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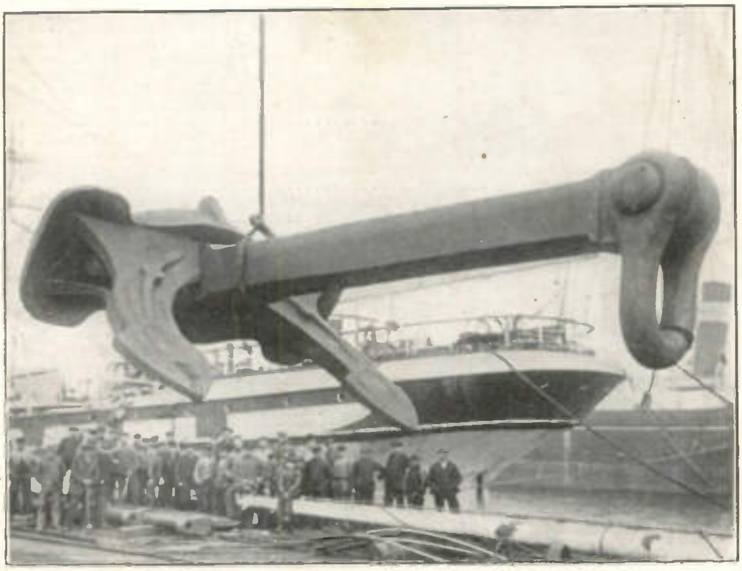

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A Magazine devoted entirely to the Electrical Arts

MODERN ELECTRICS

"The Electrical Magazine for Everybody"

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

Volume 6. August, 1913 No. 5

Contents

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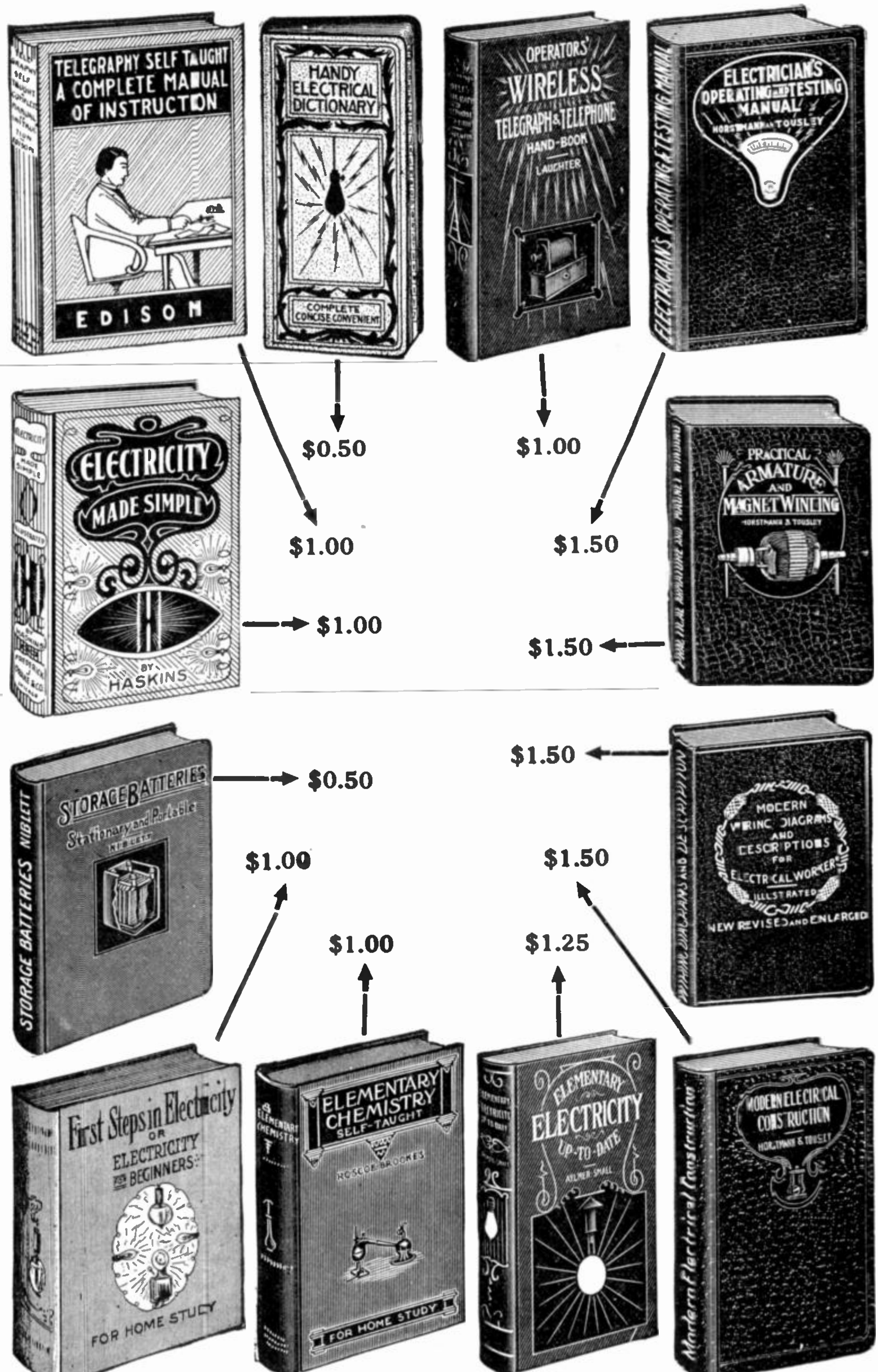
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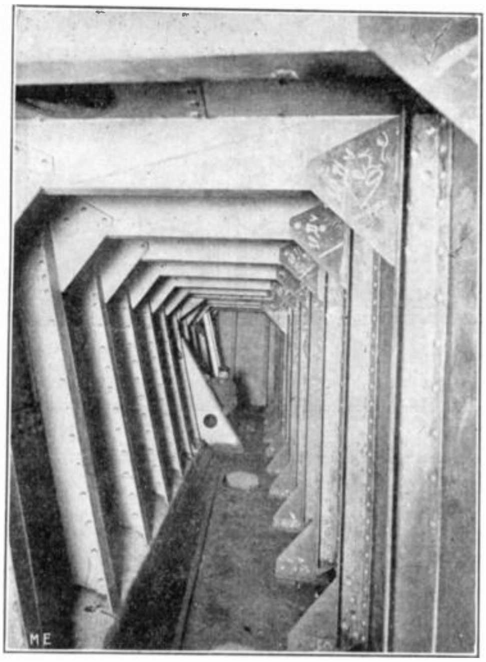
VOL. VI. August, 1913 No. 5

The World's Largest Ship

THE *S. S. Imperator,* the new marine wonder, which arrived in New York June 18th, on her maiden trip to America, opens a new chapter in marine history. The great liner is not only the largest ship in the world, but establishes new standards by the completeness of her mechanical equipment, her safety devices, and the variety and luxury of her cabins. The *Imperator* is built with an inner-skin, with both longitudinal and transverse bulkheads, and other original features. Taking advantage of her great dimensions, the ship's public cabins have been made so large as to avoid any suggestion of crowding. The *Imperator* is the latest addition to the fleet of the Hamburg-American Line, the largest steamship company in the world, which profits by an experience of sixty-seven years in directing its services in all parts of the world.

The *Imperator* measures 919 feet in length or almost one-fifth of a mile, 98 feet in width or that of a great boulevard, and has a tonnage of 50,000. Her powerful quadruple turbine engines drive her at an average speed of 22½ knots, crossing the Atlantic in six days. She is manned by a crew of 1,180, selected for their long service on other ships of the Line. The rigid discipline for which this service is famous obtains in every department. Despite her great size, the *Imperator* carries only a few more passengers than ships of half her tonnage, assuring complete comfort of all on board.

No hotel on either side of the Atlantic offers its guests so great a choice of dining rooms, ball rooms, winter gardens and palm rooms, grill rooms, smoking rooms, gymnasiums, roof gardens, public baths and luxurious lounges. The leading decorators of Europe have been entrusted with the decorations of the *Imperator's* cabins, and each is a masterpiece of its individual style. The great size of the *Imperator* has made it possible to give her some of the most spacious rooms ever enjoyed on shipboard. The main lounge, which may be converted into a ballroom, is hung with Gobelin tapestries and equipped with a practical stage for theatrical performances. An unusual amount of space has been set aside for an elaborate winter garden with a wealth of tropical vegetation. There is a running track, an elaborate Roman bath and swimming pool, and a variety of Russian, mineral and electric baths with skilled attendants, a florist, candy and book shop, a public



SPACE BETWEEN THE INNER AND OUTER SKINS OF THE DOUBLE HULL

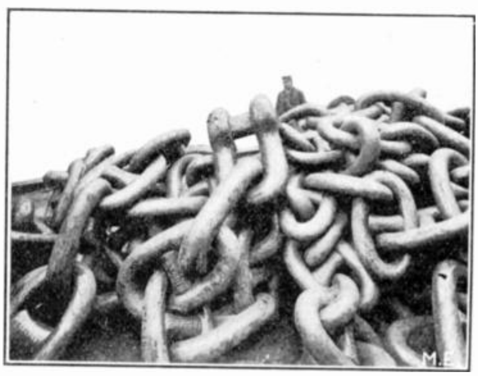
stenographer, a photographic dark room, electric elevators, and every conceivable appointment to assure luxury and variety throughout the Atlantic crossing.

The *Imperator* has been constructed with sixteen steel bulkheads, forming in all thirty-six watertight compartments. These are still further subdivided by the steel decks, giving the ship a cellular construction throughout. The bulkheads have been carried to the level of the second deck, high above the water-line. A single bulkhead weighs 1,200 cwt. These steel compartments have been completely flooded with water to test their efficiency under extreme conditions. The bulkheads are fitted with Dorrscher doors and closing appliances operated hydraulically from the Commander's bridge, while a second appliance operated from the upper deck is held in reserve.

The *Imperator* carries eighty-three large lifeboats of the most approved type, accommodating everyone on board. Two of these are high-powered motor boats, capable of towing the others. The motor boats are equipped with wireless telegraph working over 200 miles. Many of these boats are carried on the upper deck between the funnels, and may be lowered by special cranes to either side of the boat. The apparatus employed for handling all these boats is of the newest type, making it possible to lower a boat from an upper deck in a few seconds. The safety equipment also includes life belts for everybody and illuminated life buoys. The efficiency of all apparatus is assured by frequent drills and rigid discipline.

The familiar sea phrase "ship shape" has a special significance as applied to the eight kitchens of the *Imperator*. To economize the space, which is so valuable on shipboard, the kitchens are equipped with the newest time and labor saving devices which are operated by electricity. There are ingenious electrical plate washers, knife cleaning machines, silver polishing machines, electrical egg cookers, water filters, etc. Connected with the kitchens are enormous storerooms and cold storage rooms besides innumerable pantries, bars, taps and mess rooms. A series of electric elevators carry the foods quickly from the kitchens to the saloon decks.

The *Imperator* takes on board for

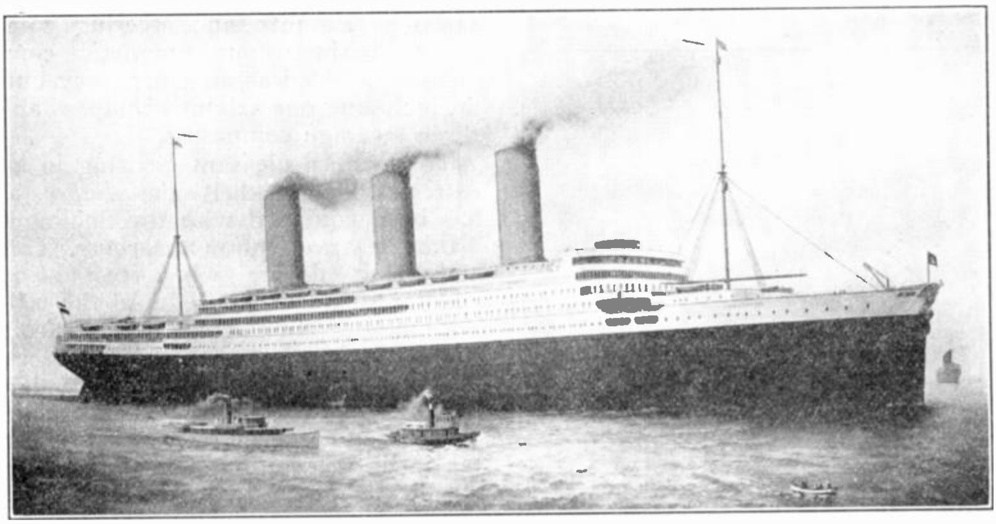


SOME OF THE ANCHOR CHAIN SHE CARRIES ¾ MILE OF THIS

a seven day voyage between New York and Hamburg some 48,500 pounds of fresh meats, 48,000 eggs and 121,000 pounds of potatoes. The larder besides contains 27,500 pounds of fresh vegetables and 6,000 tins of canned vegetables. There are, besides, 10,500 pounds of fowl and game and 9,000 pounds of fish and shell fish, 800 pounds of mushrooms and 4,000 cans of preserved fruits. The ship also carries 12,500 quarts of milk and cream, 400 pounds of tea, 500 pounds of chocolate and cocoa, and 7,000 pounds of coffee.

In every detail of its construction, the *Imperator* more than conforms to the laws governing shipbuilding, both in America and Europe. It has been built according to the regulations laid down by the Germanian Lloyd for the first class, four screw, passenger and side, each measuring 26 metres, 85 feet, in length, and weighing 30 cwt. The weight of the steel plates, angles, profiles, sheet iron, etc., totals 520,000 cwt. More than 2,000,000 steel rivets have been used in her construction, each weighing eleven pounds. More than 60,000 cubic metres, 2,130,000 cubic feet, of different kinds of wood have been used.

The *Imperator* has a Commander, an Executive Captain, and three Watch Captains, one in special charge of navigation and another of the safety conditions, assisted by seven officers. The engineering department is directed by one chief engineer, three first engineers as watch engineers, and a staff of 25 en-



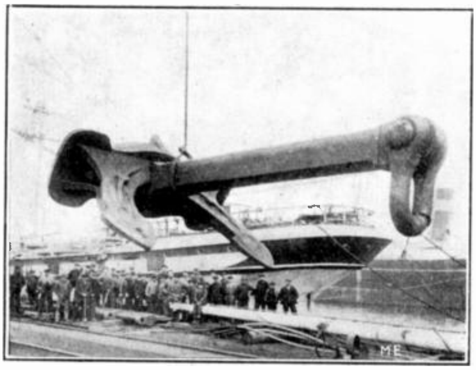
THE WORLD'S LARGEST SHIP
HAMBURG-AMERICAN LINE S.S. IMPERATOR

freight steamers, and has been equipped with every appliance required for emigrant ships by the German Laws, the Marine Association, the Sailors' Regulations, and the English and American Emigrant Laws. In the construction of the *Imperator* 1,800 workmen were engaged for three years, or for a total of more than 1,000,000 working days. The contract was given to the Vulcan Works, at Hamburg, June 18, 1910, and the ship was christened by His Majesty Kaiser Wilhelm II, and launched May 23rd, 1912. Some idea of the magnitude of the work may be gained from the fact that her sides are built upon 327 steel ribs, on either

gineers and electricians. The health of the passengers and crew is cared for by three physicians and two medical assistants. The highly complicated life of the great ship requires the services of a paymaster and three assistants, a storekeeper, provision superintendent, and five provision overseers, three baggage masters, a superintendent of materials, three telegraphers, two telephone operators, four barbers, a hairdresser, three printers, a cabinet maker, a tailor, four elevator operators and a gardener.

The wireless telegraph equipment of the *Imperator* is sufficiently powerful to work over a range of 1,500 sea miles.

The ship has two reserve antennae and two receiving instruments for long and short waves, designed for news service and rescue work. The station is directed by three expert operators, one of whom will always be at the key. The *Imperator* will be within direct communication with land through the Atlantic crossing. The electrical equipment of the *Imperator* is unusually complete. Current is developed by five Turbo dynamos and a motor dynamo driven by a benzine motor placed high above the water-line on the boat deck for emergency lighting. The ship is lighted by more than 10,000 electric lamps, distributed throughout the ship. Electrical power is employed for operating the four passenger and five provision elevators, the winches, pivotal canes, call bells, heating, etc.



THE MAIN ANCHOR
IT WEIGHS OVER 13 TONS

The *Imperator* is propelled by mammoth quadruple turbine engines developing 62,000 horsepower. She has four winged screws of turbadium bronze, measuring more than five metres, 16.4 feet, in diameter, which turn at a normal speed of 185 revolutions per minute. The machinery for reversing the engines is especially efficient, enabling her Commander to direct her movements more quickly than that of ships of far less tonnage. The backward moving power of all the reverse turbines is about 35,000 horsepower. The ship has four furnace rooms which are divided into watertight compartments by transverse and longitudinal bulkheads.

The *Imperator* carries five great anchors which are secured by steel chains having a total length of three-quarters of a mile. The main anchor weighs 26,455 pounds, her two bow anchors 17,636 pounds, a fourth 11,463 pounds, and her warp anchor 4,960 pounds. The anchors and chains together have a total weight of 485,082 pounds which alone makes an important item of cargo.

The *Imperator* carries a number of compasses distributed on the Commander's bridge, in the filter space on the third deck and in the rudder house at the stern. The equipment includes an Anschutz revolving compass, consisting of a "mother compass," two motor generators with starters, revolution recorders, and division tables. There are four "daughter compasses" which serve as azimuth and steering compasses besides four magnetic compasses provided as an emergency outfit, including one azimuth compass and three steerage compasses.

To assure a pleasant crossing in all extremes of weather, the *Imperator* has been equipped with the Schlinger Tanks or wave motion absorbers. This stabilizing device when tested on smaller steamers has reduced the rolling motion from thirteen degrees from the vertical to less than three degrees. The great size of the *Imperator* renders her naturally very steady in the highest seas, and assisted by the anti-rolling tank, she will be doubtless one of the steadiest ships in the world.

The wireless equipment is unusually powerful for a ship station and has several unique features. There are three separate and distinct aerials. The principal aerial is of the T type, and consists of two two-wire aerials strung between the two masts and from the middle of each of these four wires a vertical drop wire or down-lead is brought down to the deck, where they are connected together and carried through a single deck-insulator to the wireless room. The two other aerials each consist of a single wire running from the wireless room, one to the foremast or forward mast, and the other to the mainmast or rear mast.

The forward single wire aerial starts at the top of the forward mast and swings in one span to a set of insulators hung from an iron bracket projecting

(Continued on page 463)

An Experimental Radio-Phone

By Stanley E. Hyde

THE Radio Telephone has recently made a great stride in the direction of practicability by the combined efforts of Mr. H. Laverne Twining, Earl Hanson and F. M. Hall, of the Los Angeles Polytechnic High School.

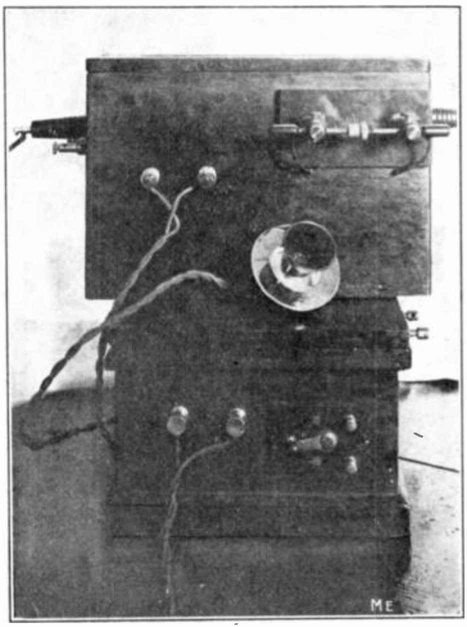


FIG. 1

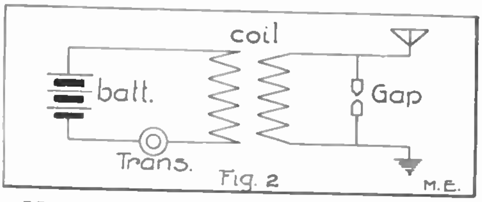
SMALL SPARK RADIO TELEPHONE TRANSMITTER

Why experimenters in general have not employed low frequency alternating current for Radio purposes before is a question. Books written on this subject mention direct current and the use of very high frequency alternators, the latter at present being impractical, for very little power can be derived from them and they must be driven at a dangerous speed, necessitating very firm and substantial bearing supports. In consubstantial bearing quency alternators the aim has been to make the frequency so high that the diaphragms of telephones would not respond, or in other words, the frequency must be raised to a point above the audibility of the human ear. But why not go in the other direction and make the frequency so low that the natural period of the telephone diaphragm will not respond to it?

This is what the above inventors have done with an arrangement of apparatus which they have named the "Oscillaphone." The purpose of this article will be to show construction of the "Oscillaphone" in a very practical form that can be used by any one possessing moderate experience with wireless telegraph apparatus. From 15 to 25 miles can be easily covered with a half kilowatt of power and moderate sized antenna.

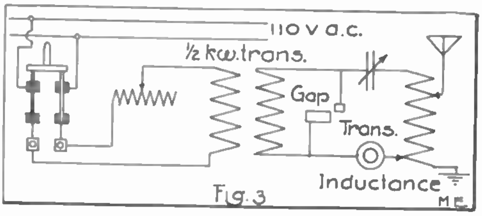
In order that the reader may gain some prerequired experience in distinctly speaking over the "Oscillaphone" and in adjusting the carbons that control the intensity of the voice variations that are superimposed upon the regular waves generated in the closed circuit he is referred to Fig. 1, in which is shown a cut of a simple form of Radio phone. It requires at least a one inch induction coil, spark gap made of sharpened carbons, batteries and a transmitter. Connections are made as in Fig. 2. The vibrator of the coil is screwed up so that the variations of the primary current, made by speaking into the transmitter, can circulate unhindered around the primary windings. The gap is set very close, the regulation being continued until little sparks jump the gap every time the transmitter is spoken into. To one side of the gap is connected a wire leading to the antenna and to the other, one leading to the earth capacity. When in operation the transmitter must be held close to the mouth and spoken into very forcibly, at the same time speaking distinctly.

For the reception of speech any of the common wireless receivers that employ tuning coils and crystal detectors will be satisfactory, but the writer has found that a detector made of a piece of chalcopyrite (copper-iron pyrite) pressing on silicon is very much more responsive to speech messages than other crystal detectors.



Upon gaining some necessary experience with this simple form of 'phone the experimenter is referred to Fig. 3, in which figure he will at once see the new departure from other systems employing direct current.

To a supply of ordinary alternating current at a pressure of 110 volts is



connected a ½ kw wireless transformer through some form of resistance for regulating the current when necessary. Across the terminals of the secondary of the transformer is a special form

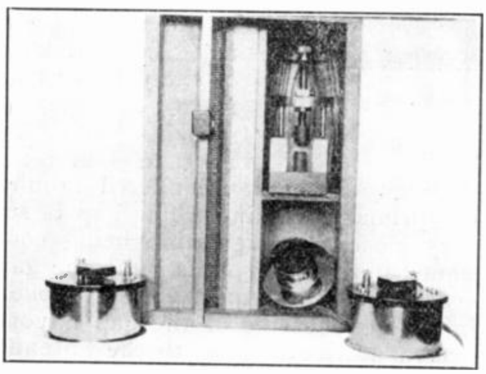


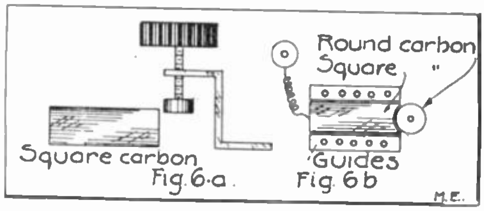
FIG. 4
VARIABLE CONDENSERS, INDUCTANCE, SPARK GAP AND TRANSMITTER

of finely regulated carbon spark gap, which will be taken up later. Across this gap is arranged a closed circuit consisting of a variable inductance, variable capacity and a telephone transmitter. See Fig. 4. In Fig. 4 it will be noted that the condensers are of the rotary type and are filled with castor oil to insulate the plates so that sparks will not pass between them. If condensers of this type are not available a condenser can be made of 4 glass plates 10 x 10" covered with tin foil. Construction of the condensers should follow the same rules as for wireless sets as they have to stand practically the same high voltages.

For the inductance it is preferable to make use of the type shown in Fig. 4. On a round wooden core one foot long and 4 inches in diameter are wound 100 turns of No. 10 SCC copper wire. The insulation is scraped off to a width of a quarter inch the whole length of the coil and a sliding contact made to bear upon the respective turns. The construction is exactly the same as a single slide tuning coil, the only difference being in the size of the wire wound on the core.

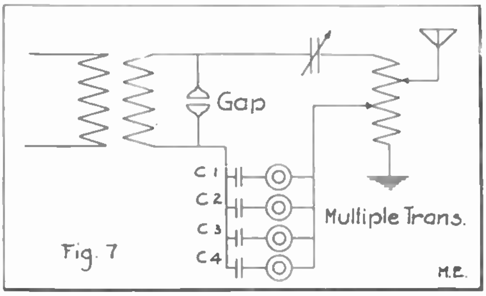
FIG. 5
CARBON MICROMETER GAP

Fig. 5 illustrates a form of micrometer spark gap that constitutes one of the principal features in this system. Fig. 6 contains details of this gap. To a base is fixed a piece of square carbon. Mounted above this piece of square carbon is another carbon electrode that



is round and filed flat on its sparking end. It is parallel with the upper face of the square carbon and should never be brought below the edge of the upper surface, Fig. 6a. The square carbon electrode is mounted so that it can slide forward toward the micrometer electrode, varying the distance between the two, Fig. 6b. Upon current passing between the two the edge of the square carbon will wear in a little and form a semicircle, as shown. In this condition the spark gap is doing its best work, for the current in passing from one carbon to the other is evenly distributed.

About the transmitter. For the set



being described an ordinary transmitter can be employed (Carbon grain type), but if the set be kept active for any length of time it is apt to heat up and cause a little trouble. The ordinary transmitter used on a ½ kw set will withstand heating for at least half an hour, and cause no trouble. For larger powers a multiple transmitter described by the writer in the Sept., 1912, issue of Modern Electrics in an article on "Experiments With the Musical Arc," can be used to advantage. A large wooden bowl has arranged around its inner surface four transmitters, so that sound waves from the voice will be focused into the transmitters. They are connected as in Fig. 7, where C1, C2, etc., are condensers each made of 3 glass plates 10" x 10". In this manner more current can be handled than with a single transmitter, and they will not heat up, as each carries but one-fourth of the total current. These transmitters may be also connected in the ground lead, but it is

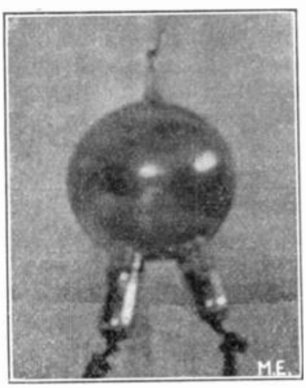
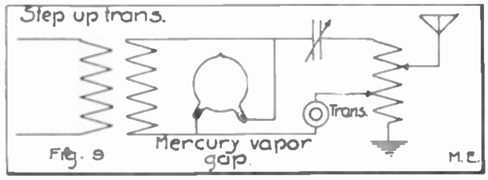


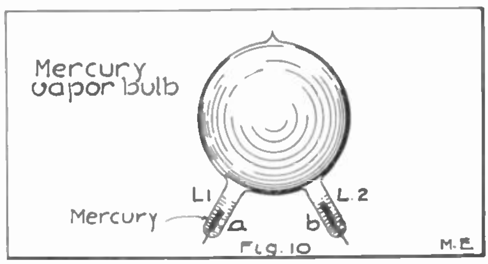
FIG. 8
MERCURY VAPOR BULB

probably as well to vary the oscillations directly in the closed circuit itself.

If a considerable amount of power is to be handled a mercury vapor gap



may be employed instead of the carbon spark gap, as indicated in Fig. 9. For cut of mercury vapor bulb see Fig. 8. Into a glass bulb of the form shown are sealed two silver electrodes, A and B, Fig. 10. The air is exhausted from the tube and it is mounted as in Fig. 11, to keep the bulb from being injured. Wooden discs are cut and large holes to fit the bulb are made to hold it in place and in an upright position. Around the silver electrodes, which



may be copper, silver plated, is mercury which comes nearly up to the top of the legs, L1 and L2. Wires that connect to the electrodes pass on to binding posts on the top of the wooden frame. The whole is then immersed in a can of transformer oil to keep the

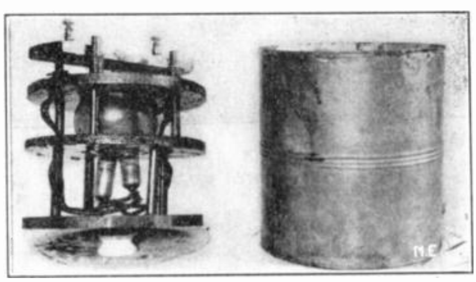


FIG. 11
MERCURY VAPOR GAP AND CASE

bulb cool. Upon closing the primary circuit a high frequency current will pass through the bulb from one electrode to the other and upon speaking

(Continued on page 468)

Wireless in the Philippines

By Charles Berntswiller

IT is curious that wireless telegraphy should be so extensively used as a means of telegraph communication in such out of the way places as the islands of Mindanao and Jolo, situated in the southern end of the Philippines Archipelago. As far back as 1905 when wireless telegraphy was still in its infancy, three stations were installed, at Jolo, Zamboanga, and Malabang, by the United States Signal Corps. At first they were erected solely for military purposes on account of the very unsettled conditions existing among the savage Moros that infest the southern islands. But later, when hostilities more or less ceased, and the merchants and planters opened up the country, these stations were turned over to the Bureau of Posts of the Philippines, and operated by the Postal Department, for commercial purposes. They have, beyond a doubt, proved much more satisfactory than the ordinary land wire telegraph on account of the destructive typhoons and tropical rain storms that so frequently sweep over the islands. At times, miles of land wire have been carried away during a single typhoon which might last but a few hours.

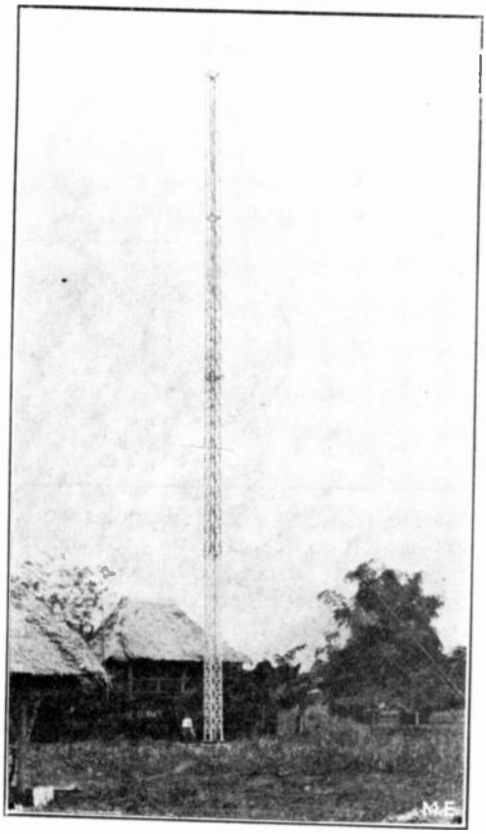


FIG. 1
STATION AT MALABANG, P. I.

Fig. 1 shows the Malabang wireless station. The apparatus is installed on the top floor of a small shack made of bamboo and nipa grass, raised about 8 feet from the ground on piles, which can be seen in the background of the photo. The transmitting set consists of the ordinary, old type, junk apparatus, with four spark gaps in series, a forty plate condenser, and an oscillation transformer. The receiving set is made up of a Wireless Specialty tuner and phones working in conjunction with a Perikon and a Pyron detector.

On the ground floor, and protected from the water in the rainy season by a shallow ditch, is the engine and dynamo, which is shown in Fig. 2. A 3 kw generator is driven by a belt by a 10 hp Fairbanks-Morse gasoline engine, water cooled from a tank at the back of the shack. The tower which is made of steel lattice work is 130 feet high, and supports an eight wire antenna arranged umbrella shaped.

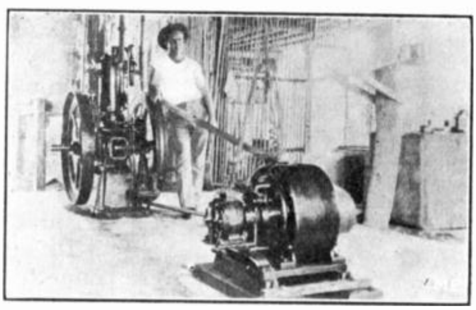


FIG. 2
POWER PLANT OF MALABANG STATION

This wireless station is the terminus of the land wire coming down through the different islands from Manila. It therefore handles all messages going south. They are transmitted to Zamboanga, the main station, and thence

FIG. 3
STATION AT ZAMBOANGA, P. I.

relayed to their respective destinations through the sub-stations at Jolo, Davao, Puerto Princessa, and Cuyo.

The above Fig. 3 shows the Zamboanga wireless station. It is situated on a small hill about three miles from the town of Zamboanga. The wooden lattice-work tower is 175 feet high, and supports an aerial similar to that used at Malabang. A 5 kw generator is driven by belt by a 12 hp Gorham gasoline engine in the small house near the operating room. The sending and receiving apparatus is identical with that used on the Malabang station, except that it is of larger build.

An idea of the interior of this station can be got from Fig. 4, which shows an operator at work.

A 3 kw station is operated at Jolo, similar to that of the Malabang Station. At Davao a 4 kw Telefunken set is used while Cuyo and Puerto Princessa have 2 kw Telefunken sets.

The atmospherical disturbances which are so heavy in these equatorial regions occasionally hold up business for hours at a stretch. But as this seldom occurs in the day time except occasionally in the static season, excellent service is generally maintained. The telegraph offices throughout the Philippines only keep open during the day time; this is fortunate, because as soon as the daylight fades, the static comes on to such a surprising extent that generally no matter how loud the signals are, further work is absolutely out of the question. These atmospheric discharges are so strong that a whole tuner and phones have been known to burn out when an operator neglected to cut in the ground switch.

A few enterprising native operators, who have learned the wireless business while working the land lines on these stations, have proved very successful wireless operators, and are now working nearly all the stations under the supervision of a white chief operator. Great difficulty has always been experienced in obtaining white operators to stay on these stations in spite of the high wages paid, because of the great hardships and dangers to be met with in such lonesome regions. There is such a great quantity of business to be handled in a comparatively short time, that exceptionally good operators are needed.

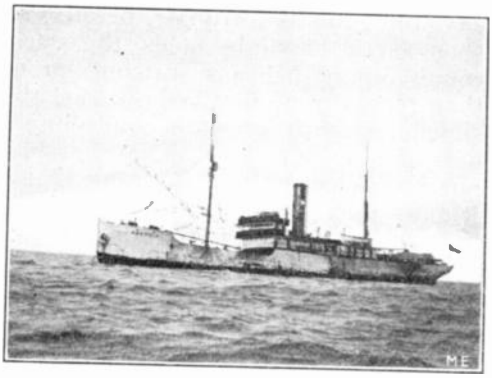
FIG. 4
OPERATOR RECEIVING AT ZAMBOANGA

A Hypothesis Regarding Aurora Borealis

Based on Observations Made in Hudson Bay, 1912, by E. G. Fulton, Marconi Officer, S. S. "Beothic," and Mr. F. M. McLennan

By E. G. Fulton

ON July 5th, 1912, the steamship *Beothic* chartered by the Hudson Bay Steamship Line, of Montreal, entered upon the work of providing the first regular freight and passenger transportation to the territory adjacent to Hudson Bay ever undertaken by any commercial steamship line. The *Beothic*



S.S. BEOTHIC
FROM WHICH THE EXPERIMENTS WERE CONDUCTED

was equipped with Marconi wireless apparatus, and on August 6th the first Marconigram ever sent in Hudson Bay was sent from that steamer to the Canadian Government Hydrographic Survey Ship *Minto* upon its arrival off Port Nelson, Manitoba.

In explanation of the circumstances leading to the observations described in this article it must be stated that the writer claims no scientific attainments and possesses only a rudimentary scientific education. Therefore the data and hypothesis outlined here are given not as conclusions, but, as no opportunity has heretofore been afforded for determining the effect of Aurora Borealis on wireless equipment in such close proximity to the North Magnetic Pole, this article is intended to suggest to those with greater scientific resources further experiments along this line.

The writer is indebted for valuable assistance during these experiments to Mr. F. M. McLennan, a member of an engineering party of the Department of Railways and Canals of the Dominion of Canada. This party was proceeding via *Beothic* to Port Nelson, Manitoba, to begin the survey and construction of a harbor and railway terminus at that point, to connect with which the Dominion Government has already under construction a line of railway.

The first Aurora Borealis to be observed occurred on August 2nd. Position of ship, Latitude North 57° 07′, Longitude West 92° 33′ (about eight miles off Port Nelson). Weather clear, moon about half, barometer reading 30.16, temperature +48° Fahr. at time of observation, 11:45 p. m. (time of 90th meridian). The Aurora first appeared as an arc of greenish-yellow light extending across the northern sky from northwest to east. The wireless receiver was carefully adjusted, but the only effect observable was that the slight "brushing" sound which accompanies the normal operation of the Marconi magnetic detector was somewhat increased during the prevalance of the

A CORNER OF THE WIRELESS CABIN ON THE S.S. BEOTHIC

Aurora. This would indicate, if anything, that Aurora Borealis would enhance rather than obstruct wireless communication. Upon transmitting wireless signals for five minutes the

Aurora became violently agitated, but resumed its original form when the signals ceased. After a five-minute interval signals were again transmitted for two minutes, during which the band of light separated into two parts and gradually disappeared. In ten minutes it reappeared with almost its original brilliance, but upon transmitting signals for

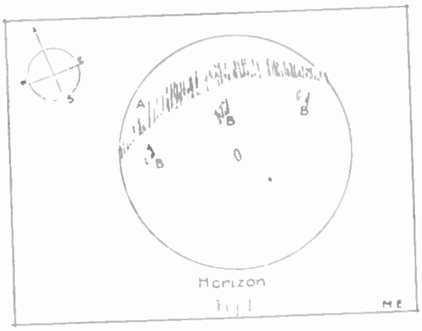


Fig. 1

two minutes again disappeared and was not further observed during the night.

The second observation was made on August 4th. Position of ship unchanged, weather clear, starry sky, barometer 29.69, temperature +65° Fahr., at time of observation, 11:45 p. m. The Aurora was generally distributed over the northern sky in the form of arcs of greenish-yellow light radiating in various directions. Upon transmitting signals for five minutes it became violently agitated and the outer ends of the arcs were apparently drawn towards the ship until concentrated overhead. Transmission was then discontinued for five minutes, during which the agitation ceased. Signals were then transmitted for five minutes and the Aurora gradually broke up and disappeared. After a ten-minute interval it reappeared rather faintly, but upon transmitting signals for two minutes again disappeared and was not further observed.

Third observation, August 5th, position of ship unchanged. At 8 a. m. barometer 29.98, temperature +62° Fahr. At time of observation, 8 p. m., weather clear, half moon and many stars, barometer 29.82, temperature +65° Fahr. The Aurora Borealis was very brilliant, but, desiring to observe its normal action, no signals were transmitted on this evening. It was generally distributed over the northern sky in various formations of greenish-yellow light, which underwent many variations in form and shadings in color. In this case, however, the changes occurred gradually and deliberately and did not resemble the rapid vibration or agitation that had been observed while signals were being transmitted the previous evenings.

Soon after this time the ship left Port Nelson for James Bay, and then for North Sydney, Nova Scotia, and the next observation did not occur until off the Northern Labrador coast on the second voyage, September 24th. Position of ship, Latitude North 57° 34', Longitude West 60° 45'. At 8 a. m. (time of the 60th meridian), barometer 30.01, temperature +42° Fahr. At time of observation, 9:45 p. m., weather clear, few light clouds to southward, full moon, barometer 30.10, temperature +45° Fahr. The Aurora Borealis appeared as a faintly-defined and comparatively narrow arc of bluish-green light extending across the horizon from northwest to east. It remained stationary for some time, but upon transmitting signals for five minutes the eastern end apparently deflected toward the ship, the whole arc

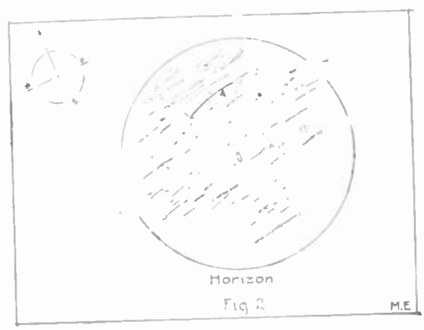


Fig. 2

increased in brilliance for a moment, then gradually disappeared.

Next observation, October 6th, position of ship off Port Nelson, Latitude North 57° 07', Longitude West 92° 13'. At 8 a. m. (time of 90th meridian), barometer 29.69, temperature +36° Fahr. At time of observation, 10:50 p. m., weather clear, no moon, few clouds in the sky. Cold north wind blowing and snow flurries experienced during the day and early part of evening. The Aurora Borealis appeared as a faintly-defined arc of bluish-green light, as shown at A, Fig. 1.

There was no apparent change for the first ten minutes of the observation, but while transmitting signals for two minutes the additional series of greenish-yellow lights shown at B, Fig. 1, appeared. The original arc gradually increased in brilliance and assumed the usual greenish-yellow shade at the same time. When the signals were discontinued the Aurora Borealis slowly disappeared, but while transmitting at alternate five-minute intervals from 11:10 until 11:30 p. m. it gradually returned to its original brilliance and to approxi-

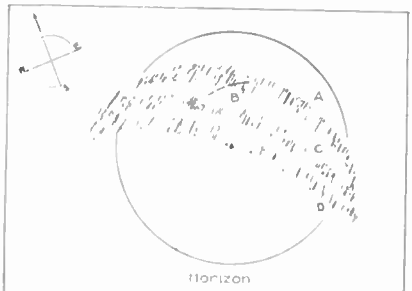


Fig 3

mately the form shown at A and B, Fig. 1. While transmitting continuously from 11:35 until 11:45 p. m., the Aurora Borealis underwent rapid changes in form and variations in color, apparently being concentrated directly over the ship and continually increasing in area, density and brilliance, and finally assuming approximately the position shown in Fig. 2. During this period a phenomenon resembling the travel through space and bursting of a meteorite was observed, as shown at A, Fig. 2. It is the opinion of the writer that this phenomenon occurred below rather than above the Aurora Borealis, as this was so dense and brilliant at the time that the stars above it were quite obscured, and a meteorite, had it occurred above the Aurora Borealis, would undoubtedly have been invisible also. When signals were discontinued the Aurora Borealis decreased materially in brilliance and area until at 12:15 a. m. it was barely visible. At 12:25 a. m. it again appeared, gradually increased in area and brilliance, and at 12:40 a. m. it was darting rapidly in all directions and was still quite brilliant when last observed at 1 a. m.

The last observation was made on October 16th, ship anchored off Fort Churchill, latitude North 58° 46′, longitude West 94° 10. At 8 a. m., (time of the 90th meridian) barometer 29.02, temperature +36° Fahr., 8.00 p. m. weather clear, barometer 29.01, temperature +39° Fahr. At 7.04 p. m. a rather faint Aurora Borealis appeared, which gradually increased in brilliance and formed an arc of greenish-yellow light from the northern to the eastern horizon as shown at A, Fig. 3. At 7.45 p. m. signals were transmitted for two minutes during which time the Aurora Borealis increased still further in brilliance and was set into rapid vibration. After a five-minute interval signals were transmitted for five minutes during which the Aurora Borealis continued to increase in brilliance. During this period a meteorite was observed as at B, Fig. 3. The Aurora Borealis in this case was not so brilliant as to obscure the stars and a meteorite might possibly have been seen through it, but the meteorite appeared to

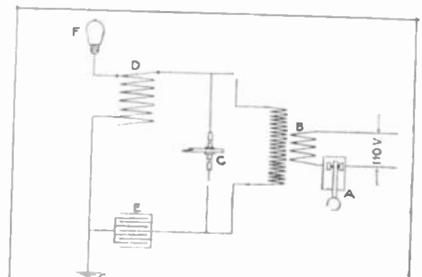


Fig 4

be far below the Aurora Borealis. After a ten-minute interval during which no material changes occurred in the Aurora Borealis signals were again transmitted and the additional arcs of greenish-yellow light shown at C, D, Fig. 3 appeared. The Aurora Borealis remained thus until about 8.45 p. m., and then began to gradually disappear.

The next experiment was as follows: The wireless set was connected according to Fig. 4, in which A indicates the transmitting key connected in series with the primary of a 110- to 25,000-volt transformer, B, to a 110-volt, 60-cycle alternating current circuit supplied by a motor-generator set driven by the ship's dynamos; C, represents a high-frequency discharger consisting of two copper-alloy stationary electrodes and a disc carrying sixteen copper-alloy electrodes mounted on the end of the motor-generator shaft and running at a speed of 1,450 rpm between the stationary electrodes; D represents an inductance consisting of 204 feet of one-fourth inch copper wire wound on a frame twelve inches square with turns spaced one inch apart; E represents a capacity consisting of four Leyden jars whose outer and inner coatings each contain 136 square inches of copper foil and whose dielectric thickness is three thirty-seconds inch. This constitutes the regular working arrangement of the wireless transmitting apparatus with which the previous experiments were made, but for the purpose of this experiment the aerial terminal was disconnected and an ordinary 40-watt tungsten lamp bulb (the filament of which had been destroyed), was connected as shown at F.

When the circuit was completed the bulb was immediately illuminated with a bluish-green phosphorescent light. The whole interior of the bulb glowed, but the light appeared the most intense near the glass surface and near the small terminal wires which had served as the path of the current during the life of the bulb's filament. The striking similarity between this light and the Aurora Borealis was at once apparent, particularly when, with the variations of the current, the light fluctuated and darted around the interior of the bulb exactly as a miniature Aurora Borealis might be expected to do. The writer, after carefully insulating himself from any grounded objects, grasped the glass outer end of the bulb in his fingers, whereupon the light was greatly intensified and changed from the bluish color to the identical greenish-yellow that had characterized all the Aurora Borealis so far observed. The bulb also heated up rapidly where it came in contact with the fingers and soon became too hot to hold.

This was possibly due to the same principle that causes the anti-cathode or "target" of an X-ray tube to heat up from the continual bombardment of the electrons composing these rays of light. This heating, as well as the change in color and increased intensity of the light, showed that more energy was flowing through the bulb when the "capacity" of the body was placed in contact. Only a slight shock was felt while touching the bulb.

After considerable study of all the data available to the writer regarding Aurora Borealis, and of the observations described above, the following hypothesis was evolved: That the earth is essentially an immense magnet. That it is being constantly traversed by magnetic lines of force extending between the north and south magnetic poles. The

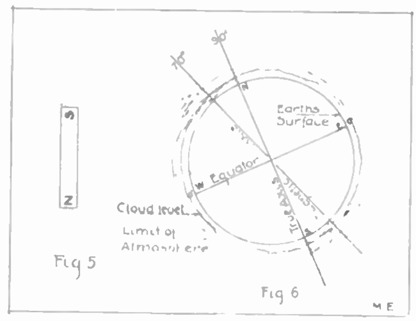


Fig 5

Fig 6

lines of force are concentrated in the vicinity of the poles. That when these magnetic lines of force pass near the earth's surface, parallel to the clouds, they induce an electrical charge upon the clouds. That when this electrical charge becomes great enough it is discharged through the air as lightning. But near the poles where this energy is greatest instead of inducing an electrical charge upon the clouds it is projected out beyond the comparatively thin layer of the earth's atmosphere into the partial or complete vacuum beyond, where it is dispersed over the region surrounding the poles as the phosphorescent, fluctuating light known as Aurora Borealis.

This hypothesis is illustrated in Figs. 5 and 6. First the familiar bar magnet will be recognized, with its magnetic lines of force shown approximately as they would be shown to exist by the time-honored experiment with iron filings. It should be noted that near the magnet poles where the magnetic energy is greatest the lines of force project much farther out than they do in the center where it is least. If the earth is indeed a magnet it must obey the same laws that govern the small bar magnet, and Fig. 6 shows the writer's idea of the arrangement of the lines of magnetic force about the earth. This drawing, of course, is only an approximation and for the sake of clearness the line defining the limit of atmosphere is much farther from the line representing the earth's surface than it should be. The north magnetic pole is located at about latitude north 70° and longitude west 97°, and the drawing represents a cross-section of the earth taken upon the meridian upon which the magnetic poles fall. That these lines of force do exist is so conclusively proven by the action of the compass and the matter is so generally understood that no comment is necessary on that point. It only remains to show that they are the cause of the two phenomena known as lightning and Aurora Borealis. This latter, though not universally conceded to be of electrical origin, has never been shown to be due to any other of the physical forces and the electrical origin has been generally accepted for want of a better explanation. To show that this explanation is indeed the correct one the principal assumptions made in the above hypothesis, and the data upon which they are based, may now be considered.

First, can it be established that the magnetic lines of force which cause the action of the compass are capable of inducing an electrical charge upon the clouds over which they pass? The writer cannot define the cycle of transformation that might take place between the simple, unseen magnetic impulse and the disruptive lightning discharge; but in the laboratory the magnetism present in the core of the induction coil is manifested at the secondary terminals as a crackling spark that duplicates, on a smaller scale, the lightning. Is it not, therefore, reasonable to concede that in Nature's laboratory the same cycle of transformation might take place, even though all the processes cannot be definitely understood.

If this magnetic energy is the cause of lightning it would seem that in the vicinity of the magnetic poles where this energy is greatest, lightning would be most frequent. This, however, is not the case; on the contrary it is doubtful if lightning ever occurs in the vicinity of the poles. The writer spent the entire summer in Hudson Bay, and though storms were frequently experienced and weather conditions were often such that lightning might have been expected, none occurred north of the 55th parallel. Inquiries were made of several engineers and navigators of long experience in the Arctics and none of them were able to recall having experienced any lightning north of the 60th parallel. In the experiment illustrated in Fig. 4, if the aerial terminal had been brought to within a short distance of the ground terminal, the energy would have discharged through the air as a crashing spark corresponding to lightning. However, when the same energy was radiated into a vacuum it manifested itself as a quiet, phosphorescent light closely corresponding to Aurora Borealis. Applying this laboratory truth to natural occurrences is it not reasonable to suggest that the energy which manifests itself as lightning when discharged through the air might manifest itself as Aurora Borealis when discharged into a vacuum?

The final assumption upon which the hypothesis rests is that Aurora Borealis does occur under atmospheric conditions sufficiently different from the normal to account for the different form in which the same type of energy is manifested. The writer is informed, by a civil engineer of long experience in the Canadian Government Survey of Hudson Bay, that Aurora Borealis is not frequently seen north of latitude north 76°, and when it is seen north of this parallel it is seen to the southward instead of to the northward. It would appear, then that Aurora Borealis originates at about north 70° or, as has been stated, in the vicinity of the north magnetic pole. The writer has observed at least one brilliant Aurora Borealis from his home at latitude north 41° 35′, longitude west 82° 35′. Many authentic observations have been made from points much further distant than that. It is obvious, therefore, that if Aurora Borealis occurs in the vicinity of the north magnetic pole it must occur at very high altitudes to be visible over the curvature of the earth from points so far south. It was stated that during the observation made on October 6th the Aurora Borealis was so dense and brilliant that the stars could not be seen through it, yet a meteorite was plainly observed. The meteorite must have been below the Aurora Borealis. A second meteorite was observed on October 16th that was very probably also below the Aurora Borealis. Meteorites do not become visible until they reach the earth's atmosphere, as it is the friction of the atmosphere on the swiftly-falling body that causes it to heat up to incandescence. Evidently, if the Aurora Borealis was above these meteorites it must have been above the earth's atmosphere.

From a property inherent in Aurora Borealis itself it seems most probable that it actually occurs, not in the complete vacuum outside the earth's atmosphere, but in the higher levels where the atmosphere is so rarified as to serve the same purpose, so far as electrical phenomena are concerned, as a vacuum. This property is the variation in color so noticeable in Aurora Borealis. It is known that when electrical energy at high frequency and potential is radiated into tubes containing various gases, each gas will impart a characteristic color to the light that will result. The atmosphere is well known to be not a chemical composition whose constituents exist in unvarying proportion, but a mechanical mixture the proportions and constituents of which vary under certain conditions. It is reasonably certain that the proportions of the gases of which the atmosphere is composed do vary to a certain extent at different altitudes. With these two facts in mind, and in the light of the above hypothesis the variations in color noted in Aurora Borealis can easily be accounted for.

It has been impossible to arrive at any definite conclusion as to the reason for the effect the wireless transmitter evidently had upon the Aurora Borealis. The writer is not even so dogmatic as to assert positively that the phenomena here recorded were due to the influence of the wireless transmitter. Appearances were such, however, that it is scarcely conceivable that all of these phenonema were due to coincidences. Previous to the Boethic's voyage, no powerful wireless set ever attained such close proximity to the probable origin of Aurora Borealis, and it seems that these observations should, therefore, be worthy of considerable study, particularly from the viewpoint of the above hypothesis. It has been stated to the author that if wireless waves were capable of affecting Aurora Borealis it would constantly be under the effects of powerful land stations at various points, which are radiating many times the energy of the Boethic's equipment. This objection, while a reasonable one, can hardly be accepted, because the wireless receiver was kept carefully adjusted during the entire summer in Hudson Bay and not a signal from a land station was heard. If no land station is powerful enough to affect a sensitive receiving apparatus in the vicinity of the Aurora Borealis it certainly could not be expected to affect the Aurora Borealis itself.

In connection with this hypothesis the following experiments may be particularly suggested: To produce, in the laboratory, such lights as are described in Fig. 4, though an induction coil or static machine would answer even better than the wireless transmitter as a source of high-potential current. Tubes exhausted to various percentages of vacuum and tubes containing various gases, especially the atmospheric gases, nitrogen, oxygen, hydrogen, argon, etc., should be tried, and the gas or combination of gases emanating the light most nearly corresponding to Aurora Borealis determined The rays of light from this tube should then be subjected to a spectrum analysis and the results compared with the results of a similar spectrum analysis of Aurora Borealis. The tube should also be brought under the influence of a powerful magnetic field and of magnetic waves such as are sent out by a wireless transmitter, and its action noted. The rays of a Crookes tube are deflected by a magnet and some useful analogy might be determined in this way, between the action of the Aurora Borealis in some of these experiments, and the rays of a Crookes tube, the nature and origin of which are, of course, definitely known. Another experiment of interest would be the construction and magnetization of a steel sphere, so that, by means of iron filings suspended in glycerine or any other suitable method, it might be determined whether or not the magnetic lines of force about a sphere would arrange themselves as shown in Fig. 6. Finally, one of the vessels which are frequently sent to Arctic latitudes by the United States or other Government Hydrographic Survey departments, might be, at no prohibitive expense, equipped with apparatus suitable for performing these and other experiments which would suggest

(*Continued on page* 472)

The Measurement of Electromotive Force by the Potentiometer Method

By Stanley E. Hyde

THE potentiometer method of measuring electromotive force is the method generally followed where accuracy is desired. This form of potentiometer and the form (so called) that is used in radio telegraphy must not be confused. Why the variable resistances used in radio receptive circuits were ever called potentiometers is hard to figure out because they do not

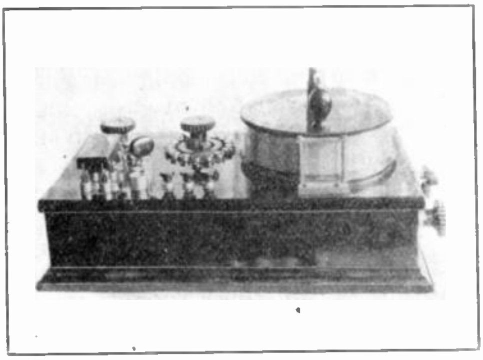


FIG. I
LEEDS & NORTHRUP POTENTIOMETER

measure electromotive forces but merely vary it to suit the needs of the rectifier. They are nothing more or less than plain non-inductive resistances, the name potentiometer being stuck on by some manufacturer probably to let the radio experimenter know that he had a new type of wireless instrument for sale. There's no doubt but that it sounds "scientific."

The accompanying cut shows a Leeds & Northrup potentiometer that can be made to give accurate results to the fifth or sixth place of decimals. Fig. 3 constitutes the real wiring diagram of this potentiometer, but for the sake of simplicity and for explanation we will consider Fig. 2, which is essentially the same in principle involved. A storage battery B, or any combination of bateries having an EMF which is constant and somewhat higher than that of any of the cells to be compared, is connected to the ends of the wire, ab, of sufficiently high resistance to prevent a current from flowing which is large enough to heat the wire appreciably. The resistance, ab, must also be so high, in comparison with the internal resistance of B, that the potential difference maintained by B, between a and b, is greater than the EMF of either E1 or E2, the two cells to be compared. These cells are connected as in the figure, so that their negative terminals are joined to the same point, a, to which the negative terminal of B is connected, their positive terminals being connected to the contact points, m and n, of a double throw switch, S, through which either cell can be put in connection with a resistance box, R, a galvanometer, G, and a wire, w, which can be touched at any point along its length, ab. The comparison of the EMF'S is made as follows: Suppose that the switch, S, is turned so as to touch the contact, m, and thus put the cell, E1, in the galvanometer circuit. If now the free terminal of the wire, w, were to be touched to any point on ab, for example, c, a current would always flow through G and R, from right to left, provided there were no cell in the circuit, cGRma. The cell, E1, which is in this circuit, however, tends to force current in the opposite direction, namely, from left to right, through R and G. If, then, the PD (potential difference) which already exists between c and a, when the wire is touched at c, is greater than the EMF of E1, a current will actually flow through G and R from right to left; but if the EMF of the cell, E1, is greater than the PD which is maintained between the points c and a by the battery, B, then a current will flow through the galvanometer from left to right. If the PD between c and a is exactly equal to the EMF of E1, then no current whatever will flow through the circuit of the cell, that is, through G, for G only deflects when a current is passing through its windings. We have then only to find the point, on ab, which can be touched by the free end of the wire without producing any galvanometer deflection whatever, in order to obtain the point such that the PD between it and a is exacly equal to the EMF of the cell.

Suppose now that the switch S is

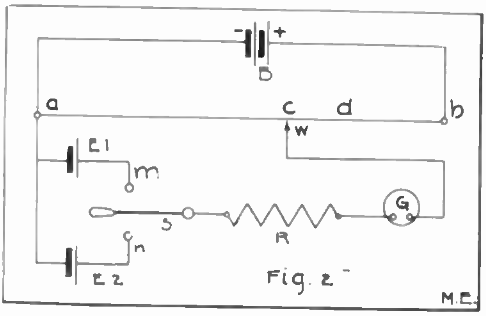


FIG. 2
SIMPLIFIED WIRING DIAGRAM

turned so as to make contact with the terminal, n, of the other cell. If it is now found that some other point, d, is the point for which the galvanometer shows no deflection, then, if the wire, ab, is uniform we have:

$$\frac{E_1}{E_2} = \frac{\text{PD from c to a}}{\text{PD from d to a}} = \frac{\text{length ac}}{\text{length ad}}.$$

While the point of no deflection is being found, the resistance, R, should be made very large (20,000 ohms), for then no appreciable current will flow through the cell circuit, and hence this cell will not polarize, even if it be one of the polarizing kind.

After the point of zero deflection is found, the resistance, R, may be varied, or in fact entirely removed, without altering the point of balance, for obviously at this point the cell is in exact equilibrium with the PD between c and a; that is, it is virtually on open circuit. The only reason for introducing R at all was to prevent the cell from polarizing while the point of balance was being found, and to protect the galvanometer from too violent deflections. Varying the value of R will then alter nothing save the sharpness with which the point of zero deflection can be located.

Referring to the cut and Fig. 4. The large revolving drum resistance shown in the cut to the right is M' in Fig. 4, the three little buttons in front are K1, K2, K3, the resistances on the right end of the potentiometer are 23R and 8.3R respectively. The resistance, .1, .2, .3, etc., correspond to the knob switch just to the left of the revolving drum, and the one marked T is the resistance just back of the DPDT switch. All binding posts are on the other side of the instrument.

Instruments required are, potentiometer, galvanometer, battery to operate potentiometer (storage battery), Standard Clark Cell and the EMF to be measured. The standard cell is constructed so that temperature fluctuations do not affect it and the EMF is always constant, and upon this fact rests the accuracy of the potentiometer.

All resistances are previously calibrated when manufactured so that no computations are necessary.

To operate: The battery to operate the potentiometer is connected and the DPDT switch thrown to the standard cell. The resistance, T, which has its lugs marked for different makes of standard cells is moved until the EMF of the cell corresponds to the nearest numerical EMF marked on the lugs. The average EMF of a number of

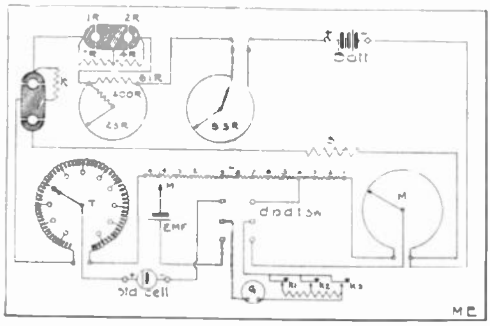


FIG. 3
ACTUAL WIRING DIAGRAM

standard cells tested by the Bureau of Standards at Washington, D. C., was found to be 1.01800 volts. Now the little resistances 23R and 8.3R are adjusted until the galvanometer shows no deflection. In doing this the key K1 should first be touched to connect the galvanometer in circuit as the first adjustments are only rough and the excessive current might injure the galvanometer, as mentioned previously. When the galvanometer shows no deflection the two batteries are exactly bucking each other, otherwise the stronger would force current through the galvanometer and show a deflection. Now we are ready for the comparison to find the EMF of the battery to be measured, say a dry cell. The DPDT switch is thrown so that the dry cell is connected to the potentiometer and the knob switch, L, moved to where you think would be the approximate voltage of the dry cell, about 1.4. Then the revolving drum resistance, M', is turned until the galvanometer again shows no deflection, this showing that our dry cell is just bucking the potentiometer battery. The revolving drum has numbers on its rim and also on the glass dial in front of it which are calibrated, so we put down 1.4 which we took from L and find that the numbers that coincide on the edge of the drum and the glass dial are 0 and 73, these being set down after the 1.4, making 1.4073. By special shunts voltages from small fractions up to 1000 volts can be measured with great accuracy; and although the diagram looks complicated it works on exactly the same principle as that of Fig. 2 and the operation can be performed in a very short time when one is familiar with the operation of the potentiometer.

Below are some tabulated data on different commercial cells.

Kind of Cell			
Crowfoot	Sampson	Edison Primary	Dry Cell
0.9281	0.8495	0.3739	1.4073
1.0154	0.3715	0.8456	1.4375
0.8474	1.0236	0.8075	1.4311
0.8483	1.0244	0.3930	1.4450
0.9108 Av.	0.8173 Av.	0.6050 Av.	1.4302 Av.

Test tube cell consisting of carbon and zinc elements immersed in Dilute $CuSO_4$ (Copper sulphate), gave 0.1224 volt.

Cell composed zinc and copper immersed in damp sand in tubing ¾" diameter, 20" long moistened with $CuSO_4$ gave 1.0175 volt.

Voltaic element composed of a copper and zinc plate 4" square with separation of moistened blotter paper $CuSO_4$ gave 1.0175 volt.

THE HETERODYNE RECEIVING SYSTEM

At a meeting of the Institute of Radio Engineers held in New York on June 4th, Mr. John L. Hogan, Jr., of the National Electric Signaling Co., presented a paper describing the principle and apparatus involved in the Heterodyne receiver. Much interest has been shown in this invention of Prof. R. A. Fessenden's, especially since the recent test between Arlington, Va., and the U. S. S. Salem, in which it was used for all long distance communication.

Since the "beats" principle, upon which the heterodyne operates, is not generally understood, Mr. Hogan opened his paper by a discussion of the classification of radio receivers and of the addition of simultaneous wave motions. Radio receivers are of two broad classes: (1) the relay or "trigger" type, in which the received energy releases an amount of local potential energy which in turn operates an indicator to produce a signal, and (2) the "converter" type, which acts merely as a transformer linking the antenna and the indicator, and in which the signal is produced by energy actually received by radio from the transmitting station. Receivers of the first class (such as filings coherers) are limited by their delicacy and inefficiency, while those of the second, such as the gas, liquid or solid rectifiers, cannot utilize in producing a signal any more energy than that actually received. This has led to attempts to use microphonic or other telephone relays to amplify received signals, but in general these have been unsuccessful. A selective receiver which will amplify persistent waves but will not increase effects due to highly damped discharges (such as those of atmospheric interference) is needed in the art of radio transmission. The only receiver of this type is the Heterodyne, whose action is to give an indication by the conjoint operation of two high frequency alternating currents, one received from the transmitter and the other usually generated at the receiving station.

Mr. Hogan illustrated by lantern slides the graphical addition of waves of various types, treating mathematically the several cases. The production of acoustic beats by organ pipes and singing flames was shown, and the distinction between polarized and non-polarized indicators demonstrated by generation of inaudible air-wave beats with Galton's whistles.

Five types of Heterodyne receiver were described. In the first, two streams of waves having slightly different frequencies were received on two separate antennas. Currents set up by them passed through the coils of a non-polarized magnetic telephone and reacted on its diaphragm to produce audible signals. In the second form, a single antenna was used, one of the two interacting currents being generated by an alternator, arc or other oscillator at the receiver. The third form shown had its sensitiveness increased by use of a dynamometer telephone, and the fourth type was made still more effective by the use of a static telephone receiver.

With this last arrangement of Heterodyne apparatus signals had been received over 3,000 miles, in spite of the notoriously low sensitiveness of the static telephone. The great increase in effective sensitiveness could be explained by a theory of operation which had been proposed and which indicated that the static telephone used upon the Heterodyne principle would respond to a given strength of sustained wave several hundred times as loud as if used simply.

The fifth type shown adds to the sensitive rectifier and telephone combination of modern receivers the amplifying power of Heterodyne excitation. Receiving either from sustained wave or spark transmitters it is possible to read signals so weak that they cannot be heard with the ordinary receiving apparatus. On spark signals the intensity of Heterodyne response is from 5 to 15 times as great, in audibility, as that of the best rectifier receivers operating normally, while on sustained waves the effective amplification is still greater. This increase of sensitiveness to continous waves accounts for the long distances transmitted by the arc temporarily installed at Arlington and used for special tests during the cruise of the Salem to Gibraltar. During those trials all long distance signals, whether from arc or spark sender, were received on the Heterodyne, the tikker receiver having been abandoned by the U. S. Navy engineers after the first few days of the test.

Data secured on the trials between Arlington and the Salem permitted modification of the constants in the Austin-Cohen transmission expression* so as to compensate for the increased sensitiveness of the Heterodyne. Extending such data it is found that two stations of the Arlington type could exchange messages regularly by day and night over a distance of 4,500 km. (2,800 miles), or could transmit between them daylight signals of 25 times audibility (readable through light static) even if 5,500 km. (3,400 miles) apart. These distances would be impossible with anything like similar transmitting power if any receiver other than the Heterodyne were used.

A form of Heterodyne still more effective than any of those described has been put into use and shows great promise, but even if no step had been made beyond the type used on the Arlington-Salem test, this invention of Prof. Fessenden's would seem certain to work a revolution in radio communication.

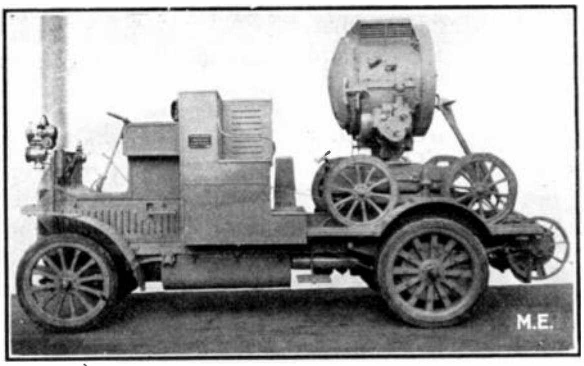
*Bulletin Bureau of Standards, Feb. 1, 1911, Vol. 7, No. 3. pp. 315-363.

80 WORDS A MINUTE BY WIRELESS 3,500 MILES

A wireless system between Great Britain and Canada will be in operation for the first time next September, contracts having been signed recently between the Universal Radio Syndicate operating the Poulsen system, and the Canadian Government. The Syndicate has agreed to a test of the Poulsen "continuous wave" system between Arlington (Washington) and a European station over a distance of 3,500 miles a thousand miles in excess of the requirements of the Anglo-Canadian service. The company has contracted to receive and despatch messages at the rate of 400 letters per minute and proposes to charge eight pence per word for code messages and four pence for plain word messages.

Military Automobile Searchlight

THE new type of automobile searchlight which is in use in the French army may be taken as the latest advance in this direction. What is to be noticed is that a single automobile serves to carry all the material, and the car is thus self-contained and the searchlight does not need as before two separate vehicles, one for the dynamo apparatus and a second for the searchlight. The war department wished to find the most suitable solution of the problem by the use of the automobile, and thus had the present cars constructed under the plans of Comm. Cordier and Capt. Doizan, the car being built at the De Dion automobile works at Paris. In the present type, of which quite a number have now been put in actual use, the gasoline motor of the automobile not only drives the car but also operates a dynamo of good size, this being directly coupled upon the motor shaft. In consequence, the searchlight can throw its beam while the car is running on the road, should this be necessary, although in usual practice the automobile is stopped for this purpose.

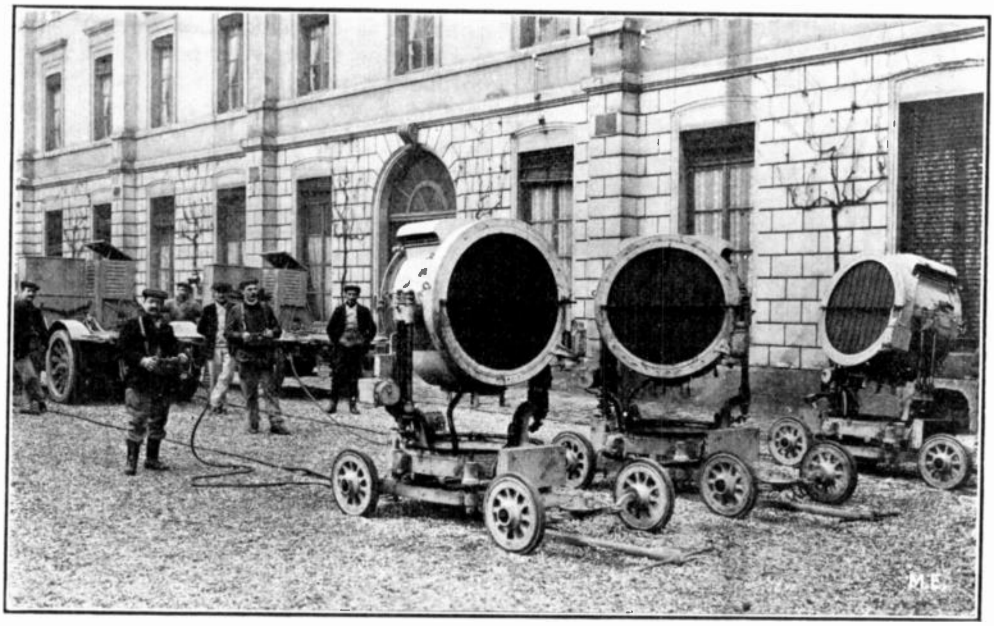


SEARCHLIGHT MOUNTED ON TRUCK

Of 7,000 candlepower, the projector has a diameter of 3 feet, and throws a powerful beam which is intended during military operations to show up the enemy's movements or positions. When the car is on the road, except in unusual circumstances, the projector is lowered, so as to keep down the general centre of gravity. This movement is carried out by the use of a rack and pinion which has about 3 foot range of working. Mounted on its 4-wheeled carriage, the searchlight can be run off bodily and transported to a distance of 150 to 300 feet from the car, two men being enough for this. Cables unroll at the same time from a drum carried on the car so as to keep the searchlight connected to the automobile.

Modern practice with projectors shows that observations cannot be well carried out when the person is stationed near the source of light, as a powerful searchlight of this kind is apt to give a blinding glare owing to the reflection of the light from small particles of vapor in the air even though the body of the apparatus is well closed. The officer charged with directing the beam on a distant spot is required to keep at 75 to 300 feet from the apparatus and work the movements by an electric control method. The searchlights are provided with a very ingenious electric motor mechanism for working the turntable base or for swinging the projector on its trunnions, also to light or extinguish the arc lamp and to open and close the shutters for the beam. All these movements are obtained by the use of a small set of controllers which can be used upon the automobile or removed from it, for directing the current into the various parts of the electric mechanism, and one common cable encloses various wires for the control, and a second cable carries the current wires for the arc light. The automobile carries an 18-horse-power, 4-cylinder motor and is built to run under good conditions even over very rough roads where the searchlight needs often to be taken during campaign work, and the car is therefore light as well as solid and can make a speed of 20 miles an hour on the road and mount grades as steep as 12 and 15 per cent. Power enough is given by the motor to keep the searchlight burning while the car is traveling, as already mentioned. The maximum fuel consumption of the motor is 8 gallons of gasoline per 60 miles run.

At the time when the automobiles were delivered to the war department they were put through a series of very severe trials which lasted for about a week over the roads in the country around Paris. For most of the time the roads were wet by rain and were in the worst of shape for automobile travel, but this did not hinder the good performance of the cars. On one occasion especially, a heavy rain and wind storm prevailed, but this did not prevent the cars from starting out for their night trip at the regulation hour, and they climbed up the specially hard grade of Clamast, then the cars were drawn up in line above Jouy, on the Versailles route. Gen. Albaut, artillery inspector, and Col. St. Claire-Deville, technical director, presided at the tests, and the projectors were put in position and working in less than two minutes so as to send the beams over the valley of the Bièvre. The rain was falling in torrents and the powerful beams produced a striking and somewhat fantastic effect. It threw the beam upon a point lying at 2 miles distance. On other days the automobiles were put through runs of 60 miles, followed by projection trials lasting for four hours, and the results were all that could be expected.



SEARCHLIGHTS ON GROUND READY FOR ACTION. NOTE CONTROLLING APPARATUS CARRIED BY OPERATORS

WIRELESS TELEGRAPHY IN BRAZIL

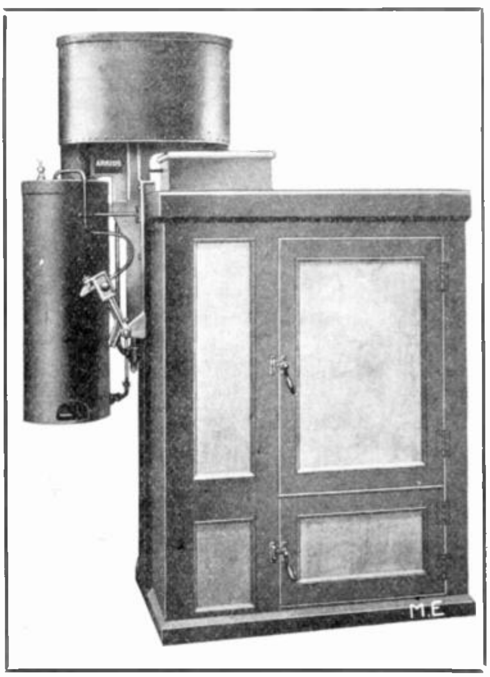
Vice-Admiral Belfort Vieira, the Brazilian Minister of Marine, in his annual report to the President of Brazil, states that the wireless telegraph service in the republic has increased during the past year. Wireless stations are to be erected at Rio de Janeiro, Bauru, and Porto Murtinho, which will enable communication to be established with the base of the Matto Grosso Squadron. The contract for these stations has been awarded to Marconi's Wireless Telegraph Co., Ltd., and a commission has been appointed, consisting of three officers of the navy and a representative of the Marconi Co. Another station at Santa Martha will communicate with ships south of the republic. The Minister's report adds that the naval wireless telegraph stations have worked with unfailing regularity. New Marconi stations have been purchased, and, in the opinion of the Minister of Marine, the good results obtained justify the adoption of the Marconi system in the Brazilian navy. It is proposed to transfer the apparatus which was formerly used in the Ilha das Cobras station to Abrolhos, and to adapt the former as a training school for wireless operators.—*Electricity*.

Residence Iceless Refrigeration

By Frank C. Perkins

There is a great demand for an iceless refrigerator, in the home, of low cost, fool proof and economical in operation. Such a device has been developed in England and a similar equipment in America operating by gas or electricity for heating and water for condensing the ammonia.

The illustration shows an English vertical type of self-contained semi-automatic iceless refrigerator and cabinet, for country houses, with cooling power equal to that of about 200 pounds of ice every 24 hours. The panelled teak cabinet measures approximately 4 feet by 3 feet and 5 feet high, and is lined with marble walls and fitted with marble shelves and solid nickel ice mould. The walls are insulated and about 6 inches thick, while the available capacity is about 23 cubic feet.



MODERATE SIZE ICELESS REFRIGERATOR

A simple appliance for artificially producing cold for a variety of purposes is a growing necessity. There are many refrigerating machines on the market, and for very large cold storage of ice making installations, where skilled engineers are always in attendance, these machines have been found eminently suitable; but where such skilled attention is not available, they are certain to get out of order sooner or later.

For this reason and because they all require some form of motive power, they have not found great favor with those requiring cold only on a moderate or small scale; it is for this class of users that the new iceless refrigerator shown in the accompanying drawings and illustrations was specially designed.

It will be seen that this refrigerator is a simple appliance which has no running machinery or complicated mechanism. It is constructed in various sizes for making from a few pounds of ice up to one ton per day, or for cooling from one to 10,000 cubic feet of storage space without motive power and without skilled attention.

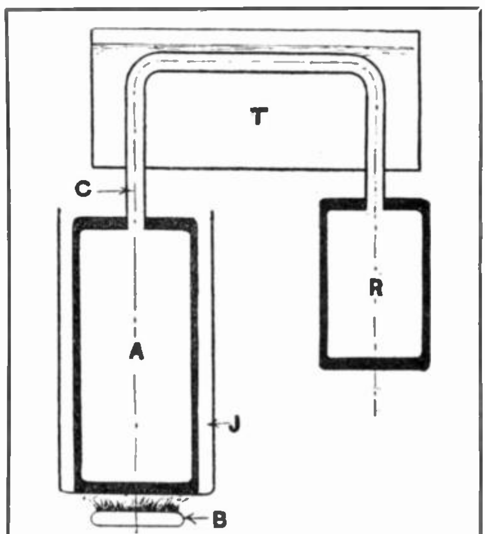


FIG I.

It is operated by the direct application of heat from any available source, such as gas, steam, oil, wood, coal, or electricity.

The apparatus is noiseless and vibrationless; it is constructed to maintain any required temperature down to many degrees below freezing point, according to requirements specified when the apparatus is ordered.

The ammonia absorption principle is used with this iceless refrigerator, and it is the simplest apparatus of its kind, and differs from all others in that it is hermetically sealed, has no working parts

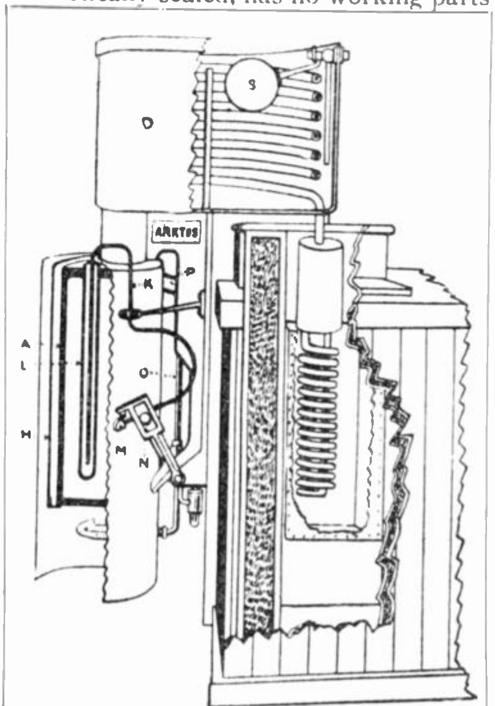


FIG 2

and requires no motive power. From the drawings it will be noted that the essential part of the device includes a combined absorber and generator (or still), a condenser and a receiver.

The generator, A, which contains strong ammonia liquor, a mixture of ammonia and water, is heated by a gas burner, B, or other suitable means. The ammonia is thereby distilled and, passing through the pipe, C, which is surrounded by water in the tank, T, it is cooled and condensed. The resulting liquid, pure anhydrous ammonia, runs by gravity into the receiver, R.

This process is continued until all the available ammonia has been distilled and collected in the receiver. At the same time there is left in the generator only hot and very weak liquid, practically pure water. The generator is then cooled by admitting cold water to the jacket, J.

This creates a partial vacuum which causes the anhydrous ammonia to evaporate very rapidly. At the same time the weak liquor is cooled and becomes "greedy" for ammonia. It therefore absorbs the vapor resulting from the evaporation of the liquid in the receiver as quickly as it is formed. The evaporation of the ammonia in the receiver continues until the whole of the liquid has evaporated and been reabsorbed by the liquor in the absorber, the vessel which previously acted as the generator. The liquid in evaporating takes up a large amount of "latent heat" and consequently the receiver becomes intensely cold and cools all surrounding objects.

As soon as all the liquid has evaporated from the receiver the same state of affairs exists in the apparatus as before the heating was begun. This process can therefore be started again and the same cycle of operations can be repeated an unlimited number of times. The ammonia is not altered or weakened by the process and as there is no possibility of escape the same charge of liquor will last indefinitely.

To increase the evaporative surface

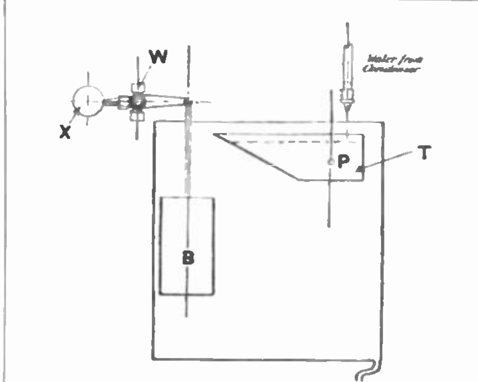


FIG 3

and hasten the evaporation, the receiver often has a coil of pipe connected with it. In many cases this coil is immersed in a tank of brine or other non-freezing solution. This brine acts as a store for a large quantity of cold and maintains a uniform temperature during time when the apparatus is not being worked.

It will be seen that the machine is operated by alternately heating and cooling the vessel, A, which acts alternately as a generator and absorber. There is an automatic device for turning off the heat and admitting water to the cooling jacket. The tube, K, is filled with water and sealed. The curved portion is flattened. The straight end of it dips into the well, L, which is surrounded by the liquid in A. As the temperature of the latter rises the water in the tube, K, becomes heated and expands. Owing to this expansion the curved part of the tube tends to straighten out more and more as the temperature rises. At the end of the tube is a catch, M, against which rests the weighted lever, N.

The catch is so adjusted that at the required temperature the lever is released and falls. The lever is connected with the gas tap and a three-way water cock, and when it falls it turns out the gas, leaving only a small pilot light burning, and admits water through pipe, O, from the tank, D, to the jacket, J. The water fills the jacket and overflows through the spout, F, and is either carried away to waste or collected in a tank for future use.

The level of the water in, D, is maintained by the ball cock, S, connected to the water supply. The apparatus is reheated by raising the lever, N, which turns on the gas and cuts off the water supply from tank, D, to jacket, J, and drains the latter. There is no communication between the well, L, and the generator, A.

It may be stated that when other sources of heat than gas are used the arrangement is modified, but is substantially the same. The heating has to be started by hand each time.

A completely automatic gear can be fitted as indicated in the drawing and the device will go on working without attention so long as the water is running. Part of the water overflowing from the condenser is allowed to run into the tipping tank, T, pivoted at P.

When this tank is full up to a certain level it overbalances and pours its contents into the bucket, B, which drops and operates the water and gas cock, W. The tipping tank when empty immediately returns to its normal position. In the bucket, B, is a small hole so that while the tipping tank is refilling the bucket empties itself and the counterweight, X, raises it into position again.

The cock is fitted with a ratchet and pawl so that the rising of the bucket does not affect the cock. One stroke of the bucket turns the gas off and the water on, the next turns the gas on and the water off. The gas relights from a small by-pass. The flow of water into the tipping tank is so adjusted that the tank fills up to the necessary level to overbalance it in the same length of time that is required for heating or cooling the generator. This automatic gear can be placed in any convenient position.

It is claimed that the water required for operating the machine is not contaminated in any way, but is slightly warmed; therefore in cases where the cost of water is an item worth consideration, it can be collected in a tank and used for other purposes after having passed through the machine.

The cost of operating the machine is very low and as there are no expenses of upkeep, it is far more economical in use than any other form of artificial refrigeration.

ELECTRICAL HELPS IN LIFE SAVING

The city of Toronto, Canada, will equip its lake and river shores for miles about with an electrical life-saving equipment, said to be the most advanced in the world. By the beginning of August there will be completed a seventy-foot watch tower of steel on the outer circumference of the harbor. Sub-stations will be established over an area of about twelve miles where in the past numerous accidents have taken place and scores of lives lost. All stations will be linked by a private telephone system, and on each one a searchlight will be installed so that capsized craft may be quickly detected during the night, even though five miles from shore. Regular patrols of life-savers will cover the shore line of mainland and islands and alarm boxes will be placed along the route which they will be required to ring at intervals. Electricity will be utilized in every possible way. A new twin-screw surfboat and a thirty-five foot cruising lifeboat for heavy seas will also be added.

It is well to aim high, but be sure your gun is loaded.

HOW MUCH POWER DOES IT TAKE TO RUN A VOLT-METER OR AN AMMETER?

We are accustomed to believe that the amount of energy or power required for an ammeter or voltmeter or a wattmeter either of the indicating or recording type is very small. Under ordinary conditions where the voltage or current involved is small, this is true and the instruments take remarkably little power to operate them. Where the voltage is very high or the current is very great the power lost in operating one of these instruments sometimes amounts to several kilowatts.

This was brought forcibly to our notice by the advertisement of a well-known instrument maker on the front cover of a recent issue of a well-known electrical magazine in which a recording wattmeter of about the size of the ordinary instrument used in metering current for residence lighting purposes was shown, together with its shunt which was capable of handlng 60,000 amperes.

The shunt alone weighs 2,900 pounds and together with its oil, tank, connecting bars and clamps, weighs 8,500 pounds. The difference in potential across the terminals of this shunt is the standard drop of 50 millivolts—five one-hundredths of a volt. This difference of potential in itself is extremely small, but when this is multiplied by 60,000 amperes the product is 3,000 watts or 3 kilowatts, which must be dissipated in the form of heat in order to supply a few watts to operate the recording instrument. At first thought this appears to be a very large waste of energy to accomplish the desired result, but at the present time there is no help for it as there is no other method known in the present state of the art which would be any better.

I never saw a Kilowatt,
I never hope to spy one;
But by this meter bill I got
I see that I must buy one.
—*George B. Staff in Edison Monthly.*

HONOLULU MAIDEN WINS HONORS AS WIRELESS OPERATOR

A little Honolulu girl has the honor of being the first girl to pass the federal wireless examinations, which qualifies her to take a position as an operator for the government. The girl's name is Mary Ann Nobriga, and she is only 14 years old.

Her father writes us as follows:

"I am sending you the photograph of my daughter as being the first girl to have an amateur license. She passed

MARY ANN NOBRIGA

14 YEAR-OLD GIRL WHO HAS A LICENSED AMATEUR RADIO STATION AT HONOLULU

the examination on May 26th. The number of her license is 1907.

"Her complete outfit for sending and receiving is as follows: One loose coupler, double slide tuner used as a loading coil, one variable condenser, 2000 ohms receiver, galena detector, one fixed condenser, 1½ inch spark coil, one brass spark gap, six dry batteries. Her aerial consists of four No. 14 copper wires, spaced two feet apart, 60 feet long and 55 feet high."

A Practical "No-Slider" Tuner

By Paul Horton

IT has been explained many times, in these columns, wherein sliders are a disadvantage in devices which utilize the variation of inductance in their operation. Wearing of wire, reducing mechanical strength and conductivity, short circuitng of turns by the contact shoe or by copper chips, are only a few faults that could be cited.

However, in Fig. 1 is shown an instrument, which is, as far as the writer is aware, absolutely original.

Here the secondary surrounds and moves over the primary, contrary to

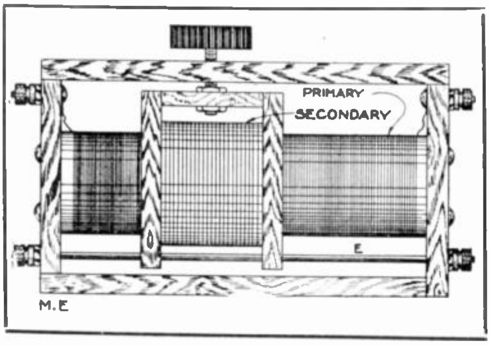


FIG. 1

the usual practice. In the instrument at hand the primary coil consists of a cardboard tube (fibre is better) 23 in. long and 2½ in. in diameter, wound with a single layer of No. 20 D.C.C. copper wire.

After completion the primary is securely fastened in place as follows: Obtain two 2½ in. circular wooden discs, ¾ in. or more in thickness, and screw

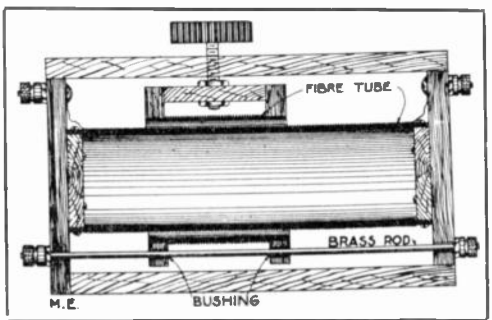


FIG. 2

in the proper place on the side supports, using brass screws. Now, the primary tube is either glued or tacked over these wooden pieces (see sectional view). A tap is taken out from each end and from a middle point, 3 in all. The direction the wires are

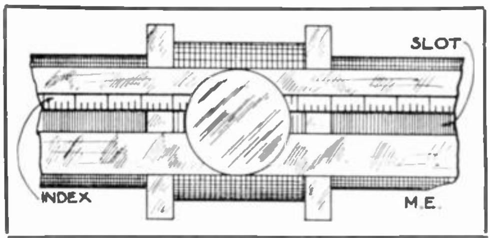


FIG. 3

wound in the 2 halves, depends upon the "hook-up" used. If Fig. 5 is followed the wires are wound in the same direction (a continuous spiral), but if Fig. 4 is followed, and it is to be preferred, the halves are wound in opposite directions. Do not shellac the turns on this coil, as it needlessly increases the capacity, which is undesirable.

The secondary tube measures 4 in. long and 2⅞ in. inside diameter, allowing ⅛ in. clearance. It is wound with No. 28 D.C.C. copper wire.

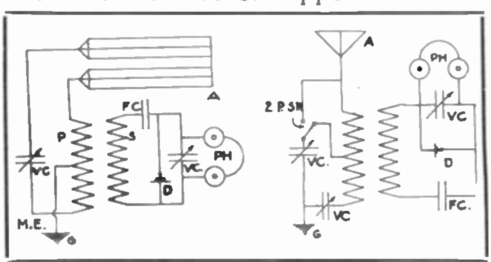


FIG. 4 FIG. 5

To construct the wooden end pieces for the secondary obtain 2 boards 4½ in. square and cut a 3 in. hole in the center, using a key-hole saw. Two smaller holes are cut in each of the two lower corners to accommodate the brass supporting rods and brass bushings are installed in each.

Now the ends are slipped over the ends of the secondary tube and secured in place by brass tacks (see sectional view). The secondary slides on the usual brass rods, which may also be utilized to bring out the secondary taps, by simply soldering the wires to the brass bushings mentioned above.

A hard rubber knob, fastened to the end of the stout brass rod, which is securely bolted to the secondary, is used to slide the secondary back and forth. An index is glued along the side of the slot cut in the top, and these readings used in conjunction with the condenser readings may be used to indicate the adjustment found by experiment to be best for any particular station, and may be filed away for reference.

All other dimensions are given in drawings.

THE WORLDS LARGEST SHIP

(*Contnued from page 440*)

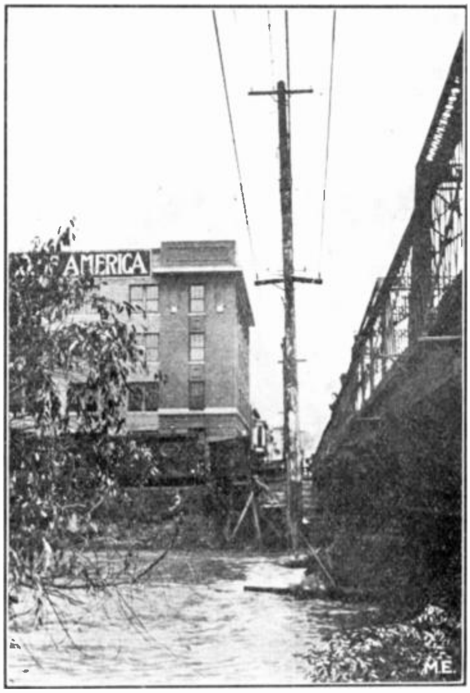
from the side of the forward smoke stack, and from these insulators it drops down to the deck insulator and passes into the wireless room. The other single wire aerial, extending to the rear, starts at the top of the rear mast and is supported from insulators attached to the two rear smoke stacks and then drops down to a deck insulator and passes into the wireless room in the same manner as does the forward single wire aerial. These three aerials, it will be evident, have different wave lengths, and enable messages to be sent on either of the commercial wave lengths of 300 and 600 meters respectively, while for long distance work a wave length of about 1,800 meters is used.

The transmitting apparatus consists of a standard Telefunken set capable of putting 7½ kw. into the aerial and draws about 15 kw. from the ship's power plant. It is equipped with an automatic or motor operated antenna switch, a break-in system, and several other additional features which contribute to easy and quick operation. In addition, there is a small set which can be used for short distance and emergency work.

Note.—We should like to have been able to show photographs and give a detailed description of the wireless equipment, but this is impossible for the reason that photographs and details of the apparatus are not available at the present time.—Ed.

POLE SUPPORTED BY WIRES IT CARRIED

The photograph shows a large power-wire pole standing in the middle of a small river bed. A six-foot section was taken out of this pole when a flood came down the stream. The wires supported the pole and no damage was



POLE SUPPORTED BY WIRES IT FORMERLY CARRIED

done to the wiring or to the upper part of the pole excepting the broken cross arm.

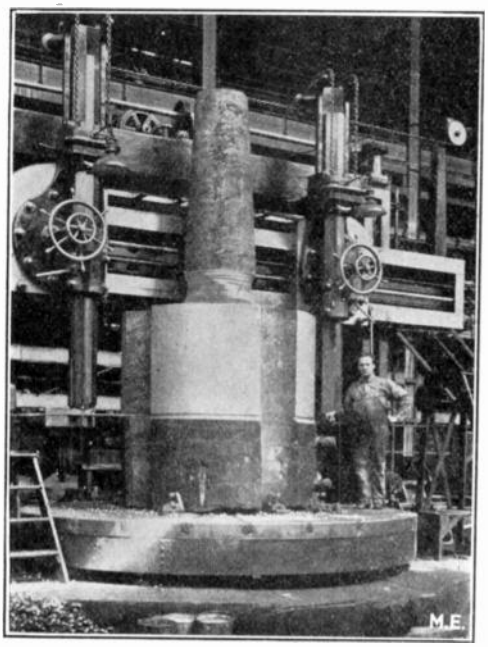
CHART RECORDING PYROMETER

An instrument that looks like the record on a mechanical piano player, which carries a six months' roll of recording paper, that travels a little more than an inch an hour, has just been invented to record volts, temperatures, amperes, revolutions and mechanical operations that require a small current of electricity.

The instrument works without friction and the pen makes a single dot of ink on the rolling paper scroll every ten minutes which forms a continual line.

MACHINING LARGE CASTING FOR TURBO-GENERATOR

Large electrical generators require, in their construction, the largest of castings, and for machining these, the largest and strongest of tools are necessary. The illustration herewith shows a 150,000-pound steel casting which will comprise one-half of the rotor of a steam-turbo-generator of 5,000 kilowatts' capacity. The machining is being done on an electrically operated boring mill, and the finished rotor will lose about one-half of its original weight. Expert machinists only are



STEEL CASTING FOR ROTOR OF LARGE TURBO ALTERNATOR BEING MACHINED ON MOTOR DRIVEN BORING MILL.

allowed to work on a casting of the size shown, as the variation of a hundredth of an inch in some dimensions would ruin the casting for its use, and entail a large financial loss, as well as loss of time.

An order for over five thousand No. 6541 receptacles and plates has been placed with the Manhattan Electrical Supply Co. for installation in the new Municipal Building in New York City. This is the largest order for installation in a single building ever placed.

AN ELECTRO-MAGNET FOR PANTAGRUEL!

The most gigantic as well as the greatest power generating magnet in the universe is about to be placed in the laboratory of the man whose discoveries directed Madame and Monsieur Curie to the discovery of radium. Professor Becquerell's place is in the Polytechnic of Paris. Here this great electro-magnet made by his colleague Professosr Pierre Weiss, of Zurich, will yield a magnetic force of 50,000 or 5,000 greater than the greatest one in the United States or elsewhere.

The polar pieces in this gargantuan magnet are made of iron and cobalt, and a new water cooling system allows Professor Jean Becquerell to work at maximum power for twenty-four hours on a stretch. 110 volts and 200 to 250 amperes are all that is required to keep it going.

Professor Bequerel expects to throw light on the phenomena of gravitation, the magnetic effects present in the atom, and in matter in general.—*L. K. Hirshberg.*

MARKSMANSHIP OF OUR NAVY 1200 TIMES BETTER THAN AT THE TIME OF THE SPANISH-AMERICAN WAR

"As evidence of the value of competition in gunnery, a comparison is made with the fighting efficiency of the vessels during the Spanish-American War and at the present writing. The percentage of hits in 1898 was 3½, with the large guns firing about once in five minutes at short range. The percentage of hits in the recent firing at the San Marcos was 33⅓, the range being 10,000 yards, and the present rate of firing a single 12-inch gun being 10 shots in five minutes. This rather overestimates the work at Santiago and underestimates the work to-day. A roughly drawn comparison shows that we are about 1,200 times better in gunnery efficiency than we were at Santiago. —*Hon. George von L. Meyer, former Secretary of the Navy, in an article in Transactions of the Efficiency Society, Inc.*

The Measurement of High Potentials

THE measurement of high potential electric currents may be, and oftentimes is performed, by the aid of a calibrated voltmeter, the same as low voltage currents are measured. However, there is another very convenient and more desirable method, of determining these high voltages which involves the use of a spark gap. As is well known, a potential or voltage having a value exceeding a few thousand, will readily jump an air gap between

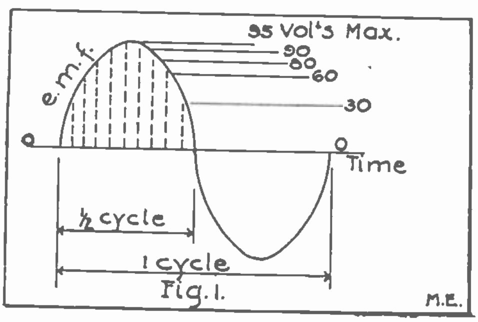


Fig. 1.

needle points or spheres. Of course to be able to measure the voltage of a spark of certain length, necessitates the calibration or determination of the voltages for various lengths of the gap, and this is dependent upon the form and dimensions of the gap itself.

In the measurement of high potential alternating currents there are two distinct values of the voltage which are useful, and under certain conditions one value may be quickly found when the other is known. To start with, we had best discuss just what the two potential values above referred to mean.

In Fig. 1 is shown a curve of a sine wave alternating current, and in this paper a sine wave current is understood unless otherwise mentioned. The two distinct values of the A. C. sine wave form, shown in Fig. 1, are known as the maximum and effective values respectively. The maximum value of ½ cycle or 1 alternation of A. C. is as shown in Fig. 1, the highest peak of the wave; and this value is often desired to be known, especially in measuring the potential applied to insulators, under break-down tests; as it is this maximum potential which finally ruptures the insulator.

The average value of an alternating electromotive force (or current) during a complete cycle is zero; inasmuch as similar sets of positive and negative values occur. The average value of an electromotive force or current during the positive (or negative) half of a cycle is usually spoken of briefly as the "average value" or "mean value," and is not zero. Let us consider an alternating current, of which the instantaneous value is i. Now the rate at which heat is generated in a circuit through which the current flows is R i^2, where R is the resistance of the circuit; and the "average" rate at which heat is generated in that circuit is R multiplied by the "average" value of i^2. A continuous current which would produce the same heating effect would be one which squared is equal to the average value of i^2; or of which the actual value is equal to the square root of the average of i^2. This square root of the average square of an alternating current is termed the "effective value" of that alternating electromotive force.

Alternating current measuring instruments, such as ammeters and voltmeters, always read "effective values," irrespective of wave form; and in specifying an alternating electromotive

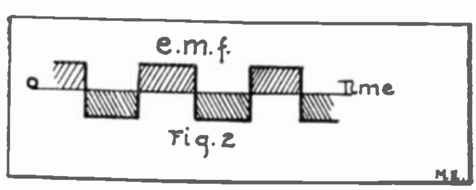


Fig. 2

force or current, its "effective value" is invariably understood, unless expressly stipulated otherwise. This effective value is the equivalent of the direct current which would produce the same heating effect in the circuit.

The effective value of an A. C. electromotive force or current is often spoken of as the "Root Mean Square" or simply "R. M. S." value. The wave form is usually determined by means of an oscillograph, which is a finely adjusted instrument, consisting of two electrical conductors, delicately mounted in an intense magnetic field, and having a minute mirror attached to the conductors. When an alternating electromotive force is passed through these conductors, the electro-magnetic reaction, or attraction and repulsion, set up between the magnetic field produced about the conductors, and the powerful magnetic field, causes the

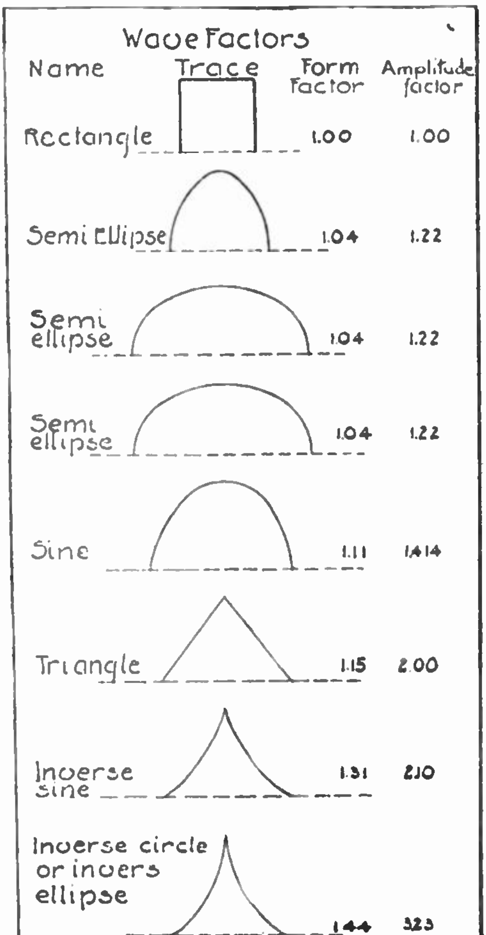


Fig. 3

conductors to swing or twist back and forth, in step or synchronism with the alternations of current or potential. A beam of light is focussed on the small mirror and as the mirror swings back and forth, it projects a reflected beam of light upon a moving strip of photographic film, with the result that a wave form or curve is outlined by the varying beam of light, as shown at Fig. 1. Of course all kinds of oscillographic curves can be taken, such as the making and breaking of a circuit carrying a current, pulsating direct or unipulsating currents, complex wave forms, induction coil discharges, etc. The Duddell oscillograph is one of the most delicate and can project wave forms of condenser discharges which are extremely rapid.* An oscillograph used by the writer at the Western Electric Co.'s laboratories, was capable of projecting wave forms having a frequency up to 8,000 cycles per second. It might be interesting to note that this was used mostly in studying the undulations or vibrations and their decay (or logarithmic decrement) of telephone receiver and transmitter diaphragms, when spoken against.

As an example, let the instantaneous values at progressive time instants, in one alternation of an alternating electro-motive force be, as seen at Fig. 1—0, 30, 60, 80, 90, 95 (maximum), 90, 80, 60, 30, volts. The sum of these values is 615 volts, which, divided by the number of values, viz. 10, gives 61.5 volts, *which is the average value* of this electromotive force during half a cycle.

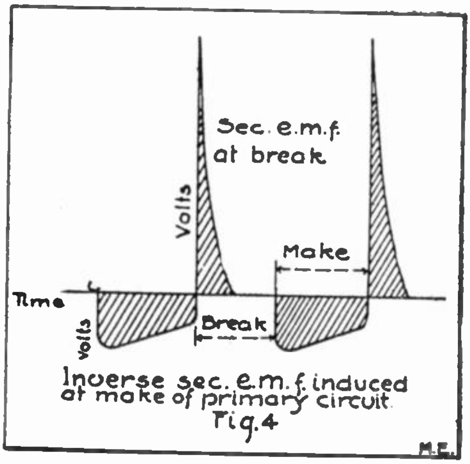
If now each of the above instantaneous voltage values are squared (i. e., multiplied by themselves) and the squares are then added together, and their sum divided by their number, viz. 10, the result given *is the average value* of the square of the electromotive force, which is 4,702.5 volts^2; and the square root of this average *square is* 68.6 *volts;* which is the *effective value* of the given electromotive force. This is the value of the potential that would be indicated by a voltmeter, also it is the "Root Mean Square" value. Another factor is the "form factor," and this is equal to the effective value divided by the *average value:* or in the case above discussed, the form factor would be equal to $\frac{68.6}{61.5}$ or 1.12. This is a common value of the form factor, and for a rectangular electromotive force curve, such as seen at Fig. 2, its value is 1 or unity. The more peaked the wave form, the greater the value of its form factor. Other values of this fac-

*For further particulars and oscillographic curves of condenser discharges, see Dr. Fleming's "Electric Wave Telegraphy and Telephony."

tor for various wave forms are given in Fig. 3.

Now comes a factor known as the "amplitude factor," and this is of great importance in measuring high potentials, as it serves as the factor, which gives us the maximum voltage from R.M.S. values, or vice versa. In the case of a sine wave form (which is nearly realized in most cases where alternating current is supplied by a dynamo) the *amplitude factor* or ratio between the maximum value and the R.M.S. value is equal to $\sqrt{2}$ or 1.414. Hence, assuming a sine wave form, if the R.M.S. value of a spark in volts is known, its maximum potential is ascertained by multiplying the R.M.S. value by the amplitude factor, viz. 1.414. As an example, suppose a sine wave spark of 1 inch (2.54 cm.) is obtained, and upon inspection of a calibration curve it is found that the R.M.S. (i. e., effective value) value is equal to 20,000 volts. The maximum value reached by the alternating current leaping the gap is equivalent to 20,000 times 1.414, or 28,280 volts. If the calibrated value of the spark had been in volts maximum, then the R.M.S. value would have been found by dividing 28.280 by 1.414. While the R.M.S. value of a spark may be, in some cases, 20,000 volts for the 1st inch, the maximum value of that spark may be very high indeed. As a case in point, consider a wave form approximating the shape shown in Figure 4, or that wave form in which the maximum potential or current values is quickly reached. Here the amplitude factor may reach a value as high as 3.0 or more. In Fig. 4, is depicted an oscillographic curve of the induced secondary potential in a 2" spark induction coil with condenser around the break or interrupter in the primary circuit. The amplitude factor of this wave form was ascertained to be 2.5, and this wave is that resultant from the breaking of the primary circuit. The amplitude factor for a regular sinusoidal alternating electromotive force is quite constant as long as the wave form is not distorted by the addition of inductance or capacity to the circuit, but with induction or spark coils this factor varies somewhat, depending upon the type and speed of the interruupter used in the primary circuit, and upon the size of condenser used across it. In general, though, it may be taken that the amplitude factor for spark coil secondary potentials induced at the breaking of the primary circuit, is equal to 2.5. Upon this assumption a curve has been plotted by the author, see Fig. 5, showing the maximum potential of spark coil secondary discharges for spark lengths up to 30" (76.2 cm.).

From these considerations it is to be observed that the rating of spark voltage may be given in two ways, and as an example a 1 inch spark may be stated to have a potential value of 20,000 volts (R.M.S.), or 50,000 volts (maximum). Both would be right, but



the meaning is vastly different, as previously explained. Likewise an alternating current such as used in electric lighting might be stated to have a potential of 110 volts (R.M.S. value), or its maximum value would be 1.414 times 110 or 155.54 volts. The R.M.S. value of this potential, i. e., 110 volts, would, of course, be indicated by a voltmeter used in regular testing work.

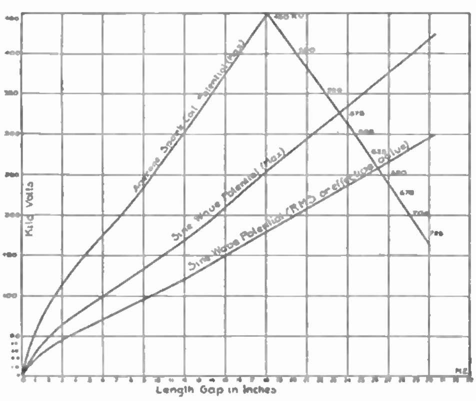
Having discussed the various meanings of the terms involved in alternating current work, as far as regards potential waves, we may now turn our attention to the set of curves presented in Fig. 5. The R.M.S. or lower curve was drawn from values given in the table of spark potentials, recommended by the American Institute of Electrical Engineers in their standardization rules.* The sine wave (maximum)

*A copy of these rules can be purchased for 10c. by addressing the American Institute Electrical Engineers, 33 West 39th St., New York City.

and spark coil (maximum) potential curves were drawn from calculated values. The potentials are given in kilovolts (kv), the kilovolt being a unit of 1,000 volts.

For accurate determination of the spark voltage a number of different functions must be taken into consideration. Humidity of the atmosphere, and location of the tests, as regards height above sea-level, or barometric pressure, etc.—all have a marked effect upon the potential required to jump a gap of given length.

A few of the rules to be applied in making careful spark gap potential tests, as cited by the American Institute Electrical Engineers Rules, are:



The spark gap method of measuring potential is preferred as its potential value is dependent upon the "maximum voltage," and is independent of wave form, and hence is a limit on the maximum electric stress to which an insulator is subjected, but the spark gap is not conveniently adapted for comparatively low voltages, say below 4,000-5,000.

The spark points should consist of new steel sewing needles, supported axially at the ends of linear conductors, which are each at least twice the length of the gap.

There should be no conductors nor other foreign bodies near the gap within a radius of twice its length. A non-inductive resistance of about ½ ohm per volt, should be inserted in series with each gap terminal, so as to keep the discharge current between the limits of ¼ and 2 amperes. The purpose of this series resistance (which may be water tubes) is to limit the current in order to prevent the surges which might otherwise occur at the time of break-down of the gap.

In measuring the high potential A. C. by means of a voltmeter there are three general methods of applying same. The voltmeter of the low reading type may be connected across the primary circuit of the step-up transformer, and knowing the transformation ratio of the windings, it is only necessary to multiply the primary potential indicated by this ratio, which gives the secondary potential. This method is not always very exact. The second method of reading the high potential in the secondary of a transformer is by means of a direct reading voltmeter of the high reading electrostatic type connected across the secondary. The third method is to employ a second step-down transformer, just for the voltmeter, connecting the primary of many turns in the high voltage circuit, and secondary of few turns, to the voltmeter of the low reading type. The transformer in question has, of course, a known transformation ratio, such as a 100 to 1, or 1,000 to 1, etc. In making close reading with this last method oscillographic curves should be taken of the voltage read by the voltmeter, and also on both sides of the step-down transformer.

The needle spark-gap has come into disfavor among engineers, owing to its erratic behavior under varying and sometimes nearly coincidental conditions. It is unreliable for commercial work on extra high potentials, because in a great many cases the broken-down air about the gap gives false readings. Its operation varies with the humidity of the air, and also upon the barometric pressure. A higher voltage is required to spark over a certain gap when the humidity is higher than usual. A variation between spark length and voltage occurs, depending upon the sharpness of the needles (Harpers No. 12 generally used) and the needles must be changed after each spark over.

The best spark-gap for voltage measurements is the sphere* or ball gap. This is now being recommended as the standard gap instead of the needle gap for the American Institute of Electrical

*See American Institute Electrical Engineers' proceedings for Feb., 1913, page 627.

Engineers standardization rules. It is stated that the sphere diameter should be chosen so that the spacing for the required voltage shall never be over four times the radius of the sphere; and that the first evidence of electric stress is complete spark-over—corona, or brush discharge not forming—also that all the undesirable effects and variables due to the broken-down air near needle gaps are eliminated. Humidity has no measurable effect. The spheres do not have to be polished after each spark-over; in fact, several thousand meas--urements may be made with this gap without repolishing the balls. Complete data and curves for large sphere spark gaps are given in the American Institute of Electrical Engineers paper, above referred to, and for the use of the experimenter a table is given here containing spark potentials in R.M.S. values as determined by Heydweiller.

SPARK VOLTAGE (MAXIMUM) BETWEEN BRASS BALLS 2 CENTIMETRES (0.787") IN DIAMETER FOR VARIOUS SPARK LENGTHS.

Spark Length Centimetres.	Spark Voltage.
0.1	4,700
0.2	8,100
0.3	11,400
0.4	14,500
0.5	17,500
0.6	20,400
0.7	23,250
0.8	26,100
0.9	28,800
1.0	31,300
1.5	40,300
2.0	47,400
2.5	53,000
3.0	57,500
3.5	61,100
4.0	64,200
4.5	67,200
5.0	69,800

1 centremetre = 0.3937 inch.

EXPERIMENTAL RADIO-PHONE

(Continued from page 443)

into the transmitter the current is varied accordingly, fluctuating in the gap in exact accordance with the voice.

To operate the set, the primary circuit is closed and a temporary adjustment of the carbon spark gap made. Very little condenser capacity is needed and no more than that specified (4 plates 10x10") should be inserted in the closed circuit. The rest of the tuning is done with the slider on the inductance, this being varied until the hot wire ammeter in the ground circuit indicates a maximum reading, showing that the closed circuit is tuned to the natural period of the antenna. The inductance must not be changed after this has been done, merely to help adjust the spark gap, or the closed and radiating circuits will be thrown out of tune again and a deficiency in radiation the result. It will be noticed that when the carbons are some distance apart the resulting arc will give out a hissing noise and this is what is to be avoided as much as possible. By screwing down the upper carbon until the noise is reduced altogether or to a minimum the voice is much clearer and heard more distinctly. The distance between the two carbons, for the set in question, should not exceed 1/16 of an inch.

It is necessary to have some one listening in while you adjust the carbon arc so that he can tell you when he hears the words at their best. In general it will be found that the words are the clearest when the carbons are close together and the hissing of the arc eliminated as much as possible.

As the transmitter is held in the hand at the same time that the arc is adjusted it is advisable to have a large hard rubber handle to turn the micrometer carbon so that the operator will not be shocked.

As a last word it must be impressed upon the reader that it is necessary that he speak in a very distinct and forceful voice. Do not run your words together. This will be acquired by practice.

In placing this "Oscillaphone" before the many thousands of experimenters over the country, there ought to be some surprising results obtained in the near future, as each person can find some little way in which he can improve the apparatus he employs. A frequency of 25 cycles would no doubt be much better than 60. As the frequency increases the noise in the telephone from the arc will grow louder, so do not waste time using higher frequencies, as this system was tried out on a 133 cycle alternator and the results were not nearly as satisfactory as those tried on commercial 60 cycle lighting current.

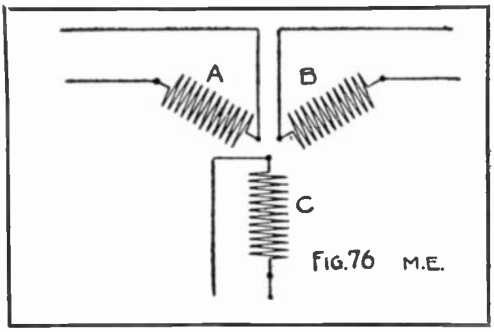
Simple Experiments in Alternating Currents

(Continued)

By P. Mertz

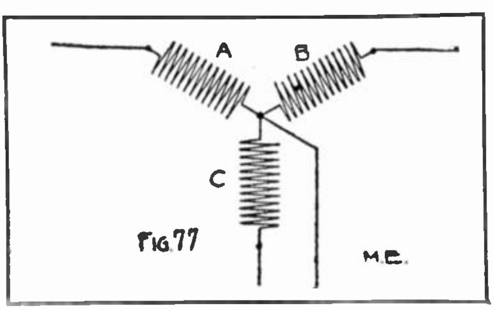
33. The different methods of connecting the windings of a three-phase dynamo are very important in alternating currents, and we will take these up here.

The simplest connections for these are shown in the diagram, Fig. 76. The



three coils, A, B and C, represent the windings as a whole for each phase. That is, suppose on the alternator armature, all the separate coils of any one phase were connected in series, this whole set would be considered in Fig. 76 as one of the windings. If all the coils of the same phase on the alternator armature were connected in parallel instead of in series, the same would be true, in regard to Fig. 76. Again, each of the wires leading out of the diagram in the figure is assumed to lead to a collector ring on the armature, each wire leading to a separate collector ring.

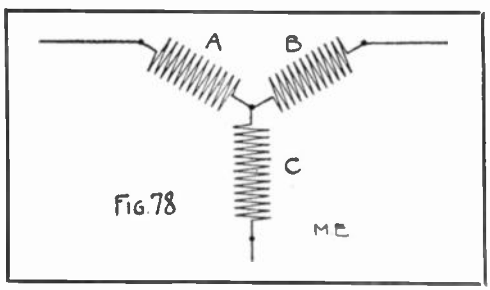
Considering the nature of the winding in Fig. 76, you will notice that both



terminals of each winding are led out to separate collector rings. This style of connection is very rarely used, on account of the number of collector rings and brushes required.

Considering Fig. 77, you will notice that all three circuits now have a common "return" wire, very similar to the ground return usually employed in telegraph and other electrical circuits. This method, as you may notice, does away with two of the collector rings in Fig. 76, and is used to some extent.

It was shown in § 30,* that at any instant the algebraic sum of the three currents in a three-phase circuit is equal to zero. Consequently, if these three currents are arranged to flow through a common wire (this does not necessarily mean that that wire is the whole circuit; it is only a part of it), the algebraic sum of the currents flowing through the wire would be zero, and there would really be no current flowing. This is the case of the common return in Fig. 77, and since there is no current flowing, there is no reason why it should



not be left out altogether, provided the loads on the three circuits are equal. There are then only three collector rings needed. This is often done, and the resulting winding, shown in Fig. 78, is commonly known as the "star," or "Y" winding for three-phase apparatus. It is used extensively when the load on each circuit is equal.

There is still another method of connecting the windings of a three-phase alternator, shown in Fig. 79. This is commonly known, from the shape of the diagram representing it, as the "delta" (coming from the Greek letter, delta, written Δ) form of winding. It is used to a great extent. Of course, these diagrams can also apply to the mechanical converter, § 31,† or to almost any appa-

*See p. 359, July, 1913, issue.
†See p. 359, July, 1913, issue.

ratus employing three-phase current.

34. We will now take up three-phase current motors. An extremely simple form of one is shown in Figs. 80 and 81. It consists of a base, A, on which are mounted six electromagnets, arranged in a circle, care being taken that the windings on these are all in the same direction. At the center of the circle formed by the electromagnets is placed a piece of tin, C, with a center-

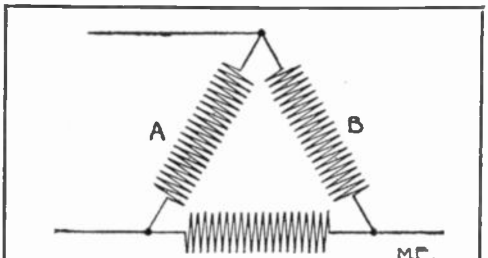
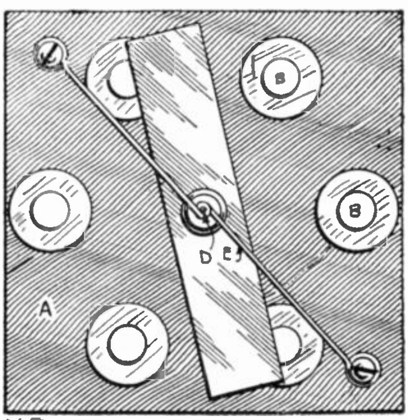


Fig. 79

punch dent in it, the dent being exactly at the center. This serves as a bearing for the armature-shaft, which consists of a steel needle, D. The other bearing is a piece of wire, E, bent and fastened to the base by means of screws, as shown in the illustration. The armature consists of a piece of tin bent over itself



M.E.

Fig. 80

three or four times to give it thickness and rigidity. It has a hole in the middle, through which passes the shaft. The tin is fastened to the latter either by means of sealing wax, or by means of small corks stuck over the needle at each end, and clamping the tin between them. It is well in this case to cover the needle with glue, shellac, or some other

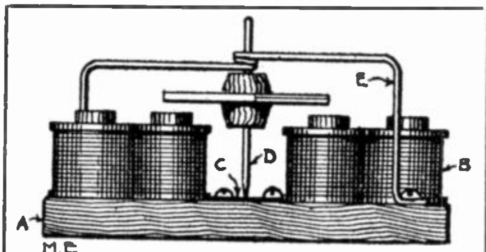


Fig. 81

adhesive, to prevent the corks, with the armature, from sliding along the length of the needle.

The field-magnets of the motor are then connected, as shown in the diagram, Fig. 82, especial care being taken to see that the relations between the inside

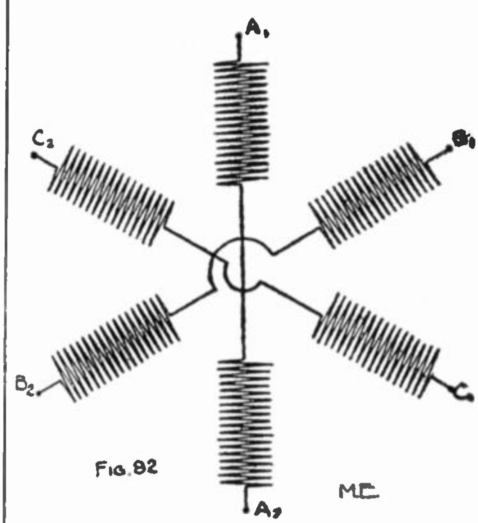


Fig. 82

and outside ends of the several windings are not altered from those shown in the figure. For example, the diagram shows that the inside ends (the ends by which the actual winding of the wire on the magnet was started) of opposite coils are connected together. If instead one inside end is connected to an outside end, the motor will not work as it should. The letters on the wires leading out of the diagram denote the binding posts on the mechanical converter (see Fig. 71‡) to which they are to be connected. Having taken care that all the connections are correct, the mechanical converter is connected to the battery and started rotating. The motor will also begin to rotate as soon as the mechanical converter drum is turned.

To illustrate the operation of this motor, we will use the diagrams in Fig. 83. The six circles in a ring represent the six electromagnets, and the rectangular-shaped bar the armature. Supposing now, that the cycle has arrived at such a point that the current flowing through the coils marked + and –, in diagram A, is greater than the other two currents, and therefore magnetizes these two more strongly than any of the others are. The armature will then arrange itself in the position shown, and will also become magnetized by the lines of force flowing through it. At the next instant (1/3 of a cycle later) the current strength will have become greatest in the two mag-

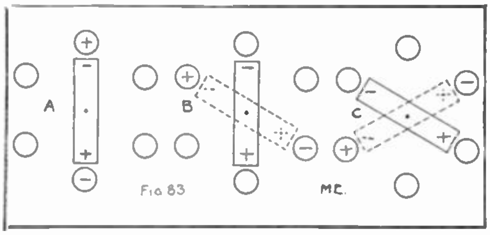


Fig 83

nets marked + and – at B. The armature retaining some of its magnetism will now tend to arrange itself in the position shown by the dotted lines. An instant later, the strongest field-magnets will again have changed, pulling the armature up a bit more, as at C; and this is carried on indefinitely.

In actual practice, the armature does not consist merely of a bar of iron, but of a laminated, wound ring or drum, on which all of the windings are short-circuited. Then, instead of residual magnetism being depended upon at B, to attract and repel the armature, a current is induced in the armature windings. This induced current magnetizes the armature core, giving practically the same result. In this case the operation of the motor is similar to that of the single-phase motor described on pp. 155-6, of the May, 1912, issue.

(To be continued)

‡See p. 360, July, 1913, issue.

AURORA BOREALIS

(Continued from page 451)

themselves. A competent scientist who could investigate and authoritively interpret the wonderful manifestations of Aurora Borealis as seen from comparatively short distances, as in the writer's experience of this last summer, and particularly if his experiments were in connection with a wireless telegraphic apparatus and along the lines suggested in the hypothesis outlined above, would be in a position to add materially to the world's knowledge of some very interesting natural and electrical phenomena.

The writer anticipates another opportunity of observing Aurora Borealis from Hudson Bay and to have opportunity of using an even more powerful wireless transmitter in future experiments. As much of the experimental work suggested above as possible will be carried out, but as the writer cannot hope to attain as authoritive results as could easily be achieved by someone with greater resources of scientific apparatus and knowledge, this record has been prepared and made available in the hope that it might suggest and assist contemporary investigation.

NEW YORK RADIO EXPERIMENTER GETS INTO TROUBLE

An experimenter whose efforts have been devoted to the development of a radio telephone has gotten into trouble with the Federal authorities.

It transpires that he has been operating his stations in defiance of the wireless law, in that he has secured neither a station license nor an operator's license. Also he is reported to have used wave lengths reserved for commercial use.

His station in New York City has been closed by Radio Inspector Terrell, of the second district, and proceedings have been instituted against him in the Federal courts.

LEAD SILK CLOTHING FOR X-RAY SPECIALISTS

Mr. C. Amsworth Mitchell, of the British Isles, has just invented a material for clothing, gloves, caps, stockings and masks, that may be expected to rid the use of the Roentgen rays from all danger. It has been long known and recognized that cancerous growths as well as other malignant maladies of the eyes and skin of Roentgen ray operators, are growing more and more frequent with the extending use of the Crooke's tubes and these vacuum rays. For some time operators have adopted various manoeuvres to protect themselves from the danger. But even Dr. W. Baetger, the radiographer of the Johns Hopkins Hospital, whose careful attention to details for protection has gone as far as anybody; who has employed lead foil screens and other measures to save himself, has lost an eye, several fingers, and has borne much other suffering because of his constant exposure to the action of the rays.

Luckily the Roentgen rays are harmless when used only a few times for purposes of diagnosis or remedial applications. The danger lies in the constant use year in and year out by physicians and surgeons and their assistants.

Now comes Mr. Mitchell with his rescue. He says that Mr. M. L. Droit and others have discovered that by the addition of the salts of lead, a silk fabric can be manufactured into clothing, underwear, shirts, stockings, socks, gloves, and other wearing apparel, which is absolutely opaque to the X-rays. Thus these dangerous penetrating particles are shut off from the physician's skin and body, and he may employ the X-rays without in any way jeopardizing his health.

Mr. Droit took a quantity of silk goods and carefully soaked it in phosphotannate of lead, oxide of lead, oxide of tin, and some other unimportant minerals such as lime, phosphates, and alkalis. Two layers of this saturated silk prevented the X-rays from passing through, while six layers protected the doctors and their assistants from moderately powerful discharges.

Clothing made of such a silk is not only superior to the rough and ready method of covering the skin with lead foil, but has the other advantages of elasticity, flexibility, and preparation without the usual delays and their accompanying nuisances. — *L. K. Hirshberg.*

ALL-NIGHT TENNIS WITH ELECTRIC LIGHTS

A tennis court so equipped with powerful electric lamps that there will be ample light to play tennis at night is the latest improvement added to the country home of John J. Raskob, an official of the Du Pont Powder Company at Holly Oak. Mr. Raskob conceived the idea of turning night into day at his estate and after working out his plans turned over the contract to an electrical company to install the equipment.

Twenty-four powerful lamps are placed on poles along the sides of the court, 12 on each side.

EXAMINATIONS FOR OPERATORS' LICENSES NOW HELD AT FORT MASON, SAN FRANCISCO

The United States Army Radio Station, at Fort Mason, San Francisco, California, is added to the list of places at which examinations of radio operators for licenses will be conducted. Applications should be addressed to the officer in charge at that station.

The Regulations Governing Radio Communication (February 20, 1913), at page 4, and Department Circular No. 241 (September 5, 1912), at page 4, are amended accordingly.

WIRELESS THAT HANDLED "TITANIC" NEWS IS BURNED

By a spark from the sending apparatus igniting the side of the wooden building, the Cape Race, Newfoundland wireless station was burned down on May 5th, involving a loss of ten thousand dollars. The station is one of the best known on the Atlantic Coast and through it came the first tragic messages a little over a year ago, announcing the horrors of the "Titanic" disaster.

This department is established for the purpose of encouraging the experimenter to bring out new ideas. Every reader is welcome to contribute to this department and new ideas will be gladly received. CONTRIBUTIONS SHOULD BE WRITTEN ON ONLY ONE SIDE OF THE SHEET AND SHOULD PREFERABLY BE TYPEWRITTEN. IF TYPEWRITTEN THEY MUST BE DOUBLE SPACED. SKETCHES MUST BE ON SEPARATE SHEETS FROM THE TEXT. The description should be as short as possible. Good sketches are not required, as our art department can work up rough sketches which are clear enough to illustrate the idea. Return postage must be enclosed if return of unusued manuscript is desired.

THREE PRIZES OF FIVE, TWO AND ONE-HALF DOLLARS AND ONE DOLLAR ARE AWARDED for the three best ideas published each month. All other contributions appearing in this department are paid for at regular space rates.

FIRST PRIZE

A PORTABLE RECEIVING SET

Now is the time of the year to make a portable receiving set for use in the fall (when the air is free from static), on your day excursion trips.

First, secure a box like the one

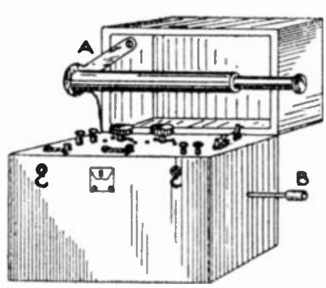


FIG. 1 M.E.

shown in the figure. One 9 in. long, 6 in. deep and 8 in. high is a very good size. The instruments are as follows: One loose coupler, a variable condenser, a galena detector, two small-sized fixed condensers and two large-sized ones. Two cardboard tubes 4½ in. long are used for the loose coupler. The primary tube should be 4 in. in diameter and wound with a layer of No. 22 enameled wire, tapped in seven places, and the windings 4 in. long. The secondary should be 3½ in. in diameter, wound 4 in. long with No. 28 silk covered wire and tapped 7 times. The position of the coupler is shown in Fig. 2, by the dotted lines.

In front of the coupler and fastened to the front side of the box are the fixed condensers. The large one on top of the small one. These are made of wax paper and tinfoil. The small one consists of 20 pieces of tinfoil, 2 x 4, and the larger one twice as many. Now make a hole on the right-hand side of the box for the brass rod to vary the coupling of secondary, and fasten the rod to the secondary. Then take the shelf of the box and drill the holes for the switches and binding posts, Fig. 2. The loose coupler switch handles are ordinary typewriter

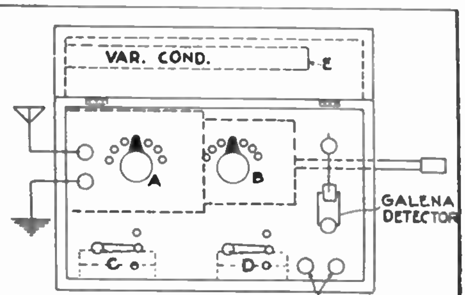


FIG. 2 M.E.

knobs. Figure 3 shows how the different switches are to be connected.

For the variable condenser, E, take two brass tubes 8 in. long. The outside one should be 1½ in. in diameter. The inner one, 1¼ in. in diameter, should be covered with wax paper. Piece A, in figure 1, is of wood and is made to hold the variable condenser so that it can be moved in and out the lid. B is the brass rod with hard rubber handle that is fastened to the secondary. The galena detector is of the "cat-whisker" type, with the fine wire sealed on to the galena with wax so it is not necessary to adjust it. A small fixed condenser may be placed in between the secondary switch of the condenser and the galena detector.

In figure 1 we have the set as it looks when completed. The phones are also carried in the box so that aerial wire is the only necessary thing to carry besides it. A single wire at least 200 feet long makes a good aerial when used with a wire fence as a

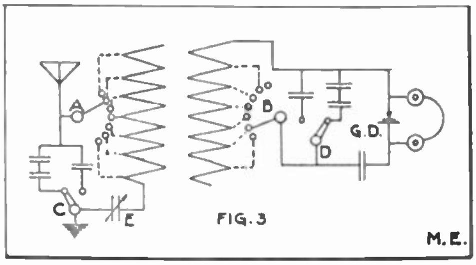


FIG. 3

ground. Using the fixed condensers and the variable one high wave lengths can be reached and great selectivity can be obtained.

Contributed by

H. A. L. Behlen.

SECOND PRIZE
A HANDY AND USEFUL RHEOSTAT

Below is a list of the material needed:

No.	Article	Marked
2	Curtain roller springs	R
2	8-32 nuts	M
1	Washer 3/5" dia., 3/16" thick	L
1	Base 9½ x 3½ x ¾ inches	A
2	Uprights 2 x 1½ x ¾ inches	B
1	Top bearing 8 x 1½ x ¼ inches	C
2	Round pieces of wood 5½" dia., ¾" thick	G
1	Round piece of wood 1½" dia., ¾" thick	D
7	3/8" wood screws	N
1	Brass disc 1½" dia.	K
1	Brass rod ¼" dia. and 4" long	E
2	Binding posts	I
2	Wood screws 2" long	O
4	Round hardwood screws ½" long	P
2	Brass strips 2½" long, ½" wide, 1/32" thick	H
1	Brass strip 2½" long and ¼" wide	F
4	¼" wood screws	S

A ¼-inch hole is drilled through

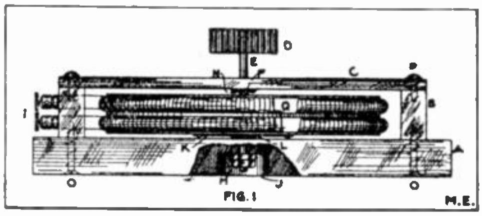


FIG. 1

the middle of the base, then a 1-inch hole is bored half way through from the bottom J, Fig. 1.

Next a ¼-inch hole is drilled in the center of top bearing C, Fig. 1. The two uprights are next screwed to top bearing with the ½-inch screw P. The two wood discs G should be turned out in a lathe and have a groove in them to take the wire R, Fig. 1. They are then nailed together and a ¼-inch hole bored through the center.

On one side of these discs the brass disc K is screwed with three screws N.

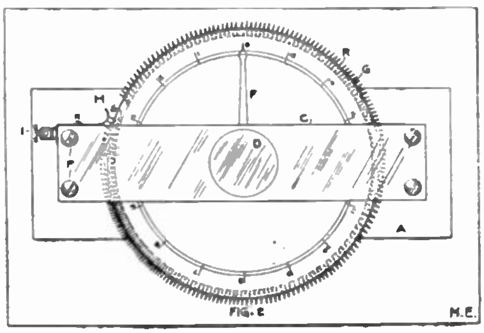


FIG. 2

The 4-inch brass rod is turned down to 5/32-in. at one end, threaded with an 8-32 die. It is then put through the discs and soldered to the brass disc so that when the washer and nuts are put on there will be little play.

The two curtain springs are put around the ends of the discs and fastened about ½-inch apart. The two springs are then connected together at one end, as at Q, Fig. 1. Any resistance wire can be used.

The pointer F, Fig. 2, is 2½ inches long and is screwed to the top bearing. The brushes are made out of the two brass strips H.

The knob has a hole ¾ through and is glued on the shaft.

The scale is marked on the wood disc G, Fig. 2. The numbering is started under the end of the pointer when the two ends of the springs which are conected together are under the brushes.

Contributed by

Oscar F. Olson.

THIRD PRIZE

A COMBINED SECTION AND DEAD END SWITCH FOR LOOSE COUPLER WINDINGS

The illustration, Fig. 1, shows the secondary of a loose coupler. This one has five taps coming down to the switch. Now, instead of just making a connection at this tap, after having brought the wire down, and then taking it up again, end the wire at the tap. Then place another tap right side of this one and start the wire from that and then take it up and wind on another section of wire. Then bring the wire down again, end it, then start it again from another tap placed side of this last one and then take the wire up again and wind on another section,

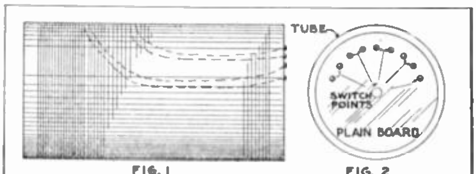


FIG. 1 FIG. 2

etc. In other words, the two ends of each section are brought to separate switch contacts.

Fig. 2 shows the switch at the end of the secondary with the switch points for the five taps. This explains itself.

Fig. 3 shows a round disc of hard rubber with its radius a little less than the distance of the switch points from the centre of the switch. In the middle of this there is a small hard rubber knob for turning the disc.

Fig. 4 shows the back of the hard rubber disc. Place on the back 4 pieces of copper ribbon wide enough so that each one would cover a pair of switch

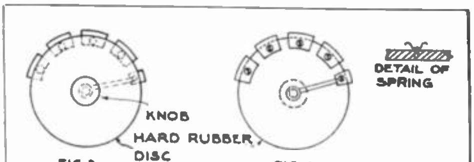


FIG. 3 FIG. 4

points and space these pieces of copper as far apart as a pair of switch points are. Then fasten on another piece of copper only one-half as wide so that it will only cover one switch point. But then continue this piece of copper right down to the centre of the disc so that it will make a connection with the bolt, which will fasten this disc to the secondary head, and from which one of the two wires of

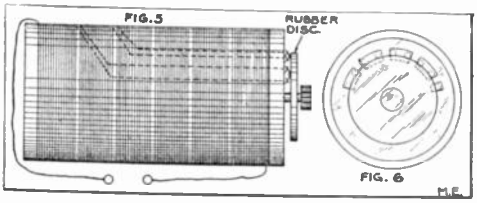


FIG. 5 FIG. 6

the secondary will come. Have these 5 pieces of copper so that they will project over the edge a little.

Fig. 5 shows the secondary with the disc fastened on and also shows the two wires of the secondary.

Fig. 6 shows an end view of the secondary with the disc on and everything completed. As the disc is turned now there are three of the five sections of the secondary in use and there is no "dead end."

This device can also be used to great advantage on the primary and on "loading coils," thus doing away with the objectionable features of sliders and large "dead ends."

Contributed by

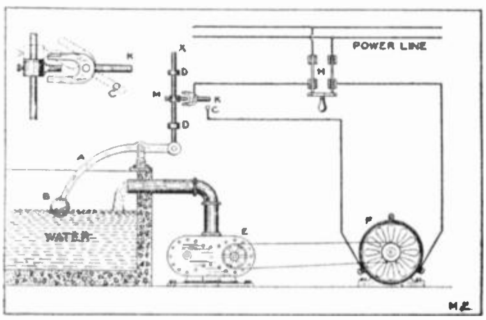
Arthur Kenison.

AN AUTOMATIC TANK FILLER

Here is a handy thing about the farm, dairy or even in town where any one wishes a supply of fresh water at all times.

This device will start the pump and fill your tank with fresh cool water as soon as the water level falls to a given point and will cost less in the long run than either wind pump or gas engine equipment. Also, it will save all the trouble with both. All that is necessary is to keep the mechanical parts in good order and they will do the rest.

In the diagram A is an arm which



rises and falls with the water by means of a float B. As the water is used up arm A falls which in turn raises M (switch closing device) which closes switch K on contact C.

When the switch is closed it starts the motor F which operates the pump E. H is the power switch. Blocks D are made of any suitable substance with holes bored through them in which the rod X is inserted, which in turn carries M—all this being fastened securely to the wall of the pump house.

As the tank fills, arm A reverses its action and rises, which lowers M and causes the switch to be thrown.

It will be noticed however that there is enough play at M to keep it from throwing the switch immediately as it moves down.

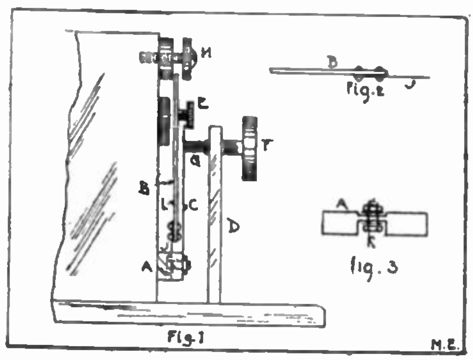
This allows the tank time to fill. The apparatus should be adjusted so the switch will be opened when tank is full.

Contributed by

R. F. Denton.

A NON STICKING INTERRUPTER

The following gives directions for making an interrupter which I have successfully used on a 1½" spark coil. The advantage of this interrupter lies in the fact that there is a quick break and a comparatively long space of time is allowed for the current to pass through and magnetize the primary. Also it is practically free from sticking. Figure 1 represents the end of the coil with the interrupter attached. B is a piece of soft iron ⅛" thick and is attached to the spring, J, by rivets, as shown in Fig. 2. A binding post is then taken and ¼" is sawed off. B is then tapped 8-32 at point shown and the portion of binding post, E, is screwed in and soldered. I also bored some holes in B, at L, to reduce its weight and consequently its inertia. C is a piece of phosphor bronze to which the platinum or silver contact, G, is soldered, as shown. A is a piece of brass, cut as in Fig. 3. To it B and C are attached by means of a small bolt and nut. D is a brass pillar to support the adjusting screw, F, which has a platinum or silver tip and a rubber han-



dle. The only other thing which needs explanation is H, which is a machine screw with rubber washers. These washers not only reduce the noise, but by their elasticity also increase the speed of vibration.

No dimensions are given because the interrupter should be made to fit the size coil which the experimenter may have.

Contributed by

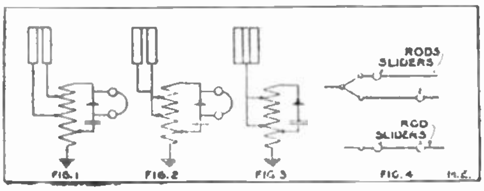
Leo Behr.

ABOUT AERIALS AND RECEIVING HOOK UPS

I am a very interested student in wireless and have done quite a little experimenting on the above lines. I am one of these kind that cannot stop until I get the best out of my set.

I have noticed in the Wireless Telegraph Contest that most of the fellows with 40 or 50 foot aerials about 60 feet long are usually content with a receiving radius of about 250 miles. Several amateurs in Denver have heard from 750 to 1,300 miles with aerials from 40 to 75 feet high and not more than 80 feet long.

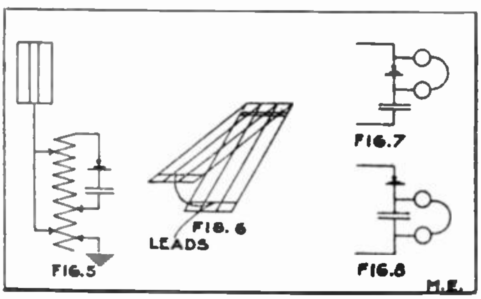
I tried several types with but indifferent success, when a friend of mine showed me a hook up for a loop aerial. I found this to be fairly good and heard



some five or six long distance stations with it. Fig. 1.

Then, at a meeting of the Colorado Wireless Association, one of the members brought up a hook up which was shown to him by an old ship operator. Fig. 2. The hook up calls for a single lead aerial; but I was using a loop aerial at the time and I did not feel like getting up on the roof to change it, so I merely connected the two leads together just above the aerial switch.

Upon trying the hook up that evening I found that it worked as good as Fig.



1. The next day I went up on the roof and changed the aerial to a straightaway and connected it as in Fig. 3. This I found to work at least 25 per cent. better than Fig. 2.

You will notice that all hook ups call for three slide tuners. Although the hook up worked well there seemed to be a lack of close tuning. I did not want to make another tuner and I did not want to spoil the one I had by tacking another slider rod onto it.

By putting two sliders on one rod and using this as the aerial slider I made the equivalent of a four slide tuner. Fig. 4 may help to make it clearer. When I had done this I connected it as in Fig. 5. I found this hook up very selective. Using this hook up on an aerial 50 feet high at one end, 44 at the other, and 60 feet long, I was able on several occasions to hear NAR, Key West, 1,300 miles. This was with a silicon detector and a pair of Brandes superior phones.

Later the aerial was raised to 70 feet and was changed to a duplex with one aerial under the other, four wires in each, and the same remaining dimensions as in the above aerial. Fig. 6. I found this type very satisfactory where only a short aerial can be raised.

The only detector I have ever used for any length of time is the silicon. When using this detector I find that if the receivers are connected around the detector, Fig. 7, instead of around the condenser, Fig. 8, as is recommended by some, that the static is much less. Either method brings in the signals with exactly the same loudness and clearness.

With the aerial in Fig. 6 and hook up, Fig. 5, I heard stations varying from 750 to 1,300 miles nearly every night last winter.

As I have never experimented with a loose coupler I am in no position to say what is the best to use with them.

If the experimenter wishes to connect a variable condenser in these hook ups, I think the best place is around the ends of the tuning coil.

I recently moved to Boston, where I have erected a temporary aerial, one wire 150 feet long, and 60 feet high at each end. I am using hook up, Fig. 5, and have heard some 34 stations in less than a week. I have picked up NAR on two occasions. This hook up with an ordinary tuner will pick up waves to about 1,600 meters.

Contributed by

James A. Kilton.

A MULTIPLE CRYSTAL HOLDER

There are endless ways and methods of making detectors but, one fact remains true, and that is, if the detector is really a "sensitive" one it will be "knocked" when the transmitter is operated if the detector is not cut completely out from the circuit, and cut *at the detector terminals*. The reason for this is that by electro-magnetic induction there are induced high voltage currents in the receiving windings and wires and

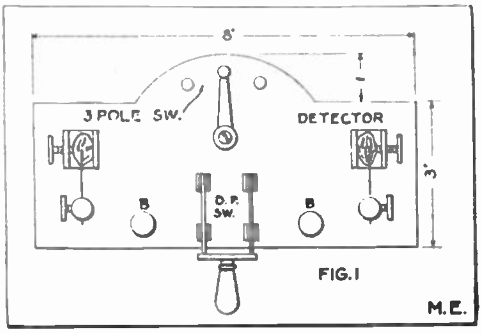


FIG. 1

this current upon passing across the terminals of the detector elements causes the two to weld together and thus destroys its rectifying qualities.

The holder shown in the drawings is designed to overcome this difficulty and has been used very successfully in commercial use, where operators have not the time to waste patience and energy fooling with their detectors, when they must "shoot" a message. It will be noticed that the cutout switch is mounted on the same base as the crystal holders, the base being intended for mounting on the wall conveniently near the operator. A plan view is shown in Fig. 1, depicting the two holders, see Fig. 2, the cutout switch, double binding posts for holding fine wire or other contact, and the 3-pole switch for cutting in either crystal. All are mounted on a piece of hard fibre cut in the shape illustrated, and then the fibre screwed to a similar

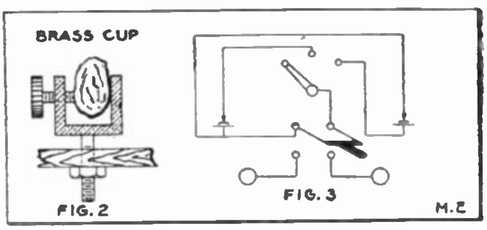


FIG. 2 FIG. 3

wood base ⅝ inch thick. Connections are made as in Fig. 3. It is preferable to operate the cutout switch by a larger handle than those usually found on ordinary DP switches, one being turned out from maple or any hard wood.

One crystal is adjusted, then the 3-pole switch is thrown to the other, and that one adjusted till it is a little more responsive than the first, and this kept up until you are sure that the very best spot on the crystal is being employed. If one should for any reason be "knocked" the other can be instantly cut in without undue interruption.

Contributed by

Stanley E. Hyde.

A LARGE SENDING CONDENSER

Most amateurs cannot afford to buy condensers of a very large capacity as they often cost as much and sometimes more than the transformer itself. The following is a description of a condenser which can handle up to and including a 1 kw. transformer. It is easy to make and costs but little more than $3.

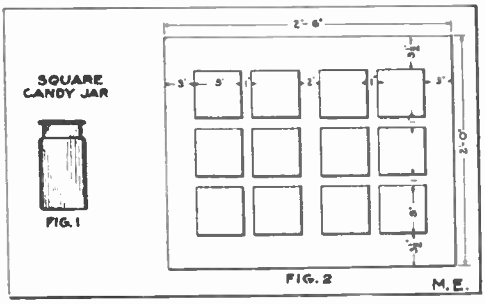


FIG. 1 FIG. 2

First go to some drug store or candy shop and ask for twelve large candy jars, the square kind, Fig. 1. After

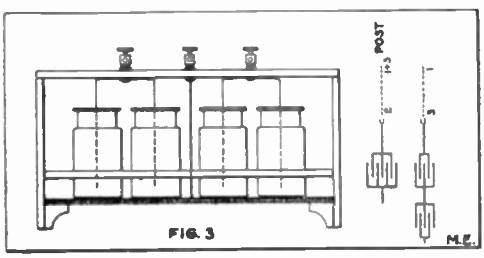


FIG. 3

you have these get some good hard wood about ½-inch thick and put it in an oven to thoroughly dry it. While it is still hot put it in some hot paraffine to make it moistureproof. When the wax has pretty well soaked in take an old rag and rub it thoroughly.

Take a piece 24 x 30 inches and cut twelve square holes in it as shown in Fig. 2. The rest of the woodwork may be easily understood by looking at Fig. 3.

The jars are covered inside and out with a heavy tinfoil which is fastened to the jars with shellac. When this is dry heavy painting of shellac is then put all over the tinfoil and especially over the edges, to stop the brush discharge.

They are then put in the case and connected in two sets of six each, Fig. 3.

The connections are of either brass chain or metal ribbon as is used to wind a helix for the inside, while for the outside a sheet of copper or brass is put in the bottom of the case. A wire should be soldered to this in the center and is brought up to the center binding post so that the capacity may be varied.

A piece of wood can now be put on the sides of the case to give it a finished appearance.

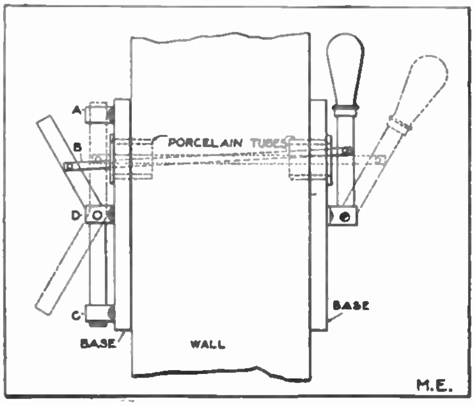
If everything has been carried out as described you will have an efficient and cheap condenser.

Contributed by

E. R. Hall.

LIGHTNING GROUND SWITCH

Lightning switches, by the new law, are required to be put on the outside



but here is one which can be operated from the wireless room.

The diagram is self explanatory and simple.

In diagram A is the contact to which lead to set is connected; D the contact to which the aerial lead is connected, and C is the ground connection.

It will be advisable to use a separate ground wire for lightning switch aside from the ground that the set is connected to.

The rod B should be fibre or hard rubber. The dimensions of the inside parts are left to the reader's fancy, but the parts outside should conform to the Underwriters' requirements—blade made from copper ⅛-in. x 1 in., and clips having a contact surface one inch square on each side of the blade.

Contributed by

R. F. Denton.

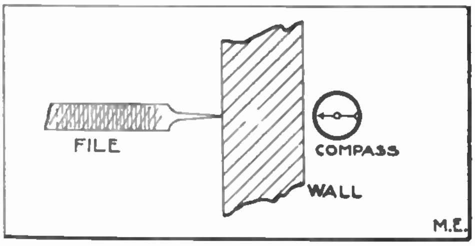
SIMPLE MAGNETIC LOCATER TO USE IN WIRING OR PLUMBING

In my electric house wiring I frequently got myself into trouble by miscalculating by rule measurement and boring holes out into rooms when they should come in the partitions. So I decided to try the following scheme:

I took a large file about ten or eleven inches long and magnetized it strongly on the poles of a dynamo by the usual stroking method. It would pick up six or seven ten-penny nails at once. Next I took a common magnetic compass and tried to see at how great a distance the file would affect it. Now anyone who has experimented with magnetism knows that a certain end of a bar magnet will attract a certain end of a compass needle. I found that the pointed end of the file that was designed to go in a handle would begin to attract the south seeking pole of the compass at a distance of a foot or more. At a distance of six inches the needle would point nearly straight to the file, and at a distance of two inches or less it would point very exactly. This will work through anything that is not magnetic just as well as through the air.

To locate a point over a partition I tie the file to a springy stick slightly longer than the height of the ceiling so that the end of the file may be placed anywhere on the ceiling and held there by springing or moving the bottom of the stick. Sometimes it is more convenient to use a shorter stick and a chair under it. Then I take the compass and go overhead—upstairs where the floor is up (one can generally guess near enough where to find the file)—and knowing which end of the compass the file attracts, I follow up with this end of the compass until the needle suddenly reverses and vibrates very rapidly, which point is over the file.

It is difficult to locate much nearer than an inch by the above method and if more exactness is wanted the compass may be placed one or two inches from the file in two positions so that intersecting lines may be drawn and the intersection will be within one-



eighth of an inch of the place where the file is.

This scheme may be used to locate through floors, where there is no ceiling, very rapidly and easily, for instance, in locating a partition to bore up into it from the cellar. Many times partitions are put in after the house is built and no nails are visible by which to locate the partitions. I take a hammer and drive up the pointed end of the file at a point down cellar that I think can be located a little way from the wall.

This method may be used to locate through a wall horizontally, and will work very well through six or seven inches and locate within one and one-half inches.

I have used this in all the wiring I have done in the last two years and have found it to be such a great time and worry and trouble saver that I now carry it as a regular tool.

Contributed by

R. J. Cleveland.

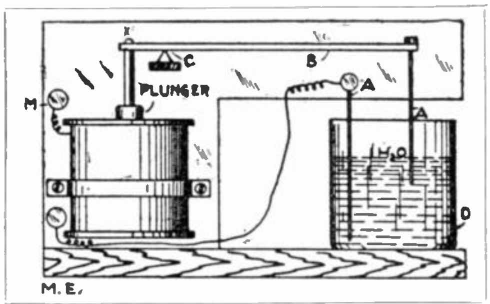
AUTOMATIC CURRENT REGULATOR AND PROTECTIVE SWITCH

Often an arrangement which will control the current through a given circuit is wanted. For instance, in the case of small power motors driving widely variable loads, extreme fluctuations of the speed are common. However, using the apparatus shown below, this trouble will be in part eliminated. Also the device may be used to protect lamps from excessive current or a possible burn-out.

As is shown in the drawing, the instrument comprises a solenoid magnet within which is freely suspended an iron plunger. This plunger is so connected to the lever, B, that upon any increase of current flowing through the circuit beyond a predetermined limit it will pull the plunger down, thereby lifting the rod, A, out of the solution in the tumbler or beaker, D.

The base and back are made from any kind of stock and to the dimensions required. The size of the solenoid, that is, the size of wire and the number of turns, depends upon the value of the current needed, and must be found by experiment.

If the instrument is found, after construction, to be too sensitive, i. e., shut-



ting off the power before the amount wanted is being delivered, either reduce the number of turns in the solenoid or weight the arm, B. The regulation in any particular case is also aided by cutting off the wire, A, to the best length as indicated by experiment.

To use, connect the instrument in series with the apparatus to be protected or regulated. In the absence of current the arm, B, should rest on the binding post, E, and the plunger should be almost entirely out of the solenoid; after the connections are made, pour some water into the cup, D.

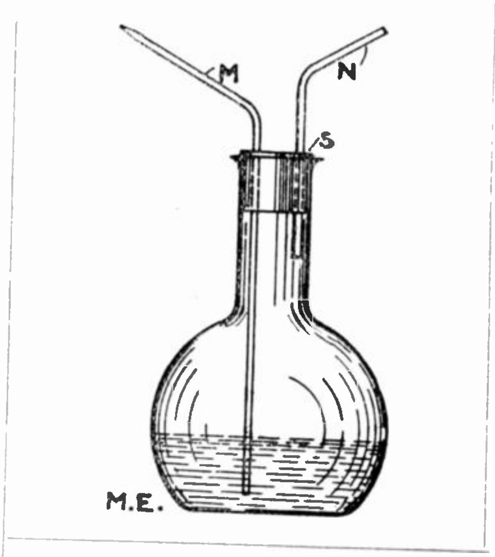
Then sulphuric acid is added slowly until the apparatus is running under normal conditions. The arm, B, should now be level,—if not, weight until it is level. If the current now increases or falls off, the wire, A, will move up or down to compensate the changes by varying the resistance. If the current becomes strong enough to lift the wire, A, out of the solution, it will start a vibration of the apparatus which is sure to compel notice by the tender.

Contributed by

Paul Horton.

A WASH BOTTLE FOR THE LABORATORY

A good wash bottle for the amateur's laboratory can be made as follows: A two-hole rubber or cork stopper is fitted into the neck of a flask, as shown at S in the sketch. Two glass tubes about



3/16 inch internal diameter are bent to the shape shown by M and N, these tubes being fitted into the holes of the stopper. The lower end of M reaches nearly to the bottom of the flask, while the lower end of N is about ½ inch below the bottom of the stopper. The upper end of M is drawn down until the opening is about 1/16 inch in diameter.

By blowing through the tube N the water in the flask is forced out through the tapered end of M in a fine stream. This makes a suitable apparatus for washing the residuum in qualitative analysis, and it can also be used for many other purposes in the laboratory. By making the orifice in M quite small the above described apparatus can also be used as an atomizer or spray.

Contributed by

Wm. H. Dettman.

ANOTHER SYNCHRONOUS ROTARY GAP FOR SPARK COILS

I have constructed a rotary spark gap and interrupter combined, for use in wireless, that has two marked advantages over the ordinary kind now used. First it works in absolute synchronism, and second it is much lighter, being no load even for a little Hustler motor.

This instrument requires a small motor of high speed. On one end of the motor shaft is soldered a brass or copper disc with four points or corners spaced equidistant around the circumference, and as the shaft rotates the points dip in a pool of mercury over which is a layer of alcohol to prevent oxidation, thus interrupting the current.

But now to the spark gap wherein lies the merits of this instrument. It is simply a disc of mica in which there are four holes spaced equidistant and about ¾-inch from the edge of the disc.

This disc is glued on to the other end of the shaft and rotates between two zinc plugs. The mica disc is glued to the shaft in such a manner that the holes in it come between the plugs at the instant the interrupter point (on other end of shaft) leaves the mercury, thus making it synchronous. This may be made into a revolving series gap by placing four plugs on each side of the disc in such a manner that the spark would travel four times through the disc. But I find no great advantage in the series gap.

Contributed by

Emmett Moffett.

A CHEAP RHEOSTAT

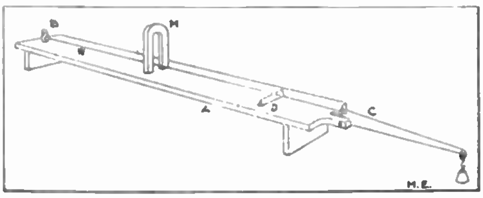
A very easily made and cheap rheostat for reducing 110 volts A. C. for use on small motors and arc lights may be made as follows: Get two No. 2 coil door springs and fasten to a board covered by ⅛" sheet asbestos, stretching out far enough to allow for their not touching when they expand. Connect two of the ends together and connect coil in series with light, motor, or other instruments. The springs only cost 5 cents each and if two of them do not reduce current enough, of course more springs may be added.

Contributed by

Hubert Ivey.

ANOTHER SIMPLE METHOD OF FINDING THE FREQUENCY OF AN ALTERNATING CURRENT

In the July issue of this magazine, Mr. Beverage explained how to find the frequency of an alternating current by



means of a pendulum. The following method makes use of the tone emitted by a vibrating string and the fact that a conductor in which a current is flowing tends to move in a direction at right angles to the lines of force when placed in a magnetic field.

The apparatus consists of a horseshoe magnet, a sonometer, and some musical instrument, such as a piano or a violin. The sonometer may be constructed as shown in the figure. The base, A, is about one metre (39.37 inches) long, has a binding post, B, at one end, and a bent lever, C, at the other. A wire, say No. 26 B & S, is stretched between B and C. When plucked the wire will give out a certain tone which may be changed by adjusting the tension or the length of the wire. That is, by changing weights at the end of C or by sliding the bridge, D, to a different place on the board. If a magnet, M, is now placed astride the wire about half way between B and D, and an alternating current sent through it, it will tend to move up during one-half the cycle and move down during the other half. If the frequency of the vibrations of the wire when plucked is the same as the frequency of the current, the wire will vibrate in unison with the current and give out a tone which must be identified by comparison with some musical instrument or other standard.

In order to make the frequency of the wire equal to that of the current, the weight at C must be adjusted and the bridge, D, slid along until the wire gives out a strong, clear tone. When the correct adjustment is found, the tone is compared with some tone that is known on some musical instrument. The frequency is then found by reference to the following table:

Tone.	No. of Vibrations per second.	Tone.	No. of Vibrations per second.
C (middle)	256	G	383.6
C sharp	271.1	G sharp	406.3
D	287.3	A	430.5
D sharp	304.3	A sharp	455.9
E	322.5	B	483.3
F	341.7	C (above)	512
F sharp	361.8		

If the tone of the wire is found to be some tone not in the table, its frequency may be found by applying the following rule: Of two tones an octave apart, the lower tone has one-half the number of vibrations per second of the higher one. That is, if the tone is below middle C, its frequency equals that of the corresponding tone in the table divided by 2, once for every octave's difference between the tones. If the tone is above middle C its frequency equals the tone in the table multiplied by 2, once for every octave's difference between the tones. For example, say the tone is identified as G^1 two octaves above G in the table. Then frequency of $G^1 = 2 \times 2 \times 383.6 = 1534.4$ per sec.

This method is better when very high frequencies are to be determined, as the human ear is so delicately adjusted that it can distinguish between two tones differing only by a few vibrations per second.

Contributed by

Francis John Nankivell.

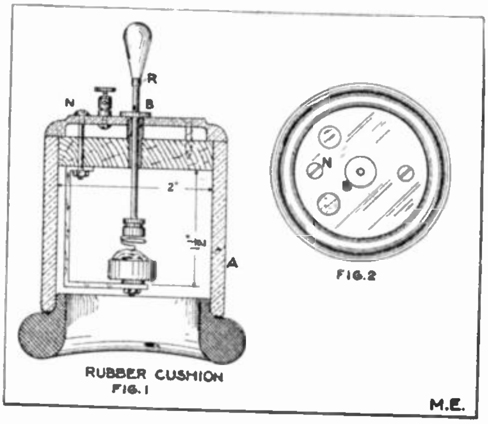
AN ENCLOSED DETECTOR

I will describe an enclosed detector I recently constructed and used with good results.

Referring to Fig. 1, A is a tube, preferably of glass, an oil cup glass does nicely. A rubber ear cushion is forced into the bottom to take up vibration.

A three point battery switch is dismantled and binding posts put in holes as shown in Fig. 2. One of these is connected to a bushing B, which is placed in the hole in the center of the base while the other is connected to the brass screw N.

A piece of wood 3/8 in. to 1/2 in. thick is made to fit tight in tube A. Two holes are made in this, one in the center for rod to pass through, and the



other for screw N. After cutting, drilling and bending a strip of 1/2 in. brass, as shown, the parts are ready to assemble, as shown in Fig. 1.

Rod R should slide easily through bushing B, and its weight will keep contact on mineral. Any kind of mineral may be used in this detector. The contact shown gave excellent results with silicon.

Contributed by

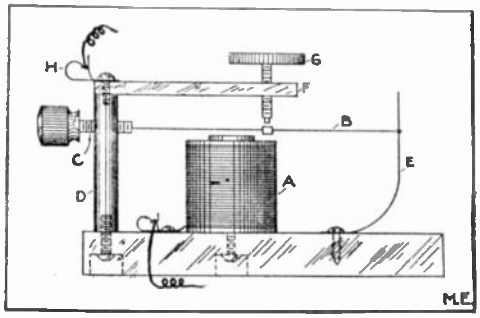
Thos. W. Benson.

A HIGH FREQUENCY BUZZER

The accompanying sketch shows a high frequency buzzer for your detector test. It is constructed of an ordinary 4-ohm bell magnet A, above which is stretched the fine piano wire B, supported by the screw C, in the fibre standard D, and by the clock spring E.

To the top of D is attached the brass arm F, supporting the contact screw G. On the steel wire, under G, is fastened a small piece of platinum or silver, by being bent in the form of a tube around the wire. Mount a binding post H on the instrument. The shorter the steel wire the higher the pitch, a piece about 3 inches long is good.

Connect one end of the magnet to E and the other to a battery. The



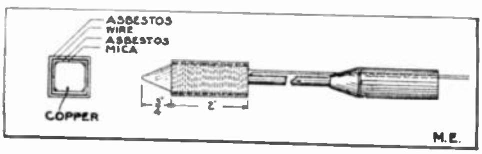
post H is connected to the other side of the battery. The maker should use the dimensions best suited to him.

Contributed by

C. J. Sedlak.

ELECTRIC SOLDERING IRON

First, obtain a medium sized ordinary soldering iron, one having 4 sides and having at least two inches of copper point. Cut four pieces of sheet mica, the same dimensions as one side of the iron (the copper), except that it comes to within 3/4-inch from the



point. Over this are put four pieces of sheet asbestos the same size as the mica.

Now procure 20 feet of No. 24 Climax Resistance Wire. Wind about 25 turns on the first layer, cover with a layer of 1/16-in. sheet asbestos and wind about another 25 turns of the resistance wire. Cover with another layer of asbestos and mica. It can now be covered with a layer of thin sheet brass or wind over a layer of No. 16 or No. 18 B&S gauge wire. The leads should be connected to insulated wires, leading through a hole bored through the handle, and an ordinary plug attached.

Contributed by

Haydn P. Roberts.

Recent Important Patent Decisions

By George William Miatt

THE Supreme Court of the United States has again demonstrated the efficiency of the existing patent laws by its decision of May 28th, 1913, in the so-called "Sanatogen" case, in which it announces as a universal rule that "a patentee who has parted with a patented machine by PASSING TITLE to a purchaser has placed the article beyond the limits of the monopoly secured by the patent act." In other words, the "passing of title," as in other property, cancels the patent owner's right to control; but it does not prevent him from licensing conditionally, nor from consigning goods for sale at a stipulated price. This decision is parallel to and consistent with the decision of the same Supreme Court in the Bobbs-Merrill case, in which it held that a copyright did not enable the publisher of a book to prevent its sale at less than a fixed price by department stores and others.

The Department of Justice has long contended that where a patentee sold his patented article he lost all control of it and was powerless, especially in view of the Sherman anti-trust law, to establish and control resale prices. Hence the officials of the department regard this decision in the "Sanatogen" case as of tremendous importance, putting an end to existing widespread extensions of patent monopolies, based upon unlawful or inequitable stipulations and conditions. The decision will affect many articles now sold under restrictions fixing the resale price, particularly certain cameras, talking machines, watches and clocks, not to forget certain kinds of safety razors, the manufacturers of which have sought to extend their monopolies and shave the public in a financial sense by questionable expedients. In fact, several anti-trust suits now pending in the courts are based on the principle involved, and the Department of Justice has been awaiting a determination of the question before starting additional prosecutions on the same theory.

It must be understood that this latest decision of the Supreme Court, while it does eliminate certain "trust" abuses that have arisen under the prior construction of the patent law, does not deprive the inventor or patent owner of any equitable right or protection; and it certainly is an efficacious answer to the pending piratical "Oldfield Bill" and those back of it. As we have always maintained, the patent laws are fundamentally broad and basic, and the United States Supreme Court is certainly competent to interpret them in such manner as to meet changed trade conditions and to correct abuses. The average politician is no more competent to tinker with the patent law than an elephant is to regulate a watch.

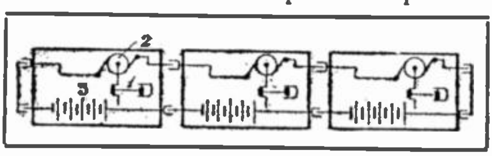
An important decision affecting Patent Office practice has been rendered by the Court of Appeals of the District of Columbia overruling the decision of the Commissioner of Patents in re. Karbeck. The point at issue in this case was the old one of invention as distinguished from the use of obvious expedients or the exercise of mere mechanical skill in attaining a desired result. The tendency of late years has been to restrict the granting of patents and construe simple though admittedly original conceptions, changes or combinations as the exercise of good judgment or selection only, lacking patentability. In fact the policy has been most illiberal, all doubts being construed as against the inventor, a policy which is emphatically reversed by the decision of the Court in this case, Judge Van Orsdel ruling that: "It is easy to dispose of a case, where the issue of invention is close, by holding that the advance over the prior art constitutes a mere mechanical change apparent to those skilled in the art. But, in the absence of proof to support this conclusion, and *where the question of patentability is close, the doubt should be resolved in favor of the applicant.* While the use of new materials to produce a known result, or of known materials to produce a new but obvious result, may not always constitute invention, *if the new idea, when applied, brings success out of failure, produces a new and useful result and saving in operation or production, or efficiency instead of inefficiency, gives to the device new functions and useful properties, it is invention and may be patented.*

We think this decision is most just and equitable as well as opportune. By all means give the inventor the benefit of the doubt and let the public decide as to the merits. If people do not want the innovation the latter will suffer a peaceful death—if they do, they should be willing to pay the piper. While so-called mechanical expedients or equivalents seem obvious enough after use they are not always primarily apparent to either the inventor or the skilled artisan. Not so many years ago Edison regretted that he did not have the aid, while expending many thousands of dollars and much time in experimental investigation in attaining a certain result, of the Judges who afterward declared the invention an "obvious expedient"—obvious to them on sight, but not to Edison and his skilled associates until after they had succeeded laboriously in solving the problem.

Recent Electrical Patents

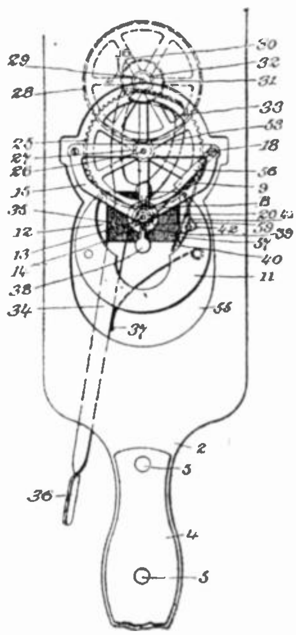
By George William Miatt

As is well known, in the "mixed" or electro-chemical propulsion system, the heat motor directly drives the wheels by means of a magnetic or similar clutch, and by toothed gearing, while the electric machine is placed in parallel



with the battery and coupled mechanically to the heat motor. The heat motor is generally diminished for average power so that the electric machine serves, when hills are encountered, to increase the power by working as a motor, and, as a generator, to store up energy during descents. According to the invention of Henri Pieper, of Liege, Belgium, set forth in patent No, 1,056,119, the electrical machines and batteries of all the vehicles of the train are connected in series. In this manner unequal demand on the electric machines and also on the different batteries is prevented. This system is illustrated in the diagram where 1 represents the heat motors, 2 the electric machines and 3 the batteries of the different vehicles. Obviously each vehicle can be provided with several electrical machines and several heat motors. The control of the entire train is effected, in the known manner, from the motorman's cab. The patent covers an electro-mechanical propulsion system for trains having a plurality of vehicles comprising heat motors, electric machines coupled thereto, batteries working in combination with the electric machines, means for connecting the electric machines, and batteries of each vehicle in separate groups in order to start the different groups of heat motors and electric machines and to start the different vehicles of the train, means for connecting the electric machines and batteries of the whole train in series for running, means for regulating the speed by varying the field of the electric machines and means for changing from the one system of connection to the other at about the commencement of the speed regulation.

PATENT No. 1,052,522, issued to Victor Sence, of New York, N. Y., relates to electric therapeutic devices, and comprises an improved portable apparatus adapted to be carried in and manipulated by one hand of the operator, and which when placed in contact with the head or any part of the operator's body will put the same in circuit with the terminals of a mechanical generator of electricity mounted on the apparatus so that any current generated is sent through the body. The most convenient form of apparatus to be so equipped is a hair brush having bristles of metal or other electrically conductive material. The mechanical generator is preferably driven by pawl and ratchet gearing actuated by the hand that holds the brush.

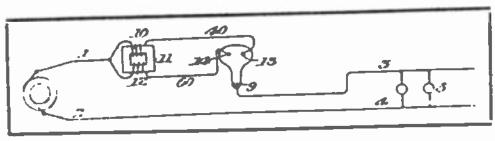


Hence the accompanying figure represents a back view of a hair brush constructed in accordance with the invention, with metallic bristles, and an ordinary back and handle, 2, cut away at, 55, to receive the electric generating mechanism.

In operation the brush is held by the handle with the thumb of the operator on thumb piece, 36, of lever, 34. If, while the brush is being used in the ordinary manner, the metallic bristles being in contact with the scalp and the operators' hand making contact with plates, 3 and 4, the lever, 34, is vibrated by the alternating pressure of the operator's thumb and spring, 37, continuous rotation will be given the magneto armature by the pawl and ratchet mechanism and multiplying gearing. As a result the armature coils are short circuited and a current of considerable volume is created. Each time this short circuit is broken a counter induced current is generated in the armature coils, and shunted through the body of the operator from head to hand.

PATENT No. 1,052,056, issued to Peter Cooper Hewitt, of New York, N. Y., assignor to Cooper Hewitt Electric Co., a corporation of New York, is for certain Improvements in the Operation of Translating Devices with Multiple Electrodes.

It is well understood that when electric current traverses a divided circuit containing only ohmic resistance, the product of the current and the resistance in both branches is the same. In such a circuit, it is not generally difficult to make an even division of the load, or, in other words, to make the fall of potential in both paths exactly the same.



The problem of running similar translating or transmitting devices in parallel becomes more difficult when the devices to be operated are either such that the drop is practically independent of the current flowing, or such that the resistance decreases more or less rapidly with increments of current, as in the well-known Nernst lamp. Under such circumstances, it is practically impossible to so construct the similar translating or transmitting devices as to get an exactly equal loss of voltage in two parallel paths, including such devices, the consequence being that all the current will flow through one to the exclusion of the other, unless special ballast devices are provided.

The solution of the problem which depends upon introducing ohmic resistance or other choking devices into one or both of the parallel circuits is open to objection on account of the loss of efficiency in the system due to the presence of such devices. By providing means, therefore, for exactly balancing the electro-motive-forces in the two paths without substantial loss of energy or interference with the regulation or the supply of energy in the system, a substantial improvement in the arc is accomplished.

Broadly, this result is accomplished by introducing into each of the parallel paths means whereby a flow of current in this path produces an electro-motive-force in the opposite path in such a direction as to assist the flow of current in such opposite path. In this way, if the electro-motive-forces consumed in the two paths be slightly unequal, due to unavoidable lack of similarity in the translating or transmitting devices, the slight increase of current in one path will cause a slight additional electro-motive-force in the second path sufficient to exactly balance the difference in the two electro-motive-forces.

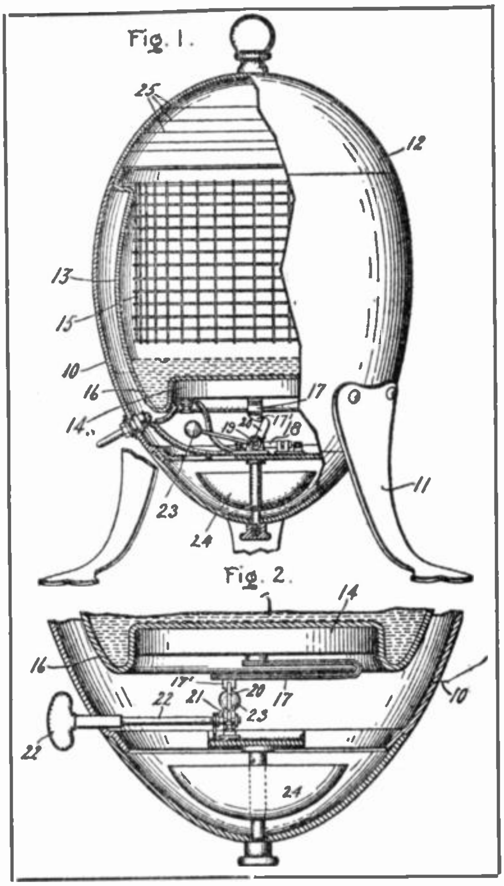
In the diagram, 1 and 2, are the mains of a supply system, the source being any suitable source of alternating currents. The main conductors of the receiving circuit are shown at 3 and 4 and translating devices requiring direct current appear at 5, 5. Between the mains, 1 and 3, are introduced two parallel circuits, 40 and 60, which it is desired to operate in parallel. These circuits are here represented as being included in a gas or vapor electric apparatus, consisting of a suitable container inclosing a conducting gas or vapor and provided with a plurality of positive electrodes, 13 and 14, and a negative electrode, 9.

In circuit with the anode, 13, is a coil, 10, surrounding a laminated core, 11, and in circuit with the anode, 14, is a coil, 12, surrounding the same core, 11. In other words, the branch circuit, 40, contains the anode, 13, and the coil, 10, while the branch circuit, 60, contains the anode, 14, and the coil, 12. The direction of current flow is always the same, inasmuch as impulses of opposite direction cannot pass from the supply to the receiving circuit owing to the character of the device.

To compensate for the unavoidable slight difference in apparatus of this class an inductive apparatus is used consisting of the coils, 10 and 12, and the core, 11. The relations of the respective coils are such that when the load is evenly divided between the two branches, the opposing inductions of the coils substantially cancel each other. Should the branch, 40, begin to take a slight excess of current as compared with the branch, 60, the inductive effect produced by the increase of current in the coil, 10, would be such as to create an additional electro-motive-force in the coil, 11, tending to increase the flow of current in the second branch. By these means a change of load in one branch will produce counter active effects upon the other branch whereby the fall of potential in the two branches will be maintained practically equal, thereby making it possible to operate the two devices in parallel circuits.

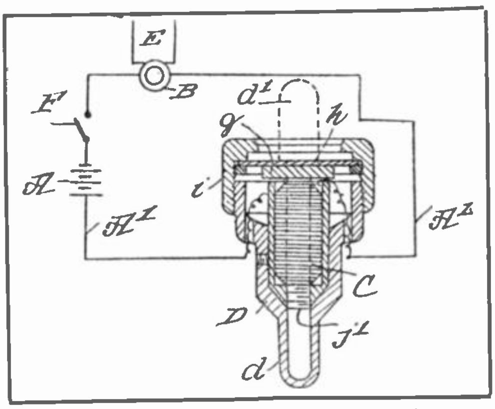
EVERY one who has a preference for eggs cooked in an individually prescribed time and manner will appreciate the efforts of Archibald S. Gubitt, of Pittsfield, Mass., to gratify their tastes, as set forth in Letters Patent No. 1,055,-882, assigned to the General Electric Company, New York.

Fig. 1 represents a sectional elevation of the device, and Fig. 2 an enlarged sectional view of the lower part thereof. The outside casing, 10, is provided with legs, 11, and with a cover, 12. Within the casing, 10, and spaced therefrom, is an inner casing, 13, in which is mounted the basket, 15, for holding the eggs out of contact with the water. The inner casing is shaped to provide a pocket, 16, for containing water after the main body of the water has been evaporated. The heating unit, 14, is arranged to be open circuited when it reaches a predetermined temperature—that to which the heater will rise when there is no longer water in contact with its effective radiating surface for keeping it cool. In order to open the circuit under these conditions a thermostatic member, 17, is mounted in contact with the central portion of the heating unit. This thermostatic member may be U-shaped, to provide an effective movement for opening the circuit, and is provided with a lug, 17^1. Switch member, 18, pivoted at 19, is arranged to open the circuit of the heating unit, being provided with a portion, 20, which engages the lug, 17^1, of the thermostatic member, and is held in closed position thereby. A spring, 21, presses against the member, 20, to normally force the switch open. A key, 22, extends out through the casing to provide means for closing the switch. When the key, 22, is turned the switch member, 18, is turned to closed position, as shown in Fig. 1, and the member, 20, holds it in place by bearing against the lug, 17^1, of the thermostatic element, providing the temperature in the heating unit is not excessive. If the temperature rises above a predetermined point the end of the thermostatic element will bend upward and release the switch. In order to provide a signal to call the user's attention to the fact, a hammer, 23, moves with the switch member, and a bell, 24, is engaged by the hammer when the switch is opened.



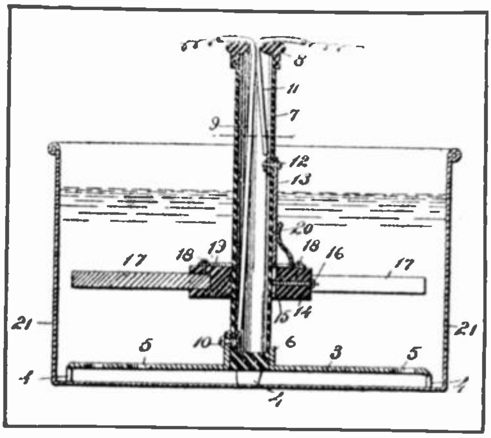
The operation is as follows: The eggs are placed in the basket, 15. The water is then poured into the bottom of the receptacle. The degree to which the eggs are to be steamed is controlled by the amount of water in the receptacle. The cover, 12, which is used as a cup to measure the amount of water in the heater, may be graduated, as shown at 25, for indicating the proper amount. The current being turned on by means of the key, 22, steam will be generated in the receptacle, and the eggs cooked. When the water in contact with the flat portion of the bottom, that is, in contact with the effective radiating surface, is evaporated, the eggs are cooked to the desired degree. A very short time after the water has evaporated, the circuit is opened by the thermostat. The pocket, 15, will still contain water for steaming the eggs for a short period, sufficient to prevent the burnings of the eggs until the circuit is opened. As soon as the temperature becomes excessive in the heating unit the switch opens and the gong rings.

THE accompanying view is a diagrammatic representation of means devised by Augustus Rosenberg, of London, England, (Patent No. 1,057,279). for the treatment of deafness and other disorders of the auditory organs by agitating the sound-conducting and sound-perceiving portions of the ear by mechanical vibrations having a continuous undulatory character corresponding to that of the sounds to which it is required



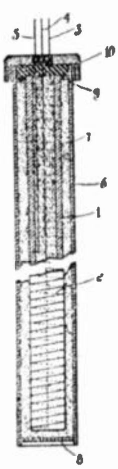
to train the ear to respond. In the circuit, A' is interposed the source of electric energy, A, and the opening and closing switch, F. A sound controlling current-regulator, B, agitated by direct mechanical contact with a phonograph or equivalent, E, is also interposed in the circuit. The undulator comprises a permanent magnet j' wound with a coil, C, of insulated wire, connected at its ends with the terminals of the circuit; the magnet-armature being constituted by a freely-vibrating piece of magnetizable metal, g, mounted on a spring, h, which is attached at both ends to the vibrator, D. The magnet, j', itself is of the tubular type, wherein a central core is surrounded by a concentric tube in magnetic connection with the core, the winding being placed in the annular space between the core and tube. The vibrator, D, which is adapted to respond to the vibrations set up in the undulator and to transmit these vibrations directly to the person of the user, is in the form of a casing inclosing the undulator from whence it receives pulsations. Any portion of the vibrator may be applied to the person, but it is generally preferable to employ that end of the casing which is opposite the magnetic armature, g; the said end being prolonged, as at d, to form a cylindrical plug adapted for insertion into the external ear to insure the communication of the vibrations to the inner and middle ear. The armature, G, may be attached by the spring, h, to the interior of a cap, i, and made to approach or recede from the electromagnet until the vibrations set up on the passage of current through the winding of the magnet exhibit the amplitude or intensity desired. Where the armature itself, or a plug, d', carried thereby as indicated in dotted lines, similar in form to the plug, *d*, is applied to the person the pressure consequently exerted upon the spring, h, will tend to damp the vibrations or even to cause the armature by contacting with the pole of the magnet, to stick. In such case it is only necessary to increase the distance of the armature from the pole of the magnet until the armature, although subjected to pressure, remains free to vibrate.

A PORTABLE apparatus for purifying water by electrolysis, adapted for domestic uses, is shown in the accompanying illustration, taken from Letters Patent No. 1,057,367, issued to Ada H. Van Pelt, of Los Angeles, Cal. The disc, 3, has a set of downturned leg members, 4, and a plurality of perforations, 5, so that water may freely circulate. Centrally the disc has a hole and an upturned annular flange, 6, to receive the lower end of a tubular stem, 7, of hard rubber, the upper end being open to receive a removable head, 8, through which the inlet wires pass. One of these inlet wires, 9, passes down through the tube and is held by a screw, 10, which passes through the flange, 6,

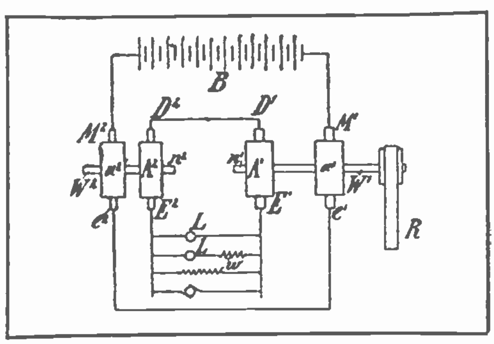


of the disc, 3, and the other wire conductor, 11, connects through the screw, 12, with a metal contact bar, 13, secured to the outer surface of the tubular stem, 7, on which is mounted a circularly-formed body of insulating material, 14, which has a vertical notch, 15, to clear the contact bar, 13, on the side of the stem, and a set screw, 16, for vertically adjusting the spider. The body, 14, has a plurality of radiating arms, 17, of any suitable conductor of electricity, each held in place by a set screw, 18, passing through a metal ring, 19, on the body, 14, so that the arms are electrically in contact therewith. This ring has an upwardly projecting contact finger, 20, to engage with the vertically-disposed contact bar on the outside of the stem. It will be seen that one conductor is in electrical contact with the base, constituting one of the terminals, and the other conductor is electrically connected with the arms of the spider, constituting the other terminal. The different waters which are to be treated have different resistances. The vertical adjustment of the spider is to so fix the distances between the terminals as to give the most effective treatment to the water, and as different voltages are found in electric systems, this adjustability is a necessary element. As the device is applicable for either alternating or direct currents, the terminals are set much farther apart, when an alternating current is used, to make the water itself act as the resistance, and thus prevent overheating.

WHEN bare resistance coils are employed for heating air and the like, there is, in effect, much loss of heat, since much of the heat is generated as radiant heat, which passes through surrounding air without raising the temperature thereof materially, and which becomes sensible heat only when it impinges upon some solid or liquid body not transparent to heat rays. To obviate this loss, the coils must be embedded in some material, not transparent to heat, but merely conductive of heat, whereby all of the heat generated will be transmitted from the heater as sensible heat. In the past, this has generally been accomplished by embedding the coils in porcelain or like material; to which practice, however, there are numerous serious disadvantages, one of which is that the porcelain is extremely apt to break as a result of sudden temperature changes, or unequal heating, and another of which is that the porcelain does not allow free expansion and contraction of heating coils. A further objection is that porcelain is a rather poor conductor of heat and therefore is a poor radiating material and furthermore does not afford sufficiently large heating surface for contact with the surrounding air to heat the latter. John F. Monnet, of Paris, France, in Patent No. 1,058,380, proposes to obviate these difficulties largely by surrounding the heating coils with a finely pulverized material of an insulating nature, inclosed within a sealed envelope, which latter is preferably of a material having a high rate of heat transmission, such as one of the more conductive metals. The pulverized material then performs the several functions of insulating the heating coils electrically from one another, of excluding air from the coils and thereby preventing oxidation, of converting all radiant heat admitted from the coils into sensible heat, of storing heat so that the rise and fall of temperature of the resistance coils is relatively gradual, of cushioning the structure so that it is not liable to injury even by excessive jar or vibration, and of permitting free expansion and contraction of the coils. The accompanying view represents diagrammatically a central longitudinal section of the heating element, in which the heating wire, 2, is wound on the support, 1, and is imbedded in the pulverized material, 7. The whole is enclosed in the metal casing, 6, closed at the top and bottom by the end pieces, 8 and 10.

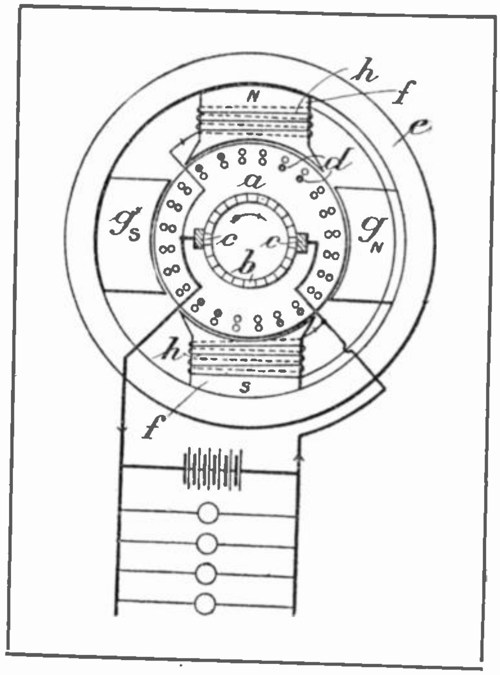


IN systems of electric car lighting wherein the car axle is used to drive the dynamo furnishing the current for the lighting system, the speed of the car axle of necessity varies considerably because of variations in the speed of the car or train, and therefore the terminal voltage of the dynamo will vary within wide limits. The object of Otto Schaller of Steglitz, near Berlin, Germany, in his Patent No. 1,059,076 is to obtain an approximately constant potential at the terminals of the working circuit irrespective of great variations in speed of the mechanically driven power shaft. To this end there is provided a second shaft and electrical means, consisting of one or



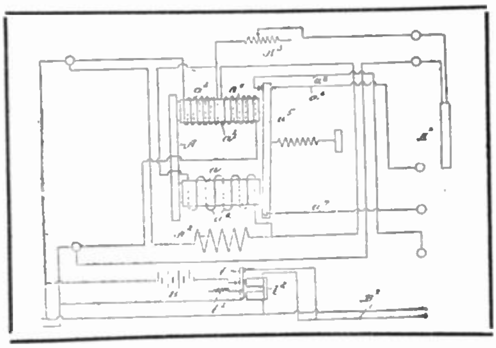
more auxiliary dynamos, for driving such second shaft, whereby the sum of the speeds of the main and auxiliary dynamos, or the relative speed of parts of the main dynamo rotating one in opposition to the other, and therefore the voltage of the working circuit will remain approximately constant. In the accompanying diagram there is indicated a shaft, W′, driven in either direction or first in one direction and then after a time in the other direction, as would happen if driven from a car axle by a belt, R. On this shaft, W′, are mounted the armature, A′, of a dynamo, D′, and the armature, *a′*, of a dynamo-electric machine, M′. A second set electrically driven comprising a motor, M2, and a dynamo, D2, having their respective armatures, A2, and, *a2*, mechanically connected by a shaft, W2. The set, D′, M′, operates as a direct current converter, and the set, D2, M2, as a motor-booster. The armatures, *a′* and *a2*, are connected together in series and to a battery, B. The armatures A′ and A2, are connected together in series, and to a working circuit in which are included translating devices such as lamps, L, or heating coils, *w*.

THE accompanying figure is a diagrammatic representation of a variable speed dynamo arranged in accordance with the invention of Albert H. Midgley and Charles A. Vandervell of Acton Vale, England, as set forth in their Letters Patent No. 1,057,759. This invention consists of a dynamo electric machine in which the brushes for collecting the useful current are arranged in such position that the coil or coils of the armature short-circuited by the said brushes are in an active zone where they are cutting an initial magnetic flux due to wound poles, and the current thus generated in the short circuited coils, as distinguished from the working current which flows through the armature from brush to brush, acts to distort the said initial magnetic flux in a manner to accomplish self-regulation. It is well known that in every armature in addition to its working current there would be another and local current produced in the coils short-circuited by the brushes if such short-circuiting took place at a moment when the coil is not situated in a neutral zone, and the magnitude of such local current depends, other things being equal, upon the strength of the magnetic flux and the speed at which the armature rotates. In carrying out the invention, this property of the local current in the short-circuited coils to produce a cross-



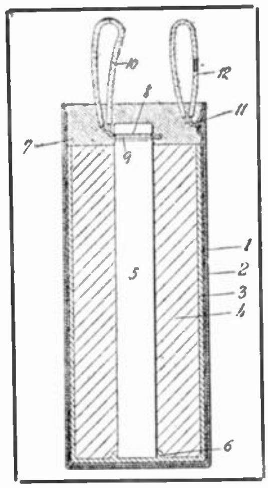
magnetizing force in the armature to distort the magnetic flux to one side of the center of the plane of the short-circuited coils is utilized, as is also the reaction of the working current in the armature winding to weaken the magnetic flux as the speed of the armature increases in order to obtain the desired self-regulation. *a* represents the armature, and *b* its commutator provided with brushes, *c*, each of which is adapted to short circuit one or more individual armature coils, *d*, while said coils are cutting the magnetic flux from the subsidiary poles, *f*, of the field magnets, *e*,—said subsidiary poles, *f*, being disposed midway between the main poles, *g*, and provided with a winding, *h*, in conjunction with means such as a short circuit for energizing said windings from the brushes, *c*. The main poles, *g*, are not provided with any winding, but as the subsidiary poles are excited independently the magnetic flux will always have one direction.

THIS invention of Henry Earl Beighlee, of East Cleveland, Ohio, pertaining to temperature controlled regulating devices, relates more especially to apparatus wherein the desired regulation is effected through the medium of an actuating electric circuit. The control of the latter is the object in view, and it will be obviously immaterial whether such actuating circuit be employed simply to give an alarm or to directly affect heating means, a damper, or other mechanism. Referring to the diagram the relay will be seen to comprise an electro-magnet, A, one leg, *a*, of which includes a single coil, *a2*, wound in ordinary fashion, the other, *a1*, of which includes two concentrically wound coils, *a3*, *a4*, differentially connected so that as long as the same current flows through said coils there will be no resulting magnetic field induced and no actuation of the armature, *a5*, had. The differential relay thus constituted by said two differentially connected coils of such electro-magnet, together with the thermo-sensitive resistance, A1, and another resistance, A2, are arranged in the form of a Wheatstone bridge, wherein said two differentially connected coils, *a3*, *a4*, constitute the arms adjacent to the thermo-sensitive resistance. The coil, *a2*,



wound about the other leg of the electro-magnet is connected across such bridge in the same fashion as the galvanometer is ordinarily included. In the same arm with the thermo-resistance, A1, there is furthermore included an adjustable resistance, A3, as shown. As a source of current a battery, B, adapted to be connected in the usual fashion to the respective coils and resistances that enter into the bridge, is provided, or current may be taken from a light or power line, B1. The main actuating circuit is shown with three leads, *a6*, *a7*, and *a8*, and the movement of the armature, *a5*, is adapted to complete the circuit through the lead, *a7* and either the lead, *a6*, or *a8*, depending on the position of the armature as controlled by the coils. The patent is No. 1,059,971.

AN improvement in the terminal arrangement of electric batteries, whereby superior results in the connection of the terminals with the conductors of the circuit with which the battery is to be used, are secured, and at the same time securing advantages in carrying, handling or shipping a battery without danger of short circuiting is the subject of Patent No. 1,061,572 issued to Charles F. Schuh, of Newark. The terminals of the battery elements are elongated, flexible conductors, which are secured in electrical contact to the respective battery elements, within the seal of the battery; such conductors extend exteriorly of the seal, and at least the portions thereof exterior of the seal are covered with suitable insulation, whereby the battery may be carried without danger of short circuiting or leakage, and at the same time affording more space between the terminals for connection with the circuit wires. After the battery has been shipped to the place of use, the insulation of the conductors may be wholly or partly removed to allow the connections with the circuit wires to be made.



LE PAS, MANITOBA, WIRELESS STATION

The wireless station to be constructed at Le Pas, Manitoba, will be the second largest wireless station in Canada. The plant will cost about $100,000 and will include four 250-foot steel towers and a 230 horse-power engine.

Wireless Club Directory

Until further notice we will publish here from time to time a list of wireless clubs. These notices are inserted free upon receipt of proper information. Notices of the organization of all new clubs, as well as any changes of officers, etc., should be sent to us promptly.

Allegheny County (Pa.) Wireless Association—Leetsdale, Pa.

Alpha Wireless Association—Box 57, Valparaiso, Ind.

Amateur Experimental Association—Spokane, Wash.

Amateur Wireless Association of New Bedford—84 Dunbar Street, New Bedford, Mass.

Amateur Wireless Association of Schenectady—R. F. D. Route No. 49, Schenectady, N. Y.

Amateur Wireless Association of Schenectady—405 Lenox Road, Schenectady, N. Y.

Amateur Wireless Club of Geneva—448 Castle Street, Geneva, N. Y.

Amateur Wireless Telegraphy Club of California—Box 55, Capitola, Cal.

Arkansas Wireless Association—216 West 20th Street, Little Rock, Ark.

Atlanta Wireless Association—159 Capitol Avenue, Atlanta, Ga.

Austin Wireless Association—406 West 10th Street, Austin, Texas.

Back Bay Wireless Club of Boston—295 Walnut Street, Brookline, Mass.

Berkshire Wireless Club—18 Dean Street, Adams, Mass.

Birmingham Radio Association—1404 South 17th Avenue, Birmingham, Ala.

Boise Radio Club—715 North 9th St., Boise, Idaho.

Boys' Experimental Club—Box 214, Virginia, Minn.

Bridgeton Radio Association—313 East Commerce Street, Bridgeton, N. J.

Bronx Wireless Association—500 East 165th Street, Bronx, N. Y.

Brooklyn Wireless Club—131 Ryerson Street, Brooklyn, N. Y.

B. W. T. A. Wireless Department—Scarsdale, N. Y.

Canadian Central Wireless Club—9 Central Avenue, Armstrong's Point, Winnipeg, Man., Canada.

Cantabridga Wireless Club—351 Harvard St., Cambridge, Mass.

Cardinal Wireless Club—South Division High School, Milwaukee, Wis.

Chicago Wireless Association—4418 South Wabash Avenue, Chicago, Ill.

Cincinnati Wireless Signal Club—1839 Hopkins Street, Cincinnati, Ohio.

Colorado Wireless Association—1545 Milwaukee Street, Denver, Colo.

Council Bluffs Radio Association—725 Sixth Avenue, Council Bluffs, Iowa.

Danvers Wireless Association—Franklin Street, Danvers, Mass.

De Kalb Radio-Transmission Club—205 Augusta Avenue, De Kalb, Ill.

Detroit Y. M. C. A. Radio Club—Detroit, Mich.

Dorchester Wireless Association—222 Harvard Street, Dorchester, Mass.

East Buffalo Wireless Club—701 Walden Avenue, Buffalo, N. Y.

East Glenville M. E. Wireless Association—624 East 124th Street, Cleveland, Ohio.

East Side Y. M. C. A. Radio Club—162 East 66th Street, New York City.

East Tennessee Wireless Association—723 North Third Avenue, Knoxville, Tenn.

Electric St. Louis Wireless Club—2008 Allen Avenue, St. Louis, Mo.

Electro and Mechanical Association of Columbus, Ohio—512 West State Street, Columbus, Ohio.

Everett Wireless Association—2716 Grand Avenue, Everett, Wash.

Ever Ready Wireless Club—167 East 71st Street, New York, N. Y.

Experimental Club of Cincinnati—523 Torrence Road, East, Walnut Hills, Cincinnati, Ohio.

Fargo Wireless Association—518 Ninth Street, Fargo, N. D.

Flushing Wireless Association—24 Madison Avenue, Flushing, N. Y.

Franklin Wireless Telegraph and Telephone Association—Bronx, N. Y.

Frontier Wireless Club—1034 Elmwood Avenue, Buffalo, N. Y.

Fruitvale Wireless Club—2510 Fruitvale Avenue, Chicago, Ill.

Geneva Amateur Wireless Association—Geneva, Ill.

The Germantown Wireless Club—5801 Germantown Avenue, Germantown, Pa.

Glenville M. E. Wireless Club—12620 Woodside Avenue, Cleveland, Ohio.

Gramercy Wireless Club—207 East 25th Street, New York, N. Y.

Granby High School Electricity Club, Granby, Mass.

Greater Boston Wireless Association—41 Lawrence Street, Wakefield, Mass.

Guilford County (N. C.) Wireless Association—Greensboro, N. C.

Hamilton Wireless Association—405 Franklin Street, Hamilton, Ohio.

Hamlin Wireless Association—2729 Noble Avenue, Chicago, Ill.

Hannibal Amateur Wireless Club—1306 Hill Street, Hannibal, Mo.

Haverhill Wireless Association—Haverhill, Mass.

Harriman Wireless Association—801 Clinton Street, Harriman, Tenn.

Hartford Wireless Association—320 Wethersfield Avenue, Hartford, Conn.

Huron Wireless Telegraph Association—Huron, S. D.

Independence Wireless Association—214 South 6th Street, Independence, Kas.

Irving Park Wireless Club—4008 Byron Street, Chicago, Ill.

Italian-American Wireless Experimental Club—146 Bleecker Street, New York, N. Y.

Inter-Mountain Wireless Association—219 5th Street, Salt Lake City, Utah.

Kappa Sigma Phi Wireless Corps—523 Torrence Road, E. Walnut Hills, Cincinnati, Ohio.

Kentucky Radio Association—1214 Jackson Street, Cincinnati, Ohio.

Killington Radio Club—36 Lincoln Avenue, Rutland, Vt.

Lane Radio Association—2147 Lincoln Place, Chicago, Ill.

Lexington Electrical and Wireless Club—517 Throop Avenue, Brooklyn, N. Y.

Long Beach Radio Research Club—Long Beach, Cal.

Madisonville Wireless Club—5609 Tompkins Avenue, Madisonville, Ohio.
Manchester Radio Club—759 Pine Street, Manchester, N. H.
Massachusetts Wireless Association—245 Commonwealth Avenue, Boston, Mass.
Metropolis Wireless Association—181 West 63d Street, New York, N. Y.
Metropolitan Wireless Association—181 West 63d Street, New York, N. Y.
Mowa Wireless Club—331 Pacific Street, Brooklyn, N. Y.
Multnomah Wireless Club—1021 Mississippi Avenue, Portland, Ore.
Murray Hill Wireless Association—334 East 34th Street, New York City.
New England Wireless Association, Inc.—125 Milk Street, Room 99, Boston, Mass.
New Haven Wireless Association—27 Vernon Street, New Haven, Conn.
Northern New Jersey Relay Club—102 High Street, Passaic, N. J.
North Jersey Wireless Association—Hawthorne, N. J.
North Shore Wireless Association—1700 Nelson Street, Chicago, Ill.
Oklahoma State Wireless Association—Box 627, Tahlequah, Okla.
Oakland Wireless Club—916 Chester Street, Oakland, Cal.
Oregon State Wireless Association—Lents, Oregon.
Pacific Radio Communicating Association—1109 Washington Street, Vancouver, Wash.
Pacific States Wireless Association—288 Wilcox Avenue, Los Angeles, Cal.
Pacific Wireless Club of Oregon—405 East Market Street, Portland, Ore.
Pittsburg Wireless Association—6031 Kirkwood Street, Pittsburg, Pa.
Plaza Wireless Club—156 East 66th Street, New York, N. Y.
Power City Wireless Association—Niagara Falls, N. Y.
Progressive Wireless Club—Poplar Bluff, Missouri.
Progressive Wireless Club—Seattle, Wash.
Radio Club of Baltimore—904 N. Fulton Avenue, Baltimore, Md.
Radio Intercommunication Club—25 Terrence Street, Springfield, Mass.
Ranger Nautical Signal and Wireless Club—Nautical Training School, State House, Boston, Mass.
Richmond. Radio Association—320 South 8th Street, Richmond, Ind.
Rochester Wireless Association—Rochester, N. Y.
Rockland County Radio Wireless Association—54 Catherine Street, Nyack, N. Y.
Roslindale Wireless Association—962 South Street, Roslindale, Mass.
Sacramento Wireless Signal Club—2119 H Street, Sacramento, Cal.
St. Paul Wireless Club—1911 Ashland Ave., St. Paul, Minn.
Santa Cruz Wireless Association—184 Walnut Avenue, Santa Cruz, Cal.
Southern Wireless Association—1435 Henry Clay Avenue, New Orleans, La.
Springfield Wireless Association—323 King Street, Springfield, Mass.
Spring Hill Amateur Wireless Association—2 Benton Road, Somerville, Mass.
Stoneham Radio Association—33 Warren Street, Stoneham, Mass.
Suburban Radio Club—5504 Wisconsin Avenue, Washington, D. C.
Sullivan Amateur Radio Association—R. R. 1, Sullivan, Ind.
Technical Wireless Association—1206 East Capitol Street, Washington, D. C.
Texas Wireless Association—1212 Prairie Avenue, Houston, Texas.
The Radio Relay Club of the Eastern Coast—Oyster Bay, N. Y.
Toledo Wireless Club—1024 Erie Street, Toledo, Ohio.
Tri-County Wireless Association—Greenfield, Ohio.
Tri-State Wireless Association—Room 101, Falls Bldg., Memphis, Tenn.
United Wireless Relay Club—102 High Street, Passaic, N. J.
Waterbury Wireless Association—26 Linden Street, Waterbury, Conn.
Waynesburg College Wireless Club—Waynesburg College, Pa.
Welcome Wireless Association—185 Chauncey Street, Brooklyn, N. Y.
Westchester Wireless Association—37 West Main Street, Tarrytown, N. Y.
Western Division High School Wireless Association—Milwaukee, Wis.
Wildwood Wireless Association—110 East Pine Avenue, Wildwood, N. J.
Wireless and Electrical Association—Lindsborg, Kans.
Wireless Association of Atlantic City—Atlantic City, N J.
Wireless Association of Buffalo, N. Y.—142 Dorchester Place, Buffalo, N. Y.
Wireless Association of Canada—189 Harvard Avenue, Notre Dame de Grace, Montreal, Quebec, Canada.
Wireless Association of Central California—860 Callish Street, Fresno, Cal.
Wireless Association of Central Pennsylvania—409 Kelker Street, Harrisburg, Pa.
Wireless Association of Easton, Pa.—123 North Main Street, Phillipsburg, N. J.
Wireless Association of Greater Fort Smith—Greater Fort Smith, Ark.
Wireless Association of Illinois—303 North 8th Street, Marshall, Ill.
Wireless Association of Keene—172 Elm Street, Keene, N. H.
Wireless Association of Milwaukee—824 Nineteenth Avenue, Milwaukee, Wis.
Wireless Association of Montana—309 South Ohio Street, Butte, Mont.
Wireless Association of New Orleans—2022 State Street, New Orleans, La.
Wireless Association of Pennsylvania—Odd Fellows' Temple, Philadelphia, Pa.
Wireless Association of Savannah—303 Price Street, Savannah, Ga.
Wireless Association of Southern California—935 Denver Avenue, Los Angeles, Cal.
Wireless Association of Woodbury—28 Penn Street, Woodbury, N. J.
Wireless Club of Newtonville—47 Gibson Road, Newtonville, Mass.
Wireless Society of Springfield—P. O. Box 562, Springfield, Mass.
Wireless Telegraph & Telephone Association of U. S.—Boys' Club, 161 Avenue A, New York, N. Y.
Young Edison Society—Rogers, Ark.
Young Experimenters' Society—Box 251, Coaticook, P. Q., Canada.
Young Marconis' Wireless Association—1024 Erie Street, Youngstown, Ohio.
Y. M. C. A. Wireless Club—211 West Fourth Street, Williamsport, Pa.
Zanesville Wireless Association—105 South Seventh Avenue, Zanesville, Ohio.

FLYING SPARKS

GAS AND ELECTRICITY

Mrs. McCarty—"Say doctor, when I comb my hair it sparkles and crackles. Is that caused by electricity in the hair?"

Doctor—"No, that's caused from gas on your stomach!"

SOME TRAP

A few days ago, a woman came rushing into a grocery store, and demanded of the first clerk who greeted her:

"Please, give me a mouse trap, I want to catch a car."

SUBTRACTION

The teacher was hearing the youthful class in mathematics.

"No," she said, "in order to subtract, things have to be in the same denomination. For instance, we couldn't take three pears from four peaches, nor eight horses from ten cats. Do you understand?"

There was assent from the majority of pupils. One little boy in the rear raised a timid hand.

"Well, Bobby, what is it?" asked the teacher.

"Please, teacher," said Bobby, "couldn't you take three quarts of milk from two cows?"—*New York Evening Post.*

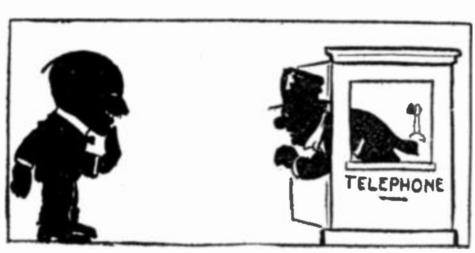
A CHANGED MAN

"Are you the same man who ate my mince pie last week?"

"No, mum. I'll never be th' same man again!"—*New York Mail.*

GOING UP!

A belated guest found his way into the Arcade Hotel, Watertown, N. Y., one night and following a series of maneuvers entered a telephone booth. After looking out several times inquiringly he hailed the night clerk and said: "Shay, I wanna go to m' room. When in thunder y' goin' t' run thish elevator up?"—*New York Telephone Review.*



The Wireless Station and Laboratory Contest is continued from month to month. The best photograph, each month is awarded a First Prize of Three (3) Dollars; second best, Two (2) Dollars; third best, One (1) Dollar. If you have a good photograph of your station or laboratory, send it in. If you haven't one, take one, or have it taken.

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

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

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

FIRST PRIZE

The illustration shows my wireless telegraph station.

For sending I have a 1-kilowatt transformer, a 1-kilowatt condenser and a helix, besides a rotary spark gap. The motor of the rotary makes 3,000 rpm., which gives me a very musical and clear note.

GEO. S. MASON'S STATION
FREDONIA, NEW YORK

For receiving I have 3,000-ohm Murdock phones, a 3,000-meter loose coupler, a variable condenser, a fixed condenser, and a two-in-one detector, in which I use silicon and galena.

For the aerial system I use an 88-foot mast, which I put up for this purpose, and an aerial-ground switch in a box outside of my window. The aerial proper is 200 feet long, 88 feet high at one end, and 50 feet at the other.

My station is located in my room. Half of the instruments I have made myself, following the instructions as given in your magazine from time to time.—*Geo. S. Mason, Fredonia, N. Y.*

SECOND PRIZE

You will find herewith a flashlight photo of my radio outfit, which I wish to enter in your contest.

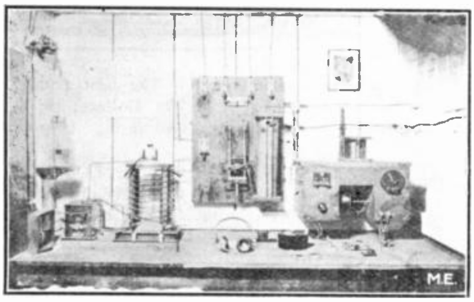
I have had unusually good success with this outfit of late, being able to hear Sayville, Long Island (W. S. L.), Key West, Florida (N. A. R.), and numerous stations along the Atlantic Coast.

Nearly any time I go into my station I can pick up Ft. Riley and Ft. Leavenworth, a distance of about 200 miles.

The transmitting set will be seen at the left of the photo and consists of the following instruments:

½-kilowatt transformer coil, large helix with E. I. Co. spark gap on top, heavy glass plate condenser of my own construction, own make electrolytic interrupter, and heavy wireless key with silver contacts which in turn operates the magnetic key seen at the upper left-hand corner of the photograph.

My receiving instruments are mostly inclosed in the case seen at the right of

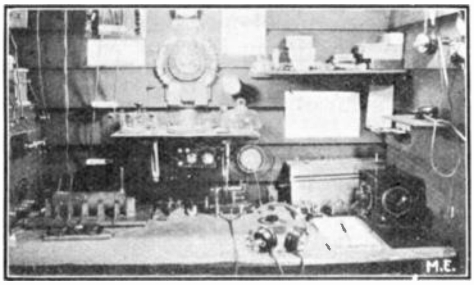


PAUL R. BREES' STATION
WICHITA, KANSAS

the photo; they are: receiving transformer of my own design, with primary taps on the front of the case, McCreary-Moore variable condenser, galena, perikon, silicon and ferron detectors, and Brandes 2,000-ohm receivers. I have tested out nearly every mineral detector known and found that galena is by far the most sensitive. There is not much doing here in wireless in the summer because of the hot dry climate, which produces so much static. I am a subscriber to *Modern Electrics* and consider it the best wireless magazine published.—*Paul R. Brees, Wichita, Kan.*

THIRD PRIZE

Herewith is a photograph of my radio station, taken by myself.



CHAS. E. EVERARD'S STATION
PASADENA, CALIFORNIA

I started to build this station in December last. I secured all back numbers of *Modern Electrics* I could buy or borrow and with the help of these and good tools I made most of the instruments shown.

The antenna is of the inverted L type, consisting of 6 wires, each composed of 7 strands of No. 18 aluminum, 150 feet long, 75 feet high, with 16-foot spreaders.

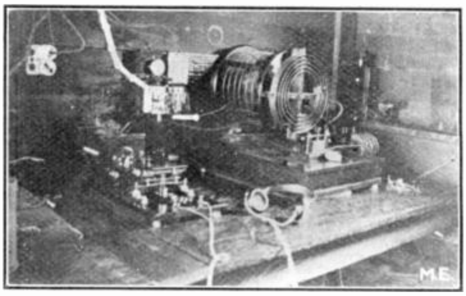
My sending set comprises a ½-kilowatt transformer, plate condenser with switches, water rheostat, silver contact key, roller switch for disconnecting receiving and sending, 100 ampere S. P. D. T. ground and aerial switch, helix with pilot lamp, anchor gap, 3 spark gaps and a rotary in the process of making.

Receiving set consists of a 12 x 3 double slide tuning coil, navy type loose coupler, fixed condenser, large capacity variable condenser, 3 pairs of Murdock phones, complete buzzer test and an assortment of detectors, of which I find galena the best.

I also have a complete sounder and buzzer telegraph line working with a friend down the street; have also a lot of apparatus, etc., for experimental work.—*Chas. E. Everard, Pasadena, Cal.*

HONORABLE MENTION

The accompanying picture is of my wireless telegraph apparatus. Taking the apparatus in order from left to right



ALEX. POLSON'S STATION
WINNIPEG, MANITOBA, CANADA

we see on the extreme left the receiving outfit. This consists of a loose coupled tuner, variable condenser (not shown in picture), double detector stand, hard rubber base switches and push button and binding posts for telephone receiver connections. All this apparatus is mounted on a polished

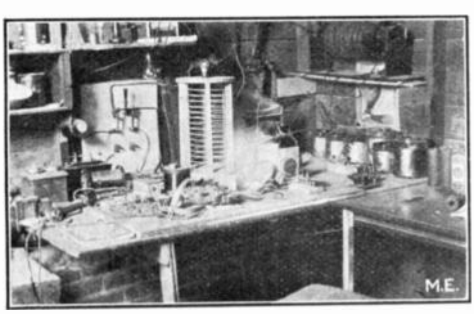
hardwood base, 9-in. x 16-in. For a buzzer test I use a relay connected in such a manner as to make the armature buzz. Thus there is very little external noise from the test. I use 2,000 ohm Brandes phones in connection with this set.

To the right of the telephone receivers is the large sending condenser box upon which the series spark gap is mounted. The oscillation transformer is mounted on the wall just back of the spark gap. At the extreme right of the picture is shown the key and the sending transformer, which is a home-made ¼-kw. close core transformer. The aerial switch and fuse block are mounted on the wall as shown. All the apparatus is mounted on an oak base, 2 ft. x 3 ft. x 1 in., thus making a very compact outfit. Connections are made on the sending side with copper strip.

At present I am using a two-wire aerial, composed of No. 14 copper wire, spaced six feet apart. I have had good success in every way with this set, a great deal of which I consider due to the knowledge gained from your valuable magazine, which I have read constantly for three years.—*Alex. Polson, Winnipeg, Ontario, Canada.*

HONORABLE MENTION

Inclosed herewith is a picture of our wireless station. We have two sending and receiving sets, one for long distances and one for short. Our long



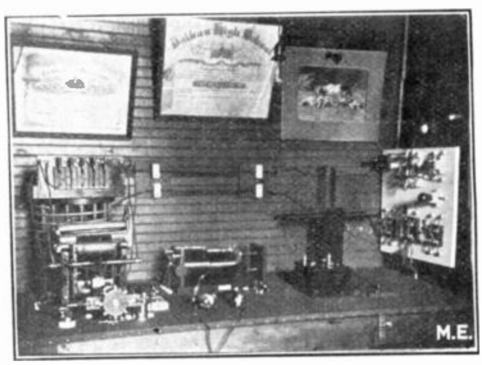
R. H. CASEY, JR.'S, AND JACK WILLIAMS' STATION
CLEBURNE, TEXAS

distance outfit consists of a ¾-kw. transformer, six Leyden jars, a 20-inch Tesla transformer, helix, suitable spark gap and wireless key, a pair of Brandes 3,200-ohm headphones, pancake tuner, Blitzen variable condenser, three fixed condensers, ferron, galena, iron pyrites, electrolytic and peroxide of lead detectors, and a potentiometer. Our short distance outfit consists of a key, 2-inch coil, gap, rheostat, foot switch, E. I. Co. 3,000 ohm headphones, galena detector, fixed condenser and a tuning coil.—*R. H. Casey, Jr., and Jack Williams, Cleburne, Texas.*

HONORABLE MENTION

In construction and connection of apparatus, simplicity is featured at all hazard; especially is this true in regard to the transmitting set, where short, direct connections are made between all instruments carrying high frequency current.

On the transmitting side we employ a 1-kw. closed core transformer, 8



LAWRENCE E. HUGHES' STATION
BIRMINGHAM, ALABAMA

point zinc electrode rotary, helix wound with 10 turns of No. 2 aluminum, oscillator with primary and secondary composing of 16 turns of copper ribbon, and condenser comprising 30 brass plates with glass dielectric (8 x 10) built in five sections and immersed in oil. In this connection, it might be of interest to amateurs who make their own high tension condensers, that oil is the only insulation that successfully holds down the voltage 20,000, in use with this condenser. Although sectionally blocked in paraffine, an even score of plates were broken when placed in circuit.

For receiving we use a loose coupled tuner, tubular fixed condenser, brass plate rotary variable condenser, Ferron detector, and Navy type phones. Lead-in insulator consists of ¾- and

½-in. porcelain tubes telescoped with paraffine filling; while the antenna is of the 4-wire loop type, 80 feet in length, 65 and 40 feet in height. We have two separate grounds, one of No. 4 cable, the other No. 12 B. & S. That Birmingham has its full share of enthusiastic amateurs is evidenced by listening in any fair evening; and moreover they all pride themselves on keeping within the law.—*Lawrence E. Hughes, Birmingham, Ala.*

HONORABLE MENTION

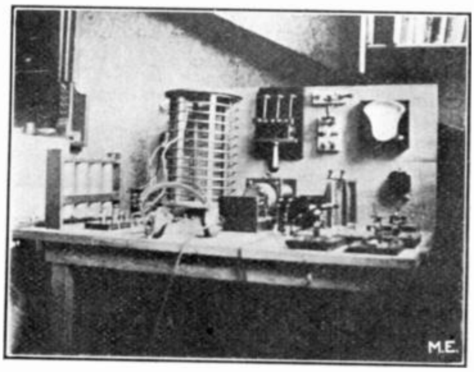
The accompanying photograph shows the results of my experience in experimenting with wireless telegraphy up to the present time.

My station consists of practically all home-made instruments, constructed by myself, aided by *Modern Electrics*.

The receiving end of my set consists of the following, starting from the antenna switch, loading coil, receiving transformer, variable and fixed condenser, galena and silicon detectors, and a pair of 1,000-ohm phones.

The transmitting set consists of a 1-inch spark coil, helix, variable condenser, consisting of large glass test tubes, spark gap and key.

I have a hot wire ammeter, mounted



DAVID HUNDERMARK'S STATION
PATERSON, NEW JERSEY

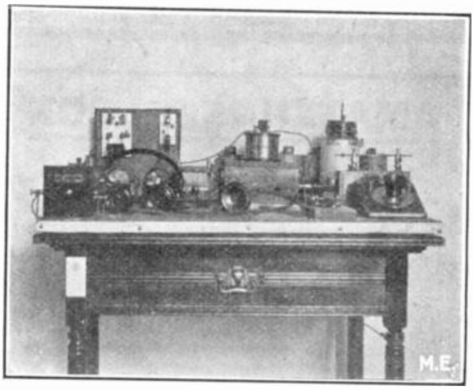
in an old volt-ammeter case, which I use for testing my transmitting set.

With this set I have picked up Key West, Fla., N A R, and on up the coast as far as Sable Island, Nova Scotia, M S D, and have done local work with the transmitting set.

My call is D H and I should be glad to meet or hear from any fellow amateur in this vicinity as I am on almost every night.—*David Hundermark, Paterson, N. J.*

HONORABLE MENTION

The accompanying illustration shows my wireless telegraph station. The sending apparatus consists of a 1-inch spark coil, spark gap, key, batteries, helix and a large Leyden jar, of my own manufacture. The helix is not



LEWIS C. NOBLE'S STATION
WINTHROP, MASSACHUSETTS

shown in the illustration, the apparatus not being in circuit when the picture was taken. My sending range is about 10 miles.

The receiving apparatus is my main hobby, and so I have tried to make it as attractive and efficient as possible, and get very good results with it, receiving all the way up to 1,000 miles.

The receiving apparatus consists of a large two-slide tunning coil, which I use also as a loading coil for my transformer, shown in the background. I have two detectors, 1 Silicon and 1 Ferron, both of my own make, which give very satisfactory results. The detectors do not show very clearly in the photograph. I also have two variables and one fixed condenser; one of the variable condensers is of the rotary type, the other the slide plate type, having 25 plates in all.

My receivers are 3,000 ohms and very sensitive. I have a buzzer test and a wireless telephone, in addition to the main apparatus. My aerial is 100 feet long, 50 feet high at each end, and consists of 4 wires, 2 feet apart.—*Lewis C. Noble, Winthrop, Mass.*

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

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

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

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

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

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

WE CANNOT ANSWER QUESTIONS REGARDING SENDING AND RECEIVING RANGES.

PORTABLE SETS

(2438) J. Vreeland, New Jersey, requests:

Q. 1. Some hints about portable radio stations, their efficiency as compared with the stationary sets, the manner of getting a ground connection, the loss of efficiency caused by bunching the instruments, etc.

A. 1. The efficiency of a portable set can be made nearly as great as that of a stationary one by taking proper care with the aerial and ground. The above are the principal sources of dissipation of energy. The aerial, of course, must be well insulated and should be as high and (for receiving) as long as possible. The ground presents the greatest difficulties. The capacity type of ground has generally been given preference in portable sets. This may well consist of pieces of insulated wire laid on the ground with the station as a center, the wires diverging outward. The instruments may be the same as the regular stationary type, made very substantially. The bunching of the instruments has anything but an injurious effect on the working of the set. Very short connections are always to be preferred in both the sending and receiving sets.

Q. 2. An explanation of the use of the condenser in radio sets.

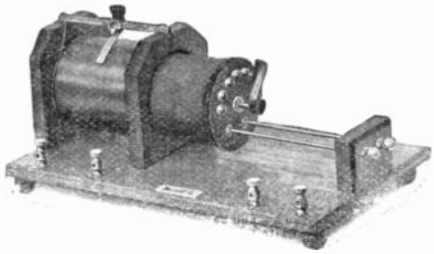
A. 2. For a complete explanation of the function of a condenser we must refer you to any good book on wireless telegraphy. This would take up too much space. Air is the best dielectric to use as the hysteresis, or energy expended in changing the polarity of the charge on the plates of the condenser, is then a minimum. Transformer oil or castor oil comes next in the line of preference.

Q. 3. Why is the capacity of the Electro-Importing Co. glass plate condenser less than that of the Gernsback variable condenser?

A. 3. The capacity of a condenser is proportional to the area of dielectric covered by the conductor and inversely proportional to the thickness of the dielectric. Thus, if, as in the glass plate, the dielectric is, say, one-sixteenth of an inch thick, the capacity will be small in comparison with that of the Gernsback condenser, in which the dielectric is only about one-thousandth of an inch thick.

YOUR OPPORTUNITY

$7.50 Loose Coupler — Special Price, $1.93



We have received so many requests for parts for our well-known loose coupler, we have decided to offer during the month of *August only*, a complete set of parts ready for assembling at a cost which you would pay for the raw material alone if purchased anywhere else. All wood parts are of heavy oak handsomely finished. We furnish enameled wire for primary winding, silk covered for secondary.

This coupler when assembled sells by most houses at $7.50 to $8.00 and is a beautiful and efficient instrument. This is your opportunity to save nearly $6.00 and secure an up-to-date well-made instrument.

Order your loose coupler to-day.

All the parts packed weigh about 3 lbs., if you desire sent by parcels post add from 11c. to 36c., according to the zone you live in. Act now before it's too late.

We have the following coils taken in lieu of a debt which we offer you while they last:

Eighteen—1½ inch wireless coils	at $4.38,	sold regularly at	$ 7.50.
Seven —2 " " "	at 6.42,	" " "	10.00.
Four —3 " " "	at 13.15,	" " "	18.00.

(Sent by express collect.)

You will never get another opportunity like this again. If you need a coil send for it at once. Also send for bulletin M, it is FREE.

SPECIAL ORDER BLANK

HUNT & McCREE, Date..............................

92-94 *Murray St., New York.*

Gentlemen:—Enclosed find money order / cash / check *for*..................*for which kindly send me the following as per special offer in August Modern Electrics.*

Name...

R. F. D. *Address* ....

RECEIVING TRANSFORMER

(2439) Edward B. Wood, New York, asks:

Q. 1. Kindly publish data for a rotary receiving transformer.

A. 1. You will find all necessary data for the construction of such a transformer in the June issue of this magazine in an article in the Experimental Dept.

Q. 2. Can crystal detectors, such as the perikon, silicon, etc., be used for a receiving set for wireless telephony?

A. 2. Yes, but the Audion is better.

LICENSE

(2440) C. W. Cushing, North Dakota, inquires:

Q. 1. How to calculate the output in watts and kilowatts of a coil from the voltage and amperage supplied?

A. 1. The product of the volts and amperes supplied to the coil (this must be measured at the primary terminals and is not always equal to the line voltage) will be the input in volt-amperes. To convert this to kilovolt-amperes, divide by 1000. This is the input and if a closed core transformer is used and the efficiency known the output can be calculated by multiplying the watts input by the efficiency, which will always be a fraction of one. If the efficiency is not known, there is no simple way to calculate the output.

Q. 2. I have a four-inch coil, what is the output in watts and kilowatts?

A. 2. See answer to first question.

Q. 3. There is no commercial station within five miles of me and I am in about the center of the State. Do I need a license?

A. 3. If you do not interfere with any station which receives from another State you will not require a license. You had better write to the Radio Inspector of your district and ask him about this.

WAVE LENGTH AND PILOT LAMP

(2441) Wm. L. Knoepke, New York, asks:

Q. 1. How can I construct a pilot lamp for my helix and what voltage should the lamp be?

A. 1. See answer to query No. 2393 in the June, 1913, issue. The pilot lamp

may also be connected to a single turn or two or more turns wound inside of the helix. It is not advisable to keep the lamp on all the time, as this takes energy from the circuit. The proper voltage for the lamp depends on the set. This must be determined by experiment.

Q. 2. Please tell me the wave length of the following aerials, etc.

A. 2. See answer to query No. 2419 in the July number.

GROUNDS

(2442) Fearing Pratt, Massachusetts, asks:

Q. 1. Would a small pond be all right for a ground? The pond dries up in summer, but the ground remains thoroughly moist.

A. 1. This would make a good ground if you provide a large piece of sheet copper or some other metal to make contact with the earth.

Q. 2. Compare the results to be obtained from this ground with that from a water pipe (city mains).

A. 2. Probably the mains would give better results, but if you use a large sheet to make contact with the ground and bury it pretty deeply you can obtain good results from this ground.

Q. 3. Don't you think the ground wire should be insulated so that the current sent out will not leak into a poor ground?

A. 3. You forget that electricity always takes the easiest path. If you use a large ground wire, you will have no difficulty in confining the current to the proper ground.

BUZZER SET

(2443) D. H. Coxshall, Wisconsin, inquires:

Q. 1. Does the Radio High frequency buzzer described in the March issue comply with the wireless law?

A. 1. This buzzer sends out a very sharp wave and if the wave is below two hundred meters it will comply with the law.

Q. 2. If I get an arc in my spark gap instead of a snappy sounding spark, what would be the trouble and how could I remedy it?

A. 2. If the spark arcs there is probably not enough condenser. The remedy, of course, would be to put more condenser on.

WAVE LENGTH AND LEADS

(2444) H. N. Swain, Ohio, requests:

Q. 1. What is the best material for connecting up the transmitting set?

A. 1. Stranded copper wire or copper ribbon are best for connecting the set. The leads should be very heavy, and very short,—the heavier and shorter the better.

Q. 2. How many feet and what size iron wire should be used for an anti-flickering device on a transformer?

A. 2. If you refer to a reactance coil, do not use iron wire, as the object is not resistance, but impedance in the circuit. Use copper wire, either the same or preferably two sizes larger than the wire on the primary of the transformer.

Q. 3. What is the wave length of my aerial, etc.?

A. 3. See answer to query No. 2419 in the July issue.

AERIAL

(2445) M. Winglemire, Michigan, asks:

Q. 1. Would it pay to change my aerial from the back to the front of our store if by so doing the length would be increased from 120 to 250 feet, also to use stranded copper wire?

A. 1. This aerial would be too large to send on without using a series condenser, but for receiving it would certainly pay to make the change.

ANTENNAE AND PERIKON CRYSTALS

(2446) A. S. Boritilier, Massachusetts, wishes:

Q. 1. Diagram of an antenna showing where the No. 4 wire starts.

A. 1. It starts at the ground clip of the lightning switch.

Q. 2. Is there any way of renewing the sensitiveness of perikon crystals?

A. 2. Washing them in carbon disulphide will renew the sensitiveness to a certain extent.

Q. 3. Can an antenna be built and work properly as the one shown?

A. 3. Yes, but it is not as good as if the horizontal part were on a straight line.

ROTARY GAP WITH A SPARK COIL

(2447) Ray F. Yates, New York, inquires:

Q. 1. In the January issue I noticed an article on the use of the rotary gap with a spark coil. Would the results be the same if the current were to be interrupted instead of reversed?

A. 1. While the results would not be quite as satisfactory as with the reversing method, the rotary gap could be run with an interrupter in this way.

Q. 2. Is there any other method of using the rotary gap with a spark coil?

A. 2. No. None that is satisfactory.

Q. 3. Would the series gap described in the January issue give a pure wave?

A. 3. No.

INDUCTION

(2448) Rev. H. E. Bright, Ohio, writes:

Q. 1. Will I be bothered by induction from the electric light wires if I put my aerial at right angles to them?

A. 1. No, we do not believe that you will be bothered by it.

Q. 2. Where can I get bamboo spreaders?

A. 2. We must refer you to our advertising columns for this article.

Q. 3. What and where are the nearest commercial stations?

A. 3. The nearest stations are at Cleveland, Buffalo, Chicago, Toledo, Ashtabula and numerous places on the Great Lakes.

MECHANICAL CONVERTER

(2449) W. A. Irvin, Missouri, asks:

Q. 1. Can the rotary gap and mechanical converter be used on 110 volts A. C.?

A. 1. If you have A. C. there is no use in using a converter even if it could be used. The reason for using the converter is that when a vibrator is used, the interruptions are irregular and the secondary voltage is consequently irregular. The rotary spark gap can be used with a spark coil run on A. C. without any converter. Proper precautions should be taken, however, to limit the current taken by the primary from the A. C.

Q. 2. Do the teeth of one side of the converter have to be any certain dis-

tance from the teeth of the other side?

A. 2. No, so long as the teeth are evenly spaced.

WIRELESS LAW

(2450) Arthur Johnson, Missouri, writes:

Q. 1. Some time ago I was told that a new law had been passed (in Missouri, I think) that amateurs could not send more than one-half mile because it interfered with commercial work. Is this so?

A. 1. We have never heard of any such law and should think that you, being a Missourian, would not believe anything until you saw a copy of it.

Q. 2. In using the electric current with a transformer, reducing it to two volts, is there any danger of getting a bad shock from your spark gap?

A. 2. We do not understand your question. Where are you using a spark gap in connection with a step down transformer? If you mean that you pass the two volts through a spark coil, there is some danger of getting a shock, the severity of which depends on the size of the coil.

VERTICAL AERIAL

(2451) Otto Farrill, New York, asks:

Q. 1. Can I receive messages with a vertical aerial running up the side of a building?

A. 1. Yes, a vertical aerial is a very good type for receiving.

Q. 2. To what wave length can I tune using a small E. I. Co. tuner?

A. 2. About 800 or 1000 meters.

FLICKERING LIGHTS

(2452) R. M. Mueller, Canada, inquires:

Q. 1. What to do for flickering lights? His coil draws about 200 watts and the lights flicker dreadfully.

A. 1. The only thing to do in this case is to run a separate line from the meter or from the main distributing panel to the wireless room. This will prevent flickering to a great extent. The wire used for the line should be heavy, about No. 10 B & S.

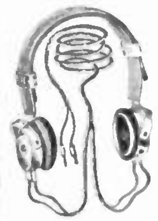
Q. 2. The resistance coil which is always in circuit, heats up very quickly. What can be done to remedy this?

A. 2. The coil might better be re-

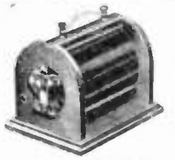
HEADQUARTERS

"Electro" Commercial Detector Stand. ⅞" Italian Marble base and patent Rotary Sliding Cup. The finest Detector money can buy, irrespective of cost. Greatest range for adjustability. Price with felt bottom, $3.75.

Universal Detector Stand with Patent Rotary Detector Cup. The finest low priced detector stand on the market to-day. It does anything and everything an expensive detector stand can accomplish. With this detector is furnished a quantity of soft metal for mounting crystals or minerals Price $1.50.

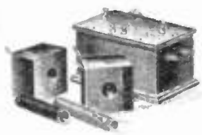


2000 Ohm Telephone head gear. More of these phones have been sold last year than any other make. The magnets are so powerful that their magnetism will lift up the entire telephone receiver. These phones are wound to 2000 ohms with No. 40 Copper wire. German Silver bands with real leather covering. Money back if not entirely satisfied. Set complete $4.50.



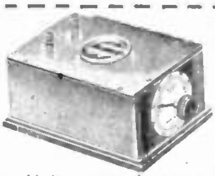
Bull Dog Spark Coils. The acme of perfection in coil building. These coils give hot fat spark and are guaranteed for one year.

½" Coil, $4.00; 1" Coil, $5.25.

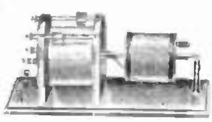


100 Mile ½ K. W. Wireless Coil. Over 12,000 in use to-day. Guaranteed to transmit 100 miles. Price, $8.00.

Electrolytic Detector, the most sensitive Detector so far discovered, bearing none. Cannot get out of adjustment like crystal detectors. Wonderfully sensitive. Price $1.25.



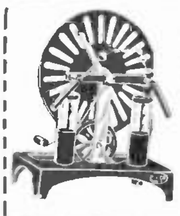
Rotary Variable Condenser. Has the marvelous capacity of .01 M. F. Entirely new principle without any plates to short circuit. At the same time ease of adjustment. You cannot do without one. Price. $4.00.



Loose Coupler; has a wave length of about 800 meters. Will catch most any of the large stations. High grade finish all through. Primary bare wire wound, two sliders. Secondary silk wire wound. Satisfaction guaranteed. Price. $4.00.

Electro Leyden Jar with new Binding Post and metal top. Cannot be damaged. 1 Pt., 75c.; 1½ Pt., $1.00.

Rheostat Regulator; our latest type. Has Rotary adjustment with large hard rubber handle. Looks right, works right, price right. The finest Rheostat on the market to-day. Price $.60.



Static machine gives 2½" to 3" Spark guaranteed. Most marvelous machine for the money. Simply turn the crank, and machine sparks. Price, $4.50.

6V. 60 A. H. Electro Storage Battery to run your spark coil, your lights or for one hundred other purposes. Treated oak case, hard rubber jars, hard rubber vents, heavy plates. Batteries guaranteed for one year. Price. $8.00. The same battery 6V. 40 A. H. $6.25.

FREE!

A beautiful Wireless Code Chart on heavy cardboard will be sent absolutely free to you if you will send us a postal-card giving us the name of the dealer in your town from whom you buy. If you do not buy in your home town give us the name of the company with whom you deal.

The Code Chart containing Morse, Continental and Navy codes will be sent to you IMMEDIATELY. DO IT NOW.

THE ELECTRO IMPORTING CO., 233 Z Fulton St., New York.

THE above goods represent but a few articles from our comprehensive catalogue No. 11. You should possess this wonderful catalogue by all means and learn more about us. We are to-day the largest distributors of experimental and wireless apparatus for the amateur exclusively in the United States. We guarantee prompt shipments and we make good on any complaint which may reach us. In dealing with us you have the experience of an organization almost ten years old WHICH HAS SPECIALIZED ONLY IN EXPERIMENTAL AND WIRELESS MATERIAL. Our goods are honestly built, and it is a surprise to many people how we can turn them out at such a low cost. The answer is large quantities and re-orders of satisfied customers. If you have never bought from us, try us and you will not be disappointed. Do not forget that this Company has built up the Wireless and experimental business in the United States and has done more for the new art than any other concern. Also don't forget that the E. I. Co. has originated more apparatus than any one else and that we control more patents for experimental and wireless material than any of our competitors. By dealing with us you get the benefit of our vast experience, our trained organization and the famous "E. I. Co. Square Deal."

THE ELECTRO IMPORTING CO. — 233 Z Fulton St., New York

PATENTS

No. 842,950. Feb. 5th. 1907. No. 902,069. Oct. 27th. 1908. No. 948,275. Feb. 1st. 1910. No. 951,788. March 8th. 1910. No. 961,855. June 21st. 1910. No. 978,999. Dec. 20th. 1910. No. 988,456. April 4th. 1911. No. 988,767. April 4th. 1911. No. 1,010,138. Jan. 30th. 1912. No. 1,033,095. July 23rd. 1912. No. 1,057,820. April 1st. 1913.

FOLD HERE, TEAR OFF AND MAIL

ELECTRO IMPORTING CO.
233 Fulton St.
New York City.

I enclose herewith 3c. stamp for which please send me your 212-page Electrical Cyclopedia No. 11 at once, containing 450 illustrations and over 1500 electrical articles and valuable information on electrical and WIRELESS subjects, also "Treatise on Wireless Telegraphy."

Name..

Address..

City..

placed by a coil of heavy wire wound on an iron core. The right amount of wire must be determined by experiment.

QUENCHED ARC

(2453) Bernard Wexler, Pennsylvania, writes:

Q. 1. I understand that in order to produce an arc between two electrodes, they must first be brought in contact and then separated a short distance. If this be so, then how does the so-called quenched arc take place if the plates of the gap are not connected and hence are not in contact? The voltage on which the gap operates is entirely too low to send a spark across the gap, no matter how near they are brought together.

A. 1. The voltage on which the gap operates (about 500) is sufficient to start the arc, except in cases where very low power is used. In this case, a drop of water or acid (very dilute) is placed in the center of the separating disk. This suffices to start the arc in every case. The distance between the electrodes in this form of gap is never more than one one-hundredth of an inch.

Q. 2. Will this gap operate on A. C. and will it produce a high pitched note on sixty cycles?

A. 2. This gap will operate on sixty cycles, but we do not think it will produce a high pitched note.

Q. 3. Could I regulate my apparatus to obtain a wave length of two hundred meters with this gap?

A. 3. Yes, provided that other conditions, such as the sending condenser, inductance, and aerial are of the right proportion.

WIRELESS LAW

(2454) Wm. Wheeler, New York, asks:

Q. 1. Are amateurs permitted to use sets containing the Electro-Importing Co.'s instruments?

A. 1. See article, "The Wireless Amateur and the Wireless Law," in the January and February issues. If these instruments can be made to produce a pure, sharply tuned wave of 200 metres or less, they may be used.

TUNING

(2455) George Pittman, Texas, inquires:

Q. 1. In tuning with a loose coupler there are so many different adjustments

to be made, viz., the primary, the secondary, and the variable condenser, I should think that if either of these parts were to be slightly off the tune the signals would not be heard. Also if the operator were to be listening for a certain station and happened to have the detector poorly adjusted, that he would not know whether it was his detector or loose coupler which was "on the fritz." Am I right about this and how is this difficulty overcome in practice?

A. 1. When properly adjusted, the loose coupler is a very selective instrument. In practice, however, it is found that the wave sent from the sending station is usually more or less damped. This, together with the resistance in the receiving circuit, makes the signals tune pretty broadly when the secondary is pushed well into the primary. In tuning with a loose coupler, to get the best results the primary should be adjusted to the wave of the incoming signal and then the secondary is adjusted to the same wave. The variable condenser is used to tune the secondary in smaller steps than is possible with the secondary switch alone and also to give the secondary a greater range of wave length. Therefore, the secondary switch and the variable are identical in their function and the switch is seldom moved until the variable is at the highest or lowest capacity. The secondary may then be drawn partly or wholly out of the primary and the variable condenser readjusted to still further increase the selectivity. It is found in practice that a slight difference in the adjustment of the primary or secondary makes very little difference in the strength of signals. A skilled operator always knows where to find each station on his receiving set, as there is not a great difference in the tune of stations except of the different classes, such as the commercial class and the navy class. In the Marconi multiple and valve tuning sets there is provided a switch to change the connections. Thus, when the operator is waiting for a call from any ship or station, he puts the switch on the "Stand By" side (Untuned), thus enabling him to hear signals with widely varying wave lengths. When he hears a station calling him, he throws the switch over to "Tune" and adjusts his tuner to the wave of the station calling.

LONG VS. SHORT AERIALS, DETECTORS AND ROTARY SPARK GAP

(2456) Lowell P. Hoyt, Maine, asks:

Q. 1. Why is it that a short aerial is not as efficient for receiving as a long one? It seems to me that wire on the tuning coil is just as good as wire on the aerial.

A. 1. Wire wound on a tuning coil is by no means just as good as wire on the aerial for several reasons.

First, it is usually of a much smaller diameter and has therefore a much higher high-frequency resistance. Second, the distributed capacity is much greater. Third, its inductance is higher. These three factors combined produce a much higher impedance, or apparent resistance, which chokes back the high frequency current set up in the aerial and leads to weaker signals. An increase in height increases the voltage generated in the aerial, while an increase in length increases the current induced in the aerial by the incoming waves.

Q. 2. It is advertised that the Audion, electrolytic and peroxide of lead are the most sensitive detectors known. Is not the perikon more sensitive than these?

A. 2. There is a great diversity of opinion in regard to the relative sensitiveness of detectors. The Audion is generally admitted to be the most sensitive detector in common use, but the different Audion bulbs vary greatly in sensitiveness. Perikon is regarded as equal to or slightly better than the electrolytic, and galena as slightly better than the perikon. Each operator has his favorite detector, which he is ready to back against all comers.

Q. 3. Data for a rotary spark gap to be used in connection with a 1 kw. transformer.

A. 3. The plugs should be about three-eighths of an inch in diameter. The number of plugs and the speed of the motor should be such as to give a product of about 800. Thus, if the motor has a speed of forty revolutions per *second*, the plugs should number about twenty. This will produce a very high tone.

INDUCTION MOTOR

(2457) Chas. J. Drake, Kansas, wants:

Q. 1. An explanation of the principle of the induction motor.

A. 1. This is too lengthy to be presented here. You will find it explained in detail in any book on alternating currents. Briefly, it may be said, however, that the alternating currents, when fed into the windings on the stationary part of the motor, set up a revolving field, or in other words a magnetic field the poles of which revolve round and round the field structure or stator. This revolving field, in turn, induces currents in the windings of the rotating part or rotor which react upon the revolving field and cause the rotor to revolve.

Q. 2. The address of a firm making same.

A. 2. We must refer you to our advertising columns for this information.

Q. 3. How many square inches of tinfoil should be used in making a blocking condenser?

A. 3. You have the wrong idea of a blocking condenser. The drawing you enclose is incorrect. The condenser should be connected as shown in diagram given in query No. 2380 in the May, 1913, issue. For dimensions of the condenser, see answer to query No. 2390 in the June, 1913, issue.

OPEN CORE TRANSFORMER

(2458) Guilderoy Smith, New York, asks:

Q. 1. Where can I obtain blue prints of the Navy standard type 1 P 76 receiving set made by the Wireless Specialty Apparatus Co.?

A. 1. We do not think it is possible to obtain blue prints of this set. If the makers won't furnish them, and they probably won't, you can't get them.

Q. 2. In building an open core transformer, is it better to wind the secondary so as to occupy seven inches of the core and be eight inches in diameter or have it occupy twenty inches of the core and be four inches in diameter? The core is 36 inches long and wound with one layer of No. 10 wire.

A. 2. Let the secondary occupy ten inches of the core.

Q. 3. What is the rating of this transformer in watts and volts?

A. 3. This depends altogether on the

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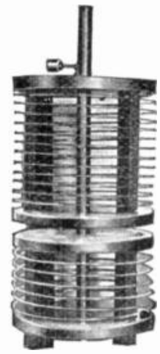

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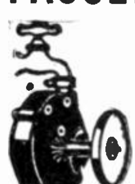

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voltage and frequency of the supply circuit.

APPARATUS EXCHANGE DEPARTMENT

(2459) Jas. Lupton, New York, writes:

Q. 1. Is the Apparatus Exchange Department a fake? I have written to six of the advertisers, enclosing a stamped, addressed envelope, but have never yet received a reply.

A. 1. This department is not a fake. The ads are sent in by the persons whose names they bear and are accepted by us as genuine. We would like to call the attention of our readers to this matter and ask that all persons who enclose an envelope as above stated be answered, even if an exchange has been already effected. It is only common courtesy to answer a note, especially when the writer has enclosed an envelope as above.

Q. 2. What size wire should be used to connect the receiving set? The sending?

A. 2. See answer to query No. 2444 in this issue. The same applies to the receiving set.

HOOK-UP AND FORBIDDEN QUESTIONS

(2460) Walter Meyer, Nebraska, wishes:

Q. 1. A hook up for the following instruments. Sending — one-quarter inch coil, spark gap, helix, condenser and key. Receiving—DPDT switch for change-over silicon detector, one 250 ohm receiver, tuning coil and fixed condenser.

A. 1. For this diagram see answer to query No. 2055 in the July, 1912, issue. The fixed condenser should be placed between the slider and the detector.

Q. 2. How far can I send and receive with this set?

A. 2. See notice at the head of this department concerning questions such as these.

SPARK COIL AND RECEIVING SET

(2461) J. L. Henderson, Virginia, writes:

Q. 1. Have constructed a coil having four and one-half pounds of No. 30

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V. Tuning and Coupling; How Tuning Is Accomplished; The Results of Tuning; The Effects of Coupling; Inductive Helixes; The Loose Coupler; The Hot Wire Ammeter; Directive Wireless Telegraphy; The Braun System; Bellini and Tosi Method.

VI. The Dignity of Wireless Telegraphy; Its Applications and Service; Wireless Telegraphy in Warfare; Wireless in the Army; Wireless in the Navy; The Wireless Telegraph Automobile; Wireless on an Airship; Wireless Telegraphy as an Aid to Press Work; The Wireless Codes; How a Message Is Transmitted and Received; The Breaking in System.

VII. The Ear; How We Hear; Sound; Sound Waves; The Nature of Sound; Speech; The Larynx and Vocal Chords; The Structure of Speech; Manometric Flames.

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X. Remarks; Maxwell's Theory; Hertz's Discovery; Electromagnetic Waves; The Position of Wireless Telegraphy in the World To-Day; The Field for Wireless Telephony; The Status of the "Amateur"; Wireless of the Future; The Transmission of Power by Wireless.

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wire on the secondary. It fails to give more than a hot three-quarter inch spark. If I take off three sections and only use the remaining one, I get the same size spark. What is the trouble?

A. 1. The secondary sections must be connected wrong or the coil is sparking inside the secondary.

Q. 2. What instruments will I need to hear Norfolk and Arlington?

A. 2. To hear Arlington you will need a very large tuning coil, a detector, a fixed condenser and a pair of phones. The same instruments will enable you to hear Norfolk.

Q. 3. There is a hill 800 feet high near me. Would it be possible to put up a long distance station to hear New York and Cape Cod?

A. 3. Yes, but if you increase the length of your aerial to about three hundred feet, you ought to be able to hear these stations at your house. You would need a loose coupler and high resistance phones, also an Audion detector.

AERIAL AND RECEIVING RANGE

(2462) T. S. Dickerson, New Jersey, asks:

Q. 1. When speaking of receiving from a certain distance, from what powered transmitter does this mean?

A. 1. It may mean anything from a 1½ or 2 kw. ship station to government and commercial stations of 20 to 100 kw. One of the reasons for discontinuing the answers was owing to our inability to more than guess the range. The question of range depends a great deal on the ability of the operator.

Q. 2. I am about to change from aluminum to copper aerial wire. Shall I use No. 12 or 14 stranded?

A. 2. Use the No. 12.

Q. 3. Using an aerial twenty-five feet high and 115 feet long, I have been unable to get Washington loud enough to read. What is the trouble?

A. 3. Your aerial is entirely too low to receive any distance. Increase the height and it would be better to increase the length also, and put up a separate aerial for sending, or, better still, use a series condenser.

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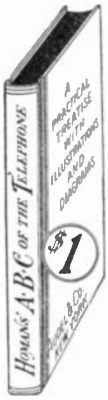

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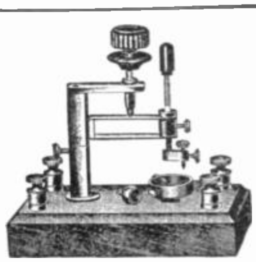

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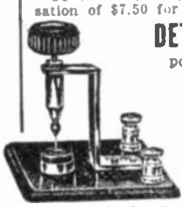

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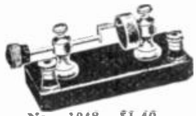

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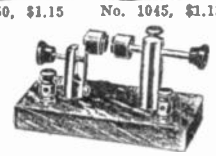

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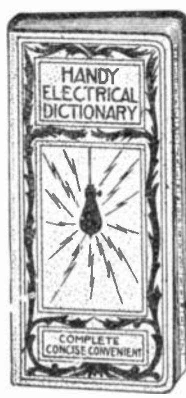

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RECEIVING SET AND AERIAL

(2463) C. O. Williams, Kentucky, writes:

Q. 1. Intend putting up a long distance set. After connecting the six aerial wires together, can I run one small wire down to the receiving set?

A. 1. No. This is done many times but always decreases the range of the set. The wire leading to the receiving set should be as large as the combined aerial wires. Thus, if you run six No. 14 wires on the aerial, the lead should be made up of six No. 14 wires bundled together.

Q. 2. Can I get a sufficient ground connection by running several iron wires 75 feet to the well and then soldering to a piece of sheet iron about six by two feet?

A. 2. You had better use copper wires and make the plate larger.

Q. 3. What instruments should be used in connection with this aerial and what stations would I be likely to hear?

A. 3. With a good loose coupler, rotary variable condenser and galena detector, fixed condenser and a pair of good 2000 ohm phones, you ought to be able to hear the stations at Philadelphia and New York.

HOOK-UP AND WAVE LENGTH

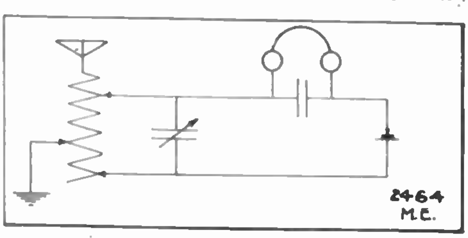
(2464) Oscar Pierson, Wisconsin, inquires:

Q. 1. Are there any high power stations in this State, and if so, what wave length do they use?

A. 1. There are no very high power stations, but there are several commercial stations. They are as follows: Two stations at Milwaukee, one at Manitowoc, Waupaca, and Scandinavia. They operate on about 600 meters.

Q. 2. Please give the best hook up for the following station. It contains one three-slide tuning coil, variable condenser, silicon detector, 2000 ohm phones and three fixed condensers.

A. 2. Find the diagram below. One fixed condenser is all that is necessary.



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First Radio District

June 3, 1913.

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1AC	Chester A. Kennedy, 199 High Street, So. Portland, Me	105
1AD	Edward S. C. Smith, 58 South Street, Biddleford, Me	81
1AE	George E. Sterling, 28 Paine Street Springvale, Me	106
1AF	Winfield C. Hodgkins, 54 Eagle Lake Rd., Bar Harbor, Me	116
1AG	Ray Hutchins, Oak Street, Springvale, Me	126
1AH	Donald G. Ward, 14 Orchard Street, Portland, Me	127
1AI	Olin C. Bronn, Ledgelawn Avenue, Bar Harbor, Me	139
1BA	Harold W. Fitts, 2 Park Street, Barre, Vt	79
1BC	Leon R. Dimick, 27 Cliff Street, St. Johnsbury, Vt	89
1BM	John L. Coppe, 138 So. Main Street, Rutland, Vt	6
1BN	Raymond Shaw, 10 E. Washington Street, Rutland, Vt	7
1BO	Wm. R. Canty. 86 Lincoln Avenue, Rutland, Vt	42
1CM	Henry R. McLane, Union Avenue, Laconia, N. H	4
1CO	Harry Atkins, 57 Pine Street, Franklin, N. H	15
1CR	Reginald F. Howe, 94 School Street, Keene, N. H	10
1CX	George H. Parker, Hudson, N. H	80
1CY	Page H. Haselton, Hudson (Nashua), N. H.. R. F. D. No. 3	46
1GA	Harold C. Snow, 41 Paradise Road, Swampscott, Mass	34
1GB	Henry G. Blount, Hamilton, Mass	38
1GC	Gilbert L. Chadwick, 19 Eleventh Avenue. Haverhill, Mass	43
1GD	Frederic A. Lane, 7 Madison Avenue, Gloucester. Mass	53
1GE	F. L. Wheeler, 23 Mt. Vernon Street, Cliftondale, Mass	59
1GF	F. M. Fowler, 16 Shore Avenue, Salem, Mass	68
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1GI	H. E. Morse, 108 Essex Street, Swampscott, Mass	92
1GJ	Richard M. Daniels, 25 Outlook Road, Swampscott, Mass	103
1GK	Lyman R. Stanley, 52 Burrill Street, Swampscott, Mass	114
1GL	Arthur W. Bush, 80 Tower Hill Street, Lawrence, Mass	118
1GM	J. Wyman Allen, 236 Hale Street, Beverly, Mass	134
1GN	Malcolm H. Smith. 115 Prospect Street, Gloucester, Mass	135
1GO	F. Clifford Estey, 3 Goodell Street, Salem, Mass	136
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1HR	Thomas H. Elliott, Jr., 41 Brington Road, Brookline, Mass	40
1HS	Herbert Shattuck, 1-A Lewis Place, Roxbury. Mass	28
1HT	James H. Anderson, 132 White Street, Waverly (Belmont), Mass	41
1HU	Harry E. Upton, 18 Jackson Avenue, Everett, Mass	2
1HV	James A. Ryan. 43 Linwood Street, Somerville, Mass	48
1HW	W. H. T. Monroe, 38 Beacon Street, Everett, Mass	50
1HX	Elmer A. Leavitt, 41 Forest Avenue, Everett, Mass	51
1HY	Lawrence S. Bennett, 2 Lawrence Street, Everett, Mass	107
1HZ	Harrie E. Duncan, 34 Foster Avenue, Newtonville, Mass	52
1IB	Starr Walker Stanyan. 75 Boston Avenue, Medford, Mass	14
1ID	Francis Kehoe, 41 Walnut Street, Boston, Mass. (Neponsit)	54
1IE	William F. Bennett, Jr., 24 Spring Street, Somerville, Mass	55
1IF	Harland A. Eveleth, 72 Gray Street, Arlington, Mass	20
1IH	Clarence C. Fuller, 50 High Street, Mansfield. Mass	56
1IJ	Andrew J. Fassett, Jr., 27 Walden Street, Cambridge, Mass	49
1IO	Walter Pratt, 28 Summit Street, Rockland, Mass	58

(Continued on page 531.)

Q. 3. What is the approximate wave of the following aerial, etc.?

A. 3. For all questions as to the wave of aerials we refer you to query No. 2419 in the July, 1913, issue.

AUTOMOBILE HORNS

(2465) Leslie Emrick, Ohio, asks:

Q. 1. The numbers of the patents which control the use of the electric automobile horns?

A. 1. We would advise you to write the Patent Office, Washington, and ask them. They may be able to tell you. The usual procedure is to send a patent attorney to the Patent Office and have him look up the records.

RECEIVING TROUBLE AND RECEIVERS

(2466) Jim J. Hayes, writes:

Q. 1. Have not been able to get the station at San Antonio (10 kw.), 156 miles away, nor a 2 kw. station 50 miles away. Aerial is insulated all right. Can get amateurs in town O. K. What is the trouble?

A. 1. It may be that you are tuning wrong. The commercial and government stations use a higher wave length than amateurs. Connect the variable across the secondary, as it may be that you cannot reach the higher waves with the secondary alone. We would also suggest that you take out one of the fixed condensers, as one is all the circuit needs.

Q. 2. Some well-known makers of wireless receivers say No. 40 wire is absolutely unfit for receivers, while others of equal rank use No. 50. Which is preferable?

A. 2. This depends on the resistance it is desired to wind the receivers. It is generally admitted that with a crystal detector a resistance of from 500 to 1500 ohms per receiver is desirable. Of course, it is not the resistance that determines the value; it is the number of ampere turns, viz., the number of turns in a given space. For this reason some firms wind the phones with No. 50, thus getting more turns, but, of course, increasing the resistance, which is undesirable. Others claim that by using larger wire and less resistance, better results are obtained. We have found that if a receiver is well made, the resistance makes very little difference, provided it is 400 ohms or over.

Call Letters	Name and Address	License No.
1IP	Harold Leland, 34 Irving Street, Somerville, Mass.	62
1IQ	Doland Luey, 44 West Street, Worcester, Mass.	68
1IR	Minott W. Lewis, 44 Kidder Avenue West Somerville, Mass.	67
1IS	George Leach, 513 Liberty Street, Rockland, Mass.	69
1IT	Irving T. Barnes, 377 Main Street, Waltham, Mass.	70
1IU	Arthur E. Church, 3 Wellington Terrace, Brookline, Mass.	71
1IV	William E. Snyder, 7 Heath Street, Somerville, Mass.	72
1IW	Phillips B. Wilde, Government Street, Wood's Hole, Mass.	11
1IX	Olof Ohlson, 472 Crafts Street, Newton, Mass.	73
1IY	Horace M. Baxter, 160 Foster Street, Brighton, Mass.	74
1IZ	Robert T. St. James, 38 Avery Lane, Great Barrington, Mass.	75
1JA	Fred A. Dimond, Jr., E. Carver, Mass.	76
1JB	Howland C. Lord, 40 Clyde Street, Newtonville, Mass.	77
1JC	Robert D. Fairbanks, 21 Carver Road, Newton Highlands, Mass.	83
1JD	Lovejoy Collins, 44 Carver Road, Newton Highlands, Mass.	84
1JE	Edward E. Haywood, Jr., 4 Pembroke Street, Newton, Mass.	85
1JF	Albert E. Snow, 30 Cary Avenue, Chelsea, Mass.	86
1JG	Fearing Pratt, 120 Main Street, Hingham, Mass.	87
1JH	Allen Hubbard, 11 Montvale Crescent, Newton Center, Mass.	91
1JI	Milford R. Lawrence, Main Street, Falmouth, Mass.	93
1JK	Alfred A. Franks, 15 Orchard Street, Jamaica Plain, Mass.	94
1JL	Sebastian Gahm, Jr., 113 Sheridan Street, Jamaica Plain, Mass.	95
1JM	Walter G. Cheever, 6 Aldersey Street, Somerville, Mass.	96
1JN	Arthur O. Bruce, 30 York Street, Cambridge, Mass.	97
1JO	William B. Snow, 11 Devon Road, Newton Center, Mass.	98
1JP	Clarence Decker, Cottage Street, Great Barrington, Mass.	99
1JQ	Frank E. Hoffman, 33 High Street, Springfield, Mass.	101
1JR	Edward C. Delano, 64 School Street, Fall River, Mass.	109
1JS	Leonard S. Powers, 431 Plymouth Street, Carver, Mass.	115
1JT	Arthur G. Carlson, 19 Mechanic Street, N. Easton, Mass.	119
1JU	Francis W. Dane, Main Street, Hamilton, Mass.	120
1JV	Henry R. Reuther, 15 Jewett Street, Northampton, Mass.	121
1JW	John J. Long, 32 London Street, Somerville, Mass.	102
1JY	John S. Herland, 48 Brush Hill Road, Mattapan, Mass.	128
1JZ	Kenneth H. Lanvuette, 21 Houstin Avenue, Milton, Mass.	129
1KA	H. E. Stickney, 25 Tufts Avenue, Everett, Mass.	131
1KB	W. T. Richards, 15 Follen Street, Cambridge, Mass.	132
1UC	Isaiah Creaser, 22 Bend Street, Providence, R. I.	137
1UD	Harold P. Donle, 18 Observatory Avenue, Providence, R. I.	66
1UE	George E. Jetts, 161 Summer Street, Central Falls, R. I.	65
1UF	Leonard M. Perkins, 28½ Warren Street, Providence, R. I.	64
1UG	Fred C. Bigelow, Jr., 128 Main Street, Lincoln, R. I.	61
1UH	William R. Handy, Manville P. O., Lincoln, R. I.	17
1UI	William M. Bailey, 57 Brownell Street, Providence, R. I.	135
1UJ	Harry Ahworth, 37 Heath Street, Providence, R. I.	134
1UK	Kenneth A. Tutin, 312 Blackstone Street, Woonsocket, R. I.	90
1UL	Clinton A. Bigelow, 96 Whittier Avenue, Providence, R. I.	100
1UM	Bernard H. Miller, 38 Doyle Avenue, Providence, R. I.	112
1UN	William E. Henry, 162 Prairie Avenue, Pιovidence, R. I.	117
1UO	John B. Doyle, 306 Thurber Avenue, Providence, R. I.	123
1UP	Francis J. Trainor, 6 Munroe Street, Providence, R. I.	113
1UQ	Karl E. Barth, 229 Washington Avenue, Providence, R. I.	111
1UR	James E. Dorthy, 22 Orms Street, Providence, R. I.	110
1US	Don C. Thorndike, 303 Doric Avenue, Cranston, R. I.	108
1UV	Edward M. Monahan, 1033 Eddy Street, Providence, R. I.	45
1UW	Arthur R. Nilson, 11 Colfax Street, Providence, R. I.	44
1UX	Clifton C. Budlong, 73 Fort Avenue, Cranston, R. I.	8
1UY	Corton T. Lippitt, 111 Benevolent Street, Providence, R. I.	47
1UZ	Arthur B. Homer, 270 Blackstone Boulevard, Providence, R. I.	82
1VL	Edward L. Belknop, 91 Vine Street, Hartford, Conn.	37
1VM	William C. McGuire, 76 Madison Street, Hartford, Conn.	57
1VN	Louis Green, 126 Central Avenue, Waterbury, Conn.	122
1WO	Harold Post, 131 Derby Avenue, New Haven, Conn.	38
1WP	Edward H. Cummings, Warwick, R. I.	13
1WQ	Arthur P. Seeley, 55 Pearl Street, New Haven, Conn.	9
1WR	Donald F. Sawtelle, 122 Gilbert Avenue, New Haven, Conn.	22
1WS	Salathiel Buffett, Quarry Avenue, Saybrook, Conn.	23
1WT	John W. Salzberger, West Main Street, Ivoryton, Conn.	25
1WU	Orville Lucas, 172 Washington Street, Wallingford, Conn.	60
1WV	Donald C. Blanke (cancelled), Old Church Road, Greenwich, Conn.	130
1WX	Jerry Sefranek, 28 South Street, South Norwalk, Conn.	5
1WY	Wallace Hoggson, Maber Avenue, Greenwich, Conn.	133

(*Continued on page 533.*)

Q. 3. What is the best way to connect a slanting four-wire aerial? May leads be brought down from the center?

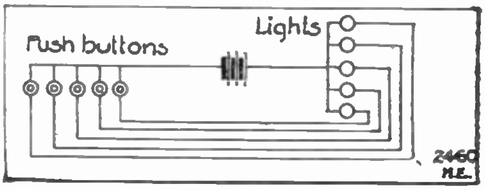
A. 3. Yes, but if there is any certain direction you would like to receive from, if you can arrange your aerial with the low end pointing in that direction and take the lead from this end, the aerial will receive better in this direction than any other.

IT CAN'T BE DONE

(2467) Harold Christner, Arkansas, asks:

Q. 1. Is there any way in which a number of push buttons may be connected in series on one wire and then to a like number of lamps, so that pressing each button consecutively will light the corresponding light?

A. 1. This is impossible. The lighting of a lamp corresponding with a push on a button may be accomplished if you are willing to wire the buttons in the following way. In this way any number of buttons and lamps may be used. You must take care not to have the lamps too far from the buttons or the resistance of the wire will be so great that the lamps will not light properly unless a very high voltage is applied.



DETECTORS

(2468) Henry Kinney, Minnesota, inquires:

Q. 1. Which detectors require battery and which do not?

A. 1. Of the common types: Those needing battery are as follows: Electrolytic, carborundum, peroxide of lead, Audion and all valve detectors. Those not requiring battery: galena, cerusite. The perikon, silicon, antimony and silicon and arsenic and silicon are reputed to work better with a very slight voltage applied.

Q. 2. What other instruments will I need in connection with, etc.:

A. 2. You have all the instruments necessary to a complete wireless set.

Call Letters.	Name and Address	License No.

Fourth District

May 20, 1913.

4AA	Alfred S. Bradberry, 806 College Avenue, Athens, Ga	—
4AB	Arthur Funk, 226 W. Liberty Street, Savannah, Ga	—
4AC	Elmer L. Rice, 1702 E. Duval Street, Jacksonville, Fla	—
4AD	Elmer Steinhauser, 19 W. Gordon Street, Savannah, Ga	—
4AE	J. F. Flagg, 118 Forest Street, Jacksonville, Fla	—
4AF	F. Stringfellow, East Main Street, North, Gainesville, Fla	—
4AG	W. H. Miller, 402 W. Oglethorpe Ave., Savannah, Ga	—
4AH	P. O. Jarvis, New Bern, N. C	—
4AI	W. B. Pope, 197 Dearing Street, Athens, Ga	—
4AJ	W. Moore, 147 Nacoochee Avenue, Athens, Ga	—
4AK	C. T. Whiting, R. F. D. No. 6, Box 1, Gainesville, Fla	—
4AL	P. C. Bangs, 918 E. Duffy Street, Savannah, Ga	—
4AM	L. F. Sebastian, 224 Parker Street, Jacksonville, Fla	—
4AN	George G. Adams, 45 Whitaker Street, Savannah, Ga	—
4AO	T. J. Swearingen, Jr., 403 So. Roper Avenue, Gainesville, Fla	—
4AP	Emmitt E. Peer, 14 W. Duval Street, Jacksonville, Fla	—
4AQ	C. C. Fisher, Mills Y. M. C. A., Columbia, S. C	—
4AR	Ralph E. Marbury, 26 Wesley Street, Newnan, Ga	—
4AS	B. A. Brandon, 23 W. Second Street, Jacksonville, Fla	—
4AT	Frank R. Ehle, 1337 Liberty St., Jacksonville, Fla	—
4AU	W. W. Avera, Watkinsville, Ga	—
4AV	Robert Treisback, 2228 Riverside Ave., Jacksonville, Fla	—
4AW	Joe N. Crevasse, 1605 Boulevard, Jacksonville, Fla	—
4AX	R. J. Cole, 1712 Silver St., Jacksonville, Fla	—
4AY	C. W. Moseley, 815 Mulberry St., Columbia, S. C	—
4AZ	Thos. R. Dunk, 1424 Laura St., Jacksonville, Fla	—
4BA	Claude A. Lewis and Manning White, 47 Bull St., Savannah, Ga	—
4BB	R. G. Rankin, Jr., 6 and 8 N. Front St., Wilmington, N. C	—
4BC	Earl I. Marx, 1654 Main St., Jacksonville, Fla	—
4BD	M. C. Speight, New Bern, N. C	—
4BE	C. A. Fowler, Athens, Ga	—
4BF	R. G. Rankin, Jr., Wrightsville Beach, N. C	—
4BG	A. G. Stanton, 1031 Highway Ave., Jacksonville, Fla	—

NOTE—License numbers for the fourth district could not be obtained.

Fifth District

May 26, 1913.

5AA	Eugene B. Knight, 2501 Battery St., Little Rock, Ark	1201
5AB	Joe Robert Scalco, 1102 8th Ave., Birmingham, Ala	1202
5AC	Gilbert George Budwig, 1404 17th Ave., S., Birmingham, Ala	1203
5AD	Harold E. Rorsebach, 619 N. E St., Muskogee, Okla	1204
5AE	Ralph Jones, 1103 Gibson St., Little Rock, Ark	1205
5AF	Wm. F. Meyer, 2610 Ringo St., Little Rock, Ark	1206
5AG	Stanley Martin, 219 N. K St., Muskogee, Okla	1207
5AH	Ben W. Martin, 438 Spring Hill Ave., Mobile, Ala	1208
5AI	Fred Ratcliff, 220 Penn St., Shawnee, Okla	1209
5AJ	Clarence E. Albertson, 416 Park Ave., Tupelo, Mississippi	1210
5AK	T. J. M. Daley, Covington, Tennessee	1211
5AL	Theophile Reboul, 2106 Charters St., S., Birmingham, Ala	1212
5AM	H. S. Brownell, 1512 Phelan St., S., Birmingham, Ala	1213
5AN	W. O. Watkins, 203 First Ave., Birmingham, Ala	1214
5AO	J. A. Buster, 316 Main St., Breham, Texas	1215
5AP	Vance Thompson, 267 Pasadena Pl., Memphis, Tenn	1216
5AQ	H. R. Goldstein, 1819 Octavia St., New Orleans, La	1217
5AR	Eugene T. Beynon, 604 Artesian, Corpus Christi, Texas	1218
5AS	Royal R. Bastian, 5528 Saratoga St., New Orleans, La	1219
5AT	Alwyn Vickers, 508 Clayton St., Montgomery, Ala	1220

CORRECTIONS

In our July issue:—The address of Charles C. B. Conley (3FZ) should be 709 N. 39th St., Philadelphia, Pa., the address of S. T. Critchlow, (3BE) should be 2632 N. 17th St., Philadelphia, Pa., and the address of C. Laager, (3CF) should be 1216 Belmont Ave., Philadelphia, Pa.

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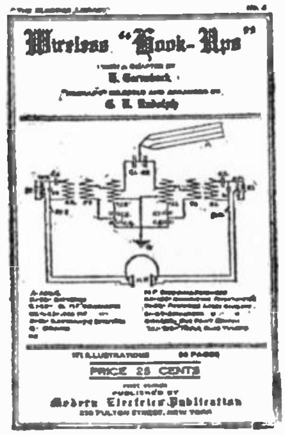

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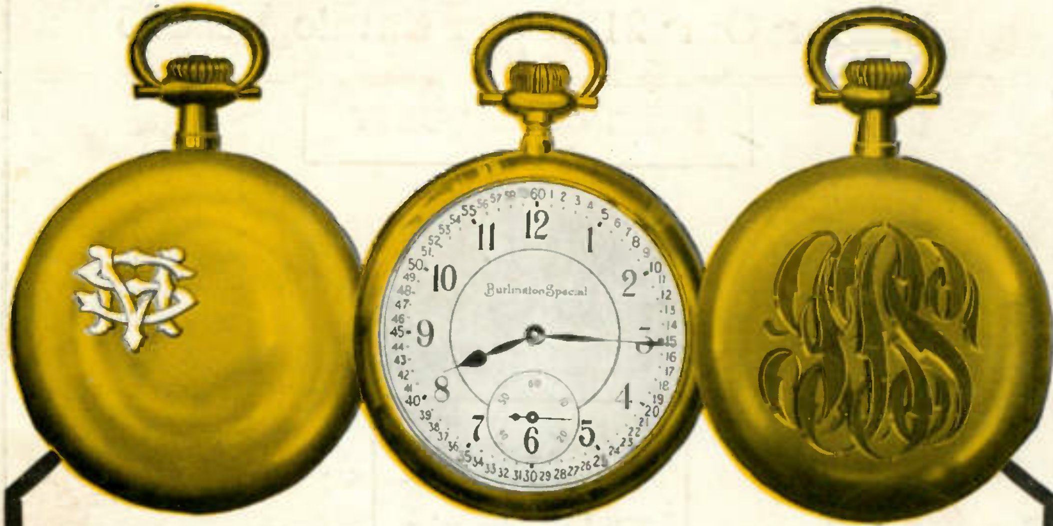

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