUPPLEMENT

Guglielmo Marconi, D.Sc., the subject of our supplement this month, is undoubtedly the acknowledged pioneer in wireless telegraphy, as we know it to-day. He it was who, by his persistent experiments and studies at the Leghorn Technical School in Italy, made possible signaling without wires over marvelous distances by means of electro-magnetic waves properly set up and propagated through the ether which, so far as we know, pervades and fills up all interstellar space, both inside and outside of our planet, the Earth.

Signor Marconi, of Italian parentage, was born at Bologna, in Italy, in the year 1874. He is therefore a comparatively young man and more zealous than ever in his endeavors to improve and perfect the art of wireless telegraphy and the apparatus pertaining thereto.

We probably are all familiar with the early history of wireless, dating from the time of Marconi's successful tests conducted at his father's estate at the Villa Griffone, near Bologna, which tests and experiments were conducted in June, 1895. Shortly thereafter it became possible for him to cause a receiving instrument to be actuated by wireless waves over distances of one and one-half miles, using poles to support large tin sheets connected with wires, and which poles were but 25 feet in height.

These early experiments were carried on principally with a small spark coil provided with ball spark gap, and for the receptor a Branly metal filings coherer was used. Marconi improved this coherer wonderfully, so as to make it reliable and sensitive to the very minute Hertzian wave currents propagated through the ether from the spark at his transmitting station.

Shortly after the successful tests in Italy, or in July, 1896, to be exact, he went to England and there introduced his remarkable invention to Sir William Preece. Marconi had already applied for a British patent during the preceding June and Preece was very favorably struck with the Italian's invention. By 1897 it was possible to transmit and receive wireless signals and messages by these methods over distances of nine miles between Penarth and Brean Down, across the Bristol Channel. On the Salisbury plain he covered distances of four miles and more overland, employing in these tests a 6-inch spark coil for distances up to four miles, but a 20-inch spark coil was used at different times in tests conducted over greater distances. Also large kites were employed from time to time to elevate a fine aerial conductor, and good results were obtained with this method. Some of the first transatlantic wireless signals in the form of that immortal letter "S," comprising three dots in the Morse code, were received by the aid of kites flying at a high altitude.

In the first few years of wireless many installations were made on various ships of the English and Italian navies, etc., and one of the first important applications made of the new Marconi wireless system was to establish communication between the King of England's yacht and a shore station.

To-day the Marconi system is the largest and most comprehensive extant, and distances of 3,000 to 4,000 miles have been covered repeatedly.

The world owes a debt to Dr. Marconi which cannot be overestimated, and his name is sure to ring down through the ages as the real inventor of practical, commercial wireless transmission of intelligence.

An Interview With Guglielmo Marconi

By Samuel Cohen

WHAT a wealth of meaning there is to the two words, "Marconi" and "wireless" to practically every educated person to-day! Undoubtedly for many years to come the name of Commendatore Guglielmo Marconi will be famous throughout the world and known in practically every household as that of one of the greatest benefactors of the age and as the pioneer inventor and perfecter of wireless telegraphy, as we know it to-day.

Dr. Marconi is well past middle age and looks in the best of health. He is rather tall and well set up, marking him, you perceive, a military man in more aspects than one. This is due, in a great measure, to the fact that he is a Lieutenant in the Italian Navy. He bears his 41 years well, indicating an uncommonly strong mind and body.

As the wireless telephone is one of the latest and most misunderstood apparatus, perhaps, of the present time, I asked him how this matter was progressing. Mr. Marconi stated that there was great hope for the future and, in fact, in the very near future, of greatly extending the range of wireless telephony. "It is being used on practically all warships of the Italian Navy," he stated, "and is being employed to a considerable extent in the British and other navies. Apparatus of the Arc and other types are being used and thoroughly tried out for this purpose, and the best grade sets, such as used in the Italian Navy, can transmit the spoken voice over distances up to 100 miles and more, which is very good, of course, considering that on shipboard it is difficult to erect a very large antenna. One of the later developments in wireless telephone apparatus is that making use of a modification of the well-known *Fleming Valve*. By suitably combining an oscillatory circuit around this valve and also by means of other super-imposing circuits containing the microphones, we have made it possible to talk over quite considerable distances by this very simple and sure means. It is more stable and certain in its character by far than the Arc type of apparatus, generally speaking."

"These wireless telephone sets are provided with a simple switch by which the operator can change over from transmitting to receiving speech very quickly, and they are operated by means of an 80 ampere-hour storage battery which heats the vacuum valve filaments and also a 500 volt current is provided for actuating the trigger control circuit of the valve, as it is called."

"This current is produced by dry batteries, and these sets are not limited to the transmission of wireless telephone speech, but can very easily be converted into wireless telegraph transmitting sets by the substitution of a Morse key in the circuit, etc. These vacuum tube transmitters are able to work over ranges up to about 35 miles thus far."

I asked Dr. Marconi about the other forms of wireless telephone apparatus or undamped wave type generators, etc. He intimated that a great deal of experimental and research work was being carried out in England and in some of the other Marconi laboratories on the multiple spark frequency wireless generator which can produce practically undamped waves by allowing several different sparks in the circuit to jump the gaps at slightly different periods. In this way there are not any long breaks between the sparks and the ordinary dead-time period between sparks of the common radio transmitter, are filled up with the waves from other sparks synchronously and critically timed.

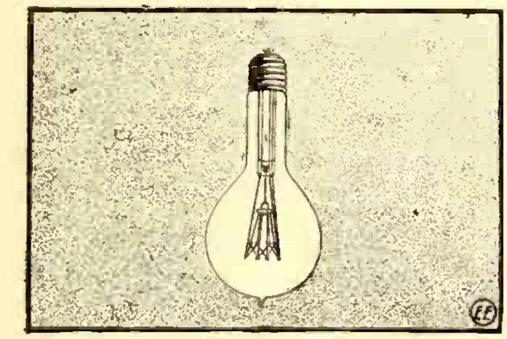
One of the latest branches of science Dr. Marconi is intensely interested in is that of seeing over a wire by electricity. He mentioned that a considerable amount of research work has been done in transmitting images by wireless and successful results were already obtained. Dr. Marconi is quite sure that the time will soon come when one will be able to see a friend in Europe by means of wireless television and at the same time speak to him.

Regarding the powerful and recently completed trans-Atlantic radio stations in England and the United States Dr. Marconi is hopeful the European war will soon cease so that these stations can be put into regular operation. These are at present tied up for the reason stated and particularly as the British Government has taken over the control of the Wales stations for official work of the War Department.

Before departing I suggested to Dr. Marconi that thousands of young experimenters in this country would highly welcome a picture of himself to adorn their dens and laboratories. Dr. Marconi then graciously autographed a photograph for the especial benefit of the readers of *The Electrical Experimenter*. It is this photograph which forms a supplement to this number.

NEW DOUBLE-FILAMENT GAS-FILLED LAMP.

A "two-in-one" incandescent lamp, as it is called, has recently been put on the market and it should find a wide sale. The filament is made in two sections, one of which can be operated while the other is out of service, or both may be burned at the same time. Thus, if the lamp is rated at 200 watts, each side takes 100 watts. Either or both sections are placed in circuit by a screw attachment in the base. The lamp is filled with nitrogen, argon and other gases. The specific consumption, the manufacturer asserts, is 0.6 watt per C.P. or less. The average life with the filament sections burning separately is 2,000 hours, and with both burning together 1,000 hours.



Latest Double Filament Gas-Filled Incandescent Lamp.

ELECTRIC SMOKE RECORDER.

By Frank C. Perkins.

The accompanying illustration shows a novel and interesting smoke recorder, electric motor driven, as recently developed at Chicago, Ill. It is held that war was declared against the smoke nuisance in the reign of Queen Elizabeth and has been going on ever since.

The problem therefore is to find the means of making the careless and negligent fireman careful. It is in the nature of every man to be more attentive to business when he is under inspection.

Recording apparatus of every kind is coming more and more into use, particularly in power plants. It is maintained that the most effective remedy for the smoke nusiance that has ever been produced is the smoke recorder. It proves itself if one admits that careless firing is the one great cause of smoke, because the smoke recorder is a check, both upon the chimney and the fireman. Smoke can always be greatly reduced and sometimes completely eliminated by careful management of the fires. No matter what kind of "smokeless furnace" one may have, it cannot live up to its title and make steam unless it is managed with care and intelligence.

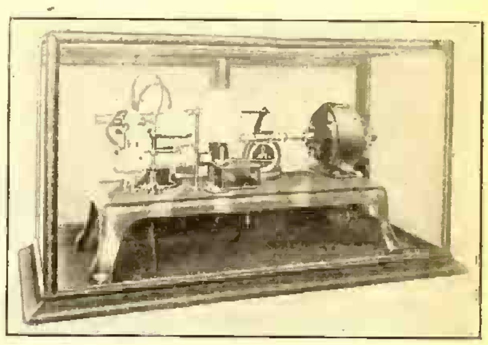
This new electric-driven smoke recorder originated in the brain of Ray L. Eddy, who has devoted many years to the study of smoke, its causes, effects and remedies.

This electric recorder is the "watchman" that informs the fireman immediately if the stack begins smoking. He can at once adjust the dampers or apply any other remedy that is recommended by this observation and experience. He can stop smoke within the time limit named by the city ordinances, and in all probability before a smoke inspector or some complaining citizen can get his eyes upon the chimney.

In order to fight smoke it is necessary to know what causes it. Smoke is usually caused by lack of air, improper mixture of the air with the gases or lack of temperature. Improper furnace design often has much to do with it.

The electric smoke recorder is built like a watch and, entering into the theory of the principles involved in the smoke recorder, it may be stated that if one drives a jet of smoke against porous paper the soot and other coloring matter will adhere to the paper and form a permanent record. It will be permanent because the soot particles will be driven into the pores of the paper. The record upon the paper will correspond with the color of the smoke, irrespective of what that color may be.

There are two things necessary in the construction of a smoke recording apparatus. To provide means to draw a sample of the gas from the stack and force it through a small orifice and also to provide a sheet of the proper paper and a clock or other mechanism to move it. Reduced to its primary elements, a smoke recorder consists of a pump and a clock and a piece of paper.



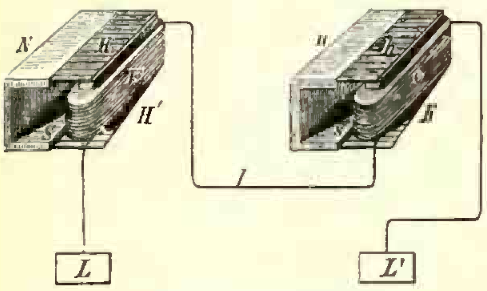
Electrically Operated Smoke Recorder.

It may be stated that the chart is sectionally ruled in hours and minutes, each chart covering a period in excess of 12 hours, and one can tell almost to the second when the chimney began to smoke and also when the fireman stopped it by proper firing.

THE BIRTH OF THE TELEPHONE.

An extremely interesting lecture on the birth and babyhood of the telephone was presented by Bell's former co-worker, Thomas A. Watson, before the New York Electrical Society at a recent meeting.

He detailed in an interesting manner how the telephone had sprung from the musical telegraph, upon which he and Prof. Bell were engaged. Although Bell had the idea in his mind for two years, it was not until June, 1875, that a successful speech-producing instrument was made. The first idea on the propagation of music or speech over a wire by electrical means was presented by accident. One of the musical telegraph reeds had stuck fast, and Mr. Watson said he plucked the reed several times. Prof. Bell at once came into the test room, demanding to know what Mr.



The Forerunner of the Telephone. Bell's Early Musical Telegraph.

Watson had done. Bell had heard the feeble undulatory magnetic impulses produced by the vibrating reed before its magnet and reproduced electrically over the short line in the musical receiver. Thus the germ was sown which laid the basis of the wonderful telephone system we have to-day.

The illustration here shown is of one of these early Bell musical telegraph systems, where a series of different-toned steel reeds currents in the coil E, which will pass through the wires l and ground L L' to the receiving coil H', mounted on a magnet also provided with tuned steel reeds in front of the coil. Thus a certain reed vibrating at the transmitter would set the "same tone reed" vibrating at the receiver. Multiplex telegraphy over one wire was the goal.

A replica of the first telephone used by Bell was shown and, of great interest also, the original wire used in the first half-mile telephone circuit ever erected by Mr. Watson in Boston. The wire was coiled on a small spool and preserved in a neat glass cabinet.

The first ringer for telephones was developed by Mr. Watson. For the first telephone installations the party was called by thumping the home diaphragm sharply with a pencil. This set up sharp sounds at the receiver end of the line and anyone near the instrument would hear the thumps, so to speak. Shortly after he invented the "Watson jingler," or polarized bell, operated by a magneto, and this device, like Bell's wonderful receiver, has practically remained the same in its design these 38 years past.

RUSSIAN DUMA GREETS ENGLISH COMMONS BY WIRELESS.

A new and powerful wireless station erected in Russia since the outbreak of the war transmitted the first messages to England recently in the form of a greeting from the Chairman of the Duma to the Right Honorable James W. Lowther, Speaker of the House of Commons. Mr. Lowther acknowledged the greeting by wireless.

TAPPING THE EARTH'S ELECTRICITY.

The latest suggestion of theoretic science is that inventive mankind will some day be able to tap the earth's electric supply. Everyone knows nowadays that the earth is, among other things, an enormous electric magnet and that as it twirls around eternally on its unseen axis its friction against the atmosphere creates a perfectly unlimited supply of electricity.

The British Royal Society claims that invention is already close on the track of perfecting a method by which this electricity can be collected from the atmosphere. If this can be done there will be no necessity for electric power plants.

Every factory will be equipped with an inexpensive machine that can absorb from the air electricity just as already there are machines that can absorb oxygen from water that costs little or nothing to collect.

The idea suggested is that some machine be created to suck down the earth's electric fluid. This is being done all the time by every tree, and it is this attractive force of tall trees that causes them to be so frequently struck by lightning during big thunder storms when the atmospheric electricity is present in enormous quantities.

A machine for collecting atmospheric electricity, however, would not depend on electric storms for its sources of supply. The atmosphere is always filled with a silent, all-pervading but powerful electric current. It is this permanent current that it is suggested mankind will some day succeed in harnessing to the triumphant car of human progress. When it is done, the race will have easier and quicker traveling toward the final triumph of mind over matter.

MARCONI A VOLUNTEER.

William Marconi has asked that he be enrolled as lieutenant of engineers and assigned to duty with the telegraph brigade at Florence.

A NEW 3-VOLT DRY CELL.

Ordinary dry cells used for bell and ignition work give but 1½ volts each. All such cells are the same as regards voltage. Now we have the "Nitrogen" 3-volt dry battery, which should find a host of friends. It is exactly the same size as the standard No. 6 Columbia cell and can be interchanged in battery boxes, etc. It is composed of two cells placed end to end, thus producing 3 volts. Owing to a new substance used in making up these cells their efficiency is much greater than that of ordinary dry cells. The experimenter will find this 3-volt cell a great convenience indeed for operating small motors, spark coils, lighting lamps, etc. It costs but little more than the ordinary 1½-volt cell and marks a new epoch in dry cell manufacture.

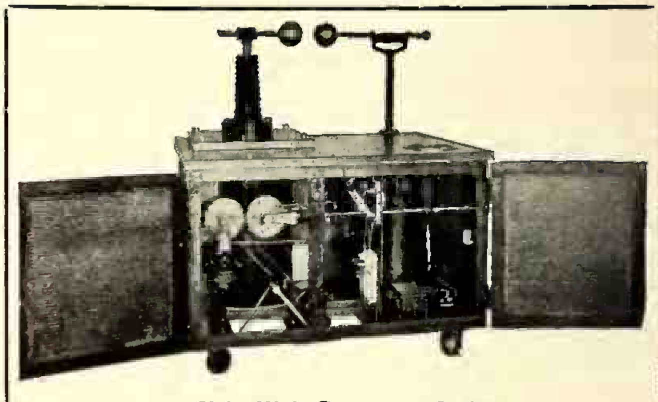
TO GO THROUGH PANAMA CANAL SHIP NEEDS WIRELESS.

It is now unlawful for any passenger steamer, whether of American or foreign register, carrying 50 or more persons, including both passengers and crew, to leave the Canal Zone unless equipped with wireless telegraph apparatus capable of transmitting messages at least 100 miles and having a competent operator.

NEW HIGH-FREQUENCY MACHINE FOR TESTING INSULATORS.

It has long been known that when a lightning bolt or discharge strikes a transmission line carrying electric currents this high-frequency atmospheric current will affect the insulators on the line in a different manner than the ordinary current, no matter whether it is direct or alternating current at any commercial frequency, such as 60 cycles, etc.

Heretofore high-voltage insulators, such as used on the wonderful long-distance transmission lines such as those in the



125,000 Volt High Frequency Oscillator.

Western parts of the United States and Canada, have always been tested at 60 cycles frequency for several times the voltage to which they were to be subjected in their regular duty on the line.

It was found, however, that very frequently these insulators would fail for some apparently unknown reason, and after much inspection and research work it was found that a lightning discharge, in view of the fact that it is of very high frequency and similar to a wireless discharge, would strike right through the insulator and put it out of commission for further service. This happened many times where it was self-evident that the transmission line voltage could not have done any such damage.

One of the latest machines for testing these insulators under such lightning discharge conditions is shown in the illustration, and it is built by the General Electric Co.

It is designed and furnished, when desired, for use on any commercial frequency circuit, and utilizes about 2½ K.V.A. at 60 cycles on 110-volt A. C. circuit. It can produce very high frequency currents, running in value as high as 300,000 cycles per second at a potential up to 165,000 volts. Special forms of this machine are furnished, when necessary, giving as high as 500,000 volts. Hence the advance of the engineer continues in his decision to hold his own with the forces of nature.

ELECTRIC POCKET LAMPS FOR THE ARTILLERY.

Among the goods recently bought in the United States for use abroad by soldiers in the fighting zones were 5,000,000 electric pocket lamps. The demand for these lamps is due to the fact that on land the war has in large part become a long-range artillery duel, the other branches of the service meanwhile seeking protection from bursting shrapnel by living in covered trenches. In these trenches, as well as in the air, on the sea, or under it, electric pocket lamps are ideal illuminants.

A Trip Through the Cooper-Hewitt Electric Works

By Theodore Hinchcliff

A trip through the Cooper Hewitt Electric Works brought to light two very interesting facts: First and most important, the advanced manufacturing processes involved in making the wonderful Cooper-Hewitt mercury vapor lamp, which is well

At Right: Fig. 1. The Complete Mercury Vapor Lamp Tube.

Below: Fig. 3. Case Containing Regulating and Controlling Apparatus.

known to our readers for its pleasant and efficient light, and second, its value in commercial applications. A. D. Child, of their sales staff, kindly conducted me through the various departments of the plant.

The first step in the manufacture of the mercury tube (see Fig. 1) is the bulb, the tube comprising three glass pieces, A, B and C (Fig. 2), which are fused together. A small stem E is made on top of the large bulb B by heating that portion and blowing it out to the proper size. Another small glass tube E_1 is fused onto the tube E. This tube is used to connect the bulb B with the air-exhausting apparatus and for filling the tube with mercury.

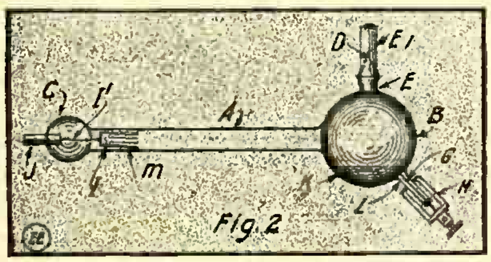


Fig. 2. Details of Mercury Vapor Tube.

The electrode G is now made and sealed in, which consists of a platinum wire sealed into the glass stem L, and is fastened to the connector H. The other electrode I is next sealed in. This electrode I consists of a cylinder of sheet iron with a small lap M for making contact with the mercury when the tube is tilted. The cylinder is joined to a small strip of platinum wire I^1, which is sealed into the bulb C and then connected with another terminal connector J.

After all these parts are made and skilfully placed in the tube the filling with metallic mercury K and exhaustion of the tube next takes place. The tube is brought to the mercury-filling department, where thousands of them are filled daily. The tube is connected by means of a rubber tube with the mercury chamber through the neck E, and a certain quantity of mercury is admitted, depending upon the size of the tube. Some tubes take six ounces, others 10 and 12 ounces. The tube being filled, it is now ready to be exhausted, and extreme care is taken in this process, as the *quality* of the tube depends entirely upon the exhausting. The tube is placed in a hot bath of air and connected with an exhaust pump, which is an ordinary mechanical exhaust pump. The connection is made through pipe E^1. While in the hot bath the mercury is boiled, thereby purifying it and also helping to drive out the air in the bulb. As soon as the operator sees that the exhaustion is complete he carefully seals the tube E_1 by heating it at point E until it melts, and gradually pulls it out to the form D as shown. Fig. 4 shows the exhausting laboratory. In this picture there is shown the apparatus where the mercury tubes are exhausted. A is an asbestos cylinder or shell in which the tube is placed while the air is being pumped out. B is a furnace producing a hot-air blast blowing into the chamber A. C represents the tube coming from the air pump located in the basement and connected to the glass tube. D denotes the mercury trap.

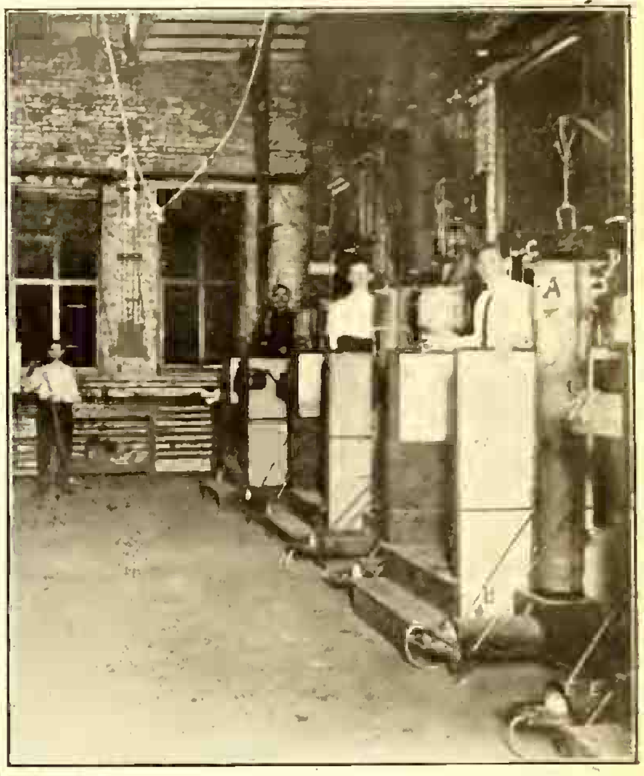


Fig. 4. Exhausting the Mercury Vapor Lamp Tubes.

The tubes are now finished and are brought to the testing room. Here each tube is carefully tested in every respect, both physically and electrically. They are first examined to see if they contain any mechanical defects. If so, they are placed aside and repaired, while the others are placed on a testing frame. Here they are kept for several hours while each tube is critically watched by experienced men. Every tube before being sent out is thoroughly tested, thereby assuring the consumer of a perfect product.

The tube is not the complete lamp, which includes a controlling device which momentarily tilts the tube automatically, while some tubes are self-starting. This is done by using a "kick apparatus," as it is termed technically. Various kinds of resistance and magnet coils are made in this plant for the mercury lamps also.

The tube is placed in a suitable frame, which also contains the electro-magnets for tilting the tube. This frame is shown in Fig. 3, and it also contains the proper resistance coils. If it is an automatic tube the frame would contain the automatic devices for that particular tube.

The second important thing is the value of the mercury tube commercially, as it is very efficient for photography, drawing, etc. It also gives, in special forms, valuable effects on alternating current, the latter being perhaps more interesting to the general experimenter.

Everyone is acquainted with the glaring light which the ordinary electric lamp emits. It has a sort of blinding effect and it also produces many shadows, due to its concentrated center of light radiation. These effects are entirely overcome by the mercury tube, because the surface of the tube is large, therefore giving a greater diffusion of light, which is, of course, more pleasing and less tiring to the eye than the ordinary incandescent electric lamp. For this reason the Cooper Hewitt mercury tube is now being extensively adopted in factories, drafting rooms, etc., where the shadows are most troublesome. The rapid effect of the light of these tubes on photographic plates makes it extremely valuable for use in photography, especially in motion picture studios and in blue-printing.

Another peculiar feature of the mercury tube is in rectifying alternating current into direct current; this form of rectifier

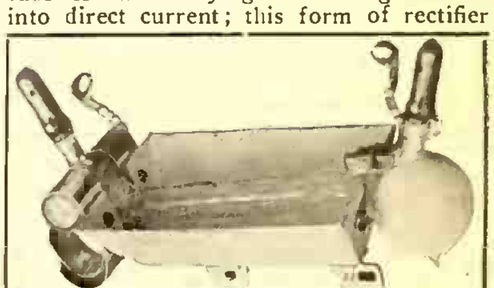


Fig. 5. Quartz Mercury Vapor Lamp.

is widely employed in auto garages where alternating current is supplied and batteries are to be charged.

One of the latest types of mercury tubes is the Quartz lamp, which is shown in Fig. 5. This tube works just the same as the

(*Continued on page* 151.)

A NEW HYDROGEN X-RAY TUBE.

By Frank C. Perkins.

The accompanying illustration, Fig. 1, and drawing Fig. 2 show the design of a unique hydrogen X-ray tube offered to Roentgenologists not as an experiment or a promise but as an actuality. It is claimed that the work with the hydrogen tube in several of the most prominent X-ray laboratories in America has substantiated in full the results in the Snook-Roentgen experimental laboratories on the new tube here shown.

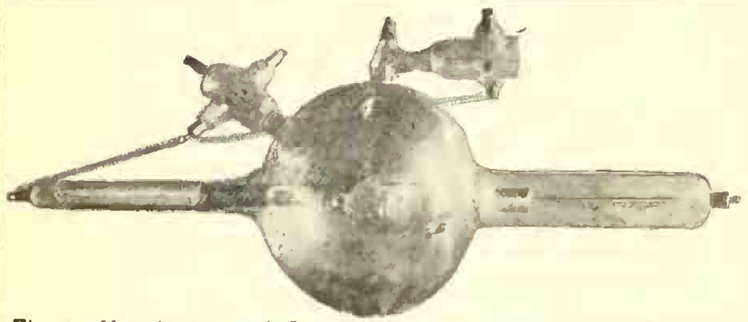


Fig. 1. New Hydrogen X-Ray Tube, Which Is Said to Be Extremely Efficient.

It may be stated that the pure hydrogen gas is the chemical means used for the regulation of the hydrogen X-ray tube. When the tube is to be lowered as to vacuum a current of approximately 25 milliamperes is discharged across a spark gap of about ⅛ inch long in a glass bulb containing chemically pure hydrogen. This spark heats to redness a metal osmotic tube. One end of the tub opens into the vacuum of the bulb proper (see Fig. 2), while the other is closed and prevents the hydrogen from entering the vacuum except when the metal, heated to redness, acts temporarily as an osmotic membrane.

The amount of hydrogen admitted to the vacuum is determined by the length of time the metal tube is kept red hot (and also by the temperature of the osmotic tube). The rate of diffusion through the metal increases with the rise in temperature, care being taken not to melt the metal. Hydrogen gas actually comes out of the tube when the vacuum is "raised," due to its own osmotic pressure, since ordinary atmospheric air contains practically no hydrogen.

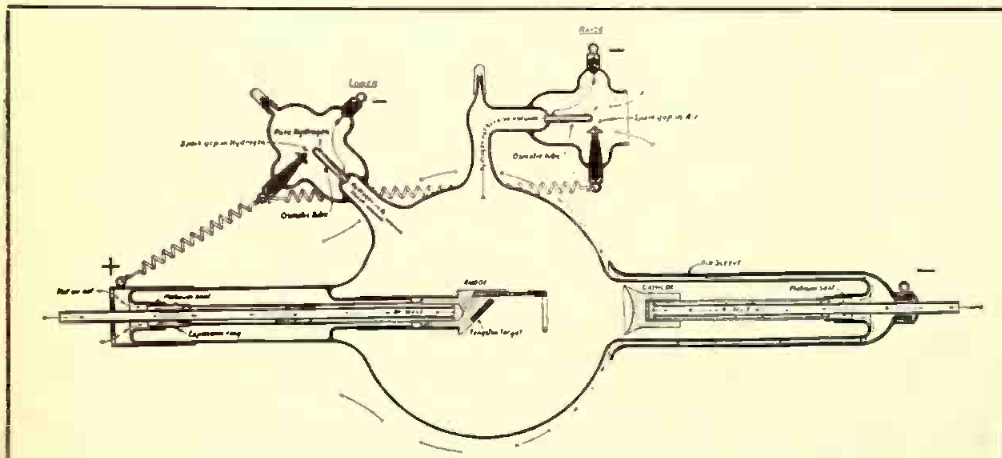


Fig. 2. Details of the New Hydrogen X-Ray Tube Recently Developed.

It is stated that for continuous, heavy work no tube ever designed has given results equal to the *air-cooled* type of hydrogen tube. Compressed air, at about 4 pounds pressure, is used as a cooling medium for the air-cooled hydrogen tube. Both the anode and cathode are hollow almost their entire lengths to deliver the air to the inner extremities, as perceived from the cut.

The air delivered to the cathode serves also to cool the main glass bulb, as illustrated in Fig. 2. The vacuum control of the air-cooled hydrogen tube is identically the same as that of the standard type of hydrogen tube. The air supply necessary for operating the air-cooled hydrogen tube can be readily obtained from the compressed-air service of many hospitals and office buildings by merely connecting with the piping and installing a pressure-reducing valve. When this is not available a direct-connected motor and air compressor can be installed of the right capacity to care for the simultaneous cooling of two tubes.

It is claimed that results from day-by-day use of the hydrogen tube in X-ray laboratories over a period of many months have demonstrated that it will accomplish from three to five times more than any ordinary tube—in duration of service and in efficiency. Both in initial investment and in repair items a real economy is effected, and the more uniform operating characteristics of the tube give uniformly better results and radiographs that are uniformly good, while tests have proven that the focus point is very steady and does not wander.

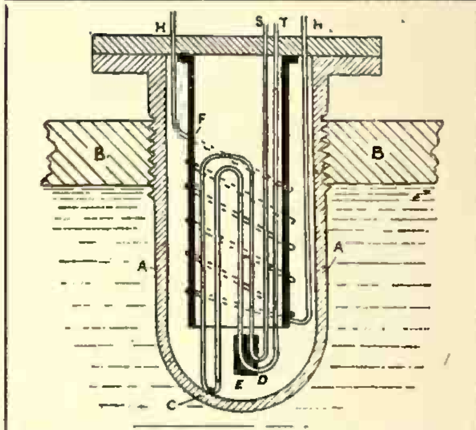
WIRELESS IN COURT.

Judge Mayer sat recently in the Federal District Court of New York City and listened to the wireless messages which were passing between vessels at sea and the land stations at Sayville, L. I., and Sea Girt, N. J. The apparatus, which had been set up in his courtroom, was erected to help him decide a patent infringement suit, brought by Samuel L. Kintner, receiver of the National Electric Signaling Co. against the Atlantic Communication Co.

The suit, which is highly technical, turns largely upon what experts call a "high frequency musical tone." It is alleged that the Atlantic Communication Co., in producing this tone by means of apparatus which has been made under the Telefunken or German patent, is infringing on the apparatus covered by the Fessenden patent, which belongs to the National company.

FEELING FOR ICEBERGS ELECTRICALLY.

It was after the disaster of the *Titanic*, when inventors realized the importance of an instrument which would notify the navigating officer of some approaching iceberg. Many different devices were invented for this purpose, and one of these is herewith described, its action depending upon the thermo-couple or electric thermometer principle.



Electrical Device Tells the Approach of Icebergs.

Looking at the accompanying sketch, a "thermo-couple" ST is mounted inside a metal capsule A, which is screwed through the ship's hull plate B. One junction C of the "thermo-couple" is soldered onto the shell A, and hence rapidly assumes the same temperature as the water outside. The second junction D, however, is imbedded in a block of material E, which permits it to assume slowly the temperature of the air inside A. The free ends of the wires ST are connected to a sensitive relay; the wire HH is wound around the insulating tube F and serves for heating purposes. At ordinary times the contacts CD are both at the same temperature, hence no current flows through ST and no alarm is given. But when an iceberg is approached the temperature of the water varies repidly and the junction C is cooled much more quickly than the junction D. As a result a "thermo-electric" current is set up, and this operates the relay, which in turn closes an alarm circuit and warns the navigating officer of the impending danger.

A NEW VEST POCKET AMMETER.

A novel, compact type of pocket ammeter has been developed by the Benford Manufacturing Co., of Mt. Vernon, N. Y. As perceived from the illustration of same, it is a metallic barrel, inside of which is a coil of magnet wire. When the tip on the flexible cord and the second tip on the base of the instrument are placed in contact with a source of current, such as a dry cell, the calibrated iron plunger in the center moves inward in proportion to the amount of current passing through the coil. The idea is old, but the make-up of the instrument as a whole makes it very serviceable and free from derangement.

The voice by telephone travels from New York to San Francisco in 1-15th of a second, traveling at the rate of 56,000 miles per second. The voice of a man speaking in New York is heard in San Francisco three hours earlier, that being the difference in the standard time of the two cities.

How to Build an Electric Writing Machine or Telautograph

By Homer Vanderbilt

THE telautograph is an electrical machine by which handwriting may be transmitted electrically over wires. Many articles have been published on the telautograph, but in these the interest of the novice has been rather neglected if he should want to build a simple electric writing machine. It is the object of this short article to show the experimenter, with drawings and general explanation, how to construct one.

The details for the construction of the individual parts are given in the accompanying drawings. These do not require much description. Fig. 1 represents the transmitting station, which consists of four resistance coils at right angles to each other and their sliders moved by brass rods, which are joined together at a common point E, where a pencil or pen is attached. These rods are swiveled by means of universal joints D, D, D, D.

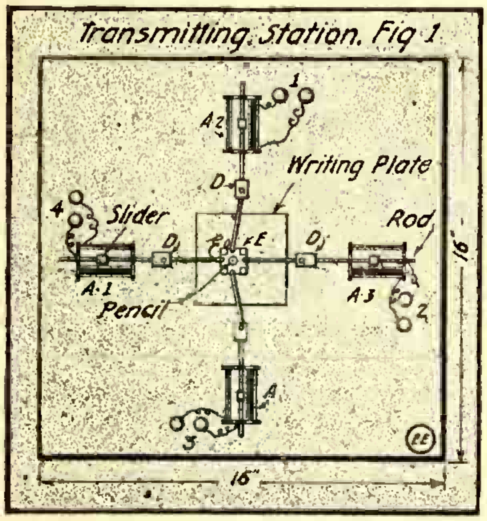


Fig. 1. Transmitting Apparatus for Sending Script Messages Over a Wire.

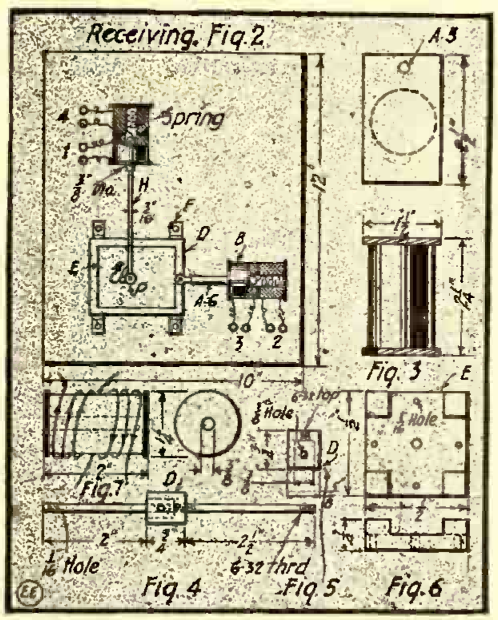
The resistance coils A, A1, A2, A3, are wound with No. 26 B. & S. German Silver wire on wooden cores as shown in Fig. 3, and well shellacked. Ordinary tuning coil sliders are then placed on top of the coils. Four of these resistance coils are made and then fastened to a wooden base 16"x16"x¾", by means of wood screws. These coils should be placed at right angles to each other, as shown in Fig. 1. A small hole is drilled on the back end of each slider and threaded with a 6-32 thread. Now construct the slider rods, which consist of two pieces of brass rod threaded together by means of a universal joint D. The slider rods are now inserted in the end holes A5, Fig. 3, on each side of every resistance coil bobbin. The details of construction of rods are shown in Fig. 4, and of universal joints at Fig. 5. All parts are made of brass. After the coil and rods are made and assembled on the base, connect all the rods at a point E by means of a brass center block shown in Fig. 6. Four small pins are inserted in each hole through the rods so as to allow a free play between the rod and connector. Each set of terminals of the coils are connected to their respective binding post as indicated.

The receiving apparatus is similar to the transmitter but different in construction. The receiver consists of two solenoid type electro-magnets arranged as shown in Fig. 2. These solenoids have two sets of windings on them, and wound in opposite directions. The two bobbins are made of hard rubber and details of dimensions are shown in Fig. 7. After the bobbins are made according to dimensions, wind in one direction and one-half of the spool, with 200 feet of No. 24 B. & S. copper magnet wire, and then wind the other half and in the opposite direction with the same amount and size of wire. Both coils should be wound exactly the same. Now construct the movable cores, which consist of two pieces of soft iron 1¼"x⅜" in diameter. On one end of these cores a No. 10-32 thread is made and a small brass rod H with No. 10-32 thread on one end is inserted, as shown in Fig. 2. Two small springs are then placed behind each end of the cores of the solenoids as shown.

The *writing board* E, Fig. 2, consists of a thin brass plate 8"x4"x¼", placed between four brass angle pieces F, suitably grooved, so it can be moved easily by the electro-magnet arm A 6, Fig, 2. This arm A 6 is the core of the electro-magnet B and is made from soft iron 2½"x⅜". A small hole is made in one end in order to attach it to the *writing board* E.

Now place these parts on a hardwood base 12"x10"x½" and arrange them as shown. Connect the respective coils to a pair of binding posts. The apparatus is now ready for use. Connect both transmitter and receiver as follows:

Binding post 1 of sender connect to binding post 1 of receiver and binding post 2 of sender to binding post 2 of receiver, and so with 3 and 4. It is to be remembered that a battery is connected in series with each set of connections. About four cells in each circuit will work very nicely. Draw a figure on a piece of paper and then place it on the transmitter writing plate

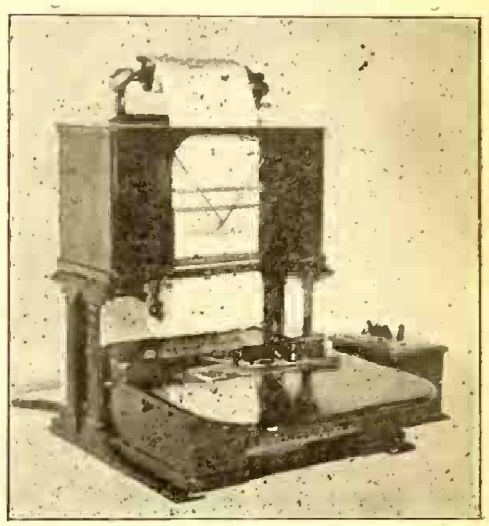


Details of Various Parts Constituting the Home-Made Telautograph.

and trace it by means of the pencil. A piece of paper is now attached to the *receiver writing plate* and a pencil inserted on the rod hole P and laid loosely on the paper. As soon as the transmitter pencil moves the receiving pencil will follow and in this way it will reproduce the exact image. Writing may be sent over the wire just the same.

The principle which this machine depends upon is the variation of resistance which the transmitter's resistance coils create by the movement of the sliders and thereby causing a different current strength to pass through the receiver solenoids by which the iron core is directly affected by the varying changes of current.

A little practise will be necessary at first



Commercial Form of "Telautograph" as Used in Banks, For Transmitting Signatures.

before good results are obtained. This machine in commercial form is now used in banks, hotels, etc. The writer will be very glad to hear from the readers of any trouble that they may have in constructing this apparatus. He will also answer any questions regarding its operation and construction if addressed in care of the Editor.

HOW TO HANDLE HARD RUBBER.

Hard rubber is one of the most frequently used materials by the electrical experimenter; first, because of its excellent insulating qualities, and second, it is easier to handle than porcelain or similar hard materials. Nevertheless a great deal is often wasted before the desired results are accomplished.

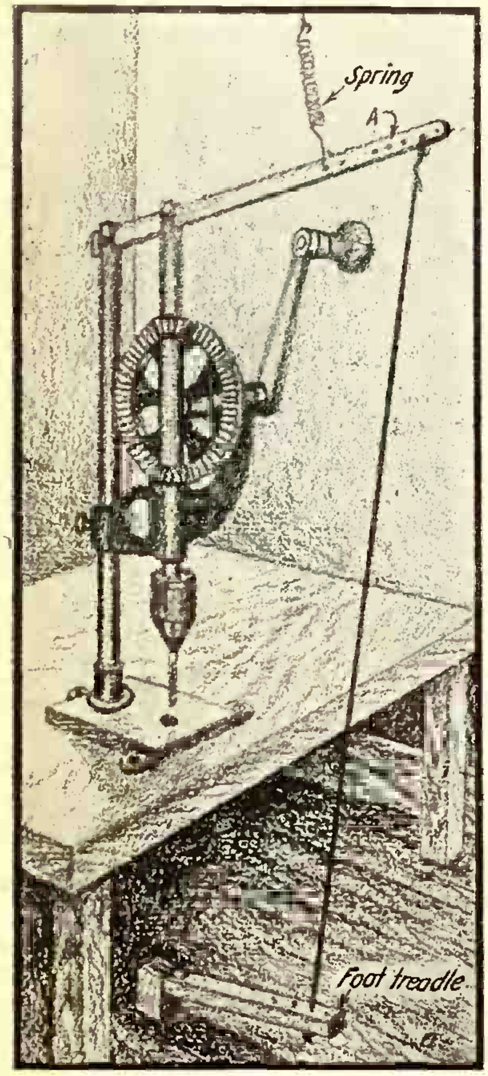
Hard rubber can be cut without chipping with a hacksaw or a fine-tooth saw. If it is cut more than half way through on one side, then starting on the other side until the cuts meet will avoid chipping. The pressure on the saw should be very light or the rubber will crack. Rubber can be drilled with ordinary twist drills in a drill press, but the stock should be laid on a perfectly flat surface and a very light pressure exerted on the drill. When finishing a base it is often desirable to have the edges rounded. This can be done with fine sand paper. To obtain a dull finish at the top it should first be sand-papered and then washed. A brighter finish can be obtained bv mixing a little emery with oil and polishing the surface with it.

In working with hard rubber it is better to have it fastened to a solid support so that the drill or saw will not bend, which will cause the rubber to crack.

Contributed by OSBORN FINN.

A FOOT-CONTROLLED DRILL PRESS.

In the small hand-feed drill presses it is necessary to place the work in a vise to



Foot Treadle Control of Hand or Breast Drill.

hold same while drilling. Very often the work could be done much more quickly and conveniently if both hands were free to hold the work. The sketch shows how this may be done. The feed is simply changed from hand-feed to "foot-feed." In the small sizes it is only necessary to drill two or more holes in the handle A and attach the treadle. In the larger sizes it may be necessary to rivet a piece of strap iron to the handle so that sufficient leverage can be obtained.

The pedal may be 2 feet or more in length, and a number of holes should be drilled in one end so that the leverage may be changed. A strong cord, chain or wire is fastened to it as shown; a hinge properly placed will allow the pedal to be thrown back under the bench out of the way when not in use.

A spring (from a window-shade roller) is good if fastened as shown to keep the drill normally above the work. Contributed by FRED'K J. SCHLINK.

WIRELESS TELEGRAPHY A DISCOVERY—NO INVENTION.

Professor Pupin, testifying in court, avers that Marconi discovered wireless by accident in the grounding of two wires. This, if so, in no wise detracts from the value of the discovery, nor does it constitute something unheard of before in the scientific world. Didn't the fall of an apple from the tree reveal to Newton the law of gravitation?

LIGHTNING'S PRANK TURNS TROLLEY POLE INTO WATERSPOUT.

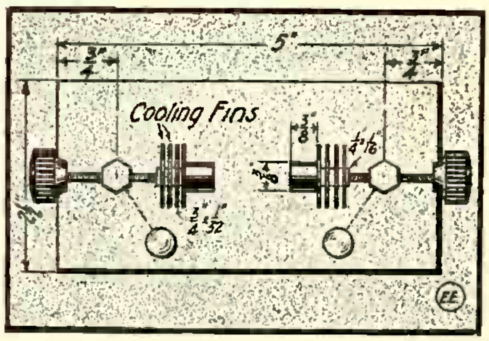
Lightning struck a tubular steel pole supporting trolley wires in New York City recently, burning the wires and messengers loose and allowing them to fall into the street. A few minutes later water began to spout from the top of the pole and to ooze from the joints, making the pole a veritable fountain. Investigation showed that the lightning had ruptured a water main beneath the pavement, and that the path provided by the tubular pole was the only means of escape for the leaking water. Since to shut off the main would have deprived a large district of its water supply, the impromptu fountain was allowed to run during the night, and the main was repaired next day.

SPARK GAP WITH COOLING VANES.

An efficient spark gap with radiating fins has not only a necessary place on the wireless table but it gives the appearance as well as the qualities of a commercial station. The commercial gap with radiating fins is in many cases beyond the pocketbook of the experimenter, so something else has to be substituted.

The drawings show the general construction of the gap, but a few words of explanation may not be amiss. The base is made preferably of marble or hard rubber, but can also be made of any hard wood, and is 5x2½x¾ inches. Holes are bored and countersunk for the screws that hold the hexagonal uprights and for the binding posts, and grooves made for the connecting wires. The hexagonal brass pillars that support the gaps are 1¼ inches high. The holes through which the threaded rod passes are ¼ inch from the top and tapped with an 8-32 screw thread. Holes are also drilled and tapped in the bottom of the pillars for the screw which holds them to the base. The pillars are placed 3½ inches apart, giving a gap of 2 inches, which is more than you will probably need. Each piece of the threaded brass rod is about 2 inches long.

Regular zinc spark-gap ends are used. These are tapped to fit an 8-32 thread. The radiating fins are cut from sheet brass or copper 1/16 inch thick. These are drilled to pass the 8-32 thread, or may be tapped and screwed on, which insures a more solid and heat-efficiency construction. These are separated by ¼x1/16-inch hexagonal brass



Spark Gap Cooling Enhanced by Washers Acting as Vanes.

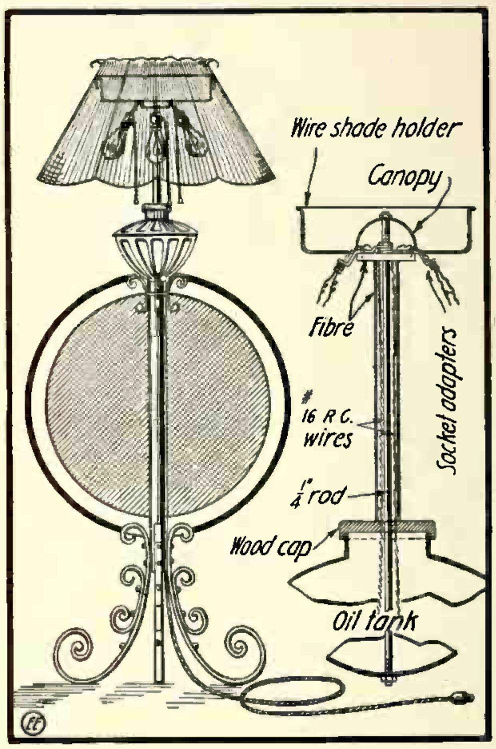
nuts. These are screwed up tightly against the fins and one should be put behind the last fin. Do not polish the surfaces of the fins, as this tends to reduce the radiation. They may be painted with aluminum paint if desired.

Hard-rubber binding posts and knobs add a finished and neat appearance to the instrument.

Contributed by JAMES W. LOWRY.

ELECTRIFYING AN OIL PIANO LAMP.

Having one of the old style, but artistic, type of oil piano lamps on hand, the writer conceived the idea recently of converting this into an electric lamp. The accompanying drawing shows how this was done, and in the writer's case it was wired for three sockets. Chain-pull sockets are best employed, and thus one or more lamps can be lighted as desired. The detailed sketch shows how the upper part of the lamp



Converting Oil Piano Lamp Into Electric Type.

was converted to support the three electric sockets. First, the three sockets were secured together on a round fiber disc ¼ inch thick by three inches in diameter with three gas-electric adapters. These adapters, which have flat brass legs on them about 3 inches long, were bent, as shown, so as to support the three sockets at an angle downward. The three tails of the socket holders were held under the brass nut at the end of the ¼-inch threaded brass rod indicated, which passes up through the oil tank and fiber tube. The fiber tube was about 1 foot long and ⅜-inch bore by 1 inch outside diameter. No. 16 rubber-covered fixture wire may be used to lead up through the stem of the lamp, a piece of flexible lamp cord of whatever color silk finish desired being secured to these No. 16 wires inside the lamp.

A wire framework to support the silk-draped shade shown was fastened also under the nut on top of the rod which clamps the fiber disc and socket holders. Undoubtedly there are many readers who have one of these lamps of the oil type lying around, and it can thus be changed into an electric type, and, with a new style shade on same, made of fabric, etc., it will make a very artistic addition to any parlor or drawing room. This particular lamp was finished up with some dull black Japalac all over. The shade was of pink china silk, artistically ruffled or draped.

Contributed by A. SHUTTE.

DESTROY WIRELESS STATION.

British troops destroyed the important fort and wireless station at Bukeba, on Lake Victoria-Nyanza, German East Africa, on June 25, the Government bureau announced.

A TRIP THROUGH THE COOPER-HEWITT ELECTRIC WORKS.

(*Continued from page 147.*)

quartz tube it thereby gives a greater amount of light for its size. This lamp is used where longer lamps cannot be used. It is also of special benefit in electro-therapeutical applications.

The latest use of the mercury tube is in wireless telephony. Dr. Peter Cooper Hewitt has found out that, when specially built, they develop a high-frequency current when they are excited by an alternating current, and successful results have been obtained in this line. Dr. Hewitt expects to develop his system to such an extent that ordinary persons will be able to handle his wireless telephone apparatus just the same as the ordinary wire telephone used to-day.

NEW USES FOR ELECTRIC LIGHTS.

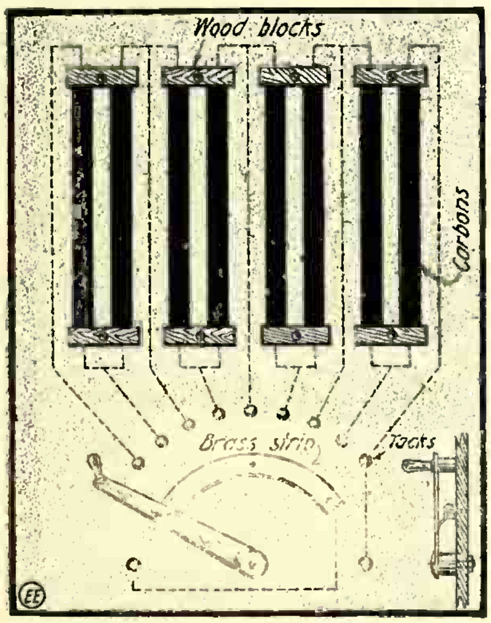
Anyone suffering from earache, toothache, neuralgia and possibly other ills will often obtain relief by taking an electric light—one on a pulley—to bed with them. Place the bulb on the part affected and it will very often ease the pain. This is a very handy way to get relief when stove fires are all out and the rooms cold.

My son once used an electric fan to cool a kettle of soap he was cooking to keep the soap from boiling over! It worked splendidly, too. It could be used in cooking jelly.

Contributed by
MRS. ELLIOT ROSS.

A CHEAP CARBON RHEOSTAT.

The construction of my home-made rheostat is as follows: On a board about 5 inches wide, ½ inch in thickness and 8 inches long fasten 8 brass-headed tacks for switch points, about half an inch apart. Or better yet, procure a drill and make holes through the board. Then in each one fasten



Battery Carbons Make a Useful Rheostat.

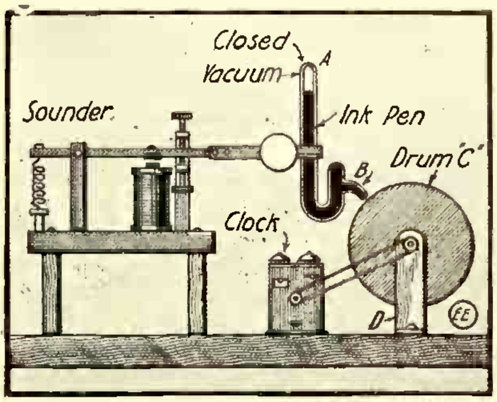
a binding post from a carbon rod of a dry battery. Now procure a circular-sha ed brass strip as seen in the illustration. Get a switch handle and fasten same in position as indicated. For the resistance procure 8 sticks of carbon either from small flash-light batteries or dry cells. These carbon sticks are fastened by small blocks of wood screwed on board. String the wires under the base and make the other necessary connections with some bell wire.

Contributed by JOHN HENRY.

ROOM ENTRANCE RECORDER.

Herewith are given directions for the construction of a novel and simple device to announce that an entrance has been made into a room.

First secure a telegraph relay or sounder, and on the armature place an inker. Below, where the hammer strikes, place a paper-covered drum, as shown. In the normal position the sounder armature containing the inker does not touch the paper. In



Room Entrance Recorder With Siphon Pen.

other words, the sounder is open. Connect one pole of the sounder to one battery pole and run a wire from the other pole of the sounder out under a carpet directly in front of the door. Then take another wire from the pole at the other end of the battery and lay it across the first wire under the carpet. Cross one of the wires over the other, but make sure that they do not touch.

When a person steps on the carpet in the act of entering the room the two crossed wires are pressed together by the weight of the foot, thus closing the circuit and actuating the sounder. The inker and hammer come in contact with the paper covering the drum, thus making a mark on same, and thus the record is made.

Different inking devices may be used, and the longer the ink supply lasts the more useful becomes the apparatus from a time-saving aspect.

As depicted in the sketch, the inker is simply a siphon-type glass tube drawn out to the shape indicated. It retains the ink by atmospheric pressure, there being a partial vacuum at the top of the sealed-up end A. Invert ink tube when filling. A "pen" point may be drawn out as at B. This principle is used on several commercial recorders. The paper-covered drum C may be a baking powder tin suitably mounted on standard D D. It may be driven by a clock motor, as shown, the drum C being arranged to rotate, say once every 12 hours, etc. Some burglar alarm matting works very well for the circuit closer.

Contributed by WARREN BAKER.

J. HOWARD MASON WIRELESS EXPERT.

Green Island, N. Y., has a prodigy in the person of J. Howard Mason, of 20 Hudson Avenue, eighteen years old, a specialist in wireless telegraphy and an electrical expert with a brilliant future. He is the son of Edward A. Mason, foreman of the passenger equipment department of the Delaware and Hudson shops in Colonie. A graduate last June of the Whitehall High School, young Mason intends next year to enter the Rensselaer Polytechnic Institute, a candidate for the degree of electrical engineer. The Masons moved to Green Island from Whitehall last May. From the roof of the Mason home to the roof of the nearest house on the south stretches the wireless apparatus, which has attracted considerable attention. The clocks and watches in the Mason household are regulated by government time, received by wireless from Washington every noon. The receiving end of this wireless system is in the basement of the Mason house, and the receiver itself consists of two telephone receivers which young Mason adapted. They work just as well, he says, as the regular expensive receivers. When young Mason was at Whitehall and had more time to spend on wireless telegraphy, he used to receive messages from as far as Charleston, S. C., and if the apparatus in his own house now were adjusted to its full capacity he could, but he would not, because it is against the law, send messages 100 or 150 miles. Young Mason, who this year is working for The Delaware and Hudson Company, spends his evenings in his laboratory, located in the basement, experimenting either with his wireless or with various electrical phenomena.

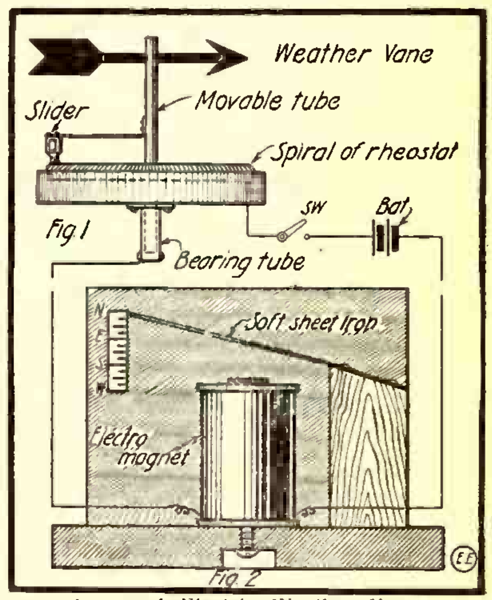
IMPROVED ELECTRIC WEATHER VANE.

I have seen many descriptions of electric weather vanes, but find fault with most of them. Some work with lamps, others with bells, and still others with magnets; but the common fault is the complexity of wires.

If four points of the compass are indicated, five wires are necessary; if eight points are indicated, nine wires are necessary. Besides this complexity of wires, the cost is quite heavy when wiring a four or six story building for this kind of apparatus.

It seems to me that the use of one or two wires is cheaper and simpler than that of five or nine wires.

In the type of vane illustrated here the movable axle to which the vane is fastened rotates a ball-bearing slider around the spiral of an ordinary rheostat. In the apparatus room a device similar to that shown in Fig. 2 is installed. By connecting a battery of two or three dry cells in series with the rheostat and indicator the



Improved Electric Weather Vane.

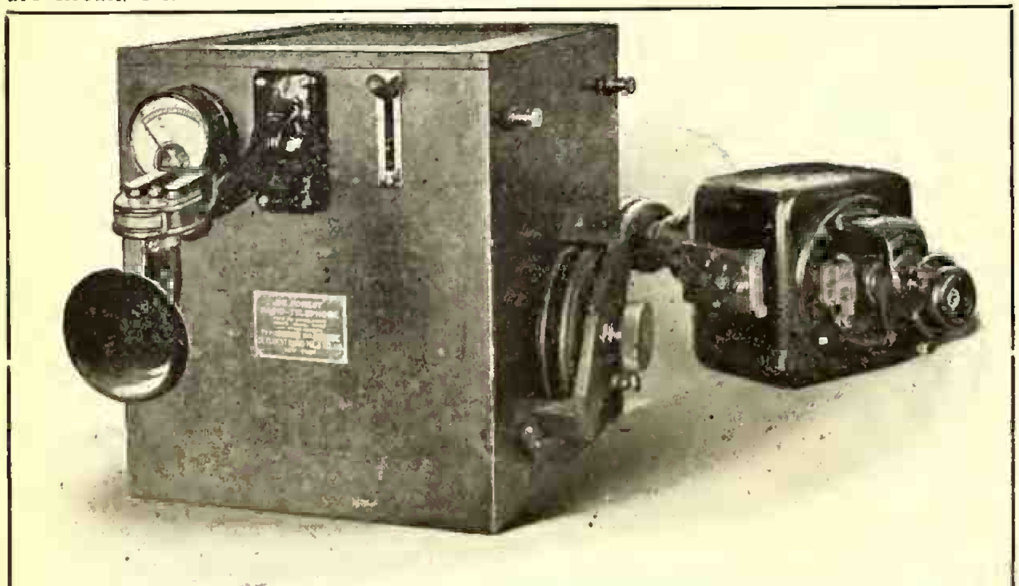
direction of the wind is acertained by the indication of the "dipping" needle on the scale.

The scale calibrations must be made by experiment, as they differ in proportion to size, ohmage of magnet, current, etc. This necessitates the use of but one wire if the other is grounded. Contributed by

JENKINS SMYTHE.

A New 100-Watt Wireless Telephone

One of the latest productions of the De Forest Radio Telephone & Telegraph Co. is a small-size wireless telephone outfit of improved type, which bids fair to find extended commercial application. The illustration shows the complete transmitting equipment, which comprises a special form of arc gap, together with heavy current microphone, regulating apparatus for the arc circuit, etc.

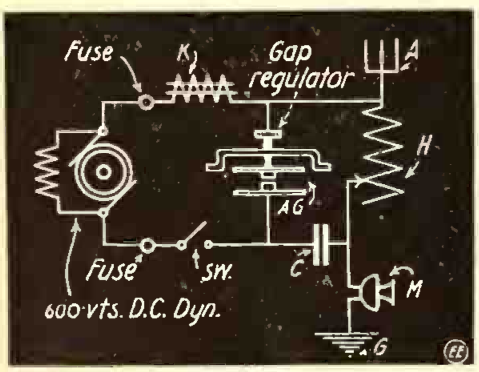


New De Forest Type Wireless Telephone Set With Range of 7 to 15 Miles.

The arc is operated from a small 600-volt D. C. dynamo, which is also shown in the illustration. This machine is driven by a gasoline engine or electric motor, whichever may be convenient.

Considerable tests have been made in the past few months of this radiophone transmitting set around New York City, and it works very well indeed. It may be said that the principal feature is the arc, and this takes place between the two platinum buttons or electrodes of small size, which are mounted on two large copper or other good heat-conducting plates. These will be observed mounted on the right-hand side of the transmitter cabinet.

A schematic diagram is given, which shows the general arrangement of these new sets, and in some of the larger sets, supplied for ship service in transmitting undamped radiotelegraphic waves, the arc is started by momentarily short-circuiting the dynamo through a large choke coil and a switch. This new set, however, is claimed to be self-starting as regards the arc, and this can be managed in several



Schematic Diagram Showing Relation of New Radiophone Apparatus.

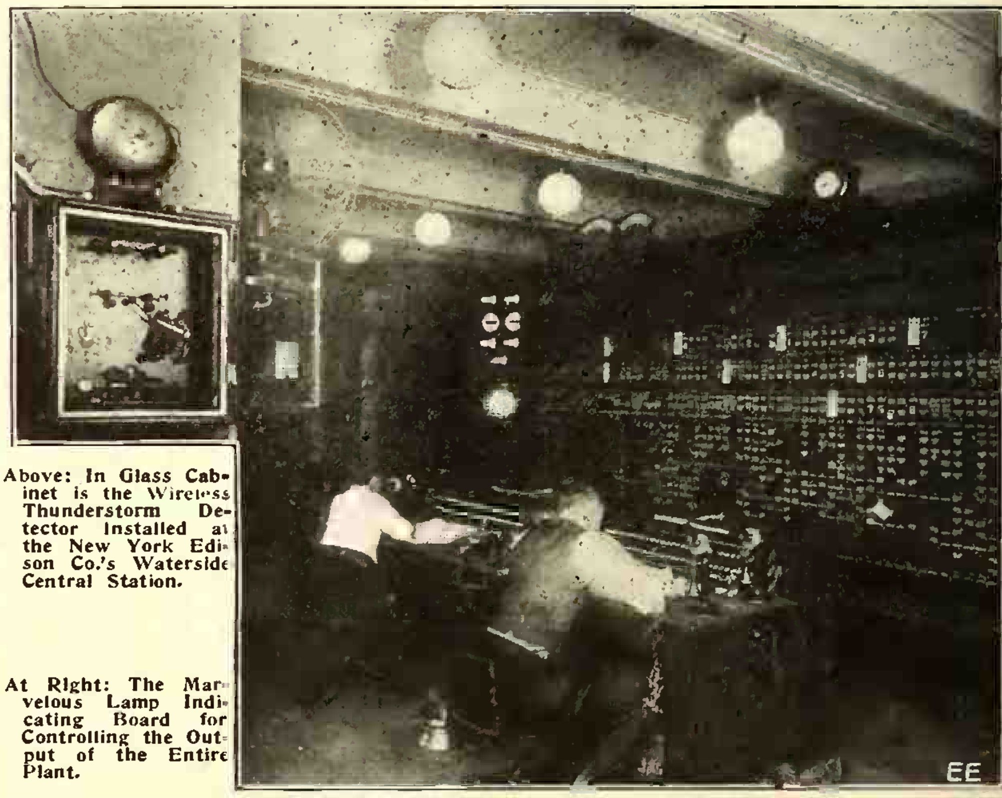
ways, such as temporarily reducing the length of the arc gap, etc.

In the diagram here shown K is a large-size choke coil in the dynamo circuit, and a switch is indicated at S. The arc gap is placed at AG. An oscillatory circuit, of course as usual, composed of a condenser C, with inductance or helix H, is shunted across the arc gap AG. A heavy current microphone into which the words are spoken may be connected in the ground wire at M or in some other part of the circuit. This set will talk from seven to fifteen miles.

WIRELESS STORM DETECTOR IN CENTRAL STATION.

The most interesting apparatus at the Waterside station of the New York Edison Co. that may appeal to the experimenter is the wireless storm detector shown in the photograph. It is an ordinary radio receiving outfit of the coherer type. The use of this outfit in the station is to inform the chief operator of an approaching electric storm. Any storm that may occur a few miles away is recorded by this detector and transmitted to a sensitive relay which relay closes a secondary circuit operating a large electric bell. Whenever electric storms approach the day load is increased on account of more lamps being used. It was noted at the Waterside station that during some storms 60,000 kilowatts in five minutes' increase in load occurred.

The other part of the photograph represents the centralized control switchboard of the same powerhouse. (The switchboard of any power plant is really its brain; just as the human brain is the control center of the nerves in the body.) The various numbers on the switchboard, as seen, indicate the supply feeder numbers. Two buttons are located under each number, so that by pressing one button the operator may supply or cut off power from that particular feeder. The main switches and meters are located in a separate room. There are also two miniature electric lamps under each number, one red and one green. These lamps are used to call the operator's attention, whether to supply or disconnect any particular feeder. Thus the absolute control of thousands of horsepower is placed in the hands of one or two men.



Above: In Glass Cabinet is the Wireless Thunderstorm Detector Installed at the New York Edison Co.'s Waterside Central Station.

At Right: The Marvelous Lamp Indicating Board for Controlling the Output of the Entire Plant.

ANOTHER BOOST.

Says J. R. Rickman, of Greenville, S. C.: "I received my first copy of the *Electrical Experimenter*, and I think it is the best magazine I know of. It contains useful hints and many other interesting points, and is well worth the sum that you ask for it."

A British officer who was a prisoner on board the German raider "Kronprinz Eitel Friedrich" reports that although the Germans' wireless outfit was limited to a 900-mile radius, they sent up 8-foot kites connected by a fine wire with their wireless receiver, and in this manner picked up messages from points 2,500 miles away.

NEW 1½-2 KW. RADIOPHONE ARC GENERATOR.

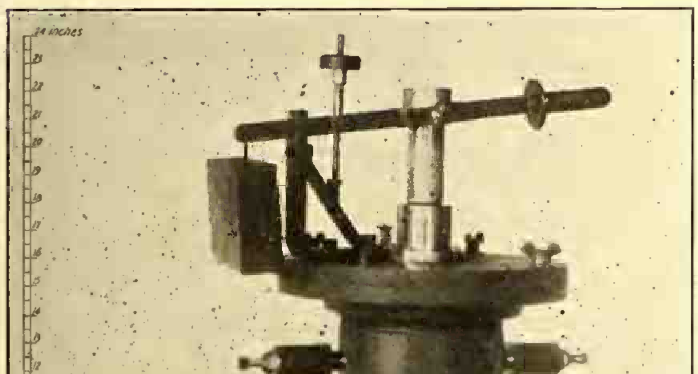
A specially built and efficient type of wireless telephone arc generator of the *Electro* type is shown in the illustration. This arc measures 24 inches high over all and takes up 12 by 12 inches table space.

The arc is designed to operate on 110, 220 or 500 volts D. C. and may be used for producing high frequency oscillations for radiophonic or radiotelegraphic requirements. In the latter case, of course, a *tikker* or *tone wheel*, etc., will have to be used at the receiving station in order to pick up the undamped waves as radiated by the arc excited antenna at the transmitting station.

This particular arc has a substantial steel gas jacket on same, measuring 5 inches in diameter by 8 inches in height. This jacket is provided with gas feed pipe, as observed on the right side of the jacket cylinder, and also it carries two special low pressure quick-acting safety valves to relieve the sudden rise in pressure within the gas jacket whenever the gas in same is exploded by the action of the arc.

The upper sliding electrode with screw hand feed carries a solid carbon of large size, while the lower or positive electrode is a water-cooled copper affair of ample proportions. This positive copper electrode is placed in a powerful co-axial magnetic blast field, supplied by a substantial electro-magnet coil mounted under the base of the arc, as will be observed from the photograph.

A balance weight holds the top lever and also the upper carbon electrode carrier in an elevated position and the carbon is fed downward, as required in operating the arc, by the small feed handle shown. The crosswise lever works freely by means of a sliding boss on the threaded feed rod, so that by striking downward the outer handle on this crosswise lever with the hand the arc can be quickly started and the carbon allowed to rise again quickly. The length of the arc is adjusted by turning the feed screw as required.



"Electro" 1½-2 Kilowatt Arc Generator for Radiotelephony and Telegraphy.

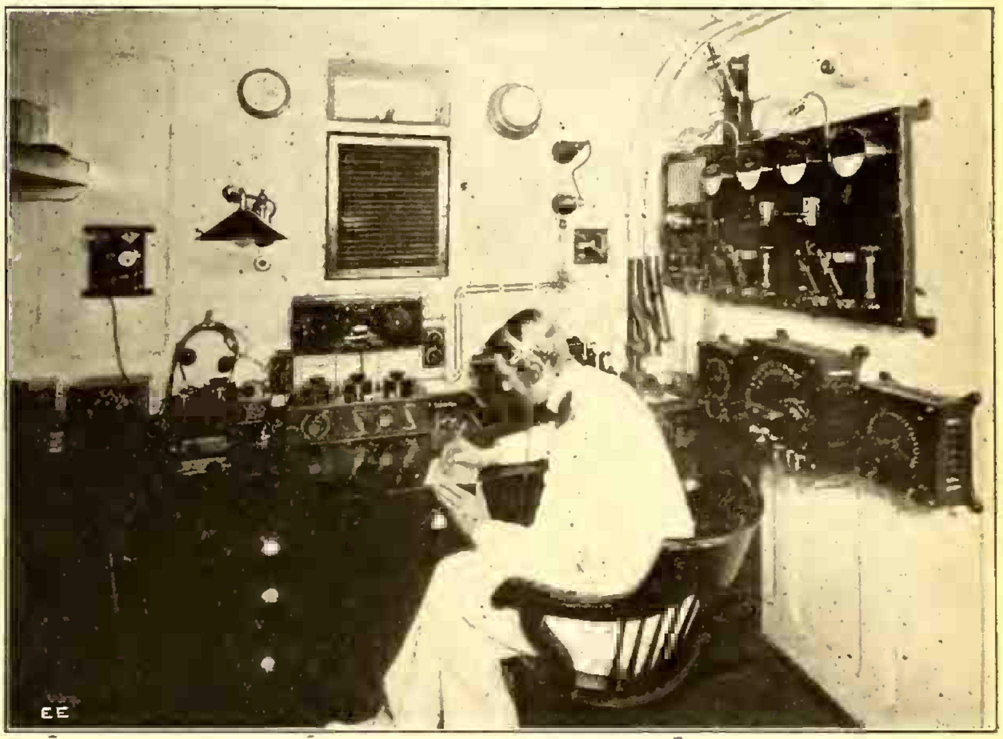
Illuminating gas is used in most cases for this type of arc, and this gas has been found very efficient for the purpose after much research by the Federal Telegraph Co. The coil shown in the picture alongside of the arc is the choke coil used in the direct current feeding circuit to prevent the high frequency oscillations generated by the arc from passing back into the dynamo circuit, etc. A suitable inductance and condenser are shunted across the arc, as usual, to form an oscillatory circuit, and this is linked with the aerial oscillating circuit either conductively, as by using a helix, or inductively, involving the use of an oscillation transformer.

Up-to-date Wireless Set of the S. S. "Olympic"

A very complete wireless set is shown in the illustration as installed on the steamship *Olympic*, one of the largest ocean greyhounds. This set, of the Marconi type, is capable of keeping the gigantic leviathan of the seas in radio communication with both shores practically all the way across the ocean. The motor generators and other heavy apparatus are installed in a separate room and control lead wires, come through the partition, as will be observed, to the manipulating resistance boxes and switchboards containing the volt and ammeters.

Also a pneumatic message tube, as well as speaking tube, communicates with the captain's cabin, and with the bridge of the vessel.

The transmitting set is rated at several kilowatts and employs a high frequency generator, which gives a musical note. Proper grounding devices are used to dissipate any static kick-back surges in the transmitting circuit, etc. These are mounted on a separate panel.



Excellent Marconi Radio Set on the Ocean Steamship "Olympic."

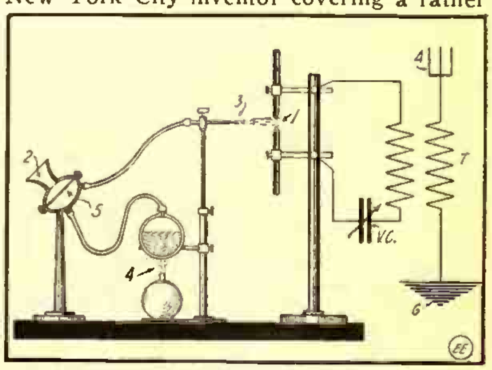
The receiving apparatus embodies the latest style multiple valve tuner of the Marconi type, as will be observed at the center of the instrument table before the operator, who is seen in the act of receiving a wireless message from shore when two days out. A magnetic detector is used, and this is observed mounted on the wall in front of the operator.

The usual auxiliary ship sending set is installed on the instrument table and comprises a 10-inch spark coil with suitable batteries, etc., for operating same in case of emergency or wreck.

The radio station on ship board to-day is certainly a wonderful improvement over those used in the early days of the art, and conjointly, also, their efficiency and operating range is much greater in every case, enabling the ship to communicate over distances of 1,000 to 1,500 miles with ease.

A NOVEL IDEA FOR WIRELESS TELEPHONES.

There was recently issued a patent to a New York City inventor covering a rather novel method for controlling the arc current in wireless telephone transmitting stations. In substance this idea is as follows:



Novel Scheme For Controlling Radiophone Arc by Varying Stream of Hydrogen Gas.

As will be seen in the drawings, arc "1" is used to produce high-frequency oscillations. These are transmitted to the aerial and ground "A" and "G" as usual, through the oscillation transformer "T." As is well known, it is always a considerable problem to properly impress the voice waves on the high-frequency circuit.

This inventor has very ingeniously arranged a talking mouthpiece and diaphragm "2" so that every movement of the diaphragm will cause a varying amount of hydrogen gas to be injected into the arc chamber through the nozzle "3," as will be observed in the sketch. Most wireless telephone arc generators, of course, employ a gas envelope surrounding the arc proper, and this has a decided effect on the arc. Therefore, by taking advantage of this function of the gas, this inventor has provided a very simple method which seems indeed quite practical for controlling the strength or degree of oscillations produced by the arc generator.

The small vessel with spirit lamp under it at "4" is the apparatus for producing the gas, which then passes through a rubber tube to the gas chamber "5," and so on through another rubber tube to the nozzle "3."

A RADIO SCHEME FOR PROTECTING U. S. COAST LINE.

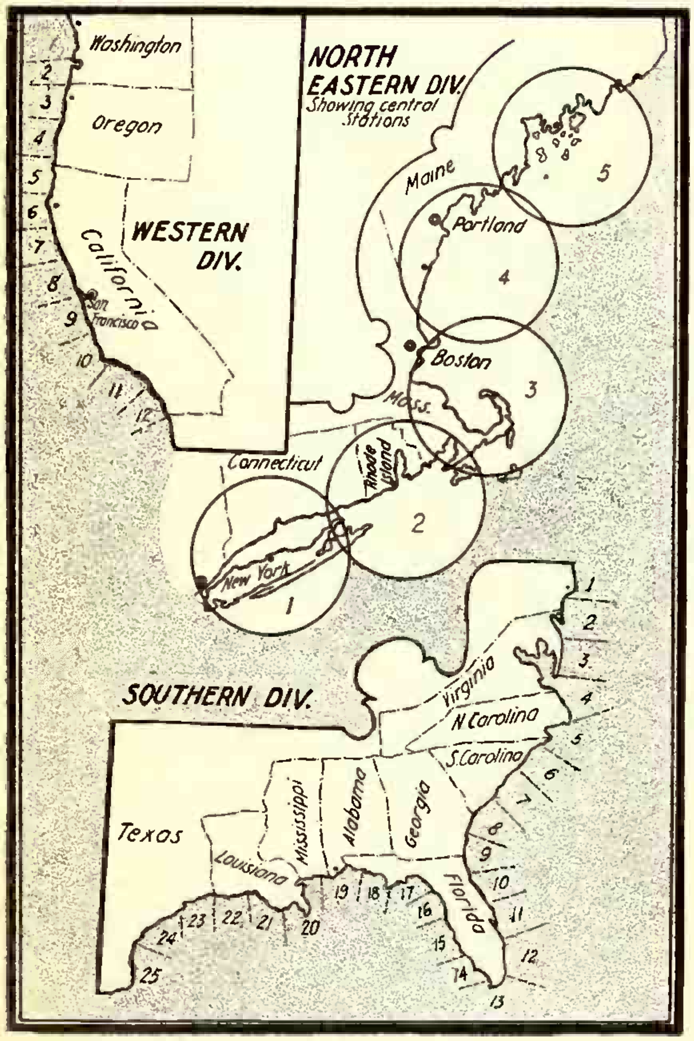
A UNIQUE wireless scheme was recently brought forth by John Hays Hammond, Jr., of wireless torpedo fame, for the protection of the entire United States coast line on both the Pacific and Atlantic shores. This scheme involves the building by the United States Government of about 44 scouting aeroplanes of large size, adapted to carry powerful wireless transmitting and receiving sets. Each of these 44 scouting aeroplanes would cover a zone of its own, as shown on the appended map layout. This sketch will help to convey Mr. Hammond's idea to the reader, and it indeed seems quite feasible.

Moreover, the cost is not anywhere near as excessive as that involved in building a tremendous navy of dreadnaughts and other ships, some of which cost as high as $15,000,000 apiece.

Briefly, it may be said that from the inventor's figures, covering cost of wireless apparatus for each aeroplane, aeroplane sheds or hangars, etc., the total cost of the 44 scouting aeroplanes complete, ready for service in the event of war, would be $398,500. He suggests, also, that the Chaffee system of wireless telephony would be very well adapted for the work, as it is simple in operation, very compact and light, and also requires no knowledge of the Morse telegraphic code, as does wireless telegraphy.

The Chaffee system also gives a large power in small aerials, is capable of being very sharply tuned and is remarkably cheap from a constructional standpoint.

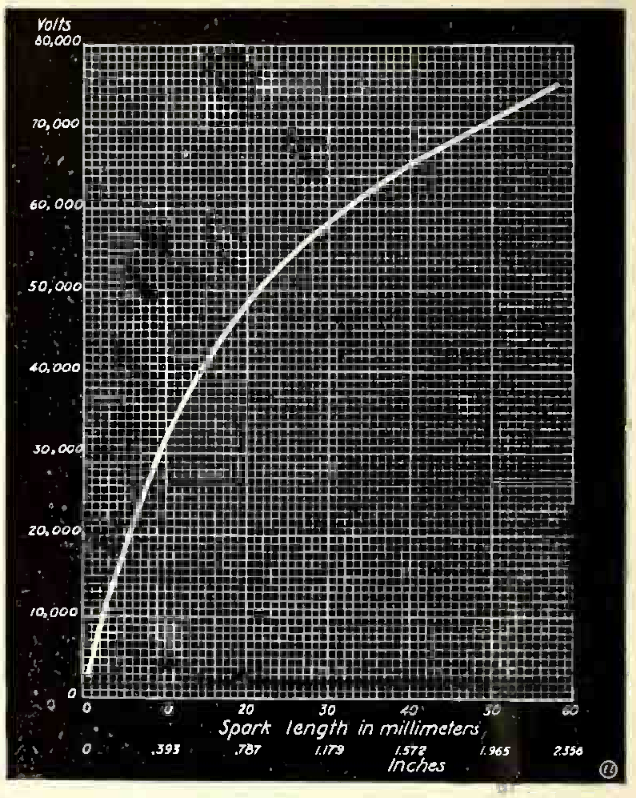
The general operation of this scheme is to provide, of course, a small wireless station at the center of each zone point along the coast, and this would be in communication with the chief military headquarters. It is thus pointed out that the approach of any foreign naval fleets or transports would be perceived a considerable space of time ahead by the aeroplanes and that by transmitting this intelligence wirelessly to the military authorities in charge the enemy could be met by a powerful home fleet in an effort to quickly destroy the hostile vessels.



John Hays Hammond Jr.'s Radio-Aeroplane Scouting Scheme for Our Costal Defense.

SPARK POTENTIALS.

Probably every "electrical experimenter" has often wondered how great the difference of potential might be between the secondary terminals of his induction coil or the knobs of his static machine when a spark of given length was passing. Unfortunately, no definite voltage can be ascribed to a jump-spark discharge, partly for the reason that the resistance of the air-gap between the electrodes is far from constant, for the material, size and shape of the terminals themselves play an important part, as do also changes in barometric pressure and various radiations that may traverse the space containing the spark. Inasmuch as most experimenters do not possess the requisite apparatus for measuring these potential differences directly, they must content themselves with an approximate determination based on the measurements of others. It is often stated that the potential difference is directly proportional to the length of the spark, and that it increases at the rate of 30,000 volts per centimeter of spark length. This is only approximately true for sparks of less than 2 or 3 millimeters in length, and where the knobs of the electrodes are large compared to the distances between them. As the length of the spark is increased, the increase in the potential difference is much less than that stated above, so that no idea of the voltage producing a spark of great length can be obtained from measurements made with a short one. Again, the length of spark corresponding to any given potential difference will depend upon the nature of the dielectric filling the space through which the discharge is passing.



Spark Voltages for Ball Gap. Balls Used 2 Cm. (13-16ths Inch) in Diameter.

The accompanying curve, based on data given in Dr. J. A. Fleming's "Radiotelegraphy," will be found to be a reliable and useful one for reference by the average experimenter. The ordinates or vertical distances are the spark voltages which were measured for discharges between polished metal balls 2 cm. in diameter, in air, at 760 mm. barometric pressure, and hence are only really accurate for the same conditons. However, they give the potential approximately for any discharge between metal balls in air through the range covered.

A brief study of this curve will show that for spark lengths up to 50 millimeters, or 2 inches, the potential increase with increasing length is not at all constant. As suggested above, some radiations have a marked effect on the spark length possible with a given potential difference. It is an easy matter to show that sparks will pass much more easily than normally if the gap, and in particular the negative ball, is illuminated by ultra-violet light, such as that from an electric arc light, or contained in ordinary sunlight. The same effect will result if the gap or negative ball is heated When, in any experimental work, including radiotelegraphy, small quantities of electricity are discharged across a gap, the best results will be obtained with highly polished balls of zinc or brass, and if the spark is in the open air the accompanying curve will afford a reliable means of determining the potential difference for distances up to 5 centimeters, the distances being taken between the nearest points on the two balls.

Contributed by E. H. JOHNSON.

Wireless Relays and Amplifiers

APPARATUS falling under this category are of paramount importance to all wireless workers, amateur and professional alike. We all realize that if we employ a proper relay, then with a given amount of energy much greater distances can be transmitted over, other things being equal, than if the relay is not used. Relays sufficiently sensitive for radio receiver circuits are now made and applied commercially in several different styles. The principal types now prominent or feasible are the Lieben-Reiss and DeForest gas or ionic stream valves, the Brown electro-magnetic relays, the Telefunken multiple stage tuned microphone relay, and the Parsons compressed air amplifier. There are several other types on the market, but the above represent the principal basic types so far developed, excepting the Fessenden heterodyne.

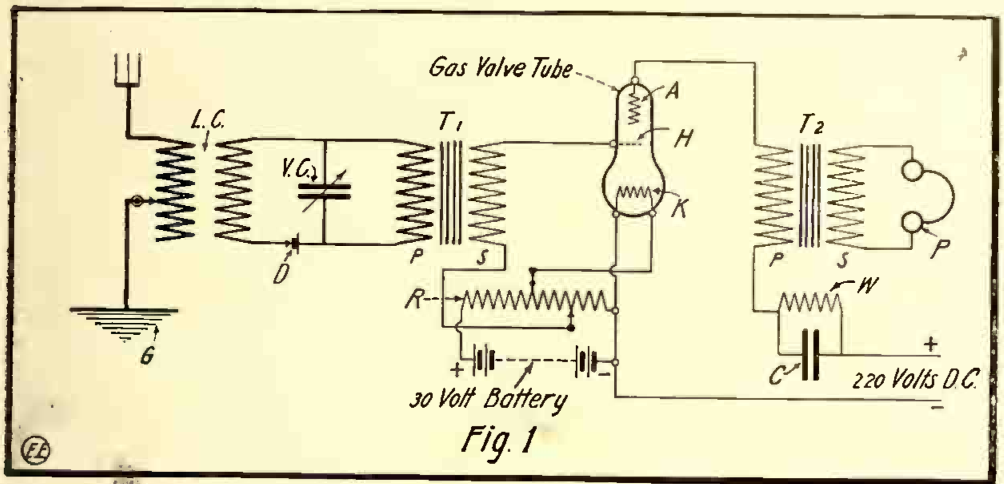


Fig. 1. Circuit and Arrangement of the "Lieben-Reisz" Gas Relay or Amplifier.

The DeForest audion detector and amplifier is already familiar to most readers, and full description of his amplifier, with two and three audions in cascade, was given by this journal some time ago.

The newer gas or ionic stream relay of Lieben and Reisz, the German investigators, is similar to the audion, but possesses distinctive features of its own which render it particularly efficient as an amplifier for weak radio currents, which vary from 1 to 50 micro-amperes usually for fair signals. Their gas relay is shown diagrammatically in Fig. 1. Here a regular radio receiving circuit is represented with aerial A, ground G, coupling transformer L C, detector D of the mineral type, variable condenser V C, and a special transformer T_1. The primary of transformer T_1 takes the place of the telephone receivers usually employed. The secondary of the transformer acts on the valve tube shown at A H K.

The glass tube is exhausted of air and filled with attenuated vapor of mercury at a pressure of 0.001 mm. (20°C.), and this vapor rises from a small portion of mercury amalgam placed at the bottom of the tube. The cathode electrode at K is a platinum strip 1 mm. wide, 0.5 mm. thick and 1 meter long wound on a glass supporting stem, zigzag fashion. This strip is coated also with a thin layer of barium and calcium oxides. The anode electrode A consists of an aluminum wire spiral, while the auxiliary electrode H is made of a thin aluminum plate extending across the tube inside, between anode and cathode. It is punctured through with many holes about 3½ mm. in diameter.

Also, in general, the cathode K is brought to a bright red heat by an electric current from the potentiometer R, attached to a 30-volt battery. Across the cathode and anode is impressed 220 volts D. C. from a dynamo, etc. The voltages must be kept quite steady. A high resistance W, shunted by a condenser C, is in series with the anode, as also the primary coil of a transformer (step-up) T_2. The secondary S connects with telephone receivers P.

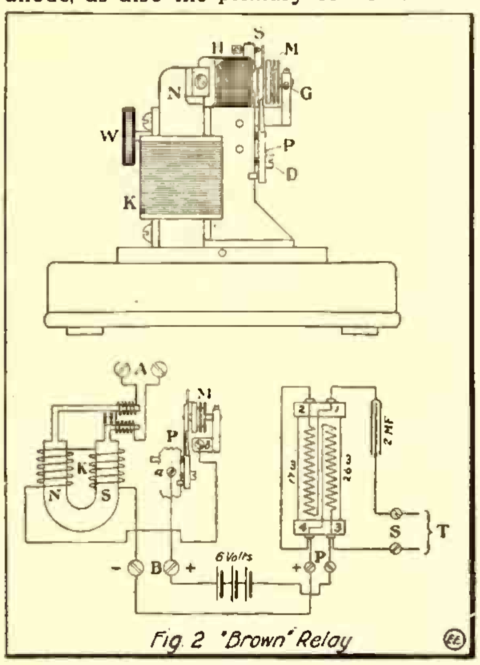


Fig. 2. The "Brown" Telephonic (Microphonic) Type of Relay Adaptable to Radio Circuits.

It was discovered by Wehnelt that heated metallic oxides emit electrons; so in the Lieben-Reisz relay the heated cathode K gives off a stream o cathode rays or electrons (cathions), which pass through the holes in the grid H connected to the radio circuit through transformer T_1. The strength of the cathion discharge through H will depend on the potential of H. Hence it will be seen that varying grid (H) potentials are constantly produced by the received hertzian wave signals acting through the circuit and transformer T_1. As the cathode stream is varied, so will the 220-volt current vary in proportion, and these variations will be heard as strong signals in phones P.

This valve tube acts therefore as a true relay, and it is said that one tube, as here shown, boosts the received currents to 33 times their original amplitude. Of course two or more tubes can be connected in circuit to give any amplification desired.

The electro-magnetic telephone and telegraph relay made by Brown, of England, is widely used for telephone current intensifying, and has been considerably employed for boosting radio signals.

Its make-up will be gleaned from Fig. 2 where N S is a permanent steel magnet frame surmounted by two magnetizing coils K, and two 4,400-ohm coils H (same size pole-pieces, etc., as used in receiver). A light spring or reed P carries a soft iron head to be attracted by the pole pieces. Attached to the moving reed is a rod joined to a delicate microphone M filled with carbon grains.

Referring to the diagram of connections in radio circuits we see that terminals A are joined in place of the regular telephones. The magnet coils K are energized by current from a battery of six volts through the primary (17 ohms) of an auto transformer P S. Across the transformer secondary (26 ohms) at 3, 1, is connected a 2 M. F. condenser in series with a pair of 120-ohm telephone receivers. Its action will be understod readily now. The varying hertzian currents react through coils H on the relay magnetic circuit balance, and cause its armature reed P and the microphone M to vary their positions. The microphone thus changes the resistance of the circuit, and these are transmitted through the transformer P S and condenser to the head telephones.

This style "G" Brown relay has an intensifying figure of about 20 times received strength of signal. Newer types can intensify 100 times and more, or several may be joined in cascade to give as high a ratio as required.

The Telefunken Co. utilizes a unique amplifier indeed, which is outlined at Fig. 3.

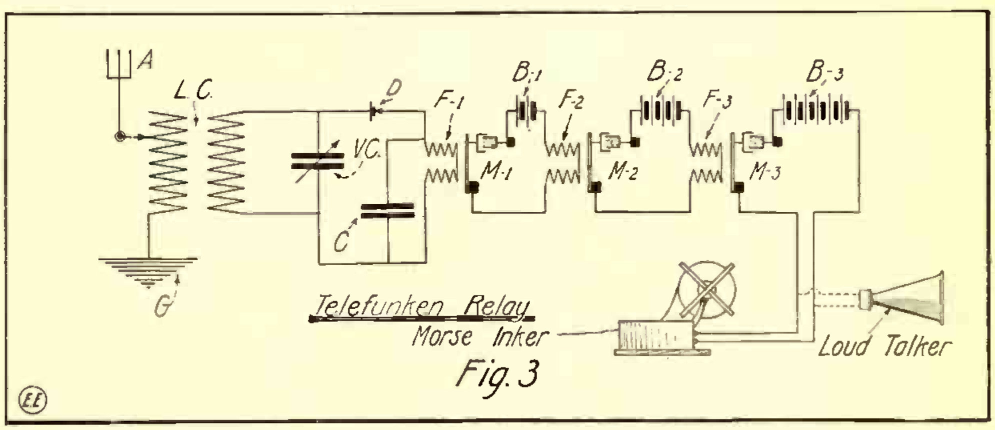


Fig. 3. The "Telefunken" Amplifier Scheme For Radio Receptors, Using Several Tuned Microphones in Cascade.

A radio coupling circuit is joined to a "tuned" reed microphone relay F_1 M_1, and this reacts or controls the battery through a second "tuned" reed microphone M_2, etc., etc. Three microphones are commonly used. Two of these "tuned" amplifiers can receive two distinct messages on an aerial simultaneously without interference, if they and the incoming waves have a tune frequency differing by 20 per cent. or over. Such microphonic apparatus is extremely delicate and must be very carefully adjusted and supported on elastic bands, etc. The third microphone circuit can control a loud talker or Morse tape recorder as desired.

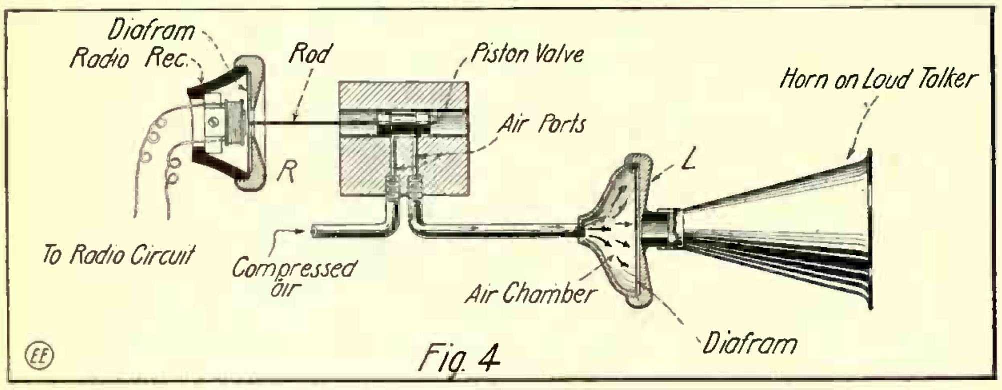


Fig. 4.—The Latest Form of Radio Amplifier Employing Compressed Air.

A new and extremely simple form of intensifier for telephone or telegraph signals is the Parsons compressed air valve, depicted at Fig. 4. A radio or telephone receiver R is connected with by a rod, as seen, to a piston or other valve. Whenever the receiver diaphragm moves or signals are received, it actuates or moves also the air valve controlling the flow of compressed air to a loud talking diaphragm chamber L, and horn as shown. This is only a rough description of this interesting device, which is now being adapted to high grade talking machines to boost the strength of the reproduced voice.

A TUNING COIL WRINKLE.

The wire on a home-made tuning coil is apt to become loose, owing to expansion and the raking effect of the slider. Here is a way to prevent it. First cover your cardboard or wooden core with adhesive electric tape, winding it on spirally and not allowing the edges to overlap. Wind your wire over this tape and it sinks in slightly, forming a groove or screw-thread for itself, so that even when the tape becomes hard, as it will do in time, the wire will not become loose.

Contributed by T. REED.

GOVERNMENT OPENS NEW DARIEN RADIO STATION.

The powerful radio-telegraphic station situated at Darien, in the Panama Canal Zone, has been recently opened for regular service by the U. S. Government.

This station is equipped with a large size Poulsen arc generator and is rated with a transmitting and receiving radius of 4,000 miles.

On the opening test radio-communication was effected between Arlington and Darien, which is a distance of 2,000 miles. There was much criticism at the time the equipment for this station was selected by the Government radio experts, because of the arc transmitter which was favored.

However, as Capt. Bullard has pointed out, the Poulsen arc has certainly proven its wonderful efficiency under the long distance conditions, especially in view of the fact that it has been in daily use for a considerable period at the Tuckerton, N. J., radio station for transmitting day and night wireless messages over a distance of 4,000 miles to Germany.

CONTROLLING 2 K.W. WITH COMMON MICROPHONE.

At one of the Spring meetings of the Institute of Radio Engineers, Dr. Irving Langmuir gave a remarkable paper on the "Electron Discharge in High Vacuum Tubes."

These wonderful tubes, having principally tungsten or molybdenum elements as electrodes, were described in the form of high-voltage rectifiers, high-frequency oscillation generators and radio detectors. Different entirely from the gaseous Audion, they have enormously high vacuums (as low as two 10-millionths of an atmosphere), and the electrodes of tungsten are specially treated so as not to give out when heated, any occluded gases whatever, i. e., gases held in the metals by absorption ordinarily. Hence these tubes always give similar results and are under perfect control, the same as the new Coolidge X-ray tube, as they are absolutely (practically) gas free.

Dr. Langmuir described two radio-telephone transmitters of this type used at the General Electric Works, the smaller set with pliatron tube developing 1½ amperes in the antenna and transmitting speech wirelessly from Schenectady to Pittsfield, Mass. Wonderful amplifying powers were also obtained in radio receiving, eclipsing the performance of Audions. He stated that a common microphone easily controlled 2 K. W. through one of these tubes, giving perfect control for radio-telephony. Several tubes can be joined on multiple to give more power when required.

AN IMPROVED ELECTROLYTIC DETECTOR.

The following detector will almost double the strength of the signals received. To construct it plane up a board 4 inches square for the base. From a piece of round, hard carbon cut a piece 1 inch long. Bore a hole 3/8 inch in diameter 1/2 inch deep on the top side. On the bottom end bore a hole 3/8 inch in diameter and 1/4 inch deep. Pour the latter hole full of molten lead. Drill and tap a hole to fit a 3/16-inch machine screw in the lead. One-quarter inch from the top bore two 1/16-inch holes opposite each other. Put a platinum wire in each so that it will project a slight distance in the cup. Fasten them temporarily in place by filling the cup with clay. In the 1/16-inch holes pour molten lead, thus sealing the platinum in the walls. Remove the clay.

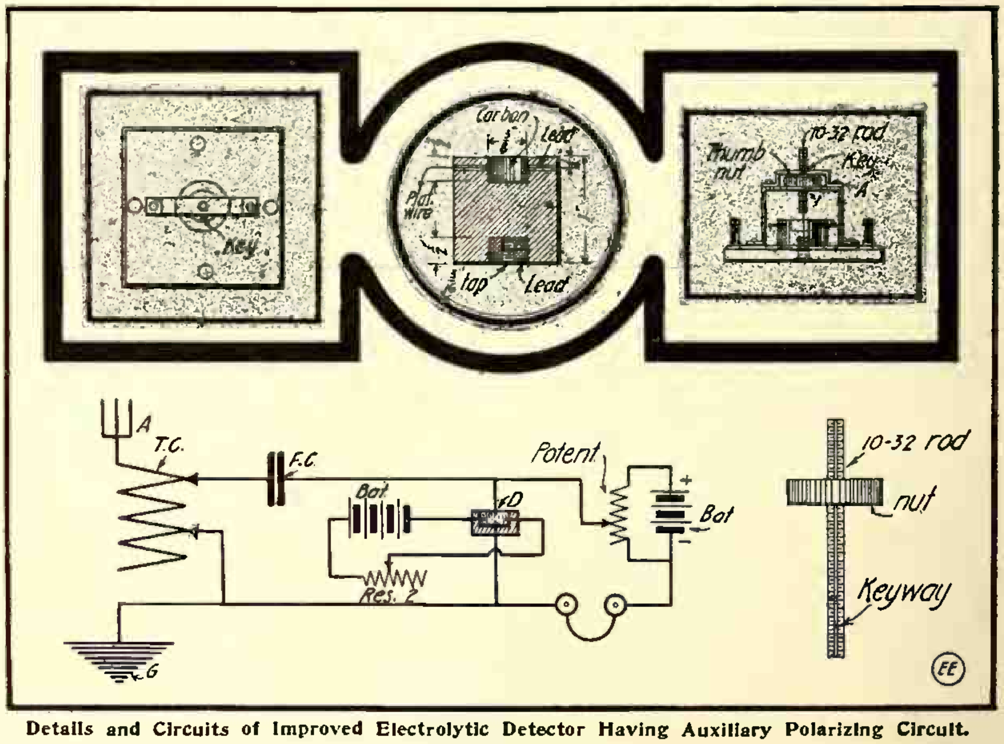
For the standard to support the thumb screw obtain a piece of brass 3/4 inch wide by 1/8 inch thick and form it as shown in sketch. Drill a hole to pass No. 10-32 thread at the place marked 1 and on top of the standard solder a piece of brass as indicated at A. Drill hole in line with the other hole and of the same dimensions.

Thread a brass rod with No. 10-32 thread and about 2 inches long. Procure a nut to fit the thread. With a 3-cornered file make a small groove in the rod. On top of the standard solder a pin or key projecting slightly into the hole. This should be adjusted so the rod will slide up and down, but so it cannot turn. Solder a piece of Wollaston wire to the rod at the lower end.

To assemble fasten the cup to the center of the base. Fasten the standard in place. Slip the head in the slot, first having forced the nut in the head. Then screw in the rod. Adjust the rod the same as in an ordinary electrolytic detector. The action is as follows: When the platinum is connected with batteries it causes electrolysis, thereby augmenting the breaking of the film of gas surrounding the bare point. Resistance 2 should be high, or variable, from 50 to 150 ohms, etc.

Note that the two platinum wires entering the carbon cup must, of course, be well insulated from the carbon.

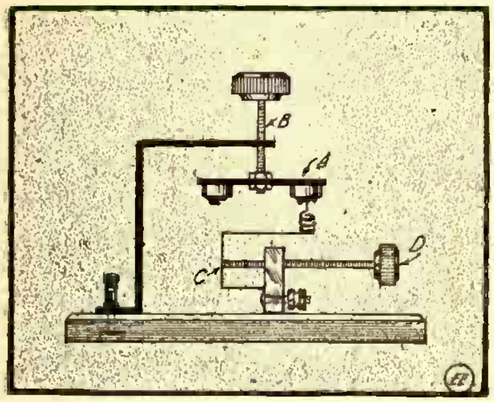
Contributed by ISAIAH ROSIN.



Details and Circuits of Improved Electrolytic Detector Having Auxiliary Polarizing Circuit.

RADICAL DUST-PROOF DESIGN FOR DETECTOR.

As is well known, radio detectors of the mineral type rapidly lose their sensitiveness when the minerals become covered with dust. A great many, of course, endeavor



Radical "Dust-proof" Detector.

to overcome this trouble by covering the detector with a glass bell or by other means.

A new scheme is shown herewith which should prove efficient, and as per sketch the mineral cups are placed on a brass bar or disc A supported by an adjustable threaded rod B. A "cat-whisker" wire contact point of the usual type may be placed on a brass spring C, which has its tension adjustable by means of a threaded rod and knob D.

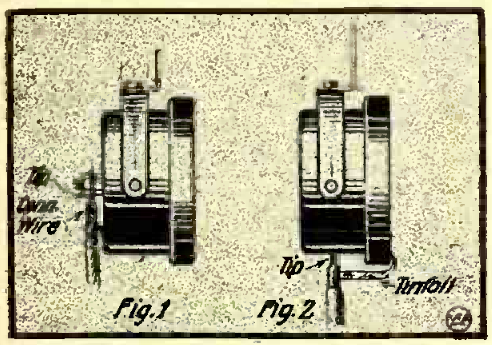
At first this may seem quite impracticable, but on second thought you will see that this is just as easy to adjust as if the mineral cups were facing upward, as in most detectors. This is because you cannot (naturally) "see" the sensitive spot on the mineral, and it must be found, of course, by placing the "cat-whisker" contact point on the various parts of same until the most sensitive spot is ascertained, as manifested by the loudest buzzer-test signal *heard* in the telephone receivers.

Contributed by CARL HENLEIN.

ANTI-HUM STUNT FOR RADIO RECEIVERS.

A great many amateurs are troubled by humming in the wireless receivers due to induction from neighboring electric light wires. The following directions will, if carried out, nearly always eliminate the said hum:

The first method, applying to receivers with metal shells and headbands (not covered with rubber or other insulating compound), consists of merely connecting the tip with copper wire to the shell of the re-



Anti-Hum Prevention in Wireless 'Phones.

ceiver or headband as shown in Fig. 1.

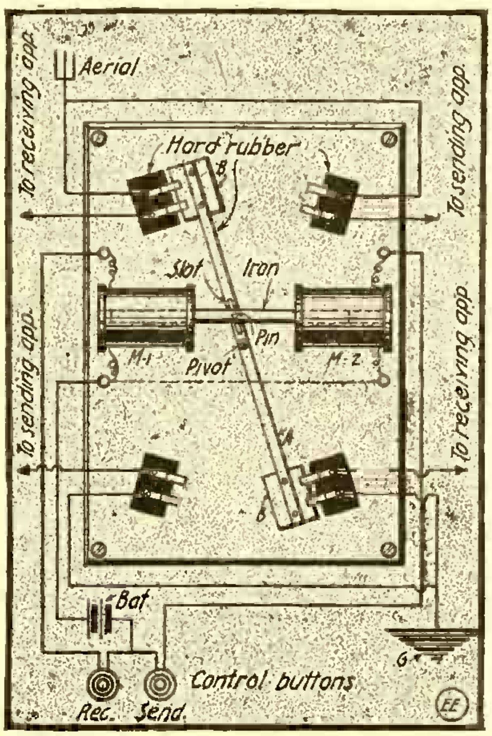
In instances where the receivers and headbands are covered with rubber or other insulating compound it is necessary to wrap a strip of tinfoil around the tip and then paste it down. Then bring it across and paste it there in such a way that it will touch the ear when the receivers are on the head. This will allow the induced current to pass through the body (see Fig. 2).

Contributed by URBAN McMILLER.

A MAGNETIC CONTROL AERIAL SWITCH.

As most wireless experimenters do not care to have the old style aerial switch on their table, etc., with which to control the aerial and ground connections from transmitting to receiving apparatus, etc., the idea here incorporated will undoubtedly appeal to them. On a wax-impregnated hardwood panel about 1 foot square, or better, a piece of marble, is mounted by means of a central pivot a fiber or hard rubber arm A. This arm may be about 1/4 by 1/2-inch stock and 7 to 8 inches long. It carries at either end a contact plate BB of about 1/16-inch copper or brass, having their edges tapered down so that they will readily slip under the sets of contact springs C C C, etc.

These contact springs may be made of phosphor bronze or brass and of about 1/32 by 1/2-inch stock, mounting the springs CC about 1 1/2 inches apart on hard rubber blocks as indicated in drawings. The connections to this switch will be readily understood by looking closely at the diagram. The pivoted arm is moved from right to



Magnetically Operated Aerial Switch.

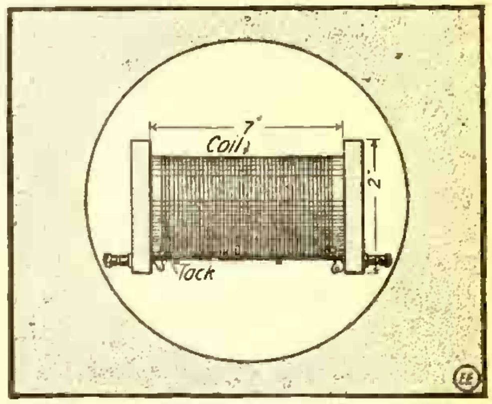
left by means of an iron armature. This armature carries a pin which moves in a slot in the fiber arm A. Two solenoid type electro-magnets M1 and M2 serve to pull the iron armature to the right or left, accordingly as the "control" push buttons are depressed.

The electro-magnets M1 and M2 should consist of brass tubes about 3/8 inside diameter and 3 inches long. They may be wound with about 14 to 16 layers of No. 20 insulated magnet wire. A battery as shown supplies current for this magnetic control circuit arrangement. If properly constructed and by using 6 to 8 dry cells for the battery, etc., this switch will prove a very efficient and attractive addition to any radio station, and it may be placed in a small box with glass front on it; or it may be placed under the operating table, as the builder and user may elect. Contributed by

J. MILTON CRANDALL.

BUZZER-TEST RESONATOR.

I have been using an arrangement called a resonator in my wireless-receiving buzzer circuit. It is such a great help that I thought I would send you the description to publish in *The Electrical Experimenter.*



Buzzer Test Amplifying Inductance.

It is very simple. First, get a 7-inch piece of wood, well seasoned and about 1 1/2 inches in diameter. Shellac or varnish this well. Now wind No. 26 enameled wire on this core for about 6 inches. Fasten the ends of the wires by driving in a tack or short nail at each end, and wind the wire around it a few times. The coil can then be mounted on two square pieces of varnished hardwood, which will increase the looks of the apparatus. The coil is connected in series with the regular buzzer-test wire, which leads to the detector. I find that it makes adjustment 50 per cent. easier, especially with the Crystaloi detector. Contributed by

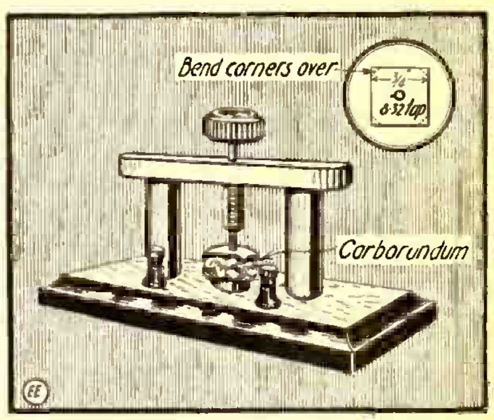
DONALD B. ROCKWELL.

A CHEAP BUT EFFICIENT CARBORUNDUM DETECTOR.

It will be necessary to purchase one Adjustable Zinc spark gap to make this detector.

Remove the two zinc points and substitute two pieces brass, 3/4" square and 1/16" thick, bending over the four corners as per diagram on both pieces. Put a hole in the center of each, and thread for an 8/32 screw. Screw the pieces on the small threaded ends left after removing the zinc points and file off the ends that protrude thru the brass squares. Purchase a piece of carborundum and place it between the brass points, then tighten down the hard rubber knob.

The detector is now ready for use. One



Carborundum Detector Made from Spark Gap.

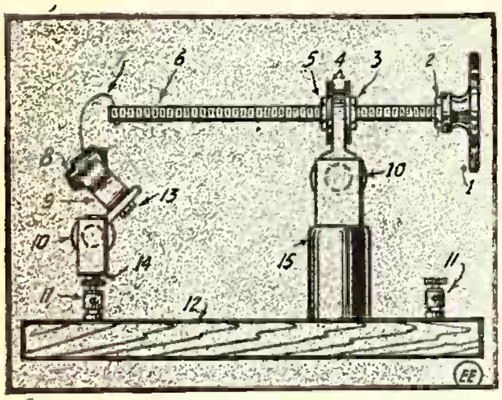
of the characteristics is that when you tighten the thumb screw, the brass points do not move out of alignment.

Submitted by H. J. ANDREWS.

CLEVER MINERAL DETECTOR.

The materials needed for the construction of this detector are as follows:

Wooden or hard-rubber base 5 inches long, 2½ inches wide and ⅜ inch thick



Ball and Socket Adjusted Detector Stand.

(No. 12, referring to diagram); spark-plug ball and socket connector with hard-rubber base (10 and 15); spark-plug ball and socket connector with short brass base (10 and 14); threaded brass rod ⅛ inch in diameter by 3 inches long (6); telegraph key knob (1); clip off small fuse block (9); four binding posts (11, 11); two small washers (4); three small nuts to fit threaded rod (2, 3 and 5); small bolt and nut (13); also two thin bolts to hold uprights to base (not shown in drawing). The four binding posts are mounted, two in front and two in the back, the wire connections being made from the back one on the right-hand side in the drawing to the front one; then to the bolt which holds upright in place, making contact with brass part of ball and socket joint, the same being done on the other side. Connect the 'phones to the front binding posts. Aerial and ground to the other two.

The "cat whisker" is made fast by passing one end of it through a small hole which is drilled in the brass rod, making the wire fast by soldering it in place. By unscrewing the two nuts (3 and 5) you may move the rod to any desired position.

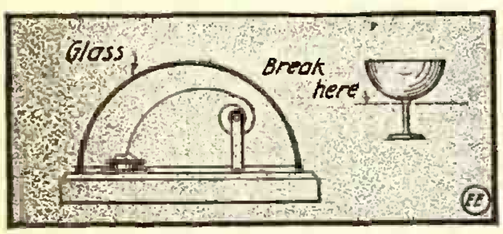
The spark-plug ball and socket connectors are made by the Connecticut Co., and may be obtained in any auto-supply store. Contributed by

WILLIAM DAVIS HAWK.

DUSTLESS DETECTORS.

Dust gathering on detector crystals necessitates repeated washings if best results are desired, and a good plan for keeping the dust out, still allowing observation, is shown in the sketch.

A wine glass, preferably of thin stock, has its stem broken off as near the bowl



Glass Goblet Serves to Protect Detectors from Dust.

as is safe and the rest of the stem is carefully ground off on an emery wheel or grindstone until the bowl has a smooth appearance. It may then be smoothed up on an oil stone. The dimensions of the detector itself must conform with the inside of the glass, and for that reason no dimensions are here given. Contributed by

FRED'K J. SCHLINK.

MAKING TUBES FOR TUNING COILS.

Here is an easy way to construct a very serviceable tube. The tube's great advantage is its lightness.

Take a strip of cardboard several feet long and a foot wide. The width may, of course, be varied if a longer or shorter core is desired. Put the piece of cardboard to soak in water till it is very soft and limp.

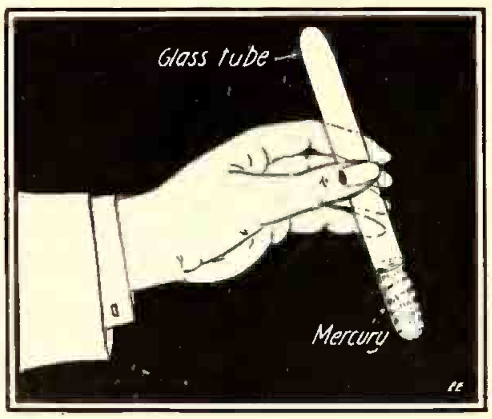
Next take a rolling pin or some other cylindrical object and wind the wet cardboard on the cylinder, glueing or shellacking one layer of cardboard to another. When you have wound on enough cardboard to give you the thickness you want, bind the cardboard with heavy string and put the bundle into a warm oven. In a few hours take the pin out, and the cardboard when taken off will be so stiff that you may easily wind it with wire of almost any size.

NORMAN HALL.

A SELF-EXCITING GEISSLER TUBE.

When the mercury in a barometer tube is agitated the friction of the mercury on the glass generates electricity and produces effects which are visible in the dark.

The self-exciting vacuum tube herewith shown operates in the same manner. The electrical effect is produced by the friction



Geissler Tube Using Mercury Only, and No Current.

of mercury on the inner surface of the glass vacuum tube as the tube is inverted or shaken. The full effect is realized only when the mercury is allowed to flow quickly from one end of the tube to the other, but any agitation of mercury in the tube produces some phosphorescent light. This principle is utilized as an auxiliary signal in bell buoys and whistling buoys.

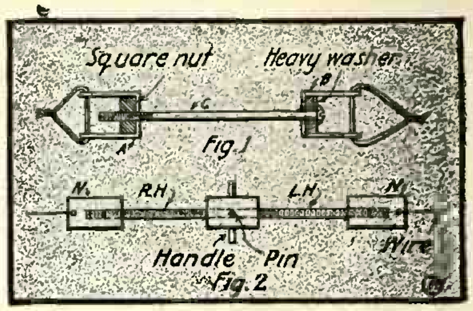
GERMANS' TREBLE WIRELESS PLANT.

The big Telefunken wireless station at Sayville, L. I., the plant through which the German Government transmits most of its official communications to the United States, and through which the German Embassy communicates with Berlin, has been quietly, almost over night, so to speak, increased from a 35 K. W. plant into one of 100 K. W. Three 500-foot towers have been added to the aerial system.

The transformation of the Sayville plant into one of the most powerful of the transatlantic communicating stations in this part of the world has been carried on so quietly that very few persons outside of the radio officials of the Department of Commerce and a few naval officials connected with the wireless naval service have known what was being done. The new and larger equipment was shipped from Germany via Rotterdam.

A CHEAP TURNBUCKLE.

The accompanying diagram (Fig. 1) shows a turnbuckle which can be readily made by everyone. The pieces A and B are of strip brass or iron about 1/8 inch thick and about ½ inch wide. At C is an iron bolt about 3 inches long with a round



Simple Form of Turnbuckle.

head. The turnbuckle is readily tightened with a screwdriver.

At sketch (Fig. 2) is depicted another easily made and serviceable type of strain turnbuckle. It is made of preferably nothing smaller than a No. 14-20 threaded steel rod, one-half the rod being threaded left-handed and the other half right-handed. The steel nuts N N are threaded right-handed and left-handed accordingly, and when the center handle, which is pinned to the threaded rod, is revolved by hand it causes the nuts N N to recede or approach each other.

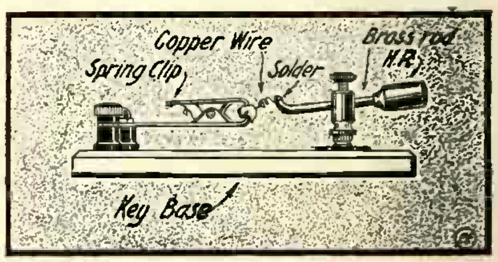
AN ALLOY FOR RADIO CRYSTALS.

Dissolve as much tinfoil (not lead foil) as possible in 5 cents worth of mercury or quicksilver. Work this mass with the fingers until no more tinfoil can be used. Place the mass in a small cup and hold the cup over an alcohol flame with a pair of pliers until the mixture melts. Pour it onto a paper and let it cool. It may then be broken into pieces and kept indefinitely. This alloy melts easily and the crystals can be mounted in it. It is quite hard when cold.—Contributed by

LLOYD STRATTON.

A SIMPLE GALENA DETECTOR.

The following is a description of a galena detector which I have made and found to be very sensitive. The base was from a telegraph strap key. The key lever was taken off and a helix clip cut off and drilled and put in its place. The contact screw was then removed and a binding post put in its place, under which was placed a battery burr, which served to



Effective Galena Detector.

raise the binding post, and also acted as a lock nut so that the binding post could turn. A small brass rod was placed through the binding post and on one end was mounted a suitable hard rubber handle and to the other end was soldered a coiled piece of copper wire, also the rod was bent as shown in the drawing.

Contributed by HAROLD PRUDEN.

HOW-TO-MAKE-IT DEPARTMENT

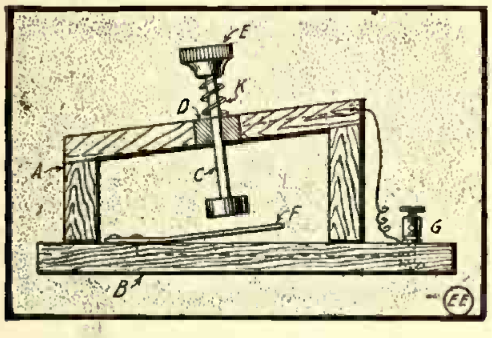
This department will award the following monthly prices: FIRST PRIZE $3.00; SECOND PRIZE $2.00; THIRD PRIZE, $1.00.

The idea of this department is to accomplish new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best ideas submitted a prize of $3.00 will be given; for the second best idea a $2.00 prize, and for the third best a prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings.

FIRST PRIZE $3.00.

FOOT-OPERATED PUSH-BUTTON FOR TEST BUZZER.

It is often found inconvenient when adjusting a crystal detector such as that of the galena type to push with one hand the button or switch controlling the buzzer circuit. In order to allow the freedom of



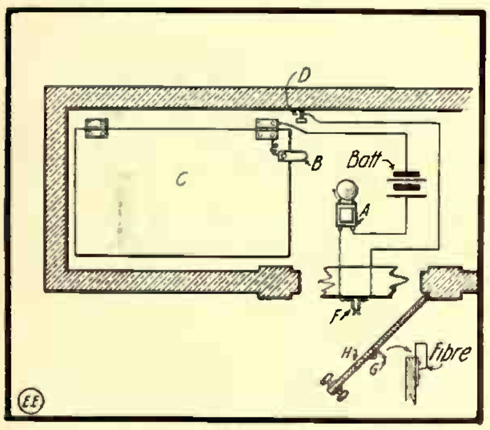
Useful Foot Switch for Buzzer Test, etc.

both hands for adjusting the apparatus yet enable one to operate the buzzer when desired, a switch arrangement that may be operated by the pressure of the foot is illustrated in the accompanying drawing. This device consists of a wooden block A, measuring 2 by 1⅛ by 2 inches; another block B, measuring 2½ by ¼ by 2 inches, which is used for the base; a metal pin C, which is threaded at one end and fitted with the composition knob E; a spring on the pin C shown at K; a metal strip F and the binding posts G. The construction of the push-button can readily be followed by studying the drawing.

Contributed by
THEODORE GATHMANN.

OPEN DOOR BELL ALARM.

Below is a sketch of a device which I think a number of the readers of the *Electrical Experimenter* would be interested in. In my house one of our cellar doors is in the pantry, as illustrated. By carelessness or forgetfulness the cellar door was left open three times, each time a person falling into the cellar. This is what brought about my idea of this little device of *safety first.*



Alarm Bell Rings If Cellar Door Is Open When Pantry Door Is Opened.

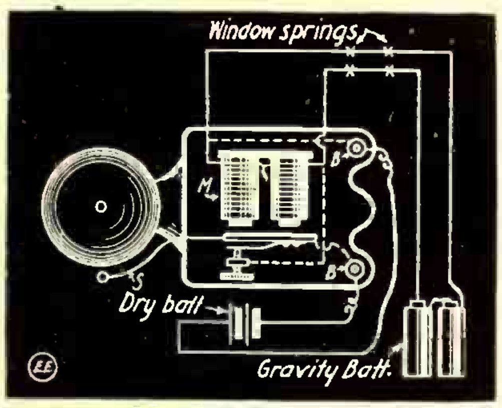
Here is how it works: When the cellar door C is left open spring B comes in contact with the nail D, thus connecting that end of the line. When the pantry door H is opened, the knife G passes between the contact spring points at F, thus completing the circuit and ringing the bell A. This gives ample warning of the danger.

Contributed by A READER.

SECOND PRIZE $2.00.

CLOSED CIRCUIT BURGLAR ALARM.

Given two dry cells, two gravity cells, some wire and the necessary tools; connect the two wires from the gravity battery to the magnets (marked "M" in the drawing). Connect the wire from the dry battery to the regular binding post of the bell. When the gravity cell circuit is broken it allows the striker "S" to rebound and touch the contact screw of the bell, which starts it vibrating in the usual manner. I have found this very efficient and at the same time the cheapest and simplest closed circuit burglar alarm on the market.

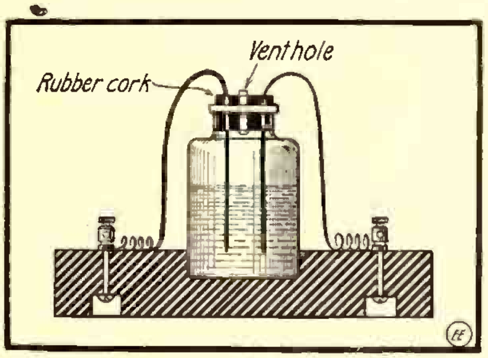


Simple Closed Circuit Burglar Alarm.

Contributed by L. A. MADISON.

A HANDY POLARITY INDICATOR.

Mount a bottle in a block of wood as the cut shows. Arrange two copper wires to dip in the solution of salt water or water to which a slight amount of sulphuric acid has been added. Mount two binding posts on the wood block. When current is connected to the binding posts



Handy Polarity Indicator.

the negative wire will indicate itself by the greater formation of gas bubbles around it. Contributed by
CHARLES ROSENTHAL.

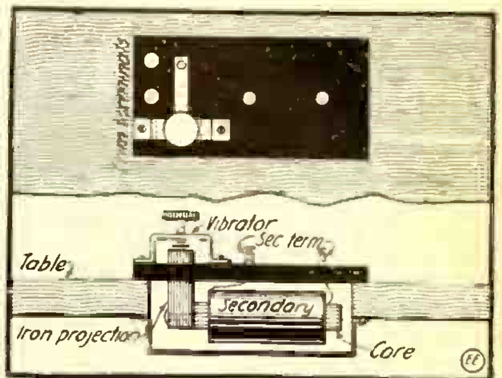
INSTRUMENT LACQUER.

A very good lacquer can be made by dissolving some alum in banana oil. With a small brush paint over the instrument with laquer and let it dry thoroughly before handling.

THIRD PRIZE $1.00.

A NEAT ARRANGEMENT FOR SPARK COILS.

The articles required for this piece of apparatus are a spark coil (any size), with vibrator and binding posts, and a piece of hard rubber about 1 inch longer than the



Unique Mounting for Spark Coils on Table.

core of the coil and 3 or 4 inches wide and ¼ inch thick.

The coil is taken from its case, together with the vibrator and binding posts, and to one end of the core is fastened by means of a nail a piece of laminated sheet iron core, so as to project at right angles; it is cut off at the proper length to work the vibrator, as shown in sketch.

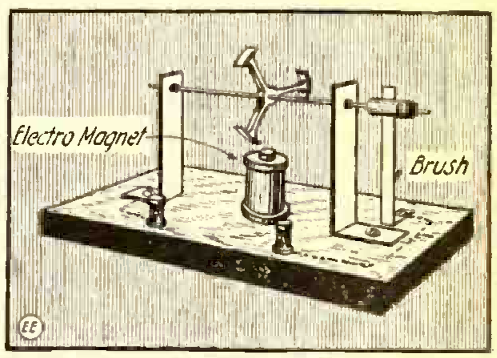
The rest may be best understood from the drawing. The coil itself is put under the table, in oil if desired, and the hard rubber is mounted on the top of the table.

This gives a finished appearance to the instrument very desirable in well arranged radio plants.

Contributed by W. F. ALLSTON.

UNIQUE BATTERY MOTOR.

A short while ago I made a little motor as shown in the illustration. The armature was a three-pole one from an old motor and had the windings taken off. I mounted the axle on which the armature and commutator were fixed between two metal uprights, and under the armature put an electro-magnet from an old bell. The brush was adjusted so that the little screw on the commutator just hit it. To



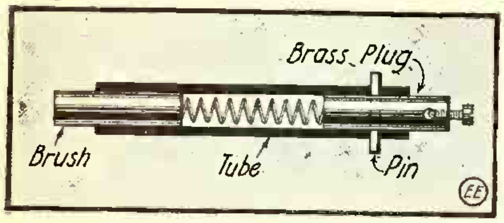
Simple Electric Motor Having But One Electro-magnet.

make the other connection to the commutator I put some small pieces of wire in the screw holes so that they pressed against the shaft.

The current coming from the battery passes through the electro-magnet, upright, axle, commutator, the brush and then back to the battery. JOHN B. MOORE.

BRUSH HOLDERS FOR SMALL MOTORS.

The illustration below shows how very efficient brush holders for small electric motors are made. To begin with, a small piece of fiber or hard rubber tubing is procured and a round carbon brush slides inside the tube; pressure being exerted behind the brush by a spiral spring, as perceived.



Easily Made Brush Holders for Small Motors.

Contact is made from the brush through the spring on to a brass terminal connecting plug, as indicated.

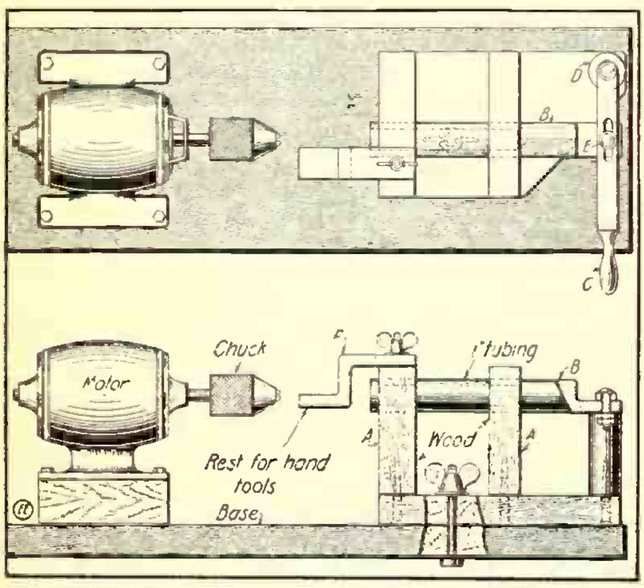
When the brush holder tube is clamped in the machine against the commutator there should be about ⅛ inch or less space between the end of the insulated tube or *brush holder* and the commutator.

To remove the brushes for renewals, etc., when the machine is assembled and when it is not desirable to remove the whole brush holder for the purpose, the brass terminal plug is easily removed by taking out the brass pin shown. The spring pressure exerted between the terminal plug and the brush will always hold the pin in place, but in some cases a small cotter pin is utilized, so that it will not work out, due to vibration.

HANDY ATTACHMENT FOR DRILLING WITH ELECTRIC MOTOR.

Those having a small electric motor at hand can very easily rig up a handy drilling or boring attachment, as shown in the illustration herewith.

The motor is simply mounted on a hard wood or iron base and the shaft is threaded to hold a small drill chuck, which can be purchased at any machine or supply house at small cost.



Drilling, Boring and Turning Attachment for Small Motors.

At the other end of the base is arranged a hard wood or iron frame having two uprights on it at AA. These are drilled so as to pass around a sliding bar B. This bar is moved back and forth by handle C pivoted at D, and by a slot at E in which a pin fastened on the sliding bar B travels, as it is moved back and forth.

To those desiring to use hand turning tools, etc., a simple brass or iron support F will prove useful. This is held by a heavy machine screw wing-nut, as perceived, so that it may be swung out of the way when not in use. The sliding bar B is used to press the work against the drill, similar to drilling in a lathe, and in fact a very good lathe for light work can be made in this way by placing a conical *center* in the spindle B and gripping the work in the chuck, or a second center may be formed on the end of the motor shaft and the work held by a "dog" clamp arrangement. A speed controller is best used in series with the motor, thus giving a wide range of usefulness to this idea.

Contributed by E. L. H.

STATIC MACHINE PLATES.

Many experimenters who wish to build a Wimshurst static machine find it difficult to obtain the necessary plates. Phonograph plates are very suitable for this purpose. Use records that have a song on one side. The tinfoil sectors can be mounted on the smooth side of the record plate with thin shellac, glue or beeswax.

Contributed by S. C. A.

MAKING SMALL LAMP SOCKETS.

The sketch presented is a socket for a miniature candelabra, or single point Ediswan base lamp. It is very simple. The drawing, I think, will explain it all.

Lamp Socket Made from Fiber, etc., and 2 Screws.

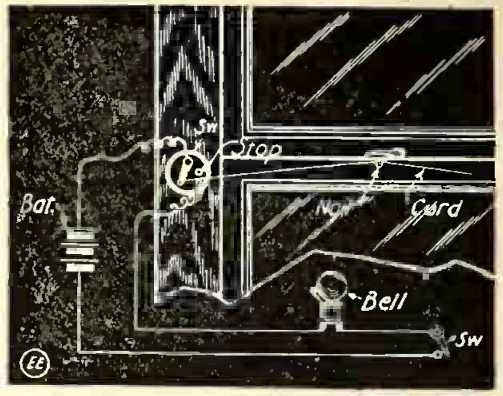
Contributed by

ROBERT McCREADY.

Arc Lamp: An antediluvian lamp which archæologists agree was invented by Noah and used on his hydroplane "The Ark" (from which it takes its name) before the new lighting regulations were enforced.

A NOVEL WINDOW BURGLAR ALARM.

Articles: Two switches (as shown), three cells of battery, some wire, a common hook. It does not require a long description, as the sketch clearly explains itself. Fasten switch on one side of window, as shown. Screw in your hook right under the sash lock of your window. Fasten bell and switch for same at some convenient place in another room. The idea of this arrangement is as follows: Suppose you set the alarm. You fasten a fine silk thread, or cotton string, from the handle of the switch, string it through the hook you have screwed right under the lock of window and tighten it on another small tack on the right hand side of the window. The intruder comes along, gently lifts the window, the gentle raising slowly moves the handle of the switch to the right (see sketch) to the switch point. A little tack in the switch prevents the handle of the switch from moving further. The burglar keeps on lifting. The thin silk string is broken by the pressure and the circuit between the alarm bell in your room is closed until you throw back your switch.



Burglar Alarm Using String to Close Switch.

It is a very simple and reliable burglar alarm. If properly adjusted no sneak or burglar can enter your dwelling.

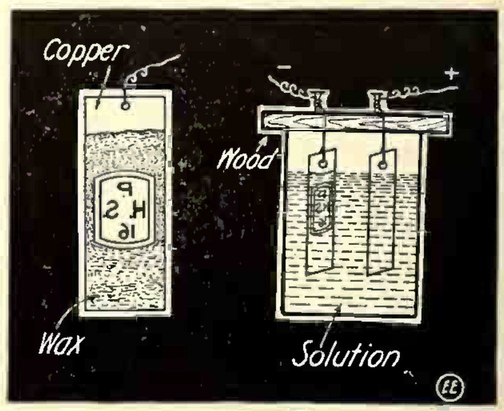
Contributed by

JAMES PEABODY.

MAKING SMALL ELECTROTYPES.

This small electrotype is a model of the way all the cuts for printing books are made. First procure at a drug store two ounces of blue vitriol and an ounce of graphite. Also procure two copper strips 6 inches by 1½ inch, preferably with wires soldered to them, and some beeswax or paraffin.

A pint fruit jar should be filled about two-thirds full of water and the two ounces of blue vitriol placed in it and stirred until water is blue. Then one of the copper strips should be covered with the beeswax or paraffin over a little larger space than the impression is to be. The wax should then be rubbed with the powdered graphite until shiny, care being taken to get graphite around the edges. The impression should then be made by placing the letters, etc., backwards. The wax should then be dusted with the graphite so the impressions will be covered. Then all parts of the strip not wanted in the type should be coated with the wax. This strip may then be fastened to the negative or zinc pole of a series of batteries and the plain strip to the positive or carbon pole. Three cells of battery



Making Small Electrotypes.

should be conneced in series to do the plating. The two strips should be placed in the solution about ½ inch apart, so that the impression faces the copper strip. They should be left in the solution about 36 hours, after which the electrotype may be taken from the wax by a thin-bladed knife. If desired, the electrotype may be backed with solder or other metal to make it more substantial. Contributed by

KENNETH SUTTON.

WRINKLES—RECIPES—FORMULAS

Edited by S. GERNSBACK

Under this heading we will publish every month useful information in Mechanics, Electricity and Chemistry. We shall be pleased, of course, to have our readers send us any recipes, formulas, wrinkles, new ideas, etc., useful to the experimenter, which will be duly paid for, upon publication, if acceptable.

FORMULA NO. 12.

Varnishes.

Varnishes (common Oil Varnish).—*Resin*, 4 lbs.; *Beeswax*, ½ lb.; *Boiled Oil*, 1 gal. Mix with heat, then add *Spirits of Turpentine*, 2 quarts.

Chinese Varnish.—*Mastic*, 2 oz.; *Sandarac*, 2 oz.; *Rectified Spirits*, 1 pt. Close the Matrass with bladder with a pin hole for the escape of vapor; heat to boiling in a sand or water bath, and when dissolved strain through linen.

Mastic Varnish.—*Mastic*, 1 lb.; *White Wax*, 1 oz.; *Spirits of Turpentine*, 1 gal. Reduce the gum small, then digest it with heat in a close vessel till dissolved.

Turpentine Varnish.—*Resin*, 1 lb.; *Boiled Oil*, 1 lb. Melt, then add *Turpentine* 2 lbs. Mix well.

Pale Varnish.—*Pale African Copal*, 1 part; fuse. Then add hot *Pale Oil*, 2 parts. Boil the mixture till it is stringy; then cool a little, and add *Spirits of Turpentine*, 3 parts.

Lacquer Varnish.—A good lacquer is made by coloring *Lac Varnish* with *Turmeric* and *Annatto*. Add as much of these two coloring substances to the varnish as will give the proper color; then squeeze the varnish through a cotton cloth, when it forms lacquer.

Gold Varnish.—Digest *Shellac*, 16 parts; *Gum Sandarac*, *Mastic*, of each 3 parts; *Crocus*, 1 part; *Gum Gamboge*, 2 parts; all bruised, with *Alcohol*, 144 parts. If yellow is required, use *Turmeric*, *Aloes*, *Saffron* or *Gamboge*; for red, use *Annatto* or *Dragon's Blood* to color. *Turmeric*, *Gamboge* and *Dragon's Blood* generally afford a sufficient range of colors.

Varnish for Tools.—Take *Tallow*, 2 oz.; *Resin*, 1 oz., and melt together. Strain while hot to get rid of specks which are in the resin; apply a slight coat on your tools with a brush, and it will keep off rust for any length of time.

Cabinet-Maker's Varnish.—Very pale *Shellac*, 5 lbs.; *Mastic*, 7 oz.; *Alcohol*, 90 per cent., 5 or 6 pts. Dissolve in the cold with frequent stirring. Used for French polishing, etc.

Waterproof Varnish.—The following is much used for waterproof textile fabrics: Boil together until thoroughly incorporated: 2 qts. *Linseed Oil* and ½ lb. *Flour of Sulphur*. Apply lukewarm.

Electrical Varnish.—The only good varnish for all kinds of electrical work, also for finishing wood and metal work, is formed by dissolving *Orange Shellac* in 95 per cent. *Alcohol*.

Mechanics Varnish.—Mix together: 5 parts of *Rosin*, 1 part of *Dragon's Blood*, 1 part of *Gamboge*, 2 parts of *Gutta Percha*, 1 part of *Shellac*, 40 parts of *Volatile Tar Oil*. S. G.

LINING FOR PLATING TANKS.

In pickling, plating and other metal treating processes the lining for the acid-holding tanks requires certain qualities to resist the corrosive action of the acids. A mixture consisting of 75 parts (by weight) of pitch, 9 parts plaster-of-paris, 9 parts ochre, 15 parts beeswax and 3 parts litharge is said to form an efficient lining for this purpose.

INK RECIPES.

(1) Black Writing Ink.—Take 6 ounces of the best gallnuts and pound them in a mortar or otherwise. Take 4 ounces of logwood and let it be cut or ground into very small pieces; these, mixed with 4 quarts of rain water, must be boiled together until half diminished. Then take 2 ounces of copperas made into a powder, and 3 ounces of gum arabic; let these be also mixed and strained through a linen cloth. After this mixture has stood a few hours it may be written with.

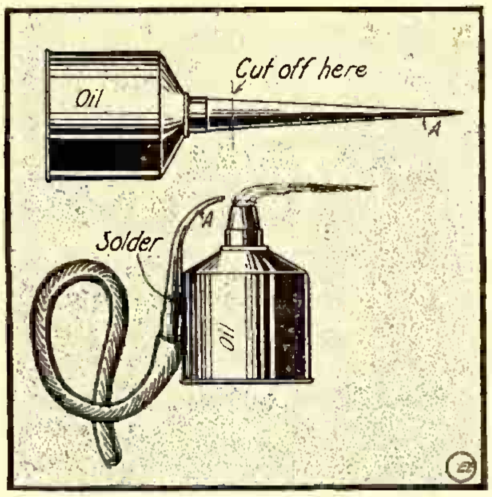
(2) Green Writing Ink.—Dissolve 1 ounce of Hoffman's Permanent Malachite Green in 1 gallon of hot water; add a little gall and alcohol. Reduce with cold water to the required shade.

(3) Sympathetic Ink.—An ordinary solution of gum camphor in whiskey is said to be a permanent and excellent sympathetic ink. The writing must be done quickly, as the first letters of a word have disappeared by the time the last are written. Dipping the paper in water brings it out distinctly, and it becomes invisible again when the paper is dried. It can be brought out repeatedly without affecting its vividness. Contributed by

CHARLES ROSENTHAL.

A HOME-MADE BLOW TORCH.

A good blow torch for the purpose of soldering wire joints and numerous other things may be made as follows: Obtain an oil can similar to the one shown in the



Blow Torch Made from Oil Can.

sketch with a rather long spout. Cut the spout off about half an inch from the top of the can. Next curve it as shown and attach to the larger end a small rubber tubing about 1½ feet long. Solder the spout to the side of the can and pinch the small end of it together a trifle, in order to give a better draft. Place a wick in the can and some alcohol. When using, light the wick and blow in the tube, which will produce a very hot flame.

Contributed by

WENDELL L. CARLSON.

SOME MORE ELECTRICAL DEFINITIONS.

Incandescent bulb: An instrument which burns up your money and makes "light" of it.

Fuse: Something which works steadily most of the time, but which, like other human beings, will have a blow-out once in a while.

Switch: Something which can be put on and off; such as hair, etc.

Magneto: Machine which generates current (except when placed on an automobile).

Buzzer: An electrically operated mosquito.

Electricity: A substance well behaved as a rule, but sometimes quite shocking.

Rotating Field: Seen with varying frequency by some members of the electrical profession and is nearly always produced by a third bottle of "Scotch"; star connected.

Current: The fruit of the dynamo, carried on poles but not used for pies. Contributed by HAMILTON A. HOOPER.

BLUE PRINTS AND BLUE PRINTING.

Since the making of plans is so closely allied with practical work the writer thought that a few words on the manufacture and use of a blue print paper, which can be made and used by the ordinary amateur with excellent results, would not be amiss.

To begin with, procure some tough, well-sized paper, preferably of a good grade, also some citrate of iron and ammonia and red prussiate of potash (recrystallized) and make, separately, two solutions as follows:

Solution 1.—Citrate of iron and ammonia, 1 part by weight; water, 5 parts by weight.

Solution 2.—Red prussiate of potash, 1 part by weight; water, 5 parts by weight.

Mix the two solutions in the dark or subdued light, and apply to the paper with a camel's hair brush or, failing this, a sponge.

The paper is coated by passing the sponge lightly over the surface three or four times, first lengthwise and then crosswise, giving the paper as dry a coating as possible consistent with an even coating. The treated paper is then hung up to dry.

The above paper will require about five minutes to print. For a quick printing paper use a larger proportion of the citrate.

A blue print is made in a printing frame similar to that for printing pictures. The process is, briefly, to expose the tracing, with the blue print paper under it for a proper length of time, and then remove the paper and wash it in water. To print place the tracing with its face against the glass of the frame. Then lay the paper with its sensitized side next the tracing. The back of the frame is then clamped in position and the frame turned over so that the glass is up and the rays of the sun will fall on it at right angles. The above operations should be carried out in the dark or dim light.

When the exposure is finished remove the print, wash it in clear water and hang up to dry in the dark.

Should any lines or dimensions have been left out of the tracing they may be put in the print, using a solution of baking soda in water and an ordinary pen.

Contributed by J. L. GREEN.

A NOVEL USE FOR HOSE CLAMPS.

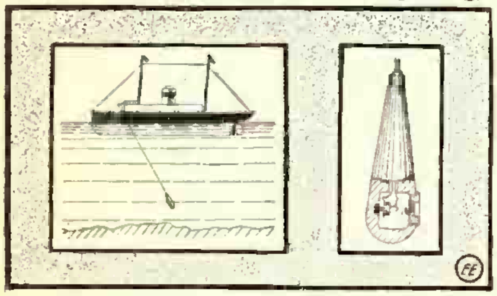
Many amateurs connect the ground lead of their wireless to a water or gas pipe. The best method to do this is by using a ground clamp. The author, not having a ground clamp available, used a hose clamp instead. It is used in the same way as a regular type of ground clamp. These hose clamps may be had in sizes from ½ inch to 2¼ inches; the prices range from 2 cents to 9 cents, according to size.—Contributed by FRANK J. ZACHARIA.

If a voice were loud enough to be heard from New York to San Francisco it would take four hours to travel that distance through the air.

ELECTRICAL-MAGAZINE-REVIEW

ELECTRICAL "SOUNDING" FOR SHIPS.

Believing that depth of water could be measured by mechanical and electrical means from shipboard, a series of experiments were recently conducted from a boat on the Ohio River. The principle adopted and on which the experiments were based was not unlike that of submarine signaling,



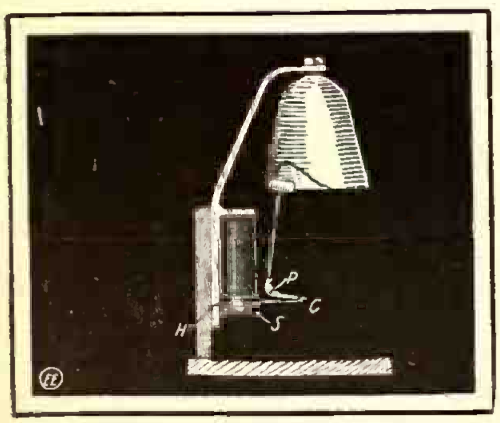
Electrical Device for Finding Depth of Water.

viz., if a sound could be produced on the bottom of the sea such as that caused by dragging a weight across a floor and then transmitted electrically to a telephone receiver at the ear of the pilot on shipboard, a means would be provided which would give warning of the vessel's approach into shallow water. With proper charts, giving speed of boat in knots, length of cable let out and depth of water in feet, it is quite practical to utilize this electrical "sounding" method, which has many advantages over the older method of lowering a weight until it reaches the bottom. A boat can move rapidly and readings taken just the same, says H. R. Gilson in *Electrical Review and Western Electrician.*

AN IMPROVEMENT IN ELECTRIC BELLS.

Considering their importance, electric bells have received singularly little attention, and the design remains substantially as when originally invented. The operation of the ordinary bell leaves much to be desired both from the electrical, mechanical and user's point of view.

A properly designed electric bell should have a hammer arranged to swing through an appreciable arc, while the contact should be made when the hammer is right back and broken only when the armature has come against the pole-pieces. A bell on these lines appears in the illustration. The



New Form of Electric Bell Said to Be Most Efficient.

armature is hinged at H, while the hammer is pivoted at P, the electric contact being at C. The armature rests against the stop S at the beginning of the stroke, while the hammer falls far enough backwards to make the contact C. Current flows through C when the circuit is completed, thereby exciting the magnets which draw up the armature with a jerk, so that the hammer is thrown against the gong and the contact C is also broken. The armature then falls back on to the stop S, and remains there until the hammer falls back and remakes the circuit when the cycle is repeated. The stop S is made springy, which materially increases the force of the blows. Owing to the fact that the contact is made when the armature is right back and not broken until it is against the poles, this form of electric bell is very efficient, while the slow and rhythmic stroke permits the use of musical gongs which ring out with pleasant tones. Laminated magnets give an appreciably sharper hammer blow, and should be used for large bells. The contacts may be made of nickel or similar metal, and are self-cleaning if the metal is thin enough to insure that the pressure is concentrated on a small area where they meet.—*The Electrician*, London.

ANNOUNCEMENT

THE beautiful art supplement with which we present our readers to-day is the little surprise of which we spoke in our June issue.

While we feel proud of our August number, the September issue will eclipse it by far. To begin with, THE MAGAZINE WILL BE ENLARGED AGAIN, the fourth enlargement in five months. Many important new features will be found, all after your own heart. Yes, there will, of course, be another supplement, one over which our "How to make it fiends" will go wild! Then there will be a wonderful illustrated article on Radium, and last, but not least, you will find a rattling good short story in this number, which we know you won't pass up.

If you are not a subscriber, order the September issue without fail today, so your dealer won't tell you, "sold out." Also before we close, remember:

EXPECT MUCH

VOLTS FOR WOMEN.

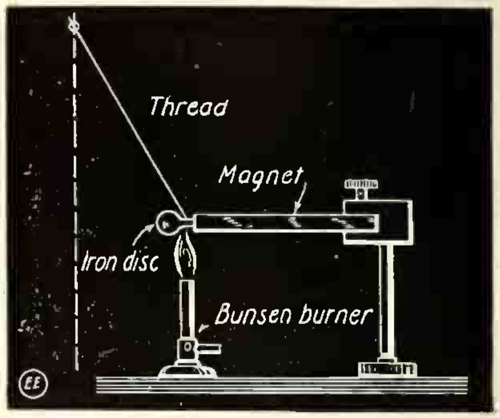
There may be some among our readers to whom the newspaper item about Policeman Ohm being put in a cell means very little. As for ourselves we merly inquire, "Watt for?" and whether he made much resistance. If so, he probably got hot about it. His attorney wanted him discharged, so he could light out. He lost his star connection. Somebody blew on him. Poor man.

EFFECT OF HEAT ON MAGNETISM.

An interesting experiment, depending for its action on the fact that iron when heated ceases to be magnetic, is here described.

A pointed disc of sheet iron is suspended by a thread and is placed with the point against the magnet, which holds it there by attraction. A flame is allowed to burn under the point, which when heated strongly is no longer attracted by the magnet, and therefore swings away. By the time that it has completed its swing it has cooled sufficiently to be attracted again by the magnet.

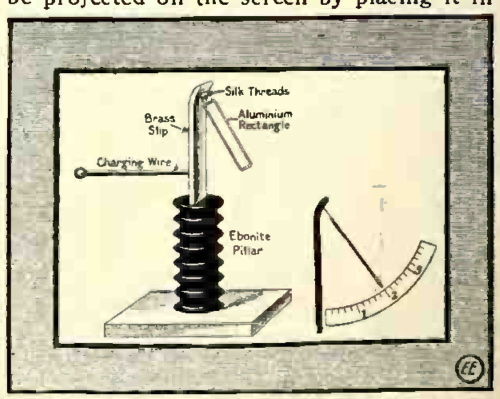
The iron, becoming reheated, swings away again and the cycle of events is repeated. The iron disc should be large enough to cool by radiation sufficiently (during the swing) to become magnetic again, says a writer in *Model Engineer.*



Demonstrating the Effect of Heat on Magnetized Iron Disc.

ELECTROSCOPE FOR LECTURE TABLE USE.

In his recent lectures at the Royal Institution on photo-electric phenomena, Dr. J. A. Fleming made use of an ingenious form of electroscope which he has devised for lecture purposes. In Dr. Fleming's electroscope a slip of brass about 0.25 inch wide and 2 inches long is fixed vertically on the top of a corrugated ebonite or sulphur pillar. The top of this metal slip is slightly bent over. A rectangle made of fine aluminum wire of nearly the same width and length as the slip of metal is attached by two very short cocoon silk fibers to the top of the rectangle, and these fibers are wetted with a solution of chloride of calcium to make them conduct. When the system is not charged the rectangle hangs vertically in contact with the metal slip. If a charge is given to it the rectangle stands out at an angle as seen. It is essential that all edges of the metal shall be carefully rounded so as to leave no sharp points. To the back of the metal slip may be attached a thin wire ending in a small ball, which is convenient for making contact with electrified objects. For lecture purposes the image of the electroscope can be projected on the screen by placing it in



Large Lecture Table Electroscope.

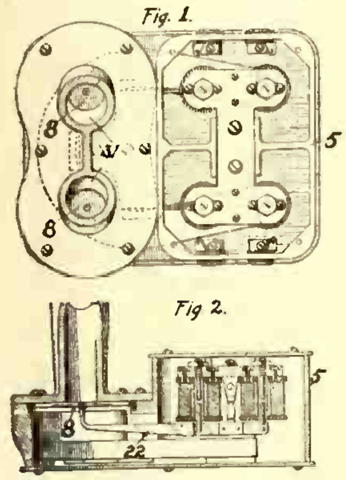
a parallel beam of light and employing a projecting lens and correcting prism. Dr. Fleming employs as a screen a large sheet of paper, on which a curved arc divided into degrees is drawn, as depicted at right of sketch. The radius of this arc is adjusted to be the same as the length of the image of the aluminum rectangle, so that the end of that image moves over the arc, as apparent.—*The Electrician*, London.

LATEST PATENTS

Telephonic Relay or Amplifier.

(No. 1,140,3?6; issued to Henry C. Egerton.)

A rather novel form of telephonic relay or amplifier arrangement, comprising, as shown, a soundproof case, 5, containing in

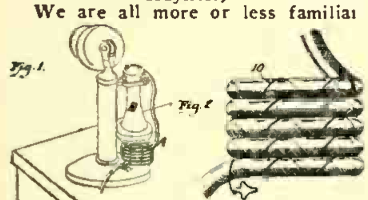


two divided compartments of same two distinct sets of polarized electro-magnetic mechanisms with pivoted armatures 22, as observed. One side of a telephone line is connected with one set of electro-magnets and the vibrations of their armatures vibrate in turn a diaphragm 8. This sets up (acoustically) air vibrations in the return air chamber 31, causing the second diaphragm 8, on the other side of the case, to begin vibrating synchronously. When this second diaphragm starts vibrating it also moves its attached pivoted armature, and this sets up periodical changing electric currents in the second set of electro-magnetic windings, which connect with the second part of the circuit, etc.

Telephone Cord Coiling Device.

(No. 1,140,980; issued to Lorenzo E. Haynes.)

We are all more or less familiar

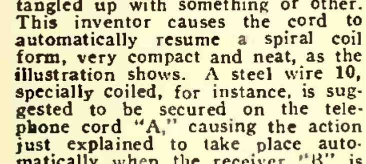


with the troublesome telephone receiver cord, which is forever getting tangled up with something or other. This inventor causes the cord to automatically resume a spiral coil form, very compact and neat, as the illustration shows. A steel wire 10, specially coiled, for instance, is suggested to be secured on the telephone cord "A," causing the action just explained to take place automatically when the receiver "B" is hung up.

Improved Dry Battery.

(No. 1,140,826; issued to William Hoppic.)

Concerns improvement in the manufacture of electric dry cells with the object in view of providing a battery device having improved means, whereby the life of same may be materially lengthened. Further the invention relates to the

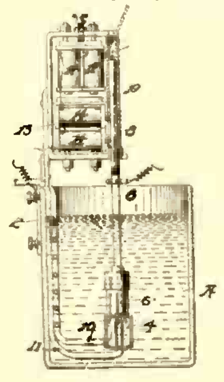


use therein of mercury and aluminum, which are decomposed by chemical affinity and the metallic atoms electrolytically deposited on the zinc, protecting thereby and prolonging the life of the zinc, making it a more active element and generating a higher electromotive force. Several other improvements are covered in the patent, such as improved container, insulation and non-buckling features for same.

A Magnetic Oscillation Generator.

(No. 1,142,196; issued to Alfred H. Cohen.)

A magnetically operated oscillation generator, intended to be used in a wireless transmitting circuit for producing radio-frequency oscillations directly. The main circuit current is broken in an insulating bath "A" in a container 2. The lower electrode 4 is water-cooled, as also the bath, by suitable tubes 10 and 11. The upper electrode 6 is raised by a peculiar magnetic system 14 and 17. The upper electrode 6 is joined to an iron lifting rod 8. The electromagnets 14 first act on this rod and an instant afterward the upper set of electro-magnets 17, 17 attract an iron armature 19 on the movable magnet frame 13. By this compound magnetic action the patentee claims to be able to synchronize and properly tune up a set of these interrupters operating in series, etc., so that they will work to a maximum efficiency in a perfect manner. They are intended to be hooked up directly across the dynamo circuit and to have a capacity and induct-

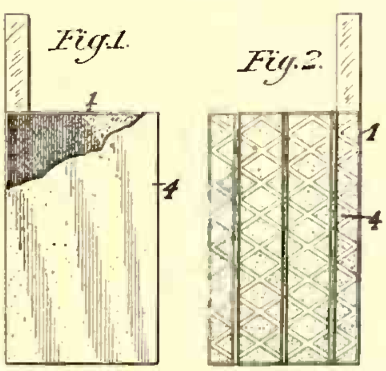


ance shunted across the gaps here described.

Storage Battery Plate.

(No. 1,141,251; issued to Joseph O. Luthy.)

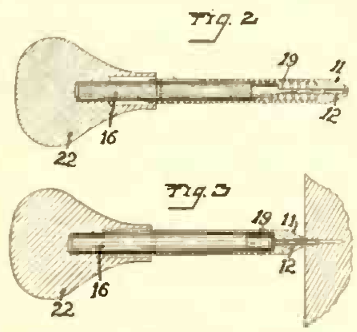
A novel method of improving storage battery plates and to prevent the active element of same from disintegrating or peeling off. This patent covers a process for coating the outside of the battery plate 1 with a porous, enamel-like



coating 4 which, it is claimed, does not lower the efficiency of the battery in any way or introduce any undue resistance, as proved by actual tests. A method is also mentioned for improving this process by having the enamel coating supported on a fine mesh screen. It is claimed that this patent absolutely prevents the active element of the plate from falling out or becoming damaged otherwise, electrolytically (? *Editor.*)

A Magnetic Brad-Set.

(No. 1,141,073; issued to Charles H. Parks.)

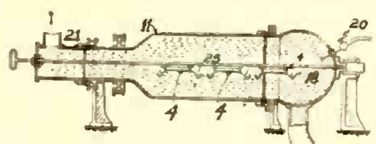


Another practical application of magnetism. In this particular invention there is provided a magnetized steel bar 16, which is repelled out of the hollow barrel 11 by a spiral spring 19 within the barrel. Small iron brads, etc., are held within the opening of the barrel 12 by the magnetized stem of the steel rod. By exerting a sharp, quick pressure on the ram head 22 the brad is driven home.

Ultra-Violet Ray Water Purifier.

(No. 1,140,819; issued to Victor Henri, André Helbronner and Max von Recklinghausen.)

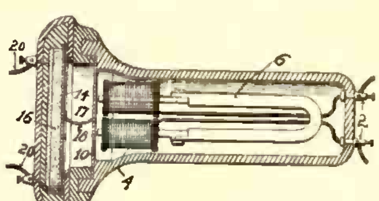
A new form of ultra-violet ray device for water purification purposes. Ultra-violet ray tubes 4, such as quartz mercury vapor lamps, are mounted on a suitable support 8 within a rotatable water chamber 11. In operation this chamber is filled with water from the inlet 21 and when full the chamber 11 is rapidly rotated. This causes the water at the center, by centrifugal force, to leave a vacuous space at the center, as indicated by the dotted line space 23. Thus the water does not come in contact with the tubes, yet the rapidly swirling mass of liquid is thoroughly permeated by the ultra-violet ray and thus sterilized. The air space 23 may be varied as to size by admitting more or less compressed air through pipe 20.



Simple Telephone Repeater.

(No. 1,143,173; issued to Gustavus A. Janicke.)

A very simple form of telephone repeater or amplifier whereby the telephonic currents enter terminals 2, joined to the usual electromagnetic coils 4, mounted on permanent magnet 6. In front of their pole pieces is a diaphragm 10, connected by a metallic wire 18 with a second diaphragm 14, behind which are carbon granules forming a microphone 16. The space 17 between the two diaphragms 10 and 14 is air-tight, so that each diaphragm can vibrate independently of the other, as the wire 18 is flexibly

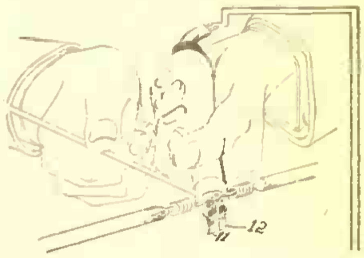


joined to the diaphragms. The secondary circuit of this repeater or amplifier is joined to the wires 20, connecting with the microphone.

Electric Soldering Iron.

(No. 1,142,306; issued to John G. Clemens.)

A distinctly novel form of electric soldering iron, quite different from the usual form we are familiar with. This device is arranged to pass electric current through one of its electrodes 11, through the wire joint to be soldered and thence back to the second electrode 12. The patentee mentions that it is best to make these electrodes 11 and 12 of some high resistance material, such as German silver, etc., so as to cause as much heat as possible to be generated by the passage of the current through these parts. Also, no solder is used on the "iron"

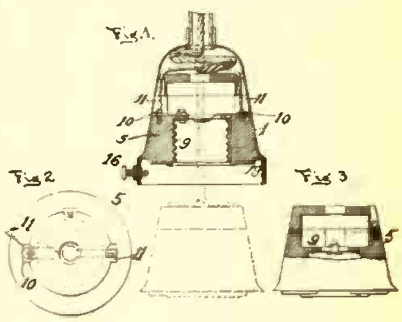


proper, as is the case with ordinary soldering coppers.

Improved Lamp Socket.

(No. 1,140,498; issued to Charles L. Cassidy.)

The inventor of this electric lamp socket has endeavored to make it

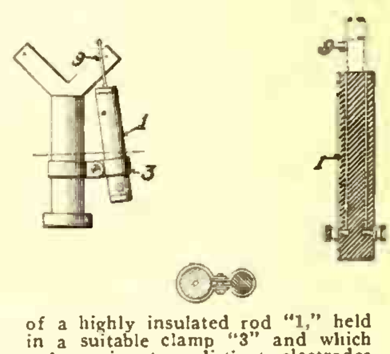


as simple as possible from the manufacturing point of view. The shell "1" is made from one piece of stamped metal and, as the dotted lines show, the interior insulation plug "5" carrying the lamp base contacts "9, 10, 11" slides forward when the three retaining screws "16" are removed. The plug "5" is held in place by a flanged ring "19." The screws "16" hold this ring in place and also secure lamp shades or reflectors. A promising patent.

Electrical Head-Lamp Igniter.

(No. 1,139,759; issued to Francis N. Fox.)

This patent covers construction



of a highly insulated rod "1," held in a suitable clamp "3" and which rod carries two distinct electrodes "9," which have between their upper free ends, a spark gap of short length. A regular high tension ignition coil can thus be connected to these two insulated sparking wires "9" and it is thus possible for the owner of gas head-lamps to light them from the seat of his automobile.

(Copies of any patent above mentioned supplied at 10 cents each.)

AMONG THE AMATEURS

AMATEUR RADIO STATION CONTEST.

Monthly Prize, $3.00.

This month's prize winner.

JOHN J. GROSSMAN'S WIRELESS STATION.

Herewith is photo of my wireless station, which I should like to appear in your valuable magazine.

Views of Mr. Grossman's Wireless Station and One of the 70 Foot Aerial Masts. Also a Likeness of the Owner of This Very Efficient Plant Appears Below.

This station made some records in the past winter, having worked with the University of North Dakota, 920 miles; with Northampton, Mass., and 8 O. Z., Kane, Pa., several times. We are a *sure link* in the American Radio Relay League and the Central Radio Association, as we have two operators and are "in" right along. An Audion set is used for reception.

Tiffin, O. JOHN J. GROSSMAN.

E. C. WAIDLER'S LABORATORY.

Herewith is photo of my wireless outfit. It consists of a ½-K.W. transformer with meters, regulators and an air-cooled gap. The receiving set is composed of a Ferron

E. C. Waidler Busy in His Wireless Laboratory.

and Perikon detector, two fixed condensers and a Blitzen variable condenser, a loading inductance of 3,000 meters' capacity and a receiving transformer of my own make.

My aerial is composed of six copper-clad wires on 12-foot spreaders, and is 75 feet long by 80 feet high. I get Arlington every night and sometimes I hear Key West and Colon. I also use a Geissler tube for a radiation tester and it works very satisfactorily. I think your magazine is excellent.

E. C. WAIDLER.

East Toledo, O.

Beech's Wireless Installation.

Herewith is presented the radio station of Guy Beech, of Clarinda, Iowa. The sending set comprises the following instruments: One-quarter-inch Bulldog spark coil, key, home-made condenser, helix and spark gap. The receiving outfit is com-

Guy Beech and His Radio Outfit.

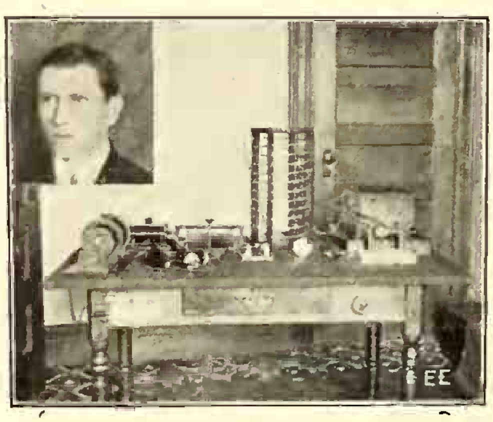
posed of a 75-ohm receiver galena detector, "junior" fixed condenser and tuner.

Good results are obtained with this set and Arlington and (I. W. Co.) Illinois Watch Co. can be easily heard.

Clarinda, Iowa. GUY BEECH.

HOOVER WIRELESS PLANT.

The receiving set of my wireless outfit consists of a loose coupler made from a design given in Modern Electrics. A variable condenser, Brandes' navy 'phones loading coil and perikon detector, from crystals furnished by Electro Importing Co. The sending set is a ¼ K. W. closed core transformer, with glass plate condenser, helix, key and spark gap. I use a sending wave of 190 meters. I notice only about two out of ten amateurs seem to



Raymond Hoover and His Neatly Arranged Wireless Set.

have a Government license; I would like to see all the amateurs get a license, it is so easy to procure. They only try you in one wireless code, and very slow. Also the questions asked most any amateur knows. My call is "2 L. Y."

RAYMOND HOOVER.

Newark, N. J.

To find the approximate wave length of radio aerials multiply the total length of aerial in meters by 4.5.

ANTONE SYLVIA'S STATION.

I give you herewith a photograph of my wireless station for publication in your magazine. The station comprises the following:

Two loading coils, a loose coupler, one sliding plate variable and a Clapp Eastham rotary variable, two fixed condensers, one silicon detector and one Perikon, one pair of Brandes' 'phones, transatlantic type, and also one pair of Brandes' navy type. The cabinet set was designed and built by myself. I use an inside antenna and get good results.

Sending outfit includes Mesco 1-inch spark coil, spark gap, a Clapp Eastham ¼-K.W. helix, one section of Murdock condenser and Mesco key mounted on a

Mr. Antone Sylvia's Excellent Radio Station.

marble base. The station also has a switchboard, seen at the right, which contains all the necessary switches to operate the station.

The microphone seen in the picture is used for wireless telephone experiments and, using the inductive system, I have talked about four blocks away, or 518 feet, to be more exact.

I have read your magazine and find it valuable for radio experimenters.

ANTONE SYLVIA.

New Bedford, Mass.

RADIO SET OF F. F. DENNIS.

Below is photo of myself and my radio receiving and sending apparatus. My aerial is 135 feet long and 60 feet high, and consists of five wires 2 feet apart. My receiving apparatus consists of one double-slide tuning coil, one E. I. Co. single-slide tuning coil, one fixed condenser, a galena detector and one pair of Brandes' 2,000-ohm superior 'phones.

My sending apparatus is composed of a 1-inch spark coil, one home-made condenser, Mesco key, large home-made helix,

Wireless Signals Coming in at Station of Fred Dennis.

zinc spark gap, 10 dry cells and a three-pole double-throw switch. The receiving range is about 600 miles at night.

I would be pleased to talk to any amateur within by range, or will be glad to hear from anyone. My call is 2 J. T.

Fair Haven, N. J.. FRED F. DENNIS

Phoney Patents

Under this heading we will publish hereafter electrical or mechanical ideas which our clever inventors, for reasons best known to themselves, have as yet not patented. We furthermore announce the grand opening of the

PHONEY PATENT OFFIZZ

For the relief of all suffering daffy inventors in this country as well as the entire universe.

We will revolutionize the Patent business immmediately and OFFER YOU THREE DOLLARS ($3.00) FOR THE BEST PATENT. If you take your Phoney Patent to Washington, they charge you $20.00 for the initial fee and then you haven't a smell of the Patent yet. After they have allowed the Patent, you must pay another $20.00 as a final fee. That's $40.00 ! ! WE PAY YOU $3.00 and grant you a Phoney Patent in the bargain, so you save $43.00 ! ! When sending in your Phoney Patent application, be sure that it is as daffy as a lovesick bat. The daffier, the better. Simple sketches and a short description will help our staff of examiners to issue a Phoney Patent on your invention in a jiffy.

PHONEY PATENT OFFIZZ

A. WALL-EYED PIKE, OF MOMBASHIA, N. Y.

No. 41144¼ (For Luck) FISHERMAN'S DELIGHT **Patent not Applied for June the foist, 1915**

Specification of Phoney Patent

Application junked December the onc't, 1890½

To Those Whom It May Not Concern:

I, Wall-eyed Pike (note the hyphen), of the Principality of Mombashia, N. Y., have invented means whereby the *sadly neglected fisherman* has come into a heaven of his own, by virtue of my marvelous invention, which shall be known hereinafter, henceforth and ever after, as the "Fisherman's Delight.".

Just why the fisherman, on whom we all depend at times for food, has been so sadly neglected by the numerous inventors of our marvelous age is hard to reason out, and therefore I have devoted my best energies in perfecting an invention, so devised that when the tired fisherman is at home he can have all the peaceful slumber he cares to indulge in, without having to arise early in the morning, or in fact any time in the morning, to catch a mess of fish for dinner.

In further description of this infamous scheme, the reader is referred to the hieroglyphical sketch, and the various parts are numbered to correspond with inscription given below: To begin with, the basic part of this wonderful invention, albeit, centers on the rain-catching tripper 1. On a fine rainy morning, the "Tomato can" fastened to switch lever 2 soon becomes filled with water, opening the lever switch contacts 3. Thus the electrical circuit 4 is prevented from operating when the alarm clock 5 operates in the early hours of the morning. If it is a bright, fair morning the lever switch 2 remains closed, and when the clock 5 goes off it closes the electrical circuit 4, by means of battery 6 and wires 7, to start operating an electrically driven rising and falling baited net mechanism 8. The net is depicted at 9.

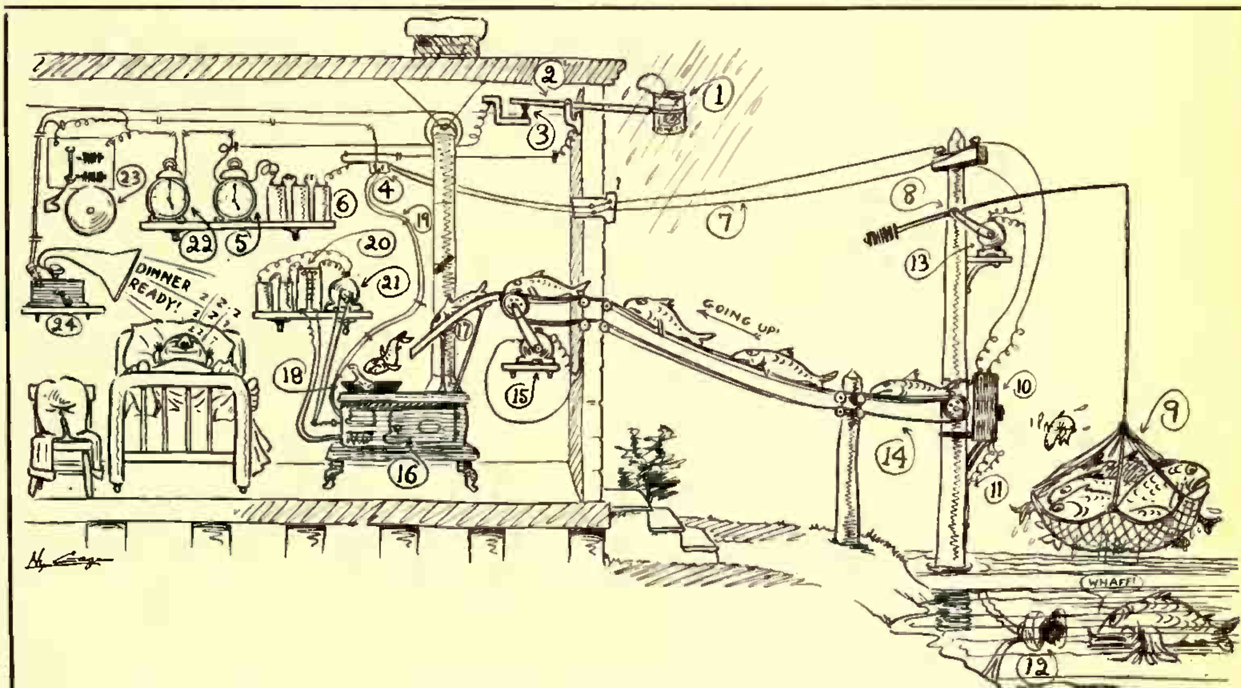
This part of the apparatus may seem somewhat hazy to the uninitiated, and so we hasten to explain. At 10, on one of the wooden piles supporting the fish-catching parts of the perfected "Fisherman's Delight" machinery, is mounted an automatic electrical relay device, which is hooked up with a couple of heavy insulated wires 11 to a very sensitive microphone 12. Now this device is so arranged that when the clock 5 closes the circuit 7 in the morning, the electric motor 13 moves the lever 8, to lower the net 9 into the water. As this net should not be raised until filled full of fish, of course, some arrangement must be provided that will close the circuit of the motor 13 again to raise the net only when the fish have entered same.

I duly provide for this function by means of a sensitive microphone 12 (which has been used by fishermen for some years to "hear" fish approaching). When the school of fish approach the baited net their swishing about in the water sets up sounds, and these strike the microphone 12, which communicates them electrically to the relay 10, and so the net is raised into such a position that it ejects the fish on to the moving belt conveyor 14, which is driven in the house by an electric motor 15, whose circuit was closed by the clock 5 when it first went off in the morning. This belt conveyor is always moving and carries the fish into the house, and when they near the stove 16 they are precipitated through an inclined shute 17 into the frying pan 18.

The fire in the stove 16, which may use wood, coal or oil, etc., is to be started by electric current through the wires 19, joined on to the circuit 7 from the clock 5. When the fish have been fried sufficiently and, conjointly, when the fire has burned to a sufficient degree of heat, it will cause a thermostat 20 to operate an electric motor 21, which will close the damper or regulator of the stove.

This whole arrangement is, of course, to be so proportioned and designed when practically installed, that all of the foregoing operations will take place in the forenoon and at dinner time the alarm clock 22 will then operate, and should the fisherman not hear the ordinary bell, it is arranged to close a circuit through a 12-inch fire alarm gong 23.

A somewhat more gentle awakening device may be provided, if preferred, by utilizing a talking machine 24, electrically actuated or started from a circuit such as that connected to the gong 23. Some folks prefer to be awakened according to the latest scientific theories, or by music; and so a musical record may be placed on the machine, or if the announcement, "Dinner Ready!" is preferred, then a specially prepared record may be made with a continuous rapid-fire string of such words on it.



The "Fisherman's Delight" Patent Insures Plenty of Sleep for That Individual. Does Everything but Eat the Fish.

In testimony whereof I have hereunto scrawled my name this foist day of December, 1890½.

A. WALL-EYED PIKE.

By his attorney:

S. W. Healy, Troy, N. Y.

Witnesses:

A. DILL PICKLEFRESSER,
I. M. A. HELGAMITE,
A. BLACK BASS.

Chappie—"Electricity is wonderful. I tell you it wealy makes one think."

Miss Cutting—"Yes; why don't you get a battery?"

QUESTION BOX

This department is for the sole benefit of the electrical experimenter. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail.

RADIO LAW AND WAVE LENGTH.

(294) C. Howard E——, Sandwich, Mass., asks several questions relative to the wireless law, etc.

A. 1. We are pleased to advise you as follows regarding your radio queries:

The matter of a wireless license, as required by the radio law now in effect, is explained in detail in papers procurable from your local radio inspector; address care of Custom House, Boston, Mass.

This law requires that where an amateur is to transmit wireless messages his radiated wave length shall not exceed 200 meters in value.

Also with regard to the latest rulings with respect to the U. S. radio law and experimental radio-transmitting stations, would say that where the amateur radio-transmitting station is located so far inside the State border line that it cannot transmit over the border line no Government license is required, ordinarily. However, if this station can interfere with the transmission and reception of commercial or Government radio messages over that State border line, then the amateur transmitting plant must have a license, and this decision has been handed down recently in several court cases.

STORAGE BATTERIES.

(295) William A. Collins, Philadelphia, Pa., writes us regarding storage battery capacity, lamps to be used, etc.

A. 1. The usual discharge rate for 6-volt 60-ampere-hour storage battery is about eight hours, or in other words, about seven to eight amperes for that period.

As the volts times the amperes give the watts used in the circuit, you can readily, of course, figure out how many lamps you can operate of any type you are interested in, figuring 1 watt per candlepower for the battery-type tungsten lamps.

LIGHTNING RODS vs. WIRELESS.

(296) Clifford Pinkerton, Spencer, S. D., wishes to know whether lightning rods on a building will affect a radio antenna on the same building.

A. 1. Lightning rods, of course, will have some effect on wireless aerials, as they tend to dissipate some energy in the earth.

However, they are generally of relatively small area as compared to the large metallic spread of the antenna, so that they do not have such a great effect as might be imagined. This refers to either indoor or outdoor aerials. Also the aerial proper should be placed as far as possible from such conductors.

SPARK GAP QUERIES.

(297) C. D. Blair, Richmond, Va., wants data on best form of spark gap to be used on radio transmitter, employing electrolytic interrupter, so as to give the highest pitch possible.

A. 1. You can improve the tone or pitch of your spark by using a quenched gap. It is not usually beneficial to use a rotary-type gap with electrolytic interrupter, as the interruption frequency is not regular enough.

Hence to realize the best results with a variable frequency in the primary you should use a quenched gap, as this form of gap will operate on any frequency very nicely, and it makes practically no difference in the design of the gap whether 60 or 500 cycles are used in the transformer primary circuit.

We believe this to be the best solution of your problem, and of course you can raise the spark tone some by careful adjustment of the electrolytic interrupter anode.

RECEIVER GIVES SOUND WITHOUT DIAPHRAGM.

(298) A. B——, Amboy, Ind., inquires for construction data of 3,000 meter loose coupler.

A. 1. You will find this data, with complete working drawings, given in the March, 1914, issue of this journal.

A. 2. As far as we know, a person holding a commercial radio license can obtain a position in a land radio station without first serving at sea.

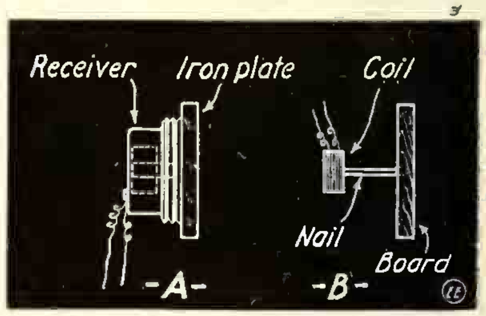
A. 3. We are very much interested in your experiment whereby you cause a telephone-receiver shell and magnet only, without any diaphragm and cap on same, to give forth a sound as usual.

This matter has been explained in several ways from time to time, and as near as can be judged from the various theories and explanations regarding it, it is based on the change of the molecules making up the iron core in the receiver. We should imagine that with a receiver connected across the vibrator of a buzzer, as in your case, the sound heard in the receiver would be naturally more pronounced than if speech were being reproduced, owing to the fact that the buzzer *make and break impulses* are very strong.

We give herewith sketch showing how a very interesting experiment can be made by means of a telephone receiver without the usual diaphragm. We may say, before going further, that in all these experiments it has been found best that the coils shall be wound rather loosely, but not necessarily so loose that the turns can jump about or vibrate.

In the sketch a peculiar experiment is shown at "A," where a thick iron plate, which may be as thick as 1 inch, is placed in front of the receiver and the magnet coil and the pole piece of same acts on this plate. Speech has been reproduced in this way, and of course, as it is impossible for the small receiver to vibrate the whole plate by bending it in the way the diaphragm of 1/64-inch iron does, the iron must vibrate in unison with the speech waves, etc., by molecular vibration.

Regarding the exact theory of how these molecules become magnetized and demagnetized so as to manifest this change in their condition physically, this is not very



Telephone Receiver with Thick Iron Diaphragm at A; Board Reproduces Speech When Arranged as at B.

well defined. It has been pointed out by several authorities such as Silvanus P. Thompson, of England, that a *magnetized* steel bar is longer than when it is *not magnetized*. He has also stated that a definite click can be heard when the bar is magnetized and demagnetized, and he says theoretically that this is undoubtedly due to the fact that the molecules when magnetized tend to set themselves, end to end, and thus the steel bar is lengthened.

It may be said that in such experiments with solid iron plates or bars having coils mounted on them to create speech without the usual diaphragm, the iron used is always best of very soft or cast stock, and steel works very poorly, if at all.

At "B" in the sketch is shown another experiment of interest where the receiver magnet coil has inside it an iron nail with, preferably, a good, large head on same. The nail is driven into a piece of board as shown. If this board is held against the ear, it will be found that the speech can be heard all right, as well as if a regular receiver were used, but of course not quite as loud. The board acts probably as a sound-resonator.

FATAL SHOCK FROM TELEPHONE WIRES.

(299) William F. M., Jr., Cleveland, O., says he has read of people having been electrocuted by coming in contact with telephone circuits, and wishes to know how this is possible.

A. 1. It has happened a number of times that people have been electrocuted by coming in contact with telephone wires where there seemed no possibility of such a thing happening.

It has usually been found the case, however, when such fatal results have occurred, that the telephone circuit with which the person came in contact was crossed, perhaps temporarily, due to a broken wire, etc., by a high-voltage lighting or power wire carrying several thousand volts.

It is readily seen, then, that a person coming in contact with the telephone wire so charged would, in many cases, complete a circuit to earth through his body, and undoubtedly fatal results would obtain.

The fuses you speak of in the telephone circuit would not be of any benefit in such a case, for the reason that the current of dangerous potential would be several thousand volts and the current in amperes would only have to be a fraction of an ampere to prove fatal. Then again, it is quite possible that the circuit through the body would be made over a full metallic circuit in which no fuses were inserted.

1,000 AND 75 OHM TELEPHONE RECEIVERS ON ONE CIRCUIT.

(300) A. E. Eichner, Trenton, N. J., is using a 75 and a 1,000-ohm telephone receiver on a common circuit, and wants to know why they don't talk good, telephonically.

A. 1. The reason why you cannot get good results using the 1,000-ohm receiver is due to the fact that the voltage generated by the movement of the diaphragm in either case is not correctly proportioned to operate the opposite receiver, owing to the different number of turns on each coil, etc.

In other words, you will appreciate that if, for instance, the voice waves operate or move the diaphragm of the 75-ohm receiver, currents will be generated in the magnet coil of same which will have only a few volts potential, with a comparatively large current value.

These currents, of course, when they reach the high-resistance receiver with many thousands of turns of wire on it at the other end of the circuit, cannot operate same efficiently, as such a high-resistance receiver is suited to, relatively speaking, high voltages with small current values, and vice versa.

You will readily understand how the 1,000-ohm receiver would have generated in it currents of much higher voltage, of course, than a 75-ohm receiver with a consequent very small current value, and as the 75-ohm receiver, as we know, requires a relatively low voltage with a strong current value, the current passing over the circuit from the 1,000-ohm receiver will not operate efficiently the 75-ohm instrument at the opposite end of the line.

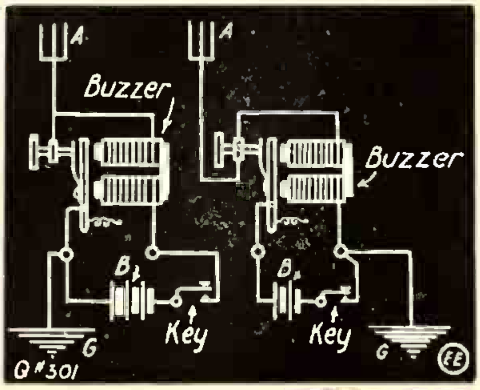
You will always find in this sort of work, as well as in most telegraphic circuits, etc., that the instruments should approximately be balanced to each other as regards current, voltage and resistance ratings.

BUZZER INDUCTION CURRENTS.

(301) Wynn Boyden, Medina, O., states that he has been able to transmit radio signals by a buzzer, and asks why it is

that the same results are obtained whether the aerial and ground are connected across the vibrator or across the whole buzzer circuit.

A. 1. In regard to your wireless transmission by buzzer, would say that it is generally found that practically the same results are obtained whether the ground and aerial wires are joined directly across



Showing Buzzer Connected in Two Ways to Aerial and Ground.

the buzzer vibrator, as diagram A shows, or across the whole buzzer-induction circuit, as indicated at B.

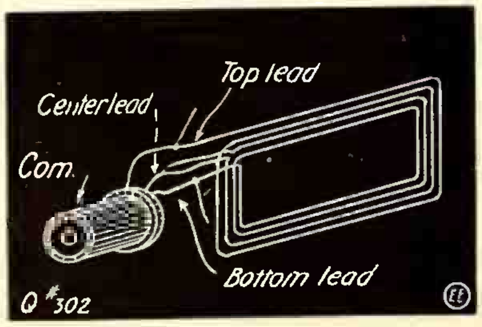
In any case, the increase of voltage in the circuit by self-induction whenever the vibrator breaks the circuit will be evidenced throughout the circuit, and is bound to charge the aerial and ground conductors whether one of these wires is joined ahead of the magnet coils in the circuit or behind them, due to the reason that the self-induction surge in the circuit passes throughout the whole circuit, roughly speaking.

ARMATURE WINDING.

(302) Gilbert M. M——, Savannah, Ga., asks us about hooking up leads from a motor armature which has one-half as many slots as commutator bars.

A. 1. Regarding the winding of small D. C. motor armature containing twice as many commutator bars as slots for winding, the diagram will help to show how this is usually done, especially on small armatures such as those used in fractional horsepower motors of the fan type.

As you will see from the diagram, there is a loop or lead left out in the middle of each coil as it is wound, lap-fashion, and thus each coil will have three leads projecting from same, and for small armatures it is common practice to place the central lead half way through the coil as regards the number of turns in the coil. For instance, if the coil had two hundred turns of wire in it, at the 100th turn the center or looped lead should be left out. In other words, this lead would be left



How Armature Coils Are Tapped by a Middle Lead When Twice as Many Commutator Segments Are Used as Slots in Armature.

extending several inches. With such complicated windings it is always invariably the best policy to mark these center leads in some way with a piece of string, etc., so that when joining the leads to the commutator the proper sequence will be followed without any trouble. Otherwise the coil is liable to be connected to the commutator backward.

ELECTRICAL PLANT CULTURE.

(303) Alan E. Simmons, Palmetto, Fla.

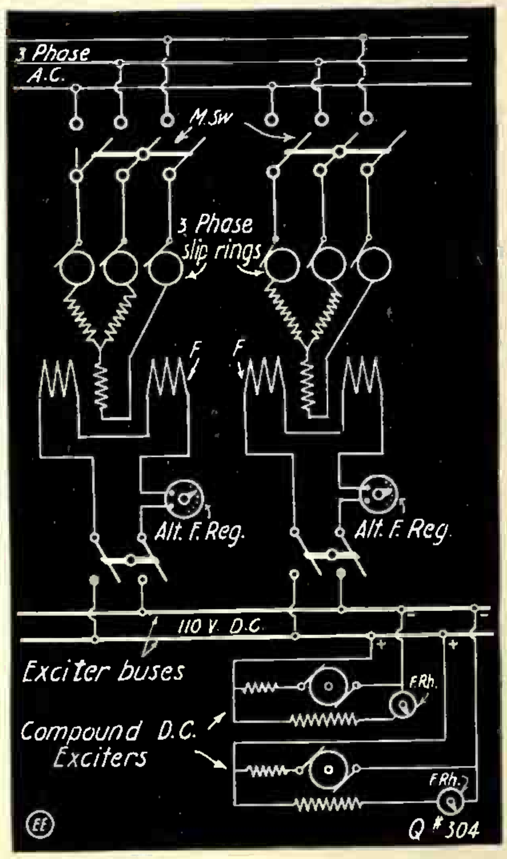
We do not know just what arrangement you intend to use, but from what we know of the matter of electrical plant culture it may be said that a regular spark coil and high-frequency set is generally utilized for the purpose.

Also it would be possible to utilize a closed-core wireless-type transformer giving a high voltage at the secondary, such as a ¼-K.W. unit, developing 10,000 to 12,000 volts.

High-frequency current could then be produced by means of this transformer and a suitable helix and condenser in the regular way.

PARALLEL OPERATION OF TWO A. C. GENERATORS.

(304.) Mr. C. O. W——m. White Plains, Ky., asks us about a problem he has relative to parallel operation of two A. C. generators, also several other queries.



Suggested Hook-Up of Two Exciters and Two 3-Phase A. C. Alternators to Give Steadiest Operation.

A. 1. With reference to the parallel operation of two 75 kilowatt, 60-cycle, 220-volt, 3-phase A. C. generators would say that the special diagram you show where exciter No. 1 is hooked up with the rotating field winding of alternator No. 2 and exciter No. 2 with alternator field No. 1 is quite practical and has been used considerably in practice so as to help keep the two machines driven from separate engines in as nearly as possible strictly synchronous relation.

This arrangement, however, has a bad disadvantage in that if one of the alternators should for some reason be shut down quickly it would affect the *exciter* of the *second alternator;* and thus the whole plant will be shut down. This naturally would be a bad state of affairs.

(*Continued on page* 170.)

PATENT ADVICE

Edited by H. GERNSBACK

In this Department we will publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Questions addressed to "Patent Advice" cannot be answered by mail. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

Applying for His Own Patent.

(6) Benjamin Hurst, Los Angeles, Cal., would like to know if it is feasible for him to make his own patent application at the Patent Office instead of engaging a patent attorney to do the work.

(A.) While quite a few people prosecute their own patent business and apply for patents themselves instead of through a patent attorney, we would advise that unless the would-be applicant is an attorney himself or knows legal phraseology, not to attempt it, for he will be sure to overlook the most vital points. It is not enough to just describe your invention and send in a drawing showing what the idea consists of, but the most important part in a patent is the "claim." These claims, which make a patent valuable, are quite technical and the average layman does not as a rule understand the language used in them. Where the layman could usually not find more than two or three claims to a given patent, an experienced patent attorney will easily find from ten to twelve, and while the Patent Office may not allow all the claims, they certainly, as a rule, will allow more than the layman could make up.

In our opinion it is always best to engage a reputable attorney to obtain a patent and while the cost may be greater, on the other hand, the protection is vastly greater also. It has, as a rule, a certain value which the same patent obtained by the untrained layman would not have.

Cost of Patent.

(7) Edwin P. Powell, Red Bank, N. J., desires to know how much it would cost him to patent an invention.

(A.) A patent can be obtained for as low a price as $50 from reputable patent attorneys if the invention is a simple one and does not require more than one sheet of drawings and if it is not too complicated.

If a long search in the Patent Office is necessary in order to convince the attorney that it is safe to go ahead with the application it must be, of course, understood that such extra work must be paid for. As a rule it would be safe to say that simple patents with one sheet of drawings would not come higher than $75 with most reputable attorneys. If the patent is extremely complicated and has many sheets of drawings the cost will, of course, be much higher.

We would advise correspondents to send for all literature of patent attorneys and ask for their fees. Most of the attorneys get out attractive booklets that very often contain valuable information which the inventor who is interested in patents should possess by all means.

Can He Trust Attorney?

(8) A. B. Wilson, Pittsburgh, Pa., writes as follows:

"I have invented a new loud talking telephone receiver which I am sure will revolutionize the present telephone receiver. My telephone receiver has several new points not found in any other receiver and, being cheaper to manufacture and talking very much louder than the ordinary one, I think that my invention is quite important and this is what I would like to know:

"I have heard that some patent attorneys have appropriated inventions themselves or otherwise have given out information obtained from their clients to the detriment of the original inventor. Therefore I do not feel like trusting an unknown patent attorney and would like to have your advice just what to do."

(A.) This is one of the fears uppermost in the minds of most inexperienced inventors and we might say that it is a very groundless fear. It should be understood that patent attorneys are professional men, the same as your doctor, and while there are cases on record where patent attorneys have appropriated ideas, the total of such cases, as to the number of inventions which actually have been patented, is less than twenty in a million.

From this you can understand that an inventor does not take a great chance by trusting a patent attorney with his invention. As a rule the latter considers one patent much the same as another, and very few if any bother to think about the commercial possibilities of inventions as a whole. We have not heard of a single case during the last ten years of a patent attorney appropriating any ideas of his client and for this reason we think that you may trust yourself safely to most any reputable attorney.

Arc Light Can Be Patented.

(9) Henry S. Fisher, Jr., Hoboken, N. J., sends in a plan and description of an electric arc light and wishes to know the commercial value of his invention.

(A.) The arc light shown seems to have some novel features and a search through our files has shown that nothing similar has been described or patented to the best of our knowledge. We feel quite sure that a patent can be obtained on this extremely novel invention.

We advise you to send your model and a full description at once to a good patent attorney in order to obtain a patent on the invention if possible.

As to the value of any kind of an invention this department cannot give such information because at best it is only pure guesswork. It is impossible for anyone to foretell what a given invention is worth. We might say $5,000 when an invention of this kind in the open market perhaps might not bring $500. Or if some manufacturer wanted it really bad he might pay quite a good deal more than $5,000. It depends entirely on how much a manufacturer or a corporation requires such a device and how much money they think they can make out of it. For that reason it is quite impossible to give any kind of a figure. At best it would only raise false hopes in the inventor's mind, and this department must therefore refrain from giving an opinion as to the commercial or money value of inventions submitted.

Dynamos to charge storage batteries should produce 2.7 to 3 volts for each cell in series, as the cells give a back E. M. F. of 2.2 to 2.4 volts at full charge.

QUESTION AND ANSWER DEPARTMENT.

(*Continued from page* 168.)

One of the best methods ever devised for the type of plant you speak of is that where the individual exciters are all operated on parallel to a pair of "common buses," all of the alternators then receive their field excitation current from these common exciting bus bars. You will thus see that it is a very simple matter to regulate the alternators by means of their field rheostats, and it is best also to have the exciter dynamos rigidly coupled together in some way if possible, so as to minimize the voltage fluctuations in them which would tend to cause one of them to take more of a load than it should, etc. In a great many modern plants the exciters comprise two D. C. dynamos driven by gears, from a single De Laval steam turbine. These two D. C. generators operate in parallel on a pair of common exciter supply buses.

A. 2. In regard to your question on figuring out the resistance and voltage drop in a circuit, etc., would say that if you will think over this matter you will undoubtedly see why both formulas you cite agree. You can prove this by simply taking a voltmeter and connecting same across any given resistance coil, etc., and you will find that the resistance of that particular unit is proportioned to the voltage drop. Therefore that resistance drop as indicated on voltmeter is divided by the current passing through the circuit, as indicated on an ammeter.

Ohm's law also, as you will remember, states that the resistance of a circuit in ohms is equal to the voltage required (or conjointly the voltage drop) to force a given current through the circuit. It is self-evident that the voltage required, in other words, is also the natural *voltage drop*

A. 3. We are not quite certain about your last query regarding calculations of the *average load current* in amperes from the factor of the known load in kilowatts, or whether you mean here the energy put out from the plant in kilowatt hours.

If you mean that the average load as indicated on a direct reading kilowatt meter of the switchboard type was 90 kilowatts during the two hours' run of the plant, then the average current would, of course, be deduced very readily by dividing the 90 kilowatts (or 90,000 watts) by the voltage; which would give you the average amperes load carried during the two hours' run.

BARON MÜNCHHAUSEN'S SCIENTIFIC ADVENTURES.

(*Continued from page* 137.)

stands out in a strong contrast against the inky sky. This pink fringe is not absolutely uniform in thickness; it is thickest near the earth's poles, thinnest near the equator. The difference in thickness is not very great, but quite perceptible. The explanation is that the terrestrial atmosphere, due to the centrifugal force produced by the earth's rapid rotation, tends to throw the air away from the equator. It is therefore forced to move toward the poles and as practically no centrifugal force exists there the air is naturally "thicker" here.

Another curious phenomenon is the position of the earth in the lunar sky. As seen from my present location (near the moon's equator) the earth is almost fixed in the heavens, i. e., it never sets or rises as does the moon when observed from the earth. But otherwise the earth for us goes through the same phases as does the moon for you. Thus during one month the earth changes from *new earth* to *first quarter*, then *full earth*, then *last quarter*, finally *new earth.* During these major phases we see the earth as a crescent, exactly as you see the moon as a crescent, only the earth crescent we see appears 14 times as large as the moon's crescent appears to you.

During *full earth*, however, we witness a spectacle that is truly wonderful to behold. As the earth rotates on its axis once in 24 hours, and inasmuch as the earth is fixed in the moon's sky, it follows that we must see the earth revolve before our very eyes. Nor do we have to strain our eyes to see the continents; everything is in plain view. As the lighted earth revolves in a black sky the contrast is extreme, impossible to describe. No such scene has ever been beheld from the earth.

The earth revolving from west to east, we see the continents moving from left to right. Thus, when the eastern shores of the American continents are first seen on the extreme left, it takes just three hours till the western shores come in full sight. In three more hours the broad Pacific Ocean and the Hawaiian Islands are directly in front of us, although they can only be seen as dots. Within four hours Japan, then the Philippines and the Australian continent have swung into view, while in four more hours all of Asia is spread before us, with India in the center, like a map. In three hours more eastern Europe, Arabia, as well as Africa, have appeared. Within two hours we see the rest of the European continent and western Africa; then follows Iceland and Greenland and below the Atlantic Ocean. Within five hours from the time western Europe disappeared on the right the eastern shores of the American continents appear once more. Thus we have seen all of the earth in exactly 24 hours—we have been "around" the earth in one day!

The waters of the oceans as seen from the moon appear to be a bluish-green, while the color of the Arctic oceans appears to vary from a pale green to a white. The white color is, of course, produced by the immense snow and ice fields of the Arctic. The color of the continents varies, of course, but the general appearance is a muddy yellow or red. Great plains and forests, as, for instance, those located on the American continents and Siberia show in a darkish green.

Nothing shows up very defined on land. One color merges into the other without showing abrupt breaks. The only lines which stand out tolerably strong are the shore lines, the great inland lakes and the islands. Even these lines do not stand out as strong as one might imagine. The reason for this is found in the earth's atmosphere. As the latter is ever moving, and as we have to look through 35 miles of it—an atmosphere not always clear—it follows that we can never see very sharp lines or markings on the earth.

When I said before that we can see the continents move plainly before our eyes it must, of course, be understood that large tracts are nearly always covered and hidden either by clouds, haze or fogs. Only in very rare instances can an entire continent be seen through its length and breadth, and since I am on the moon I have only seen it occur once, the continent in this instance being the American. Within one hour, however, large clouds had formed over a part of Central America, which became lost to all view within a short time.

With the naked eye, as seen from the moon, it is impossible to discern any object created by man's hands on the surface of the earth. Even large cities such as London and New York cannot be distinguished from the surrounding country. The reason is obvious, for it must not be forgotten that we look upon the top of the towns—the roofs—and the general color of these does not differ essentially from the streets and the surrounding grounds. For that reason the cities cannot be seen. If all the roofs and the streets were painted in white I am sure that the large towns could be seen, given a clear atmosphere. Thus, you observe, the earth as seen from the moon appears quite lifeless. Nothing is seen moving on it except the clouds; only in one instance have I seen anything out of the ordinary. This was a large forest fire in western America. Even then I could, of course, not see the fire itself, but only the vast, rolling quantities of black smoke were easily discernible. Other objects which can be made out when the weather is very clear on earth are the rivers; but only the larger ones, such as the Mississippi, the Amazon, the Nile, the Volga, etc., can be seen at all. We repeatedly tried to see long railroad tracks stretching across plains, but we have not been successful in locating them, even by the use of our powerful 3-inch telescope. The intervening distance—240,000 miles—is simply too great to see such fine objects. For this reason also some of the greatest achievements of man, such as the Panama and Suez canals, are entirely invisible to us, even with the assistance of our telescope

From the above it must become clear that comparatively small objects such as ships, trains, animals, etc., must forever remain invisible to us *Lunarians*.*

So much for the earth. As I mentioned before the stars appear much brighter on the moon than they do on earth. This again is due to the very thin lunar atmosphere. All the stars appear several times brighter to us than they do to you; furthermore, we can see with our naked eye stars such as are never seen on earth except with the aid of powerful telescopes.

The most inspiring view, however, is the milky way. It shines with a glory undreamed of on earth; its light is so powerful that objects around you become faintly visible in the dead black of our lunar night. The milky way does not appear to be as a weak blur, but it is well defined and we see myriads of stars invisible to the unaided eyes on earth.

There is one thing, however, of importance on the moon of which few people have any conception. I am referring to the meteors which are constantly raining on the surface of the moon. When such a meteor falls on the earth this is what happens:

A great mass of meteoric iron has come under the influence of the earth's attraction and is falling toward it at a speed of several thousand miles a minute. Until it reaches the outskirts of the earth it meets with no resistance, for it moves in the vacuum of universal space. The instant it penetrates the earth's atmosphere an enormous friction is produced between the meteor and the air, and the result is that the meteor becomes wholly or partly melted. Most of it volatilizes and goes up in smoke, to fall down subquently in the form of fine dust; only a comparatively small solid part reaches the earth, where it usually buries itself in the ground. Thus when we see a "shooting star" we see in reality a stream of fire produced by the melting of a meteor.

Now, the moon with its pitiful atmosphere affords no such protection as does the earth's atmosphere. Meteors crash about us with an alarming frequency. They come without any warning whatsoever. Some are as large as a watermelon and some as big as a small house. You can hardly imagine what happens when such a heavenly projectile, moving at the frightful speed of from 2,000 *to* 3,000 *miles a minute*, collides with the moon.

*Term applied to inhabitants of the moon.

The noise of the impact is absolutely overwhelming. The crash of a cannon shot of a 15-inch gun is soft hand-clapping in comparison with it. The ground trembles violently for miles around, and if you are less than 500 yards from the scene one will usually be blown off his feet by the concussion, notwithstanding the very thin lunar air. If the meteor happens to strike a rocky or granite surface the result is even more awe inspiring. As a rule, in that case the whole meteor melts in an instant and goes up in a cloud of white-hot metal vapor. If you are near enough, say within one-half mile, the heat generated by the impact will become unsupportable for a short length of time, and within a few minutes exceedingly fine metallic dust will rain down upon you. It sometimes takes hours for this reddish dust to settle down.

Thus it can be imagined that it is rather dangerous to walk on the moon's surface. This is particularly true in November each year, when the earth and the moon pass through the meteoric "streams." At such a time I would not care to be present on the surface of the moon, and would prefer the lunar caves. Furthermore, I . . ."

Münchhausen did not finish his sentence. There was an abrupt, sharp click in my phones and the ether was ominously quiet once more. For some time I tried frantically to "raise" him, but in vain; he did not reply to me. I became highly alarmed about his safety. Had one of the meteors struck him and killed him? I could not tell. So I finally left my wireless laboratory with an uneasy feeling that everything was not quite right.

(*To be continued.*)

TELEVISION OR THE PROJECTION OF PICTURES OVER A WIRE.

(*Continued from page* 132.)

tight structure, made up of a very large number of extremely small metallic cubes, which are all carefully insulated from one another, but, however, presenting a smooth, clean (metallic) surface to the cathode ray discharge on the one side and in contact with a suitable gas, as, for instance, sodium vapor, on the other. It is proposed to construct these screen "cubes" of some metal, like rubidium, which readily discharges negative electricity under the action of a ray of light, the negative charge being imparted to the cubes whenever the thin, pencil-like beam of the cathodic ray falls upon it. The receptacle "K" in the tube chamber is filled with some gas, such as sodium vapor, for the reason that such a gas conducts negative electricity far more readily under the influence of light than in the dark. A metallic screen of gauze, parallel to "J" in the tube is placed at "LL," and through this screen the image of the object at "N" is projected by means of the condensing lens "M," until after passing through the vapor of sodium it is eventually focused on the screen "J." The gauze screen "LL" is electrically connected through a line wire, as seen in Fig. 3, to the metallic diaphragm plate "O." in the receiver tube "A1."

Referring now to the receiving instrument, as indicated in our illustrations at Figs. 1 and 3, there is placed at the end of the Crooke's vacuum tube a fluorescent screen "H," and upon this screen, under certain conditions, which will be explained directly, the cathodic rays impinge, and certain parts of this screen are searched out every tenth of a second by the thin ray, under the combined action of the two A. C.

electro-magnets "D'" and "E'," which are placed similarly to the A. C. electro-magnets "D" and "E" at the transmitter station. As will be observed, the magnet coils "D" and 'D'" are energized by the same A. C. dynamo "F" and also the A. C. magnet coils "E" and "E'" are excited by the alternator "G." It is therefore evident that the two magnetic-control circuits "D" and "D'" and "E" and "E'" and their resultants are therefore in perfect synchronism, i. e., their actions take place at the same time.

A Crooke's vacuum tube "A'" is used also at the receiving station as indicated, and its cathode electrode appears at "B'." The disk of this electrode, which shoots forth the cathodic ray, is slightly inclined so as to project the ray at a downward angle, through the small opening "a'" in the anode electrode disk "C." Thus, under normal conditions, the cathode rays pass through opening "a'," but they would be stopped by the diaphragm "P" and its centrally located orifice "S." They, in this case, are not brought under the deflecting action of the A. C. electro-magnets "D'" and "E'" and thus do not reach the image screen "H" before the observer at all. At "O" is a metallic circular disk, which is electrically connected with the screens "LL" at the *transmitter* instrument. Under ordinary conditions the cathode rays at the receiver cannot pass beyond the diaphragm "PS," but they can be made to do so, if slightly repelled by the lower diaphragm plate at "O." In this case, they will then fall on the screen "H" and cause *that part* on which they fall *to fluoresce* (i.e., light up).

Now assume that a uniform beam of cathode rays passes at marvelous velocity and without any appreciable inertia or mass in the tubes "A" and "A'" and that also the A. C. electro-magnets "D" and "E," "D'" and "E'" are energized, as previously explained. Also, suppose that the image of a person, for instance, appears at "N" before the tube "X"; this image is focused and projected through the lens "M," and through the gauze screen "LL" on to the back of the metallic screen "J," which, as will be remembered, is made up of a very large number of small metallic cubes. Then as the cathode rays in "A" oscillate under the combined action of the A. C. electro-magnets "D" and "E" they will cause a negative charge of electricity to be imparted in turn to all the metallic cubes, of which the screen "J" is composed. In the case of the shadows of the projected image, or considering those cubes on the screen on which no light falls, nothing will happen in the action of the apparatus, the charge dissipating itself in the tube. Therefore, in the case of those cubes on the screen which are brightly illuminated by the bright parts of the projected image, the negative electrical charge imparted to those cubes by the cathode rays will pass along, owing to the action of the sodium vapor, which is ionized under such circumstances, and so on until it reaches the gauze screen "LL," whence the charge will travel by the line wire to electrode "O" in the tube "A'" at the receiving instrument.

The plate at "O" will therefore become charged and will slightly repel the rays in the tube, with a result that they will thus be enabled to pass through the aperture at "S" and strike, for a fraction of a second, upon a minute portion of the screen, corresponding in position to the small cube surface on screen "J." This is possible, owing to the fact that the electro-magnets "D'" and "E'" are working in perfect synchonism or step, electrically, with the magnet coils "D" and "E" at the transmitter.

It will be understood, of course, from this description that this action will take place successively, but *not* simultaneously. In other words, referring back to our previous discussion of how a picture can be built up out of black dots, etc., it is easily perceivable how this device could produce a picture if the illuminated spots on the screen are successively shown in a sufficiently rapid manner. In the case of our little metallic cube surfaces at "J," that are illuminated successively, there appear bright spots at simultaneous periods on screen "H" at the receiving instrument. These bright spots at "H" are of course to appear so quickly, and succeed one another so rapidly and smoothly, that the appearance they present to the eye will be one continuous picture.

It is quite conceivable that the apparatus of the future, which will enable us to see the party at the opposite end of a telephone line, for instance, may indeed work on this principle or a modified one. There is no other method which can work so rapidly and with so little inertia as this one utilizing the Crooke's tube, in which a cathode ray is caused to rapidly oscillate or be deflected through various angles in the same way as the Braun oscillograph tube is used for depicting radio-frequency wave forms. It was the Braun vacuum tube oscillograph that suggested the idea to Mr. Campbell-Swinton for this really ingenious *proposed method of perfecting a Television apparatus*. This is undoubtedly one of the most interesting fields for research work open to the experimenter of to-day.

NAVY TAKES OVER SAYVILLE RADIO

In the interests of American neutrality and to avoid contravention of the Hague Convention forbidding the establishment of belligerent wireless stations on neutral soil during a war, the United States Government refused to grant a license to the Atlantic Communication Company for the operation of the great German wireless station at Sayville, L. I., and took over the operation, management and control on July 9 last.

The Atlantic Communication Company claims to have committed no improper or unneutral act. Further it says: "No charge of any such act has been brought to the attention of its officers by any official of the United States. The Government censors on duty at the station have carefully supervised all messages sent, and have retained copies of the same. The company, being a public service corporation, had no discretion in refusing or accepting messages. As a matter of fact, the station, on account of static conditions, and also on account of lack of power, was unable during the summer months to communicate with Germany for more than one or two hours during the night. This difficulty will now be overcome by the operation of the new transmitter. Communication has been possible for the past few months only when it was night in Germany and night in the United States, which has been, as heretofore stated, only for one or two hours each night."

"And I want to add," Mr. Metz, president of the company, continued, "that as a result of the Federal action to-day we will be able to communicate with Berlin all the time, day and night, instead of an hour or two each day, as has been the case up to the present time. We will now for the first time be able to use the new plant, which is three times more powerful than the old plant, and that plant will be ready the 15th of this month. And, furthermore, there will be a reduction in rates. Instead of $1 a word plus the land rate the rate to Berlin will be 50 cents per word plus the land toll, while messages for Austria and Turkey will be 58 cents per word plus the land charges instead of $1.08 per word as is now the case.

Opportunity Exchange

YOU will probably find more opportunities and real bargains in these columns than anywhere else in the country. Most good things in life are hard to find and worth going after—these little ads illustrate that point; you alone will be the real loser if you don't take the time to scan through these columns.

Advertisements in this section 4c. a word for each insertion. Count 7 words per line.

Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency.

Ten per cent. discount for 6 issues, 20 per cent. discount for 12 issues from above rate. Objectionable or misleading advertisements not accepted.

Advertisements for the September issue should reach us not later than August 10th.

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

BOOKS

360 POPULAR TOASTS. Selections suitable for all occasions; just what you need at an evening supper; 10c. "Km.," Wedge Manufacturing Co., Binghamton, N. Y.

HAVE YOU SEEN A COPY?—Amateur Photographer's Weekly, $1 per year; weekly prize competitions; criticisms; print exchange; illustrated; many features. Three months' subscription 25c. Amateur Photographer's Weekly, 915 Schofield Bldg., Cleveland, Ohio.

BICYCLES AND MOTORCYCLES

BARGAIN—$65 takes 1914 Flanders Motorcycle, nearly new; about $25 equipment. Paul Kobnke, General Delivery, South Chicago, Ill.

FOR Sale cheap. 1914 Harley-Davidson twin. Write for particulars. Walter Goerke, 321 Washington St., Newark, N. J.

1908 H. D. SINGLE with clutch and magneto, $30. 1910 H. D. battery model. A-1 condition, $35. 1911 H. D. single magneto model and clutch, $40. 1910 H. D. clutch and magneto, $45. 1 Indian motorcycle motor with magneto and Schebler carburetor, $25. 1 Excelsior motorcycle motor, $25. C. H. Lang, 1704 Michigan Ave., Chicago, Ill.

$50 TO $150 buys the best Motorcycles, every make and model in our large stock—must be cleared. Half price. Send for list to-day. Talking Machines, $5 and up. Brown Music Co., 9119 Commercial Ave., Chicago, Ill.

FORMULAS

MAKE Candy evenings; pays; receipt, 10c. Elmer Zimmerman, 1435 Walnut, Harrisburg, Pa.

ANY FORMULA WANTED—Sent for 20c. 3 Invisible Ink formulas, 25c. State requirements to Kelson Laboratory, Box 433, Elmwood, Ill.

SIX Valuable formulas for sympathetic inks, 50c. Wayne Thomas, Ithaca, N. Y.

FORMULAS for inks, black, blue, red, gold, green, silver, indelible, 15c each. 7 for $1.00. Stephen Rafferty, 2122 Arch St., Philadelphia, Pa.

CUTS anybody can make, 5c. Samples Stamp. Modern Engraving Co., Lynn, Mass.

MAGIC AND TRICKS

LOOK!! STOP!! LISTEN!!
"CHARLEY CHAPLIN PUZZLE."
The most interesting and amusing puzzle out. Send 10c. stamps or coin. Write to-day. Don't delay. Park Novelty Co., Dept. "A," 4233 Lake Park Ave., Chicago, Ill.

POST Cards, Tricks and Jokes, Coins, Notes, Stamps and curious things. Catalog for stamp. Coin Exchange, New Rochelle, N. Y.

BIG Catalogue. Magic, Entertainment goods free. Bates Co., Melrose, Mass.

MAGIC Tricks, Jokes and Puzzles. Trick with my catalogue, 10c. coin. H. V. Dils, Huntington, W. Va.

GREAT book wonders, secrets and mysteries and novelty catalogues, 10c. Wright Spec. Co. (D), Brewster, N. Y.

MAGIC tricks for the profession. Big catalogue and pocket trick free. Ventriloquial figures, $6.00 up. Magic Parlors, 192 Clifford, Providence, R. I.

NOVELTIES, Books, Tricks, Games, Etc. Illustrated catalogue free. Sample 25c. card trick, 10c. Auburn Supply Co., Specialty Dept., 7745 Peoria St., Chicago.

* * * * * * * * * * * *

Brooklyn, N. Y., April 15, 1915.

Gentlemen:—The results obtained from my advertisement in the "Electrical Experimenter" really surprised me; in fact the demand for a certain instrument of mine exceeds the capacity for manufacturing and it is all through the "E. E." To date, 79 inquiries, 12 orders. Might state last week filled a $50.00 order netting me a profit of $18.75. As to the exact value of my orders to date, I prefer not to give figures; however, you will always see my ad, month in and month out. I can truthfully say that the "E. E." has it on them all, viz., for quick results, interesting reading matter, etc. Very truly yours, HARRY Y. HIGGS.

* * * * * * * * * * * *

HELP WANTED

AGENTS—Build a business of your own with our Piano and Furniture Polish. Have used it in our shop successfully for five years. Send $1.00 for formula and trade secret. E. E. Lundberg School Piano Tuning, 143 N. Dearborn St., Chicago.

WANTED MEN AND WOMEN EVERYWHERE —Government jobs, $70.00 a month, short hours, vacations, rapid advancement, steady work; many appointments during summer and fall; common education sufficient; pull unnecessary. Franklin Institute, Dept. "A-120," Rochester, N. Y.

MODELS

MODELS made for inventors; general machine work; designing and perfecting; developing automatic devices and machinery; in a position to do all kinds of light tool and machine work. Prices reasonable; estimates cheerfully given. Ideal Machine Works, 62 Ann Street, New York City.

INVENTORS: We manufacture metal articles of all kinds to order. Also special machinery, tools and dies; punchings, lathe and screw machine work, metal spinnings, castings, plating, wood and metal patterns, etc. Send sample for estimate and expert advice, free. The Eagle Mfg. Co., Dept. B, Cincinnati, Ohio.

PRODUCERS of Results; Inventions Developed, Light Mfg., Models, Experimental Work, Tools, Dies and Stampings. Johns Machine & Stamping Works, Middle Bldg., Dept. C, Cleveland, Ohio.

MODELS, dies and manufacturing for inventors, by builders of "Tools That Work." La Croix Tool Co., 214 N. 21st St., St. Louis, Mo.

MISCELLANEOUS

PANAMA CANAL—For only 25c. will send you the great Panama Canal Telescope and a fine souvenir. Pacific Mail Order Co., 286 Second St., San Francisco, Cal.

THERE is but one Telegraph School that places all graduates direct in the Railway Telegraph service. It is Pelnars, Madison, Wis.

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WIRELESS receiving set and other instruments for sale. Howard Sorey, Newkirk, Okla.

TUNER—A fine bare wound double Slide Tuner for only $1.75, postpaid. It is made of vulcanite and is a dandy instrument. Send a 2c. stamp for my lists. Carl Rhapstock, Plainfield, Wis.

FOR SALE—Hot Wire Ammeters; two readings, Aluminum casing with bracket; complete except dials; guaranteed. L. R. Jewett, 200 Lewis St., Lynn, Mass.

WE make Loose Coupler, 2,500 meter, $5; Tuning Coils, 350 meter, $2. Cliff Mfg. Co., Box 130, Brookfield, Mass.

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UNDOUBTEDLY you have at the present time some things for which you have no further use. Do you wish to sell these things or exchange them for something, for which you have immediate use? There is no surer and quicker way to do this than by advertising your articles in these columns. The **Very** people, the **Only** people, who could possibly have a use for your things read this journal. More than 30,000 interested people will see your ad. It is furthermore the cheapest advertising medium for you in the country.

The rates are: One cent per word (name and address to be counted) minimum space 3 lines. Count about 7 words to the line. **Remittance must accompany all orders.**

We reserve to ourselves the right to refuse any advertisement which we consider misleading or objectionable. Advertisements for the September issue should reach us not later than August 10th.

The Classified Columns of "The Electrical Experimenter" Bring Positive Results.

FOR SALE—One Colby Tuner. Tunes up to 600 or 4,000 wave meters, for $3.75. Raymond Clapp, Groton, New York.

EXCHANGE—An Omnigraph and books on telegraphy and electricity for disc phonograph. J. M. Keating, 8 West Center St., Beacon, N. Y.

FOR SALE AT A BARGAIN—Medium size wireless outfit consisting of a good loose coupler, Electro loading coil and a junior fixed condenser wired on oak base. Weight five lbs. Price $5.00. John L. Miller, 1451 Grant St., Marinette, Wis.

FOR EXCHANGE OR SALE—A complete wireless sending and receiving outfit that cost $35.00. Send 2c. stamp for a complete list of instruments. Philip Asb, 3009 Greenwood Ave., Louisville, Ky.

FOR SALE—Blitzen receiving transformer. Good as new. Cost $15; will sell for $10. John H. Widmyer, 1 S. Duke St., Lancaster, Pa.

FOR SALE OR EXCHANGE—$1.25-Pocket Voltammeter-75c.; 2-One Dollar 1½-Pint Leyden Jars-One Dollar; 60c. Zinc Spark Gap—30c; 35c. Telegraph Key—25c. Articles are all E. I. Co.'s goods. What do you offer in exchange? Louis Menier, 29 West 39th Street, Room 808, New York.

FOR SALE—Pony Telephone Receiver; Automatic Transmitter; Newspaper Correspondence Course; "The Minister and The Community," by Woodrow Wilson; 6-volt 14 candlepower bulb and socket—Insect Mount—Dividers—Metronome. Mark Kistler, Centerport, Pa.

ELECTRICAL—35 K.W. Westinghouse Alternator, right for a small town plant, $300 in payments of $20 per month. 18 K.W. 220 volt direct current generator will carry 900 regular 16 candle Tungsten lamps, $200 in payments of $15 per month. 16 cells storage battery in good condition $35. Electric Bath Cabinet $25. Box M, Troy, Ohio.

TO TRADE—Small D. C. Motor, cost $14. for Wireless goods; ¼ K.W. Transformer or Loose Coupler preferred. Lenden Enloe, Eldorado Springs, Mo.

WILL EXCHANGE—A complete three year law course, also a number of electrical, chemical and mechanical text-books for laboratory apparatus or other text-books. What have you? Wm. E. Brady, 1569 Lauderdale Ave., Lakewood, O.

A GOOD Victrola wanted in exchange for some first-class wireless and electrical goods that I have for exchange. Write for complete list of goods. Charles Steck, 235 Third St., Union Hill, N. J.

FOR EXCHANGE—Electro Wireless course, 1 K.W. sending set, commercial Perikon; $5.00 set of receivers, $10.00 worth of piano music, 500 new view postals, $10.00 worth of assorted switches, $15.00 portable receiving set, $10.00 sending set, Kodak developing machine, Static machine, 6 volt 80 amp. storage battery; $10.00 powerful motor. Would like 3A folding Kodak or other articles outside of Wireless line. Charles Steck, 235 Third St., Union Hill, N. J.

TO SWAP—A College Tennis Racket and fielder's D. & M. glove for Phonograph Spring Motor and a Phonograph Needle Holder. George W. Sutherland, Jr., Suffern, N. Y.

BUY—I want to buy some good electrical books in good condition. Example: "Experimental Wireless Stations," by Philip E. Edelman, etc. Please send list with full description of each book. Will exchange apparatus. Walter Franseen, Woodhull, Ill.

WANTED—At once second-hand 2-inch Spark coil. Must be cheap and in perfect condition. Will pay cash. Lloyd Stratton, 44 Seneca St., Oneida, N. Y.

BARGAIN—3,000 Meter loose-coupler, primary 5 inches long, 4½ inches diameter; secondary 5 inches long, 3¼ inches diameter; 10 taps. Good make and brand new. First money order for $4.00 takes it. Have Murdock fixed condenser in perfect condition; cost $1.00, will sell for $.65. Russell Pyles, 4 West Melrose St., Chevy Chase, Md.

FOR SALE—¼ H.P. steam engine with boiler and shafting ready to run, dynamo, emery wheel, etc., $5.00; Knapp 9 volt dynamo motor, $2.50; two telegraphs, $1.00 each; 2 lbs. No. 32 brand new magnet wire, $1.00; $10 American typewriter, $4.00. George R. Mapstone, Aurora, N. Y.

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Gentlemen:—

It may interest you to know that in answer to my advertisement in your Scientific Exchange columns, I have received to date fourteen answers, selling instruments to second inquirer. Either your paper is extra good or my price was too low.

HAROLD B. ADAMS.

EXHANGE—Years '13 and '14 Popular Mechanics, aerial wire, small electric engine. What am I offered? W. A. Mattise, 402 Eddy St., Ithaca, N. Y.

FOR SALE—Large variety of books, electrical magazines, one set New Method Scientific books, together with other good bargains. Write for complete list. Sherman Johnson, Sidney, O.

I HAVE an A No. 1 Wireless that I will trade for a Gasoline Engine or a Motorcycle. Answer at once. Hubert Henneberger, P. O. Box 105, Hagerstown, Md.

POTENTIOMETER for sale cheap; never been used. Write for particulars. Adrian Kisbpaugh, Newton, N. J.

FOR SALE—Receiving set, good as new, 60 per cent. less than list price. Box No. 1, Wamesit, Mass.

FOR SALE OR EXCHANGE—Electrolytic and galena detectors, camera with portrait attachment, shocking machine, battery motor, Simplex typewriter and wireless books. Benj. F. Kinnick, Jr., Greenwood, Ind.

EXCHANGE—Loose Coupler, Loading Coil, Peroxide of Lead Detector, Potentiometer, factory made. Want 3,000 ohm phones or Cabinet 3,000 metre Loose Coupler. W. T. Gravely, Box 245, Danville, Va.

MAKE cash offer for new No. 2 Omnigraph, 15 dials, cost $14.00. Will trade Spaulding best double end punching bag and Reach football cover for wireless phones. Kenneth King, Talent, Ore.

FOR SALE—Slightly used wireless instruments; No. 9950 Tuner, $1.50; Sliding plate condenser, $1.50; No. 10000 fixed condenser, 50c.; No. 9250 potentiometer, 50c.; No. 8090 phones, $2.00; ¾ inch spark coil, $2.50; No. 9002 detector, 75c.; No. 9260 sending condenser, $1.75. Edgar Purdon, Vanceburg, Ky.

FOR SALE OR EXCHANGE—One inch Spark Coil, good as new; gives 1¼ inch spark on 8 volts A. C.; Wireless Key on fiber base. Write for prices or offers. Donald Rockwell, Wellsboro, Pa.

FOR SALE—$10.00 Erector Set, $4.00; $1.25 Franco Tubular Flashlight, with 3 cell battery, 75c.; Beacon Fountain-light, 50c. All good as new. Bertram Smith, Spring Valley, N. Y.

FOR SALE—Two in one Spark plug and a coil for motor boats; good as new. Will sell for $4.00. R. J. Freeman, Aloab Radio Station, Southampton, N. Y.

HAVE battery motor, weight 9 lbs. Will exchange for E. I. Co. amateur wireless 2,000 ohm headset. Forest Monroe, 1153 Te Walt St., Vincennes, Ind.

WILL sell omnigraph No. 2 Junior for $5.00, prepaid; cost $9.00. Used only a short time. William E. Youngs, Sears, Mich.

WILL SELL OR EXCHANGE for wireless goods one miniature electric railway outfit, in perfect condition. J. P. Rickman, Pinckney St., Greenville, S. C.

PART OF A WIRELESS OUTFIT, INCLUDING LATEST INVENTIONS. L. J. Becker, 2924 Ave. L, Galveston, Tex.

FOR SALE—Mesco ¼ inch Spark Coil and Single-Slide Tuner, perfect condition; Glass Transmission Condensers. Write for particulars. R. J. Liedel, 28½ Warren St., Providence, R. I.

FOR SALE—A Bunnell 43 plate rotary variable condenser, $2.50; a Mignon Vario Selective Coupler, $4.00; E. I. Co. Radioson detector, $3.00; $8.00 takes them all. These instruments are all practically new. Write George D. Todd, Jr., New Albany, Ind.

FOR SALE OR TRADE—Nearly 3 lbs. of aluminum wire. R. B. Wann, Calumet, Ia.

FOR SALE—One Loose Coupler, $2.50; one 5 bar Generator, $3.50; both for $5.50. George Goodrich, Green Cove Springs, Fla.

FOR SALE—Electric books, apparatus and tools for less than half price. Send for list. Also want to buy motorcycle engine. Alex Sesna, Lehigh, Okla.

USE flaked paraffine to paraffine paper for condensers; 2 cents an ounce, postpaid. Send stamp for sample. Shelby Blong, Hawthorne, Cal.

FOR SALE—One 1½ inch spark coil minus vibrator and condenser, home-made loose coupler and step-down transformer. Waldemar Vanselow, 310 Coolidge Ave., Syracuse, N. Y.

FOR SALE—Peroxide of Lead Detector and Potentiometer, $1.50; Galena Detector, 50c.; Variable Fixed Condenser, 75c.; Fixed Condenser, 25c.; 700 Meter Tuning Coil, $1.75; 1,000 ohm Receiver and cord, $1.50; High Frequency Buzzer, 45c.; 600 feet Aerial Wire and 12 insulators, $1.50; 2 Switches, 25c. Leighton Gilbert, Bristol, N. Y.

FOR SALE OR EXCHANGE—One $4.00 variable condenser, $3.00; one $1.50 brass ribbon helix, $1.00; both new; E. I. make. Will exchange for Audion bulb. V. C. McIlvaine, Tampa, Fla.

FOR SALE—Kohlert Clarinet, Bb, low pitch, 13 keys, two rings. New condition. Absolutely O. K. Rollinson self-instructor. C. O. D. mail $8.50. Roy Linnard, Peotone, Ill.

FOUR first-class Perikon Detectors complete; also cat whisker stands, fully adjustable. Want large variable condenser Clapp Eastham make. Furman, 5528 Echo St., Los Angeles, Cal.

FOR SALE—$6.00 receiving transformer, $10.00 magneto, $5.00 32 cal. revolver and a $2.75 spark coil; $9.00 takes the entire lot, or will exchange all the articles for a navy type receiving transformer and a pair of transatlantic phones. Will not sell or exchange any of the articles separately. Address Herbert Ewing, Point Marion, Pa.

FOR SALE—Clapp-Eastham Ferron Detector, $2.50; Fixed Condenser, 50c.; 32 cal. Target Revolver, 5 inch barrel, $4.00; King Folding Boat, $10.00. All sorts photographic bargains. Send for complete list. H. E. Davies, Jr., Vineyard Haven, Mass.

WANT TO SWAP? Join my exchange bureau. Send a postal for particulars. The Eureka Exchange Bureau, 283 Sackville St., Toronto, Can.

WANTED—Small Steam Model Boilers, also Engines, Marine, or any design, together or separate. No toys. State full particulars and price. F. Daniel, 116 West 42d St., New York.

WANTED—Brandes Superior Headset, Loose Coupler, 2 or 3 inch Spark Coil or any Wireless or Electric goods. Have a 6 volt 6 ampere Dynamo for sale, or will trade for any of above. State what you have. Miles Hart, Somers, Conn.

HAVE for sale or exchange 3,000 meter Loose Coupler and a fine 1½ inch Spark Coil. Leo B. Wilcox, Angola, Ind.

FOR SALE—E. I. 8060 Transformer coil, $4.00; Gernsback interrupter, $1.00; two Murdock moulded sending condensers, $2.75; 3½ inch Kodak film tank, $2.50; Knapp 6 volt dynamo, $2.00; Electric moving picture and lantern slide machine, $5.00; Electric question board, $1.00. Write for particulars. Raymond Schlegel, 1118 North Negley Ave., Pittsburgh, Pa.

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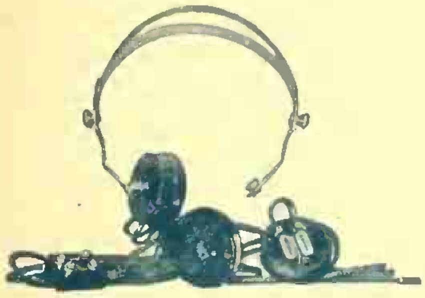

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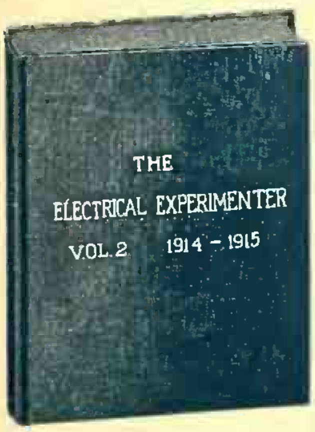

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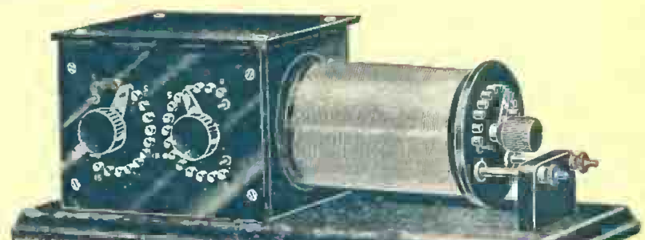

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