THE MARCONIGRAPH

An Illustrated Monthly Magazine of WIRELESS TELEGRAPHY

EDITED BY J. ANDREW WHITE

Volume I. APRIL, 1913 No. 7

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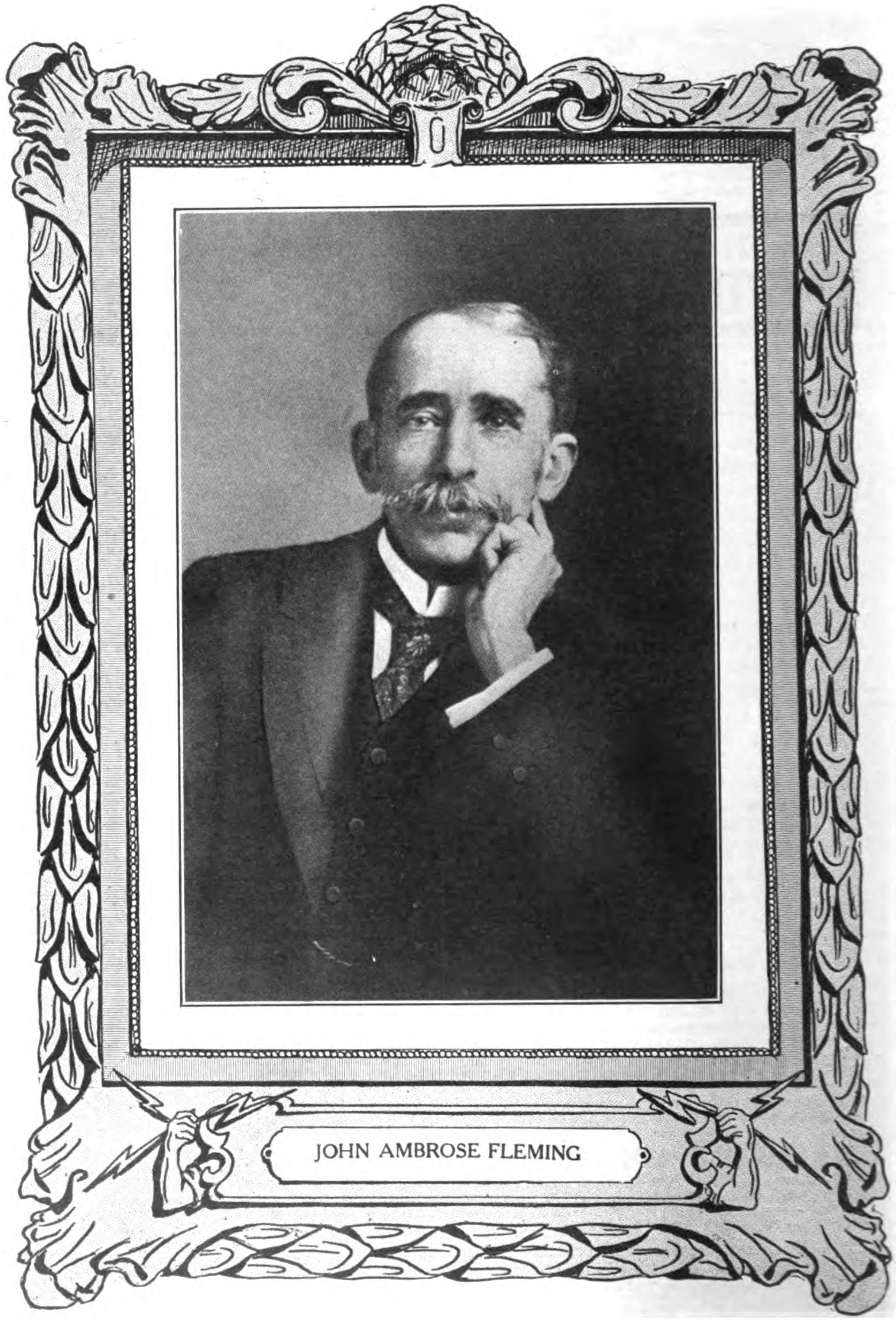

JOHN AMBROSE FLEMING

THE MARCONIGRAPH

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Vol. I. April, 1913 No. 7

IN one of Dryden's Fables we are told that science distinguishes a man of honor from one of those athletic brutes whom undeservedly we call heroes. This may be putting it a bit strong; "undeservedly" is, one might say, undeserved; for athletic heroes have their place and unquestionably are of service to the world. But when one dons the mantle of science, becomes a silent worker in the laboratory, and emerges, years later, crowned with the glory of achievement, his fame is apt to be more lasting than he who has acquired his laurels through physical prowess And when it is considered that it requires but a few months of training to bring brawn to its highest efficiency while years of training are represented in the finished brain of the scientist we can better understand how richly deserved are the honors bestowed on the man who through painstaking experiments has added to the knowledge of the world.

Nothing that this feeble pen might write could add anything to the fame of the subject of our sketch this month—Dr. John Ambrose Fleming, scientific adviser to Marconi's Wireless Telegraph Company. Let his record speak for him. He was born at Lancaster in 1849, and received his scientific training at University College, London, the Royal School of Mines, and St. John's College, Cambridge. At the Royal School of Mines he was assistant to the eminent chemist, Sir Edward Frankland, and at Cambridge was a student and worked under Professor James Clerk Maxwell, whose profound theories of electricity paved the way for the subsequent work of Hertz, and therefore for wireless telegraphy by electric waves. At Cambridge Dr. Fleming gained numerous distinctions, being made successively Exhibitioner in Physical Science, and then Foundation Scholar, Wright and Hughes Prizeman, and finally elected a Fellow of St. John's College. He came to London in 1882 to take a position as scientific adviser of the Edison Electric Light Company, subsequently remaining for nearly fifteen years in the same position with the Edison and Swan Electric Light Company, Limited, and also acting as adviser to many other companies and corporations. For nearly twenty-five years he has been Professor of Electrical Engineering in University College, London, and during that time has contributed about seventy or eighty scientific papers to various learned societies, describing researches in electricity, magnetism, and general physics. He is the author of the greatest wireless text books ever written, "The Principles of Electric Wave Telegraphy and Telephony" and an elementary "Manual of Radio-telegraphy and Radio-telephony." He has given many courses of lectures at the Royal Society of Arts and at the Royal Institution on wireless telegraphy and kindred subjects, and has taken out several patents for inventions connected with radio-telegraphy, notable among which are the agmometer and oscillation valve or glow lamp wave detector. In 1892 Dr. Fleming was made a Fellow of the Royal Society, and in 1910 was awarded the Hughes Gold Medal by the Royal Society for his scientific work. In presenting the medal to Dr. Fleming, the President of the Royal Society, Sir Archibald Geikie, K.C.B., said:—

"For thirty years he has been actively engaged in researches in Experimental Physics, chiefly in the technical applications of electricity. He was an early investigator of the properties of the glow lamp, and elucidated the unilateral conductivity presented in the partial vacuum between glowing carbon and adjacent metal, a phenomenon which has been linked up recently with the important subject of the specific discharges of electrons by different materials. He has published in the Scientific and Technical Press and in technical text-books many admirable experimental investigations and variable expositions in the applications of electricity, as, for example, to electric transformers and wireless telegraphy. Of special interest and value for theory were the important results concerning the alterations in the physical properties of matter, such as the remarkable increase in the electric conductivity of metals when subjected to very low temperatures, which flowed from his early collaboration with Sir James Dewar in investigating this domain. In recent years he has taken a prominent part in the scientific development of telegraphy by electric waves."

Wireless Warnings of Storms

How the approach of storms, hurricanes, cyclones and tidal waves from heretofore inaccessible regions of the ocean are to be reported to every vessel at sea.

THE complete and comprehensive system of weather reporting by wireless which has just been inaugurated by the United States Government will enable the Weather Bureau at Washington to forecast the approach of storms, hurricanes, cyclones and tidal waves from the heretofore inaccessible regions of the ocean. Up to now the only means the Government had to determine the aproach of a hurricane was through certain disturbances of the atmosphere as they appeared to the weather observers on land. Frequently, great storms have arisen of which no warning could be given only by use of data sent in by wireless from ships at sea.

But with the new system in operation every vessel that leaves an American port will know exactly what to expect in normal weather conditions on every point of its voyage. Not only that but it will be warned while at sea of any menace to its safety. The United States is the first nation to adopt this advanced system of weather forecasting and it marks an epoch in the marine history of the world.

While much has been written on this subject, a recent interview with Edward H. Bowie, chief forecaster at Washington, should interest our readers:

"The Government now has wireless instruments on 30 ships plying the Atlantic, the Gulf of Mexico, and the Caribbean Sea. It is the intention of the Weather Bureau to employ the navigating officers of these vessels, to report to the United States Weather Bureau at Washington, by wireless twice a day, morning and evening, the same as though they were at the regular observing stations on land. These reports will include the exact position of the ship at sea at the time of observation. It will show the state of the barometer, whether rising or falling, the temperature, direction of the wind and the force, and the state of the weather. In the hurricane season they will also report regarding the sea swells, which have a close connection with hurricanes some distance away.

"This is the first real effort on the part of any service in the world to employ wireless as a direct aid in forecasting the weather. That is, I mean, to really employ them. Up to the present it has been more or less at the will of the wireless operator on board the ship to report anything to the weather stations, but from now on the Government will pay the navigators on each vessel for this work. In other words, Uncle Sam will have regular floating observatories covering the entire North and South Atlantic Oceans which will report twice daily direct to the Weather Bureau at Washington. All of these vessels will act as scout ships for the Weather Bureau. As soon as anything is encountered in any part of the ocean, the observers at Washington will have immediate knowledge of it.

"From July to November the Eastern and Southeastern coast sections of the United States are regularly visited by storms that come off the ocean. Heretofore we have had no knowledge of the presence of these storms until some indication was observed at the land stations, and by that time the storm was but a few hours away. For instance, in 1898 we put in observing stations in the West Indies, where many of these storms seem to originate. The reason for the establishment of these stations was the presence of our navy around Cuba during the war with Spain. It can be imagined what would have happened to our fleet if one of these hurricanes had suddenly arisen and they had received no warning of it in advance. With these floating observatories practically all sections of the ocean will be patroled, and it will be rather difficult for any storm visitor to arrive unannounced.

"The first weather reports received by wireless exclusively came from a station established by the Weather Bureau in the summer of 1911 way up in the Aleutian Islands, at a little place called Dutch Harbor, in Unalaska. From this point the wireless report is flashed to Nome, about 1,000 miles distant, and from there it comes overland to Sitka, by cable to Seattle, and from there overland to Washington. This station is the outpost established on the Pacific Ocean to give us warning of the approach of storms crossing the North Pacific that are apt to reach the Western coast of the United States. This is the only station in the world that depends entirely upon wireless to get its weather reports through.

"We will use in connection with the wireless our international weather map. We have been working on this map since 1908, and it covers the entire Northern Hemisphere. It shows the weather conditions all over the world, and from this map we gather data on which to base the forecast for weather conditions for a week in advance.

"To go more into detail of the scheme—the Government has made arrangements with the United Fruit Company steamers, the Southern Pacific Line, the Clyde Line and others running from New York and San Francisco for daily reports by wireless at 7 o'clock in the morning and 7 o'clock in the evening. These reports will be picked up by the navy's wireless stations along the coast and transmitted direct to Washington, where they will be immediately made public. These steamers will also report the sighting of any wrecks or derelicts, icebergs or ice-fields and anything else that may be a menace to navigation. It is by this means that we believe we will be able to report the very beginning of any hurricane at sea and give ample warning to other vessels and coast or inland cities which may lie in its path.

"In addition to this, we have arranged for the receipt of daily wireless reports from all the great liners while at sea, wherever they may be. Their reports will embrace the same data as that to be covered by the wireless reports of the coast-wise steamers.

The steamships "Dorchester" and "Merrimack" standing by the "Alcazar," off Cape Hatteras. When the "Dorchester" came across the "Alcazar" she was listing to port heavily as shown in the picture. A wireless appeal summoned the "Merrimack" and the two vessels towed the sinking ship safely into port.

The Resistance of Radiotelegraphic Antennas

By Dr. L. W. Austin

An abstract from the Journal of the Washington Academy of Sciences

IT has been known to many experimenters that the antenna resistance was much larger at longer wave-lengths than should have been the case according to the Hertzian theory of radiation. Dr. C. Fischer has carried out some interesting experimental observations, showing that this increase in antenna resistance is, under certain circumstances, proportional to the wave-length, and he appears to believe that this increased resistance is due to radiation.

Systematic measurements on the resistance of the Bureau of Standards antenna have been carried out, and observations have been taken on the antenna of the U. S. S. *Dolphin,* lying at the Washington Navy Yard, and on the antenna of the Navy Yard station.

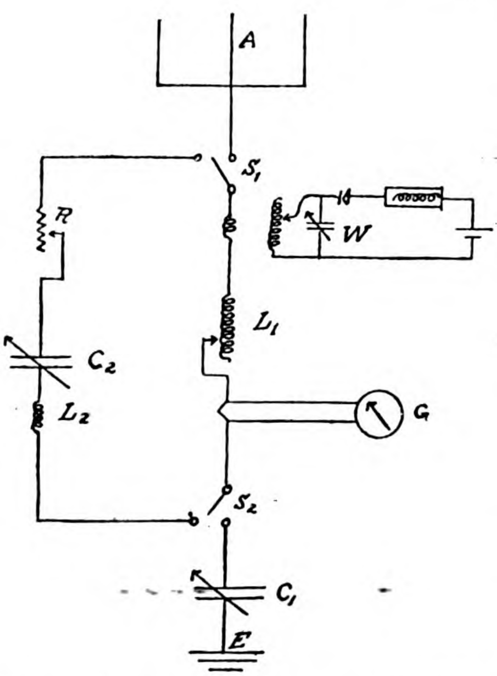


Fig. 1.—Diagram of apparatus for measuring antenna resistance.

The arrangement of apparatus is shown in Fig. 1. Here A is the antenna, E the ground, L_1 the tuning inductance, C_1 an air condenser for tuning to very short wave-lengths, Th a thermo-element, G a galvanometer, and C_2 a variable air condenser set at the capacity of the antenna to be measured. A small inductance, L_2, was sometimes inserted in circuit with the condenser, C_2, to represent the antenna inductance. This has little influence on the results, and, at least, for the longer wave-lengths may be omitted. S_1 and S_2 are switches for connecting either the antenna and ground or C_2 to the rest of the circuit. R is a resistance introduced in the circuit, C_2, to bring down the thermo-element deflection to the same value as that observed when the antenna and ground are in circuit. The high-frequency resistance consists of separate units of fine constantin wire inserted in mercury cups. The measurement circuit is excited by a buzzer-driven wave-meter, W, of the ordinary type.

Fig. 2 shows the curves obtained on the *Dolphin* at the Washington Navy Yard and at the Bureau of Standards. It is seen that, beginning with the short wave-lengths, the resistance falls rapidly in accordance with the Hertzian radiation theory, until a point is reached which is not far from twice the fundamental wave-length of the antennas.

Curve A is the Bureau of Standards, B the U. S. S. *Dolphin* and C the Washington Navy Yard. In curves B and C the resistance rises gradually, as observed by Fischer, but the rise is much slower than in his curves. The height of the flat-top antenna of the *Dolphin* is approximately 90 feet above the water, while that of the Washington Navy Yard is 150 feet. The Navy Yard has practically a water ground, the station being but a few feet from the river, which is moderately salt at this point. The fundamental of the

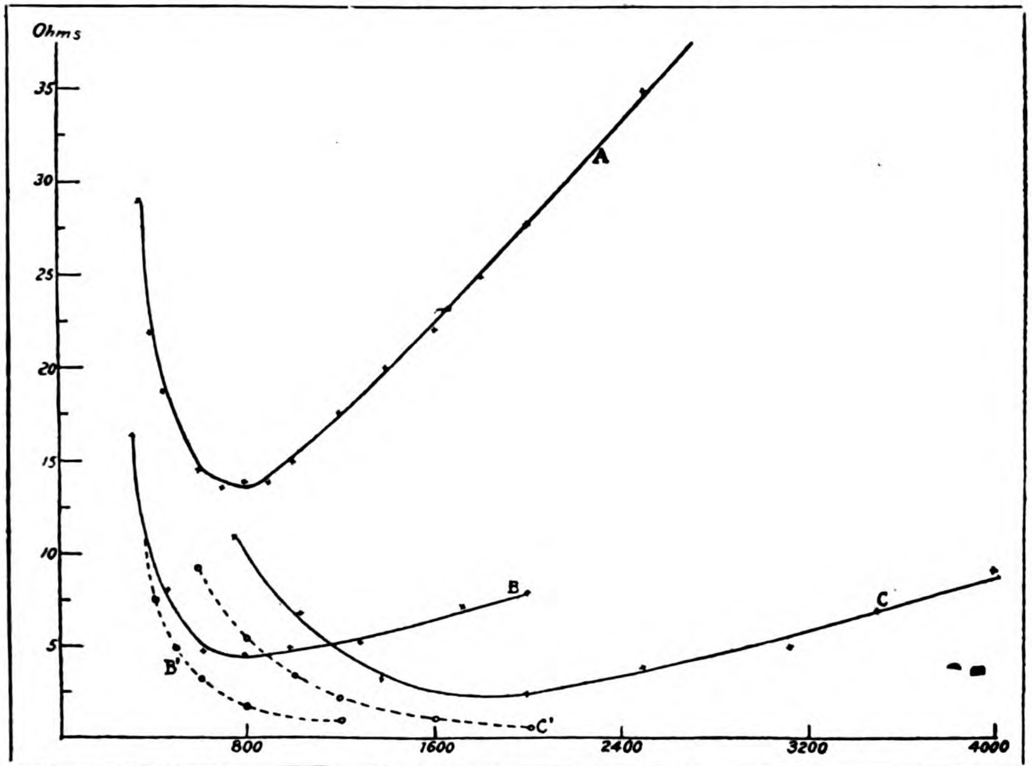


Fig. 2.—Diagram showing resistance curves.

Dolphin's antenna is 315 meters, and its capacity is 0.0073 microfarad. The fundamental of the Navy Yard antenna is about 1,000 meters, and the capacity is 0.0036. The radiation resistance for these two antennas calculated according to the equation

$$R_r = 1600\, h^2/\lambda^2$$

is shown in the dotted curves, B¹, C¹. It is seen that the observed curves for the shorter wave-lengths follow with a considerable degree of approximation the curvature of the calculated radiation resistances, although the observed curves lie somewhat higher, while beyond the minimum the two curves lie far apart. We have here an indication of two factors in the resistance—one decreasing as the square of the wave-length, while the other increases nearly directly as the wave-length. It seems probable that the portion of the resistance which increases as the wave-length is ground resistance, or more properly earth current resistance.

The resistance of the Bureau of Standards antenna is shown in curve A. This antenna is an 8-wire harp, 180 feet high at top, and 60 feet high at bottom. This makes the centre of capacity 120 feet from the earth. The natural period is 425 meters, and the capacity 0.0012 microfarad. The ground wires are connected to the water pipes of the laboratory. It is seen that the minimum ground resistance is much higher than in the case of the *Dolphin* and Navy Yard, and that the straight portion of the curve slopes more steeply upward than was the case in the other two antennas measured. It has been observed that the steepness of this portion of the curve, as well as the resistance at the minimum, differs by a very appreciable amount from day to day according to the dryness of the soil. On the day following a heavy rain the minimum frequently falls by two or three ohms; at the same time the resistance at a wave-length of 3,000 meters sometimes falls as much as ten ohms. The resistances are usually slightly higher in the afternoon than in the morning.

It is a matter of interest to know toward what point the straight portion of the resistance curve descends. According to Fischer it would cross the zero axis near the fundamental, and in the curve of the Washington Navy Yard this also appears to be the case. At the Bureau of Standards, the curve of which has been taken much more accurately than any of our other observations, it appears to point toward the zero of co-ordinates. This may, however, be due to the presence of an initial ohmic resistance of about 5.5 ohms in the pipes of the ground connection.

TABLE OF RESISTANCES FOR ANTENNA

λ	G	Rr.	Rr+G.	Observed.
Meters.	Ohms.	Ohms.	Ohms.	Ohms.
400	5·5	13·4	18·9	22·5
600	8·0	5·9	13·9	15·0
800	11·0	3·4	14·4	13·6
1,000	13·5	2·1	15·6	15·2
1,200	16·5	1·5	18·0	17·3
1,500	21·0	0·95	22·0	21·0
2,000	28·0	0·54	28·5	27·7
2,500	34·5	0·34	34·8	34·5

In the table under G is given the ground resistance, taken from a prolongation of the straight portion of curve A. Under R is given the calculated radiation resistance, from the Ruedenberg formula, while in the last two columns are given the sum of these resistances and the observed values of the curve.

Balloon as Receiving Station

An account of the arrangement of the antenna for receiving wireless telegraph messages on balloons was recently given in the *Physcalische Zeitschrift* by Mr. P. Ludewig. When the balloon was half filled a wire was wound round the equator of the gas bag, being interwoven through the protecting cordage, and the end of the wire was placed in the basket. The wire formed the upper half of the antenna. To form the lower half a heavy wire was dropped from the basket after the balloon had risen. Fig. 1 shows the completed arrangement. The object of the tests was to discover with how simple means picking up of messages was possible. A Schloemilch cell was used as receiver, and this was connected direct to the antenna, as shown in Fig. 2, in order that as little room as possible should be taken up. With this arrangement accurate tuning was, of course, impossible. Approximation of the wave-

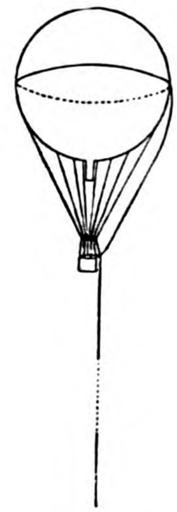


Fig. 1.

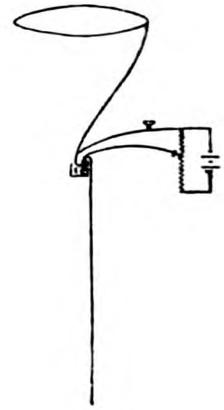


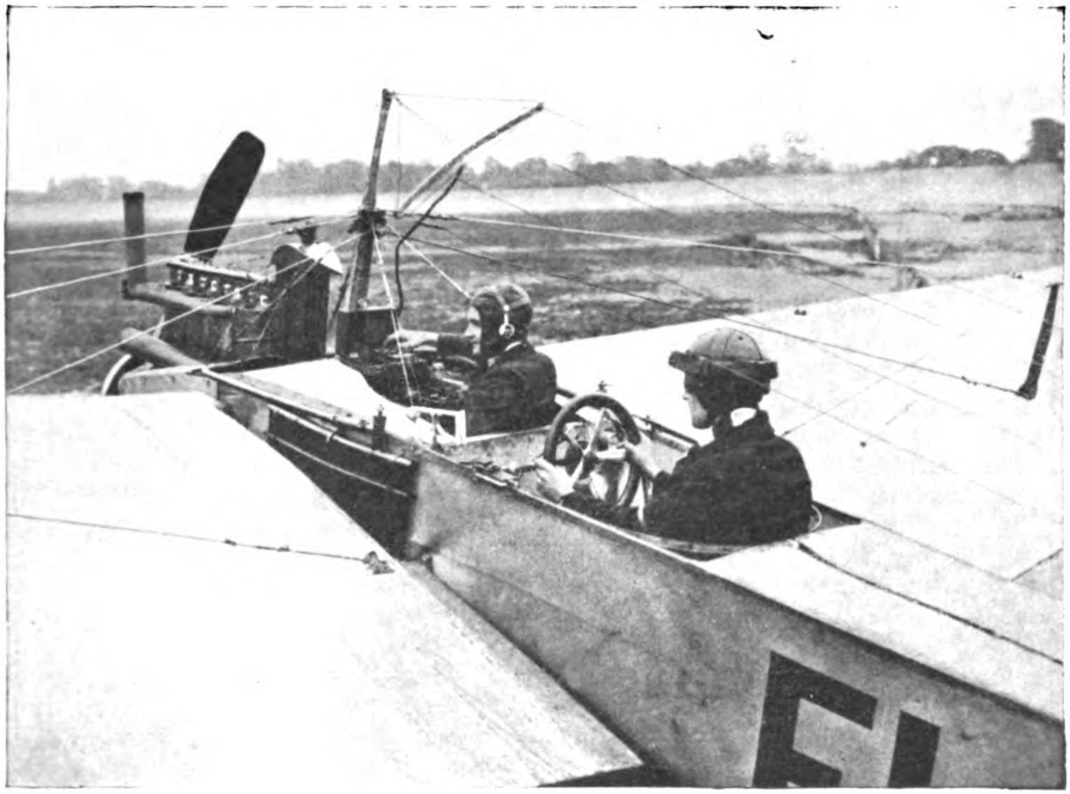
Fig. 2.

length of 500 m. at the sending station was obtained when the wire from the basket was 125 m. long, or equal to one-fourth wave-length. The choice of the simple means for receiving also solved the problem as to whether damped or undamped waves should be used for sending, the small tuning capacity of the receiving station making the use of the first-named a necessity. Some of the results obtained in the tests, although not all, were satisfactory.

American Station in Pekin

An important event in wireless communication is the establishment of a radio station at the American Legation in Pekin. This station will be operated by the marines on duty at the legation. It has been possible to communicate easily at night with American naval ships at Shanghai, a distance overland of about 600 miles, also with ships at Chefoo and Tsingtau.

This installation will add materially to the efficiency of the Asiatic fleet.



Wireless Sets for Army Scouts

THE question of fitting aircraft with wireless apparatus is of increasing interest as year by year in the army manoeuvres these machines become a more reliable means of taking military observations.

Everyone knows now that wireless telegraphy has established a place of its own in warfare, and that its importance cannot be over-estimated, since it is not possible to say to what extent it will be developed for army purposes. The only possible excuse for placing an army in the field with wireless communication unprovided for, would be the absence of reliable apparatus, or apparatus not sufficiently developed to meet progressive military requirements. Since the present-day portable stations are well on the road to perfection and are being developed to meet the new conditions as these arise, no such excuse could be sustained. Nor is their any attempt on the part of military men to belittle these stations; rather, they are making every effort to discover weaknesses and remedies through exhaustive experimentation.

The experiments in connection with wireless installations on aeroplanes have already led to results from which it can safely be said that before long a station will be developed capable of communicating over fifty miles at all times. And with the stability problem solved in aircraft, should a longer range be found desirable, there is no doubt that this will be forthcoming. One of the latest types to be designed is the Marconi aeroplane set, which has been constructed with a view of making it so far as possible adaptable to any type of aeroplane. Because it is closely akin to this type of apparatus the "K" type knapsack station will also be considered in this article.

The problem in aeroplane sets has been to design apparatus which will conform to the limitations of weight, and provide an efficient aerial system for transmission and reception. The Marconi aeroplane set, which is the outcome of considerable experiment, has been made up into several separately contained units, with the idea of having the widest possible margin for the distribution of weight. The apparatus is very strongly constructed and has stood unusually severe treatment without in any way suffering from it. This was clearly demonstrated in an accident which recently occurred in England while some experiments were being conducted with a set installed on a Flanders monoplane.

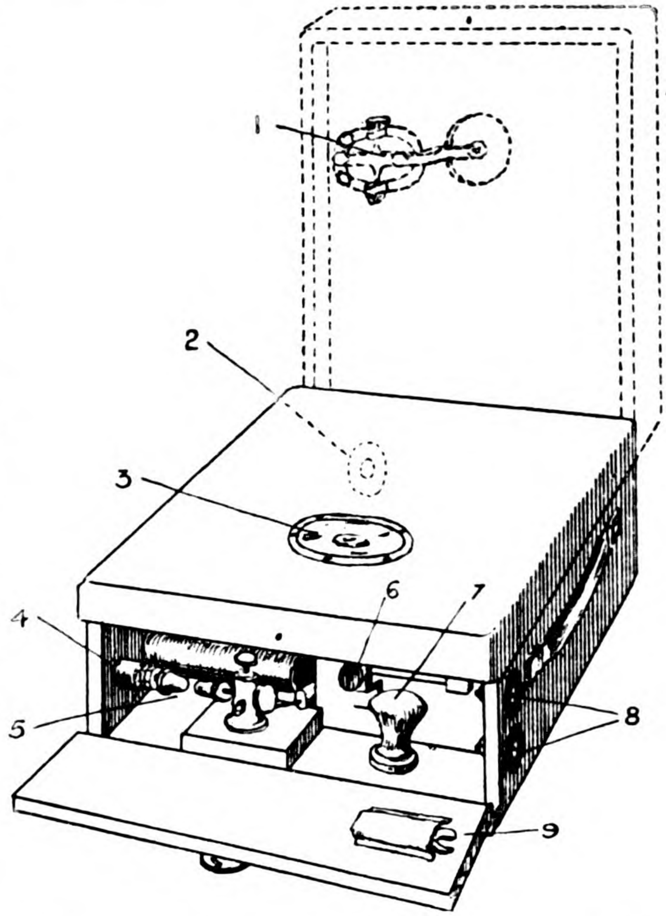
On the previous evening a trial flight had been made and everything found tc be in perfect working order, so no apprehension was felt by the aviator when on the following morning the machine left the ground for an extended flight. It was after several circuits of the surrounding country had been made that the curious mishap occurred. The aviator was flying low, and, owing to a too sudden descent on landing, his first skid stuck in the ground, and as the monoplane was making better than 60 miles an hour, the machine turned completely over. The aviator was thrown out of his seat and when picked up was unconscious.

Examination of the machine showed that the fusilage was smashed in two places and the propeller badly damaged. The wings had apparently escaped unhurt, but had to be stripped of their fabric and thoroughly overhauled. The exhaust pipes, radiators and lubricating pipes on the engine were also damaged, and the front skid was smashed in half. As the wireless apparatus was conected to the oil tank, which was severely battered in and leaking badly, it was expected that the set would be smashed beyond recognition. After removing the sand and dirt with which everything was cov-

A knapsack station working

ered, it was found, however, that the wireless apparatus had escaped entirely. Everything proved to be in working order, even the aerial wire, which was attached to the broken fusilage, remaining intact.

Since then further experiments have been made and important advances have resulted. In place of the trailing wire used formerly it is now possible to use an aerial wire contained on the machine. This advantage is an important one, especially from the pilot's point of view, since it enables the aeroplane to fly as near as flying conditions allow it to other machines, and also obviates any trouble which might arise from a trailing wire in the event of a landing being made in a confined space.

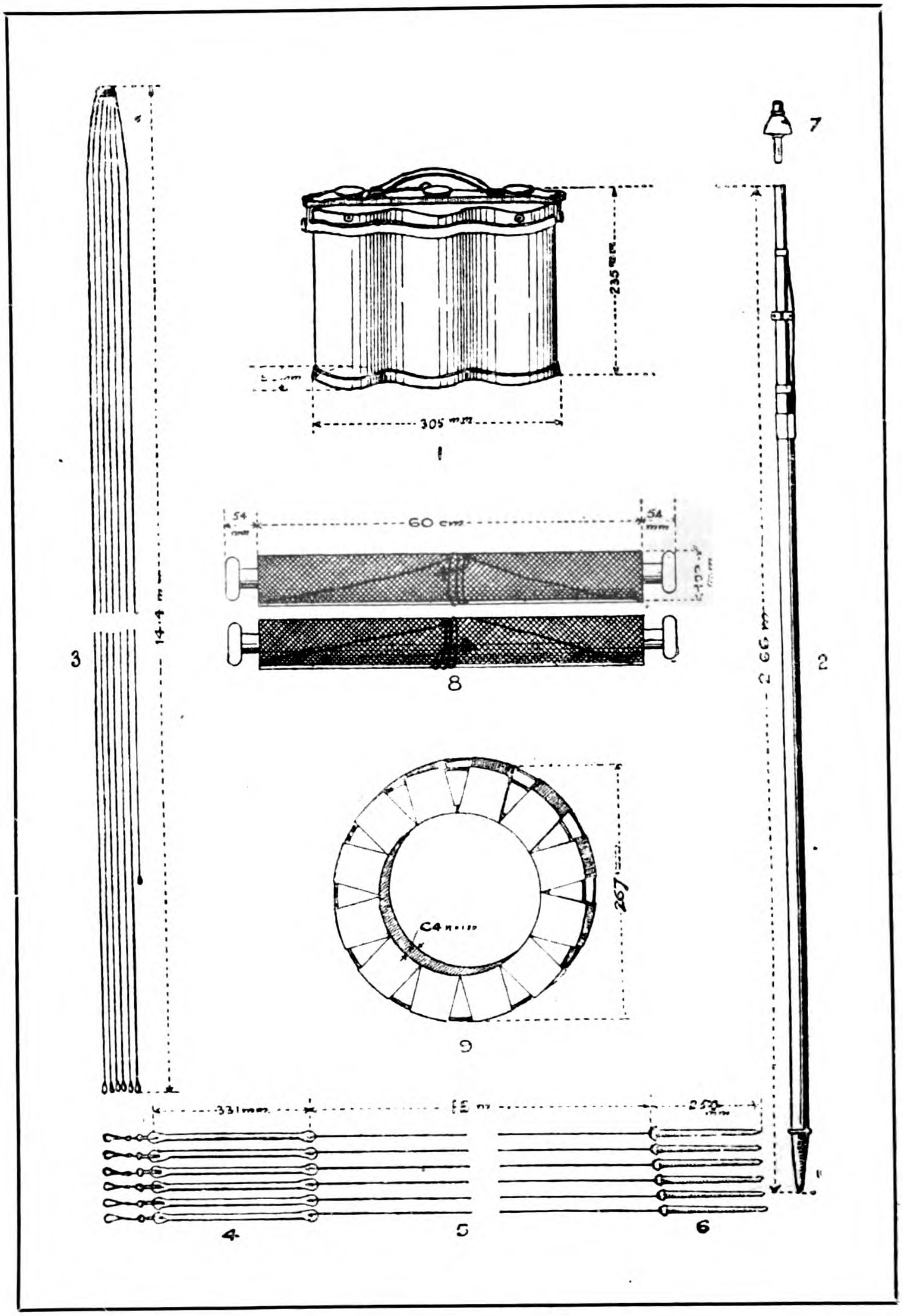


TRANSMITTING CASE FOR KNAPSACK STATION (OPEN). (1) *Manipulating Key.* (2) *Aerial Socket.* (3) *Leather Diaphragm.* (4) *Earth Socket.* (5) *Spark Electrodes.* (6) *Adjusting Screw of Coil.* (7) *Manipulating Key Handle.* (8) *Battery Terminals.* (9) *Adjustable Spanner.*

The early experiments were devoted almost entirely to the question of transmitting messages from the aeroplane to the ground, and, as previously reported, this has been carried on up to five miles with a small set. Lately, however, the question of receiving messages in the aeroplane set from a station on the ground has been receiving attention, and a few months ago the first tests were successfully carried out. The chief difficulty was found to be the noise of the engine and propeller of the machine; also the operator suffered some inconvenience from the strong propeller draught.

The development of aeroplane apparatus has been beset with many difficulties and occasionally loss of life. A serious accident which resulted in the postponement of further experiments for a time occurred not long ago at the Brooklands Aviation Grounds. Mr. Fisher, the pilot of the Flanders machine used in the wireless tests was carrying a passenger during one of the intervals between the flights devoted to the wireless experiments, and when turning on his third circuit had a bad sideslip and the machine, which was traveling very fast at the time, crashed to the ground. The fall was a considerable distance and both men were killed.

A photograph of the ill-fated aviator, taken the day before the accident, appears at the head of the article. Mr. Fisher is shown seated at the wheel. In the monoplane with him is Mr. C. V. Waynflete-Matheu, the Marconi operator who manipulated the key during the tests. On the day before the unfortunate fatality the wireless operator had flown on this monoplane with Mr. Fisher and had received signals



Aerial Gear, etc.

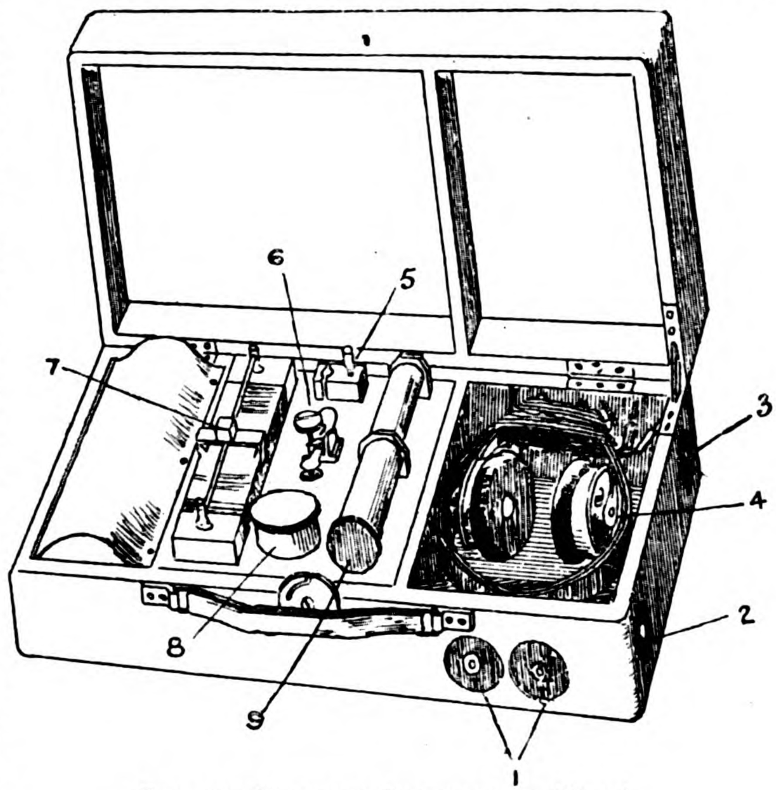
(1) *Battery.* (2) *Telescopic Mast* (30 *feet*). (3) *Aerial.* (4) *Aerial Tension Insulators.* (5) *Aerial Stays.* (6) *Anchor Pegs.* (7) *Mast Insulator.* (8) *Earth Nets.* (9) *Aerial Drum.*

from the Flanders shed continuously during a flight of several miles over the surrounding country. At the time of the accident he was waiting for the machine to alight so that he could take the place of the ill-fated passenger. None of the wireless apparatus was on the machine at the time of the accident.

In the Marconi aeroplane set the source of supply can be either primary or secondary batteries, and if the latter type is adopted, a special unspillable accumulator case is supplied, from which there is no fear of acid splashing out and damaging the machine in the event of a rough landing or a fall. The only high tension wire on the machine is run in a very well insulated tube through the fusilage of the machine, which makes the pilot and passengers absolutely immune from any chance of a shock when the apparatus is working. The trailing wire aerial is fitted with a safety plug, which is adjusted to stand only as much strain as it would be subjected to when the machine is flying, and which frees itself immediately in the event of the wire having any extra strain put upon it, such as would occur if it came into contact with trees or anything during a flight. It has been found convenient for the bulk of the apparatus to be fitted underneath the pilot and passenger seats, and it has therefore been designed with a view of placing it upside down or in any other position most suitable to the type of machine on which it is to work.

The only part of the apparatus which need be exposed is the manipulating key and the small control switch, and these can be placed in the position most suitable to the pilot or passenger who is to carry out the work of observing and reporting.

The receiving station is very compact, and is fitted with a portable mast, which can be erected in a very few minutes.

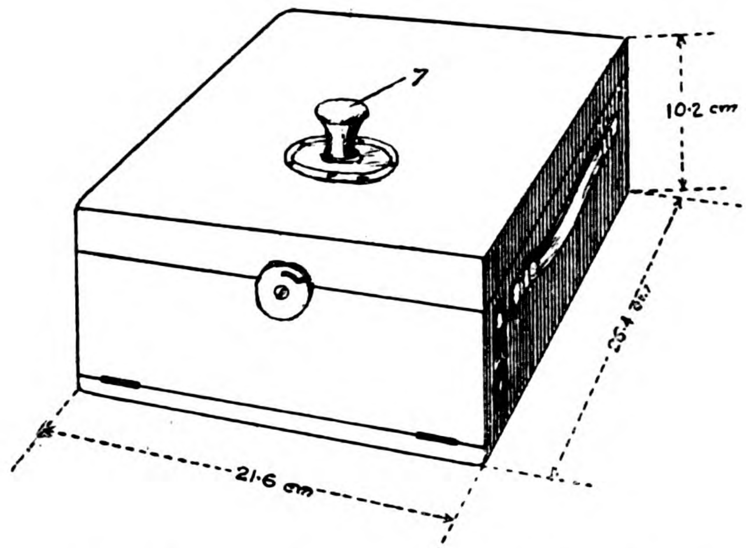


CASE FOR RECEIVING INSTRUMENTS (OPEN).

(1) *Telephone Sockets.* (2) *Earth Sockets.* (3) *Aerial Socket.* (4) *Telephones.* (5) *Plug Switch.* (6) *Crystal Holder.* (7) *Potentiometer.* (8) *Box of Spare Crystals.* (9) *Adjustable Tuning Condenser.*

The wave length of the set is comparatively short, and consequently the receiving apparatus is not in any way troubled by interference with other stations, and very little adjustment is required in tuning.

Beyond its uses from a military point of view, a machine thus equipped enables the pilot to keep in constant communication with the aerodrome or headquarters during a flight, which in cross-country and long-distance flights would be of great importance.



A view of the transmitting case for knapsack station when closed, showing ease of portability.

In a previous issue we gave some details of the work of the aerial scouts in the army. Equally important are the scouts who stick to terra firma in time of war. Designed primarily for the use of scouts and to replace to a large extent visual signaling and mounted orderlies, the Marconi "K" type knapsack station has long since demonstrated its usefulness. There are many purposes for which this station can be used, including direction of gun fire. The knapsack station has a range of about ten miles, and is carried in knapsacks strapped to the backs of soldiers. Four men, each carrying a load of between 20 lb. and 30 lb., are necessary to carry a complete installation. The first man carries the mast and battery, the second man, the earth nets, the transmitter and receiver are carried by the third man, while in the knapsack strapped to the back of the fourth man is the aerial gear. The mast is about 30 feet in height. It is of extremely light though rigid construction, made chiefly of aluminum tube, and is used to support an umbrella form of antennae, the antennae also acting as stays to the mast. The source of energy may be either a primary or a secondary battery, according to choice. If the latter be employed, it is necessary that the accumulators should be systematically charged, as required, and for this purpose a special field charging set which has a sufficient output to serve ten or twenty such stations is made. The transmitter, which consists of an ordinary ignition coil requiring a pressure of only six volts, is contained in a square wooden box weighing 11 lb. The receiver consists of the ordinary carborundum receiving circuit with jigger, tuning condenser and four dry cells, which may be switched on and off as required. This is also contained in a box which weighs six lb. No elaborate system of syntonisation is provided, this being unnecessary owing to the short wave-length employed, which is so widely different to that in ordinary use as to make these stations practically immune from interference. A buzzer for testing the wave length is also part of the equipment.

The knapsack station can be erected by one man, if necessary, in about ten minutes, or if two men are available, in about five minutes.

Simultaneous Reception and Transmission

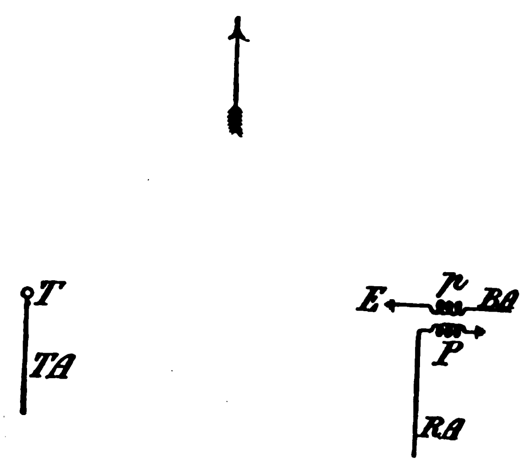
MR. MARCONI and the Marconi Company have been granted a patent which relates to arrangements whereby messages can be simultaneously sent from and received at the same station.

According to the specification the transmitting and receiving apparatus of a station are not placed close together, but are placed a short distance apart, such distance being only a small fraction of that over which communication is to take place. The receiving instruments are coupled to two distinct aerials, one of which is used for receiving, and is described as the receiving aerial, while the other (which is known as the balancing aerial) is so arranged that it is practically unaffected by the signals from the distant station with which it is desired to communicate, but that the effect produced through it on the receiver by the adjacent transmitter is equal and opposite to that produced thereby through the receiving aerial, both the receiving and balancing aerials being tuned to the periodicity of the signals it is desired to receive. This result can be most easily attained by employing horizontal or approximately horizontal aerials as described in Specification No. 14,788 of 1905.

The accompanying drawing is a diagram of a wireless telegraph station arranged in accordance with the invention. T A is the transmitting aerial earthed through the transmitter T and pointing away from the distant station the direction of which is indicated by the arrow; it will thus radiate powerfully in that direction and to a much smaller degree in a direction approximately at right angles in which is situated the receiving apparatus comprising a horizontal aerial R A, which is earthed through the primary P of a receiving transformer, and points away from the distant station so that it may be best affected by oscillations coming from that station, while it is only affected to a small degree by oscillations coming from the direction at right angles.

B A is the balancing aerial earthed at E and pointing away from the transmitter T so that it is best affected by oscillations therefrom, but practically not at all or only to a very small degree by oscillations from the distant station.

In the balancing aerial B A is included a coil *p* which acts as a second primary to the receiving transformer, and is so arranged that the oscillations set



up in the aerial B A by the radiation from the transmitting aerial T A produce in the secondary an effect equal and opposite to that produced by the oscillations set up thereby in the aerial R A.

The oscillations, however, from the distant station produce a much greater effect in the aerial R A than in the aerial B A, and will therefore actuate the receiver.

In order that the oscillations produced in R A and B A by the radiation from T A may exactly balance, it is necessary that the phase of the oscillations in R A be the same as that of the oscillations in B A. The relation of these phases depends on the relation of the respective distances of R A and B A from T A, and by moving B A a fraction of a wave length nearer or further from T A the phase can be made exactly to correspond.

If, however, owing to the nature of the ground it be difficult to arrange B A as desired, the phase may be corrected by combining the effect of two or more balancing aerials, or by any well-known method of phase shifting.

The required result may also be attained if one only of the aerials coupled to the receiving instruments be directive, while the other (and it may be also the transmitting aerial) is of the usual vertical type, but in general the more directive aerials are employed the nearer together may the transmitting and receiving apparatus be placed. The transmitter may if desired be operated through an ordinary telegraph line from the room containing the receiving instruments, and in this manner it is possible to transmit and to receive simultaneously from the same operating room. If the transmitted and received oscillations be of different wave-lengths, the distance between the transmitting and receiving apparatus may be reduced; the effect of the waves from the transmitting aerial T A is then to impulse these two aerials and to set them oscillating with their own natural frequency, which, however, is not that of these waves. Good results have been obtained with a distance between the receiving and transmitting apparatus equal to 0.4 per cent. of the distance between the stations. The aerials R A and B A may be coupled to the receiving apparatus in various ways besides that described, as, for instance, by direct connection or by an electrostatic coupling. In all cases the length of the balancing aerial, its inductance, capacity, resistance and coupling are so adjusted that the period, phase and damping of the oscillations set up in it and in the receiving aerial by the adjacent transmitter are as nearly as possible the same.

Wireless Waves Not Injurious

The physician in the French Navy whose investigations have led him to conclude that Hertzian waves as used in wireless telegraphy do definite physical injuries to those who come into their vicinity has against him the main current of experience and science. No protection of any special kind, either for the eye or the exposed parts of the body, is provided for, or demanded by, wireless operators. The notion that a wireless telegraph operator can have his health injured by the use of the electrical apparatus is based on some confusion between Hertzian waves and Röntgen rays. Now, it must be clearly and primarily understood that Röntgen rays, X-rays, and so on, have nothing whatever in common with Hertzian waves. Röntgen and X-rays do have a powerful physiological effect, and they are utilized on that very account. But Hertzian waves cannot be legitimately supposed to have any effect on the organism at all.

The idea that ultra-violet or other troublesome rays come from the arc used in wireless telegraphy is quite absurd, for the simple reason that the arc is enclosed. Thus the wireless operator is not affected by the arc in any degree, and so he is no more affected by the Hertzian waves than other persons in different parts of the body of the ship. Unfortunately, everything electrical has to run the gauntlet of prejudice, and this attack on the hygienic properties of wireless telegraphy is easily paralleled by other attacks. Wherever the source of some conflagration is doubtful the fusion of electric light wires is given the discredit. Again, electric incandescent light is accused of injuring the eyesight, whereas it gives practically the same kind of light as incandescent gas burners. Generally speaking, the comparative novelty and apparent mystery of things electrical call out the instincts of opposition and scaremongering. We suppose that the electrical industry will be open to this kind of opposition until something newer and more astounding and more useful to man is discovered.

The Progress of the British Contract Investigation

FROM London it is learned that on March 19, Postmaster General Samuel and Attorney General Sir Rufus Isaacs received judgment for libel against the Paris *Matin* in the suit brought in connection with that paper's charges that they had speculated in shares of the Marconi Company.

Both ministers went on the stand and denied the allegations contained in a London dispatch to the *Matin* based upon Leo Maxse's imputations before a parliamentary inquiry committee. Counsel stated that the *Matin* on the day after the publication of the dispatch had withdrawn the allegations, which had been made under a misapprehension, and had published an apology. The *Matin's* counsel the next day repeated the apology, and Mr. Justice Darling, with the consent of both sides, gave judgment for the plaintiffs with indemnity for costs.

Sir Edward Carson, speaking for the ministers, made a long statement of the case exonerating both plaintiffs either from delinquency or corruption, and Mr. Samuel and Sir Rufus followed with personal statements, the only new feature of which was Sir Rufus's declaration that he bought 10,000 shares of the American Marconi Company and sold 1,000 to Mr. Lloyd-George and another thousand to the Master of Elibank, and at the present price of the shares he had lost $6,000 on the transaction.

The *Matin's* libel contained the assertion that Sir Rufus and Mr. Samuel bought Marconi shares at £2 and sold them at £8. Sir Rufus said:

"I never bought a share of the Marconi Company; I neved had a share in the company nor an interest in any share; I never advised any one in connection with the shares. I heard of the American Marconi Company in April last, when I was informed that £1,400,000 of fresh capital was to be raised. I satisfied myself that the American company was an entirely separate concern from the British company, and bought 10,000 shares on April 17 at a premium."

"Did you sell a thousand each to Mr. Lloyd-George and the Master of Elibank?" he was asked.

"Yes, I was on very intimate terms with them. They were great personal friends, and I told them what I had done. I told them what I knew about the American company and told them I should not have gone into it unless I had been satisfied that the company had nothing to do with the British Marconi Company or with any contract that had been or might be made with the British Government. I told them it was a very good investment, and that if they liked they could take a thousands shares from me at the price I paid."

The London *Daily News* editorially suggested that the *Matin's* publication has done a real service by enabling the ministers concerned to deal with the anti-Semitic campaign of slander carried on by a certain section of the press. Sir Rufus Isaac's purchase of shares in the American company six weeks after the Marconi contract with the Post Office had been announced and at a time when Marconi shares were at their highest was an ordinary transaction which involved loss.

"The accusation that the ministers used knowledge which they had acquired officially in order to make money, which was the beginning and end of the campaign, is shown to have been a wicked invention," said the editorial. "There is no shred of truth in it. We do not believe the slanderers themselves believed so; they only hoped to create a general impression of corruption which would damn the Government. The indiscretion of the *Matin* revealed the facts and cleared the air. The public have now some measure by which to estimate the venom and mendacity which characterized one of the most unpleasant episodes of recent political journalism."

The London *Times,* in an editorial, congratulated Sir Rufus Isaacs and Mr. Samuel on the result of the trial.

A week later Sir Rufus sat under fire for five hours at the hearing of the House of Commons select committee and never once faltered and scarcely ever showed irritation, though some of the questions were decidedly hostile and others were barbed with suspicion and innuendo. It was an ordeal from which all but the bravest nature and clearest conscience would have shrunk. On the surface the proceedings suggested nothing more than an assemblage of ordinary men of the world, met to investigate a matter of profound importance, it is true, but of no particular immediate concern to anybody present. But below the surface political rancor, personal animosity and even racial hatreds were smouldering. Sir Rufus's smiling countenance showed no trace of it, however.

Sir Rufus was not defending himself alone; in the same boat with him are the fortunes of the present Liberal Government. A careful reading of the verbatim report of the proceedings shows that some members of the Marconi committee are seeking to make party capital out of the affair, and, as the Westminster *Gazette* justifiably says, "Mr. Bonar Law is waiting until the committee proceedings are over to ask for a day of debate on the question. The Opposition intend to run the matter for more than it is worth. Their attitude was clearly shown by the cheer with which they greeted Mr. Bonar Law when he got up to ask, as they supposed, a day for a vote of censure. Having nothing else on which to attack the Government, they seem intent on making what was in no case more than an indiscretion on the part of the minister the subject of a full-dress debate. The Government and the Liberal party may be trusted to stand by Sir Rufus when the debate comes. There is a strong feeling that the burden of the ordeal to which he voluntarily submitted is out of proportion to anything he has done."

The London *Daily Telegraph,* reporting the proceedings, said:

"Freely, openly and candidly, in the manner of a man who, far from having to hide, was only anxious to let in the fullest light upon the transaction with which his name was coupled, Sir Rufus unfolded the story. Truth to say, he had very little to add to the account he gave of his action in the Law Courts the other day. He met every query in the frankest way, frequently anticipating what was in the mind of his questioner before it had been completely expressed in words. From first to last—and he was in the witness chair all day—he never used a single note. He toyed with dates, converted dollars into pounds, played with minute fractions in Stock Exchange quotations, multiplied mentally by three and four figures, and cast up balances of profit and loss with the greatest celerity, as if it were all—as indeed it was—child's play to an intellect so keen as his.

"Only occasionally did he allow himself to throw off the calm, cool and almost subdued demeanor in which he narrated his story. Once was when he warmly stigmatized as 'foul lies' the stories which he said he found in circulation about the Postmaster General and himself, and in a lesser degree about the Chancellor of the Exchequer, during the summer of last year. Then his eyes flashed fire and he almost hissed out his reproof. On another occasion he heatedly rapped the table as he protested against the wholly unfounded insinuation published about him in certain quarters."

One of the subjects on which Sir Rufus was cross-questioned was his telegram to the New York *Times* Marconi dinner. Two Unionist members of the committee, Mr. Faber and Lord Robert Cecil, in fact, made this a feature of the cross-examination, both suggesting that the telegram might have been designed to boom the Marconi Company. Sir Rufus gave a detailed statement of how the New York

Times correspondent telephoned him at his house in Reading and asked for a message which might be read at the dinner, his relation of the incident occupying about half a column of the London *Times*. Sir Rufus said: "I would not have sent such a telegram if it was to be used in any way for share purposes; indeed, it never was. The telegram was never used except at that banquet and in the report of the banquet."

Mr. Faber remarked: "Unfortunately, a public man can never be sure what use will be made of his telegrams."

Sir Rufus replied: "I think there is some ground for that; but at the same time it does not occur to me that the investors in America are likely to put money into shares because of congratulatory telegrams from me or other persons used at a banquet."

Then Mr. Faber, persistently seeking for an ulterior motive, sought to establish some recondite connection between Sir Rufus's congratulations to his brother Godfrey and Signor Marconi, and his reference in the New York *Times* message to the coal strike.

This message was as follows:

> London, Sunday, March 17.—Please congratulate Marconi and my brother on the successful development of a marvelous enterprise. I wish them all success in New York and hope that by the time they come back the coal strike will be finished.
>
> RUFUS ISAACS.

After reading this, Mr. Faber said: "It may be hypercritical on my part, but I know you will forgive me. Isn't it rather an anti-climax to begin by congratulating Signor Marconi and your brother on the success of the enterprise and to end with the coal strike?"

"Yes, certainly," said Sir Rufus. "My head was fuller of the coal strike than of wireless. We were just then contemplating our bill."

Mr. Faber continued: "I am bound to put this, and you will not misunderstand it. You say: 'I hope by the time they come back the coal strike will be finished.' That is the meaning of the words? There is nothing behind them? I have seen in so many papers that this was a cryptic utterance, and that it might mean something else; so I want to get it definitely on the note."

"Oh, yes, certainly," Sir Rufus replied. "I am much obliged for your putting it to me. I did not know I was going to be asked to send this telegram. I sent the telegram to the New York *Times;* I never cabled my brother; I never had any communication with him from the beginning to the end, nor did I know he was going to New York until after he got there."

"So that is the plain meaning of the plain words?" said Mr. Faber. "Yes," said Sir Rufus.

Later, Mr. Faber suggested that it was unwise for Sir Rufus, in his dual capacity as Attorney General and brother of the Managing Director of the English company, to send the message.

"I confess I thought nothing of it," said Sir Rufus, "and should not think anything of it to-day if it were not that all these falsehoods have been scattered broadcast. If you had told me there were people who were going to say that in some way I was benefittng by this contract and had made use of my information and been guilty of what undoubtedly I should call corruption, I agree; but it never occurred to me that anybody would suggest that I had been guilty of any such act. If I had been the only person who sent a telegram, or if I had sent a telegram affecting the shares of the company or anything of that kind, that would have been a different thing."

Mr. Faber asked whether the reading at the Marconi dinner of those messages might not have contributed to the subsequent increased strength of Marconi shares.

"I should have thought it impossible," said Sir Rufus. "The successful conclusion of the negotiations between the English Government and the English Marconi Company had already been announced."

Mr. Faber read an extract from a financial paper stating that before the sending of the congratulations from the Attorney General, Marconi shares remained practically stationary, in spite of the public announcement of the conclusion of the negotiations between the company and the Government, but that after that message was sent they went up rapidly. The paper added that Sir Rufus's high position in the British Government was a matter of common knowledge, and his message was doubtless regarded both by the American public and the United Wireless Company as practically, if not technically, an indorsement by the British Government of the Marconi undertaking.

Sir Rufus said he could conceive nothing more scandalously unfair than that article, and went on to show that it was without justification in fact.

At a later stage of the proceedings Lord Robert Cecil also took up the question of the message to the New York *Times*. Replying to a question of Sir Robert, the Attorney General said he had no reason to suppose that the entertainment of Mr. Marconi by the New York *Times* was the first step in negotiations for a campaign. "Have you any reason," asked Lord Robert, "to suppose that your telegram was, in fact, made use of in America for commercial purposes?"

"No," was the answer. "I inquired into that, and was told exactly the opposite; it had no effect whatever except to be read in conjunction with a number of others at the banquet, of which there was a report in the New York *Times*."

Lord Robert Cecil by some further questions suggested that it had been desirable, in view of the negotiations in New York, to make the position of the English Marconi Company as strong as possible in America. Sir Rufus responded that he should have thought it was as strong as it possibly could be. "You could have nothing stronger than to say that the Postmaster General had accepted the tender they offered. The fact that the company had a contract with the Government would put it in a far stronger position than a congratulatory telegram from me."

New Station Operated Without Ground

The new Marconi wireless telegraph station at Fremantle, Australia, which has just opened communication with Sydney across the 2,500-mile width of the continent of Australia, is operated without a ground connection in the ordinary sense. On occount of the extreme dryness of the sandy soil at Fremantle (there is absolutely no rain during the six or seven summer months, and the underground water is at a great depth below the surface) a satisfactory ground connection could not be established readily. Accordingly, an insulated counterpoise is employed instead, constituting the lower element of the electrically-vibrating circuit of which the antenna is the upper element. The counterpoise consists of about 100 insulated wires radiating out from the antenna tower, and joined and supported by three concentric circles of wire. The web thus formed is supported on poles which are higher toward the center and lower at the outer edge, making a flattened cone-shaped network, which gives an open shape to the vibratory circuit, insuring satisfactory radiation, and a more outward reflection of the waves from the counterpoise.

French Army Experts Arrive

With the arrival of four French officers prominent in the army and navy of France and in European scientific circles, experiments are to be undertaken through the medium of the powerful navy wireless station at Arlington, Va., and the station of the Eiffel tower in Paris, to establish the exact longitude between the two countries.

The work is of great importance, for when similar data is obtained by other nations, the information will permit the drawing of a true map of the world for the first time.

The French officers are Lieut. Ludovic Driencort and Lieut. H. A. E. Gignon of the navy, and Col. Gustav Ferrie and Capt. Paul Levesque, of the army. While here the French officers will be the guests of the Government.

Some Simple Improvements

BY J. C. S. TOMPKINS.

As a Marconi wireless operator I would like to place before other professional telegraphists the results of observations I have made while in the service, trusting that others will follow my example and relate their experiences toward a common end—increased efficiency.

It often happens that little things bring great results, and this is especially true in connection with wireless. I have found that by placing my finger on some particular wireless receiving connection the signals would come in much louder than ordinarily, due to the capacity of the human body. This is true of almost any kind of receiving set in use, where the winding posts are exposed. Touching some will decrease the sound whereas touching others will increase it.

With the United Wireless D type receiving set it is hard to get the long wave-lengths that are being adopted by the big stations unless one is at a considerable distance from them. But by moving the variable contact on the slide marked A to the zero mark, it can be pushed off the inductance and made to break contact, when the long wave-length stations will sound very loud. This is due to the fact that the circuit is now changed, with one variable aerial connection on B slider and ground as before on B coil loop, giving the open circuit; and fixed condenser and variable detector connection on C, giving the closed circuit. The fact that the A coil, unused, is on the ground side gives the circuit a resonating capacity at ground which helps to pick up long waves, but it mostly lies in the fact that the loop aerial is only connected to one end at the receiving set, thereby affording twice the amount of the loop aerial wire to be used. Another reason for getting the long wave-lengths better is that one oscillation transformer can be better adjusted for them than two, unless a loading coil is used.

There is another way of changing the circuit of the D type receiving set for long waves; that is by tightening two screws at the anchor gap until one side of the loop touches the helix connection, thereby grounding one side of the loop aerial. Then take the ground wire off the receiving circuit, so the detector will not be injured while sending, and you have aerial and ground both variable with A as a loading coil in the open circuit and C varying the closed detector circuit.

Army Needs Operators

Ardent enthusiasts of aerial communication will be interested to learn that the United States Army is in urgent need of telegraph and radio operators, according to statements made by those in charge of the recruiting offices. The positions of radio and telegraph dispatchers in the army are very few and are among the most profitable offices in the ranks.

The Adjutant General has sent out notices that the chief signal officer of the United States Army is making urgent demands for more men for his staff, and the recruiting stations are instructed to enlist as many suitable men as possible for this occupation.

The United States Army has imported a foreign invention for signaling, known as the heliograph, a system by which the sun's rays are utilized by big reflectors to transmit the secret signal code, and this new branch of the service has also created an opportunity for profitable enlistment in the army.

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Vol. I. APRIL No. 7

Editorial

Not so long ago we were asked to give an approximate estimate of the number of wireless stations engaged in a daily message traffic throughout the world. We hazarded a figure and when it was questioned set about to discover the exact number of these stations. Although enlightenment was sought from many directions the answer was substantially the same—an accurate count was impossible as installations were being made too rapidly these days.

The International Bureau of Wireless Telegraphy has just answered our query. That is, to the best of its ability.

It may interest you to make a guess at the number of stations at this time, not including the countless amateur stations—just commercial and naval equipments. Try to name the figure before you read further.

We will assume you have made a rough guess. It will surprise us if your estimate was correct.

The latest report from the International Bureau of Wireless Telegraphy tells us there are 2,354.

Of public wireless coast stations there are 375. Of this number the United States leads with 142; Great Britain comes second with 76, 33 of which are located in Canada; Germany takes third place with 22; Italy has 19; Russia, 19; France, 17; Spain, 10, and Denmark, 9.

Of the 950 stations on board war vessels, the United States again leads with 247; Great Britain has 213; France, 141; Germany, 112; Italy, 77; Japan, 70, and Russia, 70.

In the merchant marine Great Britain leads with 455 stations; the American flag flies over 253; Germany has 206; France, 68, and Italy, 47.

We suggested that you attempt an estimate for only the other day, while riding homeward in a street car, we overheard two men in a discussion over a recent sea rescue conclude that, "There must be a couple of hundred or more wireless stations these days—it's wonderful how wireless is growing."

It is wonderful. But instead of a few hundred stations — which we have found to be the average person's estimate—there are more than two thousand. In fact, we venture to say that since the International Bureau made its compilation the figure has reached three thousand.

Before we realize it, there will be five, ten, twenty and even thirty thousand, for there can be no doubt that wireless telegraphy is here to stay. In the few years since its discovery it has become a great commercial and humanitarian factor. The world to-day looks upon wireless as a necessity and were it taken away—but it isn't going to be. Instead, it will grow into more universal use, and, despite the depredations of scientific charlatans and frenzied financiers, radiotelegraphy will continue to go forward with increasing impetus for years to come.

* * *

Whenever we think of what the future holds in the way of new discoveries in the wireless field our mind invariably turns toward the amateur, for we cannot but believe that the serious youngsters who are to-day conducting experiments with their home made apparatus will, in time, add something to the world's knowledge of the wonderful art. There are many problems still unsolved and there will be many more encountered before the wireless art becomes an exact science. And it is more than possible that some of the little fellows in knickerbockers who are now merely tinkering with their ricketty sets will become the big engineers of the future. For this reason we are always willing to lend a helping hand to the serious young experimenter, to solve his problems, so far as possible, and to encourage him in his work. But we lose patience with the young man who will not attempt to help himself. Before this we have soundly berated the malicious and thoughtless ones for interfering with commercial business. Now we have a more painful occurrence to record.

Two young men have, through the wireless craze, landed in the police court, arrested on a charge of larceny. It is alleged that they have stolen batteries and wire from a neighboring garage.

When the police searched the home of one of the seventeen-year-old boys batteries, wiring and other equipment were found in his room. It was clearly shown that he was attempting to install a wireless station in his home and with a companion had acquired the necessary batteries and other equipment without the formality of paying for them.

Beside the deliberate dishonesty, which above all things is unpardonable, the case takes on a darker aspect through the fact that both young men come of well-to-do families. Their parents could afford to provide them with what was needed for their experiments. We do not doubt that their fathers were asked by these boys to give them money to build their station; and we do not doubt that for some very good reason this request was refused.

Had these young men been the worth-while kind—the type of boy we delight in aiding—they would have worked out some plan to earn the few necessary dollars themselves, instead of breaking in and stealing another's property. We know several boys who have earned every penny that has gone toward buying apparatus for their private stations. And they are very good stations, too. There is a young man in Pennsylvania who has a station which in efficiency loses nothing by comparison with the best in the country. He earned every dollar it cost him by whitewashing fences after school hours. Another young man we are proud to know did not have this opportunity as he lives in the big city of New York. His station was bought with money he earned securing subscriptions for THE MARCONIGRAPH. And these are but two of a dozen similar cases that have come to our attention.

There are many ways in which the earnest young man can earn a few dollars a week. It means work, hard work often, but this is the type of amateur that we look to for results in his experiments.

Fortunately, we do not know the young men who became thieves because their parents would not give them a wireless station. It is the first case of the kind we have heard of, and we hope it will be the last.

Otherwise we would soon become wearied of trying to aid the amateur experimenter.

The Share Market

NEW YORK, March 27.

Growing realization of the calamity which has stricken the Middle West was reflected in all stocks to-day by a heavy tone and a volume of business which tended to contract sharply from yesterday's scale of dealings. There was unmistakable evidence in Wall Street of foreign financial willingness to relax a little the severity of control under which Europe has been holding carefully conserved supplies of capital and credit, probably because of the appreciation that monetary conditions must remain in a state of tension for some time to come, but there was nothing in the European situation to diminish the restraints of prudence in view of the fresh difficulties which storm disasters have added to domestic perplexities.

While loss of life and the suffering of the homeless among our own people in Ohio, Indiana and other States are engaging so much sympathetic attention, it is inevitable that the purely financial side of the misfortune should be overlooked. At the same time it is evident that the bill is going to be an extremely heavy one when all the items in the reckoning are taken into consideration. Accordingly, it is not remarkable that the stock market should halt or even retrace its steps after having started, under the stimulus of better foreign news, to overcome the sold out and liquidated position at which it had recently arrived. A new factor has certainly been introduced into calculations, of which account must be taken, not only in the share market, but in the general business community as well.

Yet, in spite of these conditions, the market in Marconi issues has remained firm, and although the trading is light, small gains are shown over the quotations given in our previous issue.

Bid and asked prices to-day:

American, 5⅜—5¾; Canadian, 3⅞—4½; English, common, 21—22; English, preferred, 18—19.

An Editorial in the N. Y. "Times"

On March 28, the New York *Times* published the following editorial on the inquiry into the agreement made with the English Marconi Company and the British Government for the establishment of a round-the-world chain of Imperial wireless stations:

Ingenious and persistent, but wholly futile, are the efforts to make mountains out of molehills in the inquiry of the Select Committee of the House of Commons into the facts of the Marconi contract and the investment of the British Attorney General in American shares. Sir Rufus Isaacs has admitted candidly that his purchase of 10,000 shares of the American company's stock issue was doubtless indiscreet, but even in England leading newspapers and candid men have said that the transaction was nothing more than an indiscretion, an error of judgment such as any man in Sir Rufus's place might have committed. The British Government had already made its contract with the English Marconi Company. That contract had no bearing upon the American Company and any official action with which the British Attorney General might have been associated was already a matter of the past. He was not in a position to do anything to enhance the value of the American shares he bought. Nor was he in a position to use in any way his official influence or authority to affect those shares.

The enemies of Sir Rufus and of the Asquith ministry, for it is manifest that the investigation has been turned into an attack on the Government, have had a great deal to say about the wireless dispatches sent to the *Times* by the British Attorney General and others upon the occasion of the banquet given to Mr. Marconi and Godfrey Isaacs, General Manager of the Marconi Company, in the tower of the Times building on the evening of March 16, 1912. The ignoble pettiness of the attack and the disposition to convert wholly baseless suspicion into the substance of scandal are clearly revealed in the use made of these dispatches. The managers of what we may call the prosecution in the committee of inquiry would have the public believe that these wireless dispatches were a part of a stock market intrigue to "boom" the Marconi shares. Inasmuch as these gentlemen have sought to bring the *Times* into the affair, this newspaper will take the stand as a volunteer witness for a statement of facts.

During the three months preceding the evening of the banquet on March 16, the *Times* had been receiving nearly all its daily foreign service by wireless telegraphy. It tendered its hospitality and its greeting to Mr. Marconi in recognition of his priceless service to the commerce of the world and to humanity by his invention. Up to that time the best time of transmission of dispatches from London to the *Times* office was 55 minutes. On that evening the *Times* made a special effort to improve upon this record. To that end it appealed to the British Postmaster General for more rapid transmission over the land lines from London to Clifden. The result was that a remarkable series of new records was established, two of the messages of congratulation to Mr. Marconi being transmitted from London to the *Times* office in 10 minutes, while our regular news dispatches came through that night in from 20 to 27 minutes each. As a part of the history of that dinner party, which has become the subject of so much attention in England, we here reprint the dispatches of congratulation received during the evening, all of them bearing date London, March 16:

FROM EARL GREY.

To Marconi and the New York *Times:* Heartily wish you success in your splendid endeavor to facilitate conversation between the English-speaking peoples separated from each other by distance only. GREY.

FROM LORD AVEBURY.

I congratulate both Marconi and the New York *Times* on the splendid success and remarkable powers of wireless telegraphy. I remember when I sent the New York *Times* one of the first messages which marked the inauguration of the transatlantic service, and am glad to learn of its great development. AVEBURY.

FROM LORD BLYTHE.

To Guglielmo Marconi: Of all the wonderful discoveries the world has ever seen, none is to be compared with the miraculous invention of wireless telegraphy. All honor, therefore, is due to Marconi, to whom we are under a lifelong debt of gratitude.

BLYTHE.

FROM SIR RUFUS ISAACS.

Please congratulate Marconi and my brother on the successful development of a marvelous enterprise. I wish them all success in New York and hope that by the time they come back the coal strike will be finished. RUFUS ISAACS.

FROM HON. HARRY LAWSON.

'Wish you a triumphant success. Your service will be of immense importance to the press and the people. LAWSON.

Sir Rufus Isaacs has testified that he knew nothing of the banquet, of Mr. Marconi's presence in New York, or of the presence here of his brother, Godfrey Isaacs, until the *Times's* correspondent in London, by telephone, asked him to send a message of congratulation to Mr. Marconi. Lord Robert Cecil, in the questions he put to Sir Rufus before the committee, seemed to be actuated by a suspicion that there was something cryptic, some hidden turpitude in the allusion to the coal strike. That Sir Rufus explained by saying that the coal strike rather than wireless telegraphy was uppermost in his mind at the time. The tone of these messages, the words in which some of he chief men of England congratulated Mr. Marconi upon his great invention, ought to satisfy even the meanest mind that the banquet tendered to Mr. Marconi and the messages transmitted by his system of telegraphy from London to New York, so far from being affected with any commercial interest or purpose, were intended as a tribute of appreciation to a man who had earned the gratitude of the world and made his own name imperishable by a discovery which enlists the forces of nature in the useful service of humanity. The *Times* has never made any concealment of its deep interest in the advance of an art which reduced the cost of transmitting its foreign news dispatches by one-half. Nor does it think that motives of private interest alone can be imputed to whatever recognition and encouragement it has given to Mr. Marconi, since as a direct result of the introduction of wireless telegraphy ocean cable rates to Europe have been reduced 50 per cent. Not only the *Times* and all American newspapers, but all the American people share in that benefit.

So far as we have observed, nobody has been at pains to point out to the committee of inquiry that the position of the American Marconi Company was bettered, not by anything the British Attorney General did or could do, but largely by two facts, the absorption of the United Wireless Company and the agreement of the Western Union Company to open all its offices and land lines for the reception and delivery of wireless messages. From any moral point of view it is quite immaterial that Sir Rufus Isaacs and those associated with him in the purchase of American shares lost money instead of making money. The point is that there was no taint of anything remotely resembling corruption in his act, there was at most a question of propriety. The questions put to Sir Rufus have been, many of them, frankly insulting and flagrantly unfair. They betray a personal rancor, a desire to discredit and destroy rather than to bring out the truth. Underlying all such motives is the partisan desire to destroy the Asquith ministry. Sir Rufus has to bear the brunt of the attack, which is really a political assault upon the Government, and Lloyd-George, to whom he sold some of the American shares he bought, is doubtless the best hated man in England because of the policies he has pursued as Chancellor of the Exchequer.

The inquiry has taken on a political cast which obscures its real purpose, the ascertainment of facts. The full truth has already been told by Sir Rufus, but that is not all what his enemies want. They are seeking to convince the public that there is something hidden, something scandalous, a veritable Stock Exchange plunge by responsible members of the Government in securities the value of which would be affected by their official action. That is false, and so far as the attack is turned in that direction, it is despicable. It should move the British public not to the continuing of suspicions, but to the indignant rebuke of the men responsible for these calumnies.

It Startled Bryan Himself

Apropos of the current discussions on the appointment of Mr. Bryan to the high office of Secretary of State, a story which was told to our editor a few days ago is timely, in that it shows the Nebraskan is well acquainted with the feelings of alarm which surge through the breasts of financiers as each new move of his is heralded.

"It was at the Florida State Fair, at Tampa," said Mr. E. E. Butcher, Instructing Engineer of the American Marconi Company, "that I first came in close contact with William Jennings Bryan, our new Secretary of State. One of the various exhibits at the Fair was a rather powerful wireless telegraph set which we had installed for demonstration purposes. One day during the exhibition, along came Mr. Bryan with his usual array of admirers and followers. His attention was directed to the wireless telegraph booth. He evinced great interest in the apparatus and requested an explanation of its operation. The terrific noise and crashing sound of the spark of the wireless transmitter amazed him. He asked a great number of questions and finally requested me to spell out the word "Bryan." I took hold of the telegraph key and slowly spelled out "B-R-Y-A-N." The voluminous sound resonated throughout the entire exhibition hall. Bryan was amazed. He exclaimed, 'No wonder those fellows up in Wall Street are afraid of my name. I can readily understand it if it makes a terrific disturbance like that.' "

WIRELESS ENGINEERING COURSE

EDITOR'S NOTE:—This course of instruction has been prepared with the view of teaching both the beginner and the practical radio operator basic principles and the electro-magnetic phenomena encountered in the wireless art. While much of value to the experimenter of some experience will be found throughout the course it has been designed primarily for those who are sufficiently interested in wireless telegraphy to apply themselves diligently toward the mastering of basic principles before attempting to construct apparatus and arrange circuits. Due to the tendency of youth to miss the first rung in the ladder of progress there are many amateurs operating sets at the present time who are not in the slightest degree informed upon the why and wherefore of the experiments they are conducting. They know that a certain result may be obtained under certain conditions and that various arrangements of circuits will produce various effects, but they have no conception of the electro-magnetic phenomena that make these possible. To this ignorance of fundamental principles may be ascribed most of the difficulties and discouragements experienced by those who have the ambition and enthusiasm to accomplish something of note in the wireless field but lack the patience to first acquire a true understanding of the subject. Those who will apply themselves to mastering the contents of this course will find that the art of studying properly will soon be acquired. Upon this trait is based the chief factor in education, enthusiasm, without which none can hope for success.

The publishers of this magazine have given weighty consideration to every detail connected with the proper instruction of serious students and are confident that this course will receive recognition as the most valuable work of its kind ever attempted. With the world's greatest authorities to choose from they have selected the man who, in their judgment, was best qualified to handle the subject and our readers will unquestionably recognize the wisdom of the choice as the instruction progresses.

The achievements of Mr. Shoemaker are familiar to every one engaged in wireless work throughout the world. One of the pioneers, he first commenced devoting his energies to the subject in 1900 with the American Wireless Telegraph & Telephone Company, remaining with that concern until it and its successors were merged into the American De Forest Company. Soon after the merger was effected he severed his connection with the combination and organized the International Telegraph Construction Company, which he sold in 1908 to the United Wireless. When the assets of the latter company were acquired by the Marconi Company he was appointed Research Engineer and his exclusive services are now given to the development of the Marconi system. His present high position in the commercial field, together with the fact that he has designed and built a great number of wireless sets for the Army and Navy Departments of the United States and foreign governments are the best indications of his rating as a wireless expert.

That Mr. Shoemaker can explain in understandable English the principles and use of each component part of the apparatus used in wireless telegraphy will be clearly demonstrated to careful readers.

By H. Shoemaker

Research Engineer of the Marconi Wireless Telegraph Company of America

CHAPTER IV.

Mutual Induction.—So far we have treated the effect of electro magnetic induction, when one circuit has been involved. If two circuits are so situated that the flux produced by a current flowing in one circuit cuts or passes through the other circuit they possess mutual inductance. The two circuits are then inductively coupled and are able to transfer energy from one to the other by means of the magnetic flux common to both circuits.

Mutual inductance is the measure of the inductive relation between two circuits. The symbol generally used for Mutual Induction is M and the unit is the same as the unit of self induction (The Henry).

Both mutual inductance and self inductance can be expressed in centimeters (Absolute Units). When either of these qualities are determined from the dimensions of the circuits the results obtained will be in centimeters when the dimensions are taken in centimeters.

One Henry is equal to 10^9 or (1,000,-000,000) Cm.

The unit generally used in practice is the milli-henry (10^6Cm.). In wireless telegraphy a still smaller unit is used, *viz.*, the micro-henry (10^3Cm.).

The value of M depends on the number of turns in each circuit and the relation or distance between the two circuits. M is greatest when all the flux produced in one circuit cuts or interlinks the other circuit.

This linking or mutual inductance is generally accomplished by inductance coils in each circuit and placed close together. Two such coils so placed that energy can be transferred from one to the other is called a transformer, because it is generally used to change or transform the voltage and current from one value to another. If the secondary voltage is higher than the primary it is called a step-up transformer. If the secondary voltage is lower than the primary it is called a step-down transformer.

Transformers for the lower frequencies (25 cycles to 600 cycles or even greater) have iron cores. The use of the iron core decreases the reluctance of the magnetic circuit and enables a greater flux to flow with a given number of ampere turns or magnetizing force than would be the case if no iron was used. By use of iron the magnetizing force necessary to drive the flux through the circuit is secured by less ampere-turns, thus saving a great deal of wire and losses due to the resistance of the wire. This iron core must be finely divided (laminated), that is, it must be made of small iron wires or thin sheets of iron. Transformers are made in many different forms and for different uses, but they all operate on the same principle, *viz.*, by mutual induction.

Transformers used for lighting and power circuits generally have closed iron cores and are operated at a high flux density. Densities as high as 60,000 lines per square inch are used for frequencies of 60 cycles. With higher frequencies the flux density is decreased in nearly the reverse ratio of the frequencies. These transformers are generally constructed to operate on a constant voltage and to deliver current at a constant voltage. In some cases, however, they are constructed to deliver a constant current, the voltage varying as the resistance in the circuit varies. This latter class of transformers are generally used in wireless telegraphy, for reasons which will be given later.

Transformers without iron cores are used in wireless telegraphy and are called oscillation transformers. They generally consist of two copper coils of helices which have the distance between them varied so as to change or vary the mutual inductance.

The closer two circuits are together the greater will be the mutual inductance. The absolute value, however, depends on the product of the number of turns in each coil or circuit and their geometric relation, and is expressed by the formula:

$$M = n \pi N_1 N_2/Z.$$

This formula holds only when all the flux produced by the primary turns N_1 cuts the secondary turns N_2.

The flux $\emptyset$ due to C amperes in a coil of N_1 turns is expressed by:

$$\emptyset = 4 \pi C N_1/10Z,$$

where Z is the reluctance of the magnetic circuit.

If we have N_2 in the secondary coil or circuit, then $N_2 \emptyset$ will be the flux which cuts the secondary when current C is flowing in the primary, or:

$$N_2 \emptyset = 4 \pi C N_1 N_2/10Z.$$

We have seen how the self induction of the primary can be expressed by the formula:

$$L = \frac{\emptyset N_1 \times 10^{-8}}{\text{current (in amperes)}}$$

This is equivalent to saying that the self induction of a circuit is equal to the total magnetic flux times the turns divided by the current (in amperes) times 10^8.

$\emptyset N_1$ is the flux turns of the primary, and if we substitute for $\emptyset N_1$, $\emptyset N_2$ (the flux turns in the secondary) we will have an expression for the mutual induction:

$$M = \frac{\emptyset N_2 \times 10^{-8}}{\text{current}} \text{ or } M = \frac{\emptyset N_2}{C \times 10^8}$$

Substituting for $\emptyset$ its value.

$$\emptyset = 4 \pi C N_1/10Z.$$

We have:

$$M = \frac{4\pi C N_1 N_2}{C\, 10^8\, 10 Z} \text{ or } M = \frac{4\pi N_1 N_2}{10_9 Z}$$

henrys, or, $M = \frac{4\pi N_1 N_2}{Z}$ Cm., or C.G.S. units.

In transformers having iron magnetic circuits nearly all the flux produced by the primary cuts the secondary and the above formula can be applied, but where there is no iron used, as in oscillation transformers, all the flux produced by the primary does not cut the secondary, therefore, these formulae will not hold. M can, however, be determined by a very simple method which only involves the measurement of self induction.

Let L equal the inductance of the primary and L_1 the inductance of the secondary. If we connect these two coils in series so that they assist each other in producing flux, then the self induction (L_2) of the two coils in series will be:

$$L_2 = L + 2M + L_1.$$

If they are connected in series so that they oppose each other in producing flux, then the self induction (L_3) will be:

$$L_3 = L - 2M + L_1.$$

From these two equations M can be determined in terms of L and L_1, as:

$$L_2 = L + 2\,M + L_1$$
$$L_3 = L - 2\,M + L_1$$
$$L_2 - L_3 = 4\,M$$
$$\text{or } M = \frac{L_2 - L_3}{4}$$

$$L_2 = L + 2\,M + L_1$$
$$L_3 = L - 2\,M + L_1$$
$$L_2 + L_3 = 2\,L + 2\,L_1$$
$$\text{or } L + L_1 = \frac{L_2 + L_3}{2}$$

This method is of great use in determining M and the other quantities depending on M for their value. It is especially used in measuring M in oscillation transformers where the primary and secondary are at considerable distance apart.

The reader is referred to Art. 481, Thompson's Electricity and Magnetism, for full explanation of the elementry theory of the transformer. The types of transformers used in Wireless Telegraphy will be discussed in a later chapter.

Capacity may be defined as that property of a conductor by virtue of which it can store electricity or energy in electro static form. The device used for storing or holding electricity in this form is called a condenser. The capacity of a condenser depends on its dimensions and its distance from other conductors or the earth. The unit of capacity is the centimeter. (Electro static units) or the Farad (Electro Magnetic Units).

An insulated sphere of conducting material having a radius of 1 Cm. at several feet (at least 5 feet) from the earth or other conducting bodies, has a capacity of 1 Cm. (See Thompson's Art. No. 283.) The farad is the capacity of a condenser which requires an ampere flowing for one second to charge it to one volt potential. Such a condenser would be of enormous size, much larger than any used in practical work, so the Micro Farad (one millionth of a farad of 10^{-6} farads) is the unit generally used.

One Micro Farad is equal to 900,000 Cm. (electro static units). When the capacity of a condenser or conductor is determined by its dimensions (in Cm.) the result will be in centimeters (electro static units) and must be divided by 900,000 to bring it to Micro Farads.

The whole subject is treated in Thompson's under Chapter IV, pages 244 to 293, inclusive. On pages 289 to 293 are given formulae for computing capacity from the dimensions of the conductor and for determining the total capacity of the condensers connected in series or parallel. The reader should study this chapter if he is not already familiar with this subject. Art. 305 treats of the energy of the charge and discharge of a condenser which is a very important factor in Wireless Telegraphy.

Practical condensers are constructed

with great amounts of conducting surfaces separated by insulating material, such as rubber, glass, oil and air. Paper impregnated with insulating wax or oils is also used. It is not within the scope of this work to go into the details of construction of these devices, but to confine ourselves to the effects of capacity on alternating currents in circuits of which they are apart.

The action of capacity on alternating currents is opposite to that of inductance. Instead of causing the current to lag it causes it to lead the E.M.F. This is due to the fact that current must flow into a capacity before its potential or voltage will rise.

When the current starts to flow the potential is zero, and as the current flows the potential rises and current flow decreases so that when the potential of the capacity or condenser equals the potential applied, the current has stopped flowing. If the applied potential is decreased the condenser will start to discharge and current will flow out of it in the opposite manner in which it was charged. Inductance tends to prolong or keep a current flowing, while capacity tends to drive it back. These effects oppose each other and under certain conditions neutralize each other.

Reactance of a condenser is expressed by $-\frac{1}{p\,K}$ where K is the capacity in farads and $p = 2\pi n$. The impedance will be $R^2 + \frac{1}{p^2\,K^2}$. The angle of lead ϕ will be expressed by $\tan.\ \phi = -\frac{1}{p\,K\,R}$.

If capacity and inductance are present, then the impedance will be expressed by:

Impedance =

$$R^2 + (p\,L - \frac{1}{p\,K})^2.$$

$$\text{Reactance} = p\,L - \frac{1}{p\,K}.$$

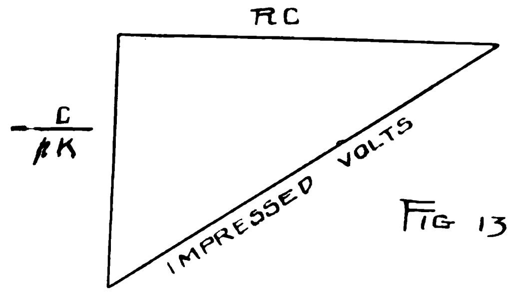


FIG 13

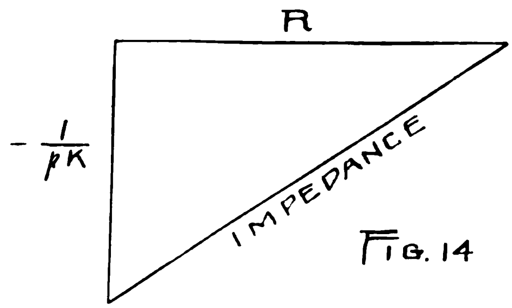


FIG. 14

The angle of lead is also expressed by: $\tan \phi = (p\,L - \frac{1}{p\,K})\ /\ R$.

These quantities can be represented by the above diagrams, Figs. 13 and 14, in the same manner as reactance and impedance due to self induction was represented.

If we have capacity alone in the circuit then $C = \frac{E}{-\frac{1}{p\,K}}$ or $C = E\,p\,K$.

If both resistance and capacity are present then: $C = \frac{E}{\sqrt{R^2 + (1/p\,K)^2}}$.

If capacity and self induction are present then $C = \frac{E}{p\,L - (1/p\,K)}$.

If $p\,L = 1/p\,K$ then the term $p\,L - (1/p\,K)$ will equal zero and the current will be infinity unless there is resistance in the circuit, in which case the current will be equal to E/R (Ohms law). This condition can be expressed: $L = 1/p^2\,K$.

This is the case where reactance due to self induction and reactance due to capacity completely neutralized each other. The phenomenom is called resonance and is of great importance in wireless telegraphy. This subject will be treated in a later chapter.

If resistance, inductance and capacity are present, then:

$$C = \frac{E}{\sqrt{R^2 + [pL - (1/pK)]^2}}.$$

It will be seen from the above that the current obeys Ohms law if reactance or impedance is substituted instead of resistance.

(*To be continued.*)

This course commenced in the December, 1912, issue.

Automatic Wireless

A small wireless equipment, which is self-operating and therefore extremely economical to work, has been devised for use at the new marine stations that are being installed on the French coast to warn ships in foggy weather. When a sufficient number of these stations have been installed it will be possible for any ship equipped with a wireless compass to ascertain her position whenever within range of any two such stations.

The interesting feature of the lighthouse stations, two of which are in operation on small islands northwest and southwest of Brest Harbor, is their very low cost; the complete outfit is stated to cost only about $100, and as the signals are emitted automatically, the expense of an operator is obviated. Two sets of signals are sent at regular intervals by means of an automatic contact maker, which replaces the ordinary Morse key. These signals are radiated, one set every ten seconds, the other every half minute, and it is proposed that each station attached to a lighthouse shall have a distinctive code signal.

A number of vessels are now fitted with Marconi and other forms of wireless compasses, with which it is possible to detect the direction from which signals are emanating within a few degrees. It is maintained that these vessels could pick their way along the channel or round the coast in foggy weather by taking their bearings from the lighthouse signals, if a sufficient number of lighthouses were fitted with the automatic radiators. Two more stations have been prepared for the entrance to Havre, and several more will, it is anticipated, be installed in due course. Each station has a limited range only, in order to avoid complication in reading the signals.

Arm Saved Through Wireless Treatment

Medical treatment by wireless is credited by William Murray, a tester of apparatus in the employ of the Marconi Company, with having saved his right arm.

The physician in the case was Dr. Ernestus O. Kuhr, of No. 299 Stuyvesant avenue, Brooklyn, the treatment being given from Havana to Sombrero off the Florida coast.

Dr. Kuhr was on the Ward liner *Esperanza* when as she neared Havana that vessel's wireless operator caught a call for medical aid. The call came from the *Altastad*, a big Norwegian freighter, which gave its position as off Sombrero. The message was a long one. It explained that Murray, a Marconi tester, was aboard and that his arm was badly infected. It had swollen, an abscess had formed and fear was entertained that it would be past saving before Tampico, the *Altasad's* first port of call, could be reached.

Dr. Kuhr told Murray that the case was one for immediate operation. He advised the opening of the arm with a sharp, properly sterilized penknife at once.

"Have you got bichloride of mercury?" he asked.

The answer from the *Altasad* was in the negative.

"Then, after you have opened the abscess, use carbolic acid freely," was the wireless prescription from the *Esperanza* to the Norwegian.

Detailed instructions as to the preparation of the dressing of the arm after the operation were also sent by wireless by Dr. Kuhr.

In this department the affairs of the various wireless clubs and associations will receive attention. Believing that all amateurs are interested in the experiments and research work of others the publishers plan to give readers each month distinctive items on the progress made by club members, thus offering all an exchange of ideas in organization and experimental matters and bringing students in closer touch with each other. To this end we will also publish a Wireless Club Directory. The names of the officers and the street address of the secretary are requested from all clubs. Notification of any changes should be forwarded at once. Short descriptive articles of experiments or new stations with distinctive features, accompanied by drawings or photographs, will be published.

Listening to the press operators sending the news of the day to the steamers far out on the ocean is certainly an entertaining evening's pastime and this is the way Rey W. Neville, of Rochester, N. Y., occupies his leisure moments every night, for with his well-equipped amateur wireless station he can pick up all the press news sent from Arlington, Va., and Cape Cod. The messages are usually given so slowly that he can take everything that comes and as a result of his evening's amusement he has a complete résumé of the news of the day, so reading morning papers is superfluous for this young devotee of the Marconi system.

Mr. Neville, who is only 17 years old, began experimenting with wireless three years ago, and to-day, as a result of his patient work, he has one of the best amateur stations in the State. His aerial is built on a pole, attached to a tree near his house, and on the roof of the house. One pole is 60 feet and the other 45 feet. His transmitting and receiving station is in the basement of his home, and every night at 8:15 o'clock he begins work, receiving and sending calls to the other 15 local stations. One of his frequent calls is to the Naval Reserve station in Charlotte. Very often he gets messages from and sends them to Batavia, where there is a clever young amateur operator. At 9:15 o'clock he hears the Arlington press stuff sent out and at 10 o'clock the operators at Cape Cod go on duty. One night Mr. Neville picked up a message from Sault Ste. Marie, Mich.

Mr. Neville made his own receiving outfit and his transformer, but had to buy the transmitting outfit. He can send messages about 60 miles. His entire outfit cost him less than $100. He is licensed as an amateur.

The young man is a junior in East High School and expects to be an electrical engineer. His real name is Rey De Neuville, the family name having been Americanized to Neville. The DeNeuville family traces its genealogy back to a son of Louis XVI of France.

* * *

One of the most enthusiastic among the young men who are conscientiously studying the intricacies of the wireless set, is T. J. M. Daly, of Covington, Tenn. A letter addressed to The Marconigraph has been received from this young man. It says:

"While in New Orleans I was examined by J. A. Davis, U. S. N., for radio operator, commercial first grade, and passed the examination. I now hold license No. 2370, allowing me to operate anywhere within the United States of America.

"My idea in writing you this letter

is to thank you for the valuable information that you have given in your magazines in the past, and I can truthfully say that it was only through the knowledge obtained through the careful study of the many different articles contained in your books that I acquired ability to pass this examination.

"I wish to state that the examination held by the Navy Department at New Orleans is very rigid and in order to make the proper grade an applicant has to know his business. The examining officer is very courteous to you, but no assistance whatever is given by him.

"I have never worked at the wireless business except in an experimental way, but some day I expect this may be of benefit to me. I took this examination, first, for the honor of having a license issued by the United States Government; second, because I was advised by Mr. R. E. Thompson, radio inspector, that the Government was very anxious to have all who could possibly do so pass the first grade examination, and, last, for the privilege of working a longer wave-length than the average amateur. By licensing my station for public service, I can work at a wave-length of 600 meters.

"You may use this letter if you so desire to encourage other amateurs, to the end that they may accomplish the same as I have done."

U. S. Cruiser Does Well

After a week at Gibraltar, testing the receptive and transmitting radius of the Arlington wireless station, the United States scout cruiser *Salem* reports success and her officers are delighted.

It is stated that on the voyage messages have been transmitted twenty-three hundred miles by day and that since the *Salem's* arrival at the Rock she has been in communication with Arlington at night.

Wireless Club Directory

Amateur wireless clubs and associations are requested to keep us posted in regard to any changes that should be made. New Clubs will be entered in the issue following receipt of notices in the form given below.

ARKANSAS

LITTLE ROCK—Arkansas Wireless association: G. A. Rauch, president; Edward Vaughn, 2622 State St., Little Rock, Ark., secretary and treasurer.

BRITISH COLUMBIA

VANCOUVER—Wireless Association of British Columbia: Clifford C. Watson, president; J. Arnott, vice-president; E. Kelly, treasurer; H. C. Bothel, 800 Fourteenth Ave., E. Vancouver, B. C., secretary.

CALIFORNIA

LONG BEACH—Long Beach Radio Research Club: Bernard Williams, 555 E. Seaside Blvd., Long Beach, Cal., secretary.

LOS ANGELES — Custer Wireless Club: Franklin Webber, president; Oakley Ashton, treasurer; Walter Maynes, 438 Custer Ave., Los Angeles, Cal., secretary.

NAPA—Aero Wireless Club: A. Garland, president; W. Ladley, vice-president; D. Beard, Napa, Cal., secretary and treasurer.

OAKLAND — Fruitvale Wireless Club: Joseph C. Brewer, president; Alan Downing, vice-president; Chrissie Eiferle, treasurer; Abner Scoville, 2510 Fruitvale Ave., Oakland, Cal., secretary.

OAKLAND — Oakland Wireless Club: H. Montag, president; W. L. Walker, treasurer; W. R. Sibbert, 916 Chester St., Oakland, Cal., secretary.

SACRAMENTO — Sacramento Wireless Signal Club: E. Rackliff, president; J. Murray, vice-president; G. Banvard, treasurer; W. E. Totten, 1524 "M" St., Sacramento, Cal., secretary.

SANTA CRUZ — Santa Cruz Wireless Association: Orville Johnson, president; Harold E. Sentor, 184 Walnut St., Santa Cruz, secretary and treasurer.

CANADA

PETERBORO, Ontario — Peterboro Wireless Club: G. B. Powell, president; C. V. Miller, vice-president; E. W. Oke, 263 Engleburn Ave., Peterboro, Ontario, Can., secretary and treasurer.

WINNIPEG, Manitoba—Canadian Central Wireless Club: Alexander Polson, president; Stuart Scorer, vice-president; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., secretary and treasurer.

COLORADO

DENVER—Colorado Wireless Association: William Cawley, president; Thomas Ekren, vice-president; W. F. Lapham, 1545 Milwaukee St., Denver, Colo., secretary and treasurer.

CONNECTICUT

NEW HAVEN—New Haven Wireless Association: Roy E. Wilmot, president; Arthur P. Seeley, vice-president; Russel O'Connor, 27 Vernon St., New Haven, Conn., secretary and treasurer.

WATERBURY — Waterbury Wireless Association: Weston Jenks, president; Alfred Upham, treasurer; H. M. Rogers, Jr., 25 Linden St., Waterbury, Conn., secretary.

GEORGIA

SAVANNAH — Wireless Association of Savannah: Philip C. Bangs, president; Arthur A. Funk, vice-president; Hugh Jenkins, treasurer; Lewis Cole, 803 Price St., Savannah, Ga., secretary.

ILLINOIS

CHICAGO—Chicago Wireless Association: S. W. Wooster, president; R. Haynes, vice-president; C. Stone, treasurer; F. D. Northland, 24 Scott St., Chicago, Ill., secretary and corresponding secretary.

CHICAGO — Lake View Wireless Club: E. M. Eckett, president; R. Ludwig, treasurer; R. F. Becker, 1439 Winona Ave., Chicago, Ill., secretary.

CHICAGO — Northwestern Wireless Association of Chicago: Rolf Rolfson, president; H. Kunde, treasurer; Edw. G. Egloff, 2720 Noble Ave., Chicago, Ill., secretary.

DE KALB—De Kalb Radio Transmission Association: Bruce Lundberg, president; Walter Bergendorf, vice-president; De Estin Snow, treasurer; Bayard Clark, 205 Augusta Ave., De Kalb, Ill., secretary.

INDIANA

FAIRMOUNT—Southeastern Indiana Wireless Asso ciation: R. F. Vanter, president; D. C. Cox, vice-president and treasurer; H. Hitz, Fairmont, Madison, Ind., corresponding secretary.

HOBART—Hobart Wireless Association: Asa Bullock, president; Charles Clifford, Hobart, Ind., secretary.

INDIANAPOLIS — Wireless Club of the Shortridge High School: Robert C. Schimmel, 2220 N. Penn St., Indianapolis, Ind., president; George R. Popp, vice-president; Bayard Brill, treasurer; Oliver Hamilton, secretary.

RICHMOND—Aerograph Club of Richmond, Ind.; H. J. Trueblood, president; Richard Gatzek, vice-president; James Pardieck, 320 South Eighth St., Richmond, Ind., secretary.

VALPARAISO—Alpha Wireless Association: L. L. Martin, president; F. A. Schaeffer, vice-president; G. F. Girton, Box 57, Valparaiso, Ind., secretary and treasurer.

KANSAS

INDEPENDENCE — Independence Wireless Association: Boyce Miller, president; Ralph Elliott, secretary; Joseh Mahan, 214 South Sixth St., Independence Kan., vice-president.

LOUISIANA

NEW ORLEANS — Southern Wireless Association: B. Oppenheim, president; P. Gernsbacher, 1435 Henry Clay Ave., New Orleans, La., secretary.

MARYLAND

BALTIMORE—Wireless Club of Baltimore: Harry Richards, president; William Pules, vice-president; Curtis Garret, treasurer; Winters Jones, 728 North Monroe St., Baltimore, Md., secretary.

MASSACHUSETTS

ADAMS — Berkshire Wireless Club: Warren A. Ford, president; William Yarkee, vice-president; Charles Hodecker, treasurer; Jas. H. Ferguson, 18 Dean St., Adams, Mass., secretary.

HAVERHILL — Haverhill Wireless Association; Riedel G. Sprague, president; Charles Farrington, vice-president; Leon R. Westbrook, Haverhill, Mass., secretary and treasurer.

ROSLINDALE—Roslindale Wireless Association: O. Gilus, president; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., secretary.

SOMERVILLE — Spring Hill Wireless Association: R. D. Thiery, president; H. P. Hood, Second and Benton Road, Somerville, Mass., secretary and treasurer.

SPRINGFIELD — Springfield Wireless Association: W. S. Robinson, Jr., president; William Crawford, R. F. D. No. 1, Springfield, Mass., secretary.

SPRINGFIELD—Forest Park School Wireless Club: A. C. Gravel, president; C. K. Seely, vice-president; D. W. Martenson, secretary. Club Rooms, 323 King St., Springfield, Mass.

STONEHAM—Stoneham Radio Association: Stuart R. Ward, president; Russell Colley, vice-president; Wendell Smith, 33 Warren St., Stoneham, Mass., secretary and treasurer.

WEST MEDFORD—Independent Wireless Transmission Co., Starr W. Stanyan, 76 Boston Ave., West Medford, Mass., secretary.

MICHIGAN

JONESVILLE — Jonesville Wireless Association: Frederic Wetmore, president; Webb Virmylia, vice-president; Richard Hawkins, treasurer; Merritt Green, Lock Box 82, Jonesville, Mich., secretary.

MINNESOTA

ST. PAUL—St. Paul Wireless Club: Thos. Taylor, president; L. R. Moore, vice-president; E. C. Estes, treasurer; R. H. Milton, 217 Dayton Ave., St. Paul, Minn., secretary.

MISSOURI

HANNIBAL — Hannibal Amateur Wireless Club: Charles A. Cruickshank, president; J. C. Rowland, vice-president; William Youse, treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., secretary.

MONTANA

BUTTE—Wireless Association of Montana: Roy Tusel, president; Elliot Gillie, vice-president; Harold Satter, 309 South Ohio St., Butte, Mont., secretary.

NEW HAMPSHIRE

MANCHESTER — Manchester Radio Club: Homer B. Lincoln, president; Clarence Campbell, vice-president; Elmer Cutts, treasurer; Earle Freeman, 759 Pine St., Manchester, N. H., secretary.

NEW JERSEY

WILDWOOD—Wildwood Wireless Association: Russell Kurtz, president; Walter Nefferdorf, vice-president; J. Crozier Todd, treasurer; Chas. E. Rockstraw, Jr., 110 East Pine Ave., Wildwood, N. J., secretary.

NEW YORK

BUFFALO — Frontier Wireless Club: Chas. B. Coxhead, president; John D. Camp, vice-president; Franklin J. Kidd, Jr., treasurer; Herbert M. Graves, 458 Potomac Ave., Buffalo, N. Y., secretary.

GENEVA—Amateur Wireless Club of Geneva: H. B. Graves, Jr., president; C. Hartman, vice-president; L. Reid, treasurer; Benj. Merry, 148 William St., Geneva, N. Y., secretary.

GENEVA — Geneva Wireless Club: Charles B. Hartman, president; Charles Smith, vice-president; Benj. Merry, treasurer; Henry B. Graves, Jr., 448 Castle Ave., Geneva, N. Y., secretary.

MT. VERNON—Chester Hill Wireless Club: Waller Morgan, president; Richard D. Zucker, 46 Clinton Place, Mt. Vernon, N. Y., secretary.

NEW YORK—East Side Y. C. C. A. Radio Club: Harold Sachs, president; C. Broggini, vice-president; David Brown, 206 West 86th St., New York City, secretary and treasurer.

NEW YORK — Gramercy Wireless Club: James Platt, President; John Gebhard, vice-president; John Diehl, treasurer; John Jordan, 219 East 23d St., New York, secretary.

NEW YORK—Metropolis Club: J. T. Smith, president; William E. Meyer, 131 West 60th St., New York City, secretary and treasurer.

NYACK — Rockland County Wireless Association: W. F. Crosby, president; Marquis Bryant, secretary; Erskine Van Houten, 24 De Pew Ave., Nyack, N. Y., corresponding secretary.

SCHENECTADY — Amateur Wireless Association of Schenectady: D. F. Crawford, president; L. Beebe, vice-president; C. Wright, treasurer; L. S. Uphoff, 122 Ave. "B," Schenectady, N. Y., secretary.

NORTH DAKOTA

FARGO — Fargo Wireless Association: Kenneth Hance, president; John Bathrick, vice-president; Earl C. Reineke, 518 Ninth St., Fargo, N. D., Secretary.

OKLAHOMA

MUSKOGEE—Oklahoma State Wireless Association: T. E. Reid, president; G. O. Sutton, vice-president; Ralph Johns, Box 1448, Muskogee, Okla., secretary.

OREGON

LENTS — Oregon State Wireless Association: Charles Austin, president; Joyce Kelly, recording secretary; Edward Murray, sergeant-at-arms; Clarence Bischoff, Lents, Ore., treasurer and corresponding secretary.

PENNSYLVANIA

LEETSDALE — Allegheny County Wireless Association: Arthur O. Davis, president; Theodore D. Richards, vice-president: James Seaman, Leetsdale, Pa., secretary and treasurer.

PITTSBURG—Greenfield Wireless Association: Edward M. Wolf, president and corresponding secretary, 4125 Haldane St., Pittsburg, Pa.

WILLIAMSPORT — Y. M. C. A. Wireless Club: Lewis Holtzinger, president; Christian Coup, vice-president; Robert Templeman, treasurer; Lester Lighton, 211 West Fourth St., Williamsport, Pa., secretary.

RHODE ISLAND

NEWPORT — Aerogram Club: J. Stedman, president; A. Hayward Carr, chairman Board of Directors; Albert S. Hayward, treasurer; Donald P. Thurston, secretary; Walter B. Clarke, 17 May St., Newport, R. I., corresponding secretary.

TENNESSEE

MEMPHIS—Tri-State Wireless Association: C. B. De La Hunt, president; O. F. Lyons, vice-president; T. J. Daly, treasurer; C. J. Cowan, Memphis, Tenn., secretary.

WISCONSIN

MILWAUKEE—Cardinal Wireless Club: K. Walthers, president; F. Dannenfelser, vice-president; Miss A. Peterson, South Division High School, Milwaukee, Wis., secretary.

Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with india ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.

H. H. S., Chicago, states:

I have two antennæ almost directly under each other and running in the same direction, but separated by the ceiling. Will one affect the other?

Ans.—The two antennæ will not affect one another provided while you are using one you disconnect the other from the earth.

* * *

G. C. H., Hamilton, Ont., inquires:

(1) Does the Marconi Cavalry Station use carborundum detectors? I work Buffalo and Toronto with good results, but am unable to keep the crystal constant and very often takes some time adjusting it between metal clips. How can I remedy this?

Ans.—We understand that the carborundum detector is used in these sets. There is no reason why the carborundum detectors should not remain constant in its adjustment except possibly when transmitting you do not use a shunt switch.

(2) I have a lump of carborundum. Is there any particular shape of crystal to choose when broken up?

Ans.—You should make us of crystals which have a decided grain and be sure to put them in the detector holder lengthwise with the grain. You will find that those crystals which have deposits of graphite in one end are, generally speaking, the best.

(3) We were also supplied with valve detectors. These through misuse have been broken. Where can I get some more and at what price? The valve is lighted by a 6-volt accumulator.

Ans.—You can secure new valves from the Marconi Wireless Telegraph Company of America, 27 William street, New York City.

C. M. S., Stege, Cal., asks:

(1) When was the first MARCONIGRAPH published and are the back numbers obtainable?

Ans.—The first issue of THE MARCONIGRAPH bears the date of October, 1912. Back numbers within three months of the current issue may be had for ten cents each. Others dating further back cost twenty-five cents each.

(2) Did the Massie Wireless Telegraph Company manufacture wireless telephone apparatus?

Ans.—We have never heard of any Massie wireless telephone set, and as we would probably have known had such been manufactured, we feel safe in saying that none were made.

(3) About what is the price of an oscilliscope for use with wireless telephony and where could one be obtained?

Ans.—We have no knowledge of any device known as an "oscilliscope" unless it be one of the weird instruments evolved by some of the minor experimenters in this field.

* * *

E. T., Galesburg, states:

Having a lot of copper ribbon on hand, I would like to know whether I could use it in place of wire in the antenna? The ribbon is .005 inch thick and 1/8 inch wide.

Ans.—There is no reason why the copper ribbon should not work as well as wire. In fact, better results should be obtained on account of the increased conductivity.

* * *

A. M. K., Braddock, Pa., writes:

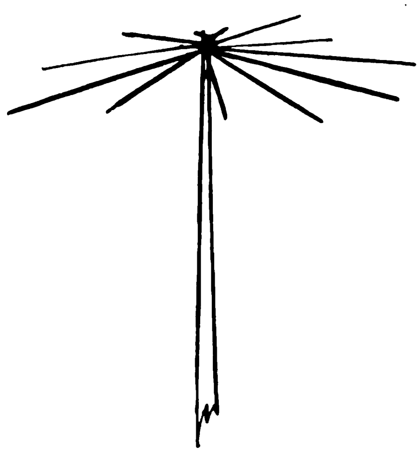
I have a static machine which has four rubber plates. It produces about an 8-inch spark, but up to this time I never have been able to control the current. Is there any possible way to control static electricity?

Ans.—No, absolute control cannot be had. It is slightly possible to accomplish some results by means of a high tension relay key.

* * *

N. S., Ithaca, wants to know how to take in his leads, using an umbrella type aerial, and encloses a sketch.

Ans.—Connect the wires to the top, as shown in the sketch herewith



W. J. C., Chicago, Ill., inquires:

Where can I purchase a magnetic detector and at what price?

Ans.—Address your request to the Engineering Department of the Marconi Company, 27 William street, New York.

Gale Wrecks Sayville Station

Two hundred and twenty-five feet of the crowning pole of the Telefunken wireless station at Sayville, Long Island, was torn off and thrown five hundred feet to the ground by the gale which struck New York on March 27.

Another wireless message has been received from Dr. Douglas Mawson, the Antarctic explorer, who is now in Adelieland. It announces he is expecting the arrival of the steamer *Aurora* daily and will attempt to embark, although he is not hopeful he will succeed, owing to heavy winds.

To Hear the Harmonies of the Heavens

The immense hold which wireless telegraphy has made upon the public interest is evidenced by the numerous allusions which are to be found in the whole range of present-day literature, and in its effective use by many of our most eminent speakers to emphasize the point of their discourse for their hearers. As a particularly noteworthy instance must be mentioned the speech of Dr. William H. Cummings, which was made at a dinner given by the Author's Club to the distinguished musician. In answering the toast of his health he spoke at some length on the birth of orchestral music, and in concluding his remarks pointed out that we were at present only on the fringe of the perception of sound. Much had yet to be learned, and John Stuart Mill's fear that the possibilities of our diatonic scales were exhausted, and that it would be impossible for composers to produce new music, had been proved by experience to be fallacious. As to the future of music, Dr. Cummings expressed the opinion that great discoveries and advances seemed inevitable. Already they noted that vibrating atoms had some mysterious attraction for each other; this was evidenced in the employment of wireless telegraphy. Probably the atom vibrated in harmonious ratios, and therefore they mutually attracted. Some day, perhaps, aided by electricity and newly-invented magnifying receivers, we might be able to hear and admire the symphonies and harmonies of the heavens. Space was all a-quiver with waves of radiant energy of various lengths which constituted the harp of life. We vibrated in sympathy with a few strings here and there: with the tiny X-rays, actinic rays, light waves, heat waves, and the huge electro-magnetic waves of Hertz and Marconi; but there were spaces, numberless radiations, to which we were stone deaf. Some day, a thousand years hence, it might be, we should know the full sweep of this magnificent harmony, and with it we should vibrate in accord with the Master Musician of it all.

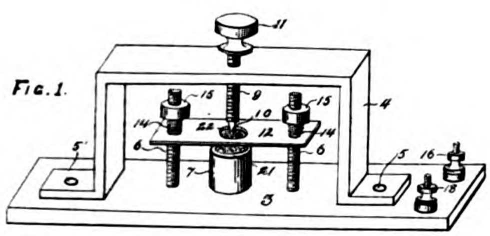
Notable Patents

Thomas L. Manning, Jr., of Ohio, has been granted a patent on a detector adapted for wireless work which is simple in construction and convenient to regulate while making experiments of various kinds.

Referring to the accompanying drawings: Figure 1 is a perspective view of an apparatus; and, Fig. 2 is a bottom plan view of the parts shown in Fig. 1.

3 is a base of suitable non-conducting material carrying the frame 4, secured to base by the screws 5, 5′. Screw-threaded posts 6, 6 rise from

FIG. 1.



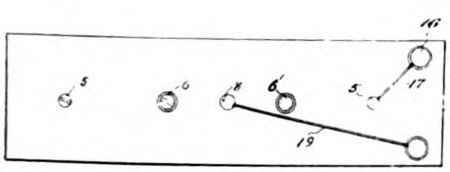


FIG. 2.

this base, and are suitably secured thereto by the screw heads 6′, 6′ (Fig. 2).

7 represents a container or cup, which may be lined with silver or other good conductor, and is filled with silicon, metallic fillings, or other materials usually employed in detectors of this nature. The cup is secured to the base 3, and has the extension 8 extending through the base to which the wire 19 is attached. A screw-threaded rod 9 extends through the frame 4, and is provided with a pointed tip 10, adapted to contact with the granular or other material, contained in the cup 7. This tip may be moved up and down by turning the screw through the member 11. Above the cup 7, is provided a plate 12, through which the screw rods 6, 6 pass. Surrounding these rods or posts, above the plate 12, are the spiral springs 14, and above the springs, are the nuts 15.

16 represents a binding post connected by the wire 17 to the screw 5, and 18 represents a similar post connected by the wire 19 to the cup member 8 of the cup 7.

In operating the detector, the granular, or other material, is retained in the cup 7 by a ring 21 of solder, or other partial cover, and the pressure of the plate 12 on this material, and, therefore, the sensitiveness of the detector, can be regulated by adjusting the nuts 15. Again, since the plate 12 is provided with the perforation 22, immediately above the granular material, it is evident that additional material may be quickly and easily added to the cup through the perforation when experimenting, and granular material may as quickly be taken from the cup after lifting said plate against the pressure of the springs 14. Of course, these springs immediately restore the plate 12 to its normal position when released.

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

* * *

The subject of detectors has also engrossed the attention of Roger F.

Williams, of Buffalo, resulting in a patent on a detector for wireless telegraphy and telephony, which the inventor's specification describes thus:

When operating a wireless telegraph or telephone apparatus the terminals of the detector are usually separated and the receivers are short-circuited or cut-out, so as to prevent burning out or injury to the detectors and receivers and also preventing shocking the person who may be listening at the time a message is being sent.

The detectors for wireless telegraphy or telephony heretofore in use have usually been so constructed that whenever the terminals were separated preparatory to sending a message the normal adjustment of the terminals relatively to each other was disturbed and required re-adjustment after each sending operation to produce the best results, thereby causing interruption and delay in the transmission of messages. Furthermore, in these prior detectors the means for moving the detector terminals and the means for cutting the receivers into or out of circuit were entirely independent from each other and necessitated separate operations for placing the same into one or another relation to the rest of the apparatus, thereby necessitating greater care in the proper manipulation of the apparatus.

The object of this invention is the production of simple, convenient and efficient means whereby the detector terminals may be quickly separated and the receivers cut out preparatory to sending a message and the terminals of the detector may be again brought together and the receivers again placed in operation after sending a message—preparatory to receiving a message without causing any disturbance in the adjustment of the detector terminals, thereby avoiding interruption and delay in wireless telegraphic or telephonic communication.

My invention has the further object to so construct the detector that the operation of moving the detector terminals toward and from each other and rendering the receivers operative or inoperative is effected simultaneously and by the same movement of the operator.

In the accompanying drawings: Figure 1 is a top plan view of a detector embodying my invention. Fig. 2 is a vertical longitudinal section thereof in line 2—2, Fig. 1. Fig. 3 is a bottom plan view of the upper base section and associated parts. Fig. 4 is a vertical transverse section in line 4—4, Fig. 1. Fig. 5 is a diagrammatic perspective view of the detector showing the electric connections. Fig. 6 is a top plan view, on an enlarged scale, showing a modification of the means for supporting the detector block. Fig. 7 is a vertical section of the same in line 7—7, Fig. 6. Figs 8 and 9 are fragmentary sectional elevations showing other forms of terminals.

Similar letters of reference indicate corresponding parts throughout the several views.

The apparatus is provided with a base which may be of any suitable construction, but as shown in the drawings the same comprises upper and lower sections A, A^1 of insulating material, such as marble or rubber, these

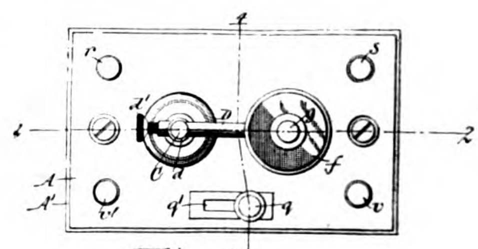


Fig. 1.

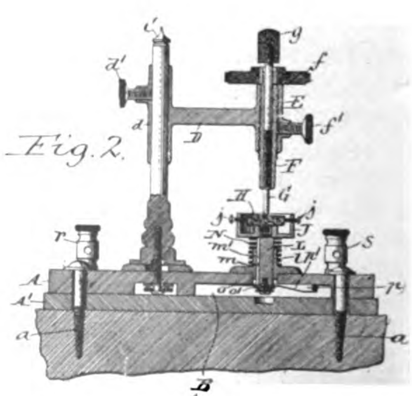


Fig. 2.

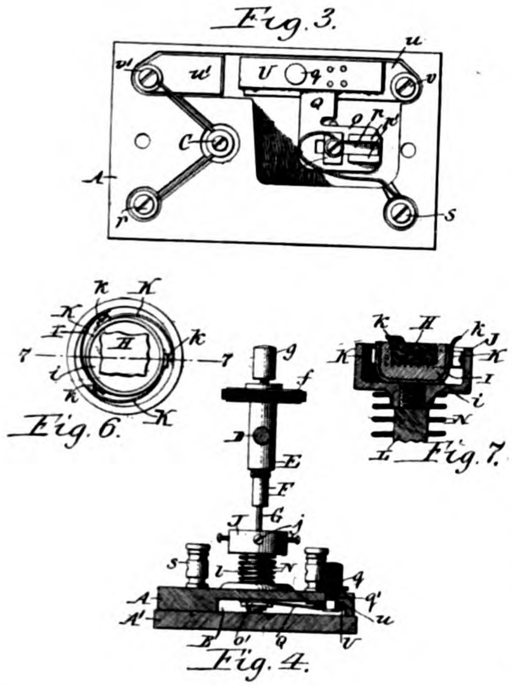


Fig. 3. Fig. 6. Fig. 7. Fig. 4.

sections being secured to each other and to a support by means of screws *a*, as shown, or otherwise. The opposing surfaces of the base sections are constructed to form a chamber or cavity B between them for the reception of parts to be presently described.

C represents a post or standard secured at its lower end to the upper base section.

D represents a horizontal arm provided at its inner or rear end with a sleeve *d* which is capable of sliding vertically on the upper end of the standard C and is held in the desired position thereon by a set screw d^1. At its front or outer end the arm D is provided with an internally screw threaded socket E in which is arranged a vertically adjustable sleeve F having an external screw thread engaging with the thread of the socket and also provided with an internal screw thread. The adjusting sleeve F may be turned by means of a thumb piece, knob or disk *f* secured to the upper end of the same. After adjustment the sleeve F is held in place by a set screw f^1 arranged in the side of the socket and bearing against the side of the adjusting sleeve, as shown in Fig. 2. Within the adjusting sleeve F is arranged a detector point or needle G which has an external screw thread engaging with the internal thread of the adjusting sleeve and a knob, button or finger piece *g* at its upper end for turning and adjusting the same.

H represents the detector block with which the lower end of the detector point engages and which may consist of silicon or other suitable material. The detector block may be supported in any suitable manner so as to be capable of movement toward and from the detector point. The means for this purpose shown in Figs. 2, 4 and 5 comprise a holder having a socket or pocket J which receives the detector block, and a plurality of set screws *j* arranged in the side of the pocket and bearing against different parts of the detector block. The detector block may also be detachably secured in the socket of the holder by the means which are shown in Figs. 6 and 7, and which are constructed as follows:

I represents a metal cup which has a rounded bottom and in which the silicon detector block H is secured by a metallic filling *i*, so that the cup, filling and block form practically one piece. The cup containing the detector block is like those now in common use and furnished by the trade ready for use. To permit this cup to be readily inserted in the socket of the holder or removed therefrom, a plurality of curved spring clamping jaws K are provided which are arranged in an annular row and each of which is secured at its outer end to the inner

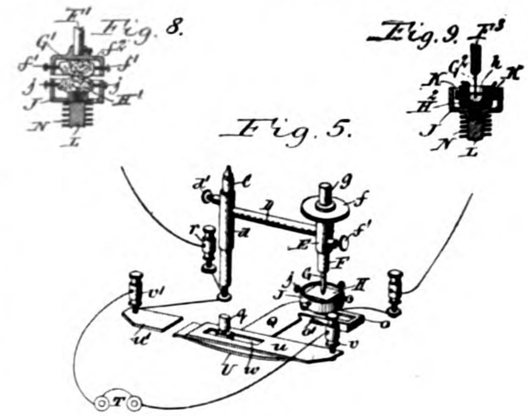


Fig. 8. Fig. 9. Fig. 5.

side of the cylindrical wall of the holder and curves from its attached end inwardly and circumferentially toward its free end in the form of a partial volute. At its inner end each spring jaw is provided with an upwardly and outwardly projecting inclined or curved guiding lug *k*. Normally the several clamping jaws when free are arranged with their inner ends close together, so that they form a contracted seat or nest. When it is desired to apply a detector block supporting cup to the holder this cup is pressed with its convex underside downwardly between the guide lugs of the clamping jaws, whereby the latter are spread and permit the detector cup to pass between the jaws, after which the resilience of the jaws holds the cup in place. The detector block and its cup can be easily removed by simply lifting it out of frictional engagement with the jaws. By this means the detector block can be quickly put in or removed from the apparatus and replaced by another, thereby avoiding prolonged interruption in the use of the apparats, which at times is exceedingly important.

The detector block holder is mounted on the upper end of an upright guide or slide rod L which projects at its lower end through an opening in the top section of the base into the chamber or cavity thereof and which is guided between its ends in a guide way *l* secured to the top of the base. The guide rod and way are preferably cylindrical and the rod is held against turning in the way, preferably by means of a spline *m* arranged on the way and projecting into a longitudinal groove m^1 in the slide or guide rod. The slide rod and the parts associated therewith are yieldingly held in an elevated position for engaging the detector block with the detector point by means of a spring N which surrounds the guide way and bears at its upper and lower ends against the underside of the holder socket and the base of said guide way, as shown in Figs. 2 and 4. By thus preventing turning of the holder the detector block is not displaced circumferentially relatively to the detector point when moving the block toward and from the point, thereby avoiding disturbance in the adjustment of the detector after the same has been properly set.

The depression of the detector block is preferably effected by means of a horizontally movable wedge arranged in the chamber or cavity of the base. This wedge is preferably constructed in the form of a plate *o* arranged between the underside of the upper base section and the upper side of a shoulder on the guide rod formed by a cross piece o^1 thereon and provided with a longitudinal slot *p* through which said guide rod projects and also provided on its underside on opposite sides of the slot and guide rod with two inclined faces p^1, p^1 in line with the ends of said cross piece. Upon moving the wedge backwardly its inclined faces clear the cross piece and permit the sprinf N to elevate the detector block into contact with the detector point, but when the wedge is pushed forwardly its inclined faces by engaging the cross piece depress the detector block out of engagement from the detector point. This forward and backward movement of the wedge is effected by means of a slide Q reciprocating horizontally within the chamber of the base and provided with a finger piece or handle *q* which projects upwardly through a longitudinal slot q^1 in the upper section of the base.

The standard C is electrically connected with one side of the main circuit of the wireless telegraph system, so that the detector block forms the terminal of this side of said circuit This connection preferably includes a binding post *r* arranged on one corner of the base. The guide rod L is electrically connected with the opposite side of the wireless telegraph or telephone system, this connection preferably including a binding post *s* arranged on another corner of the base.

When the detector block is engaged with the point the main circuit of this station is closed through the detector and the latter responds to the electrical undulations produced in the main circuit by the sending of a message at another station. But when the detector block and point are separated the main circuit through these parts is broken, thereby preventing the same from being burnt or otherwise affected by the electric current upon sending a message at the local station, which burning would disturb the adjustment of these terminals relatively to each other and necessitate readjustment. When the detector block and point are in contact with each other the message represented by the electrical undulations which influence said block and point are translated, so that they are audible by means of one or more telephonic receivers T, which are arranged in a shunt circuit around the main circuit. A switch is provided whereby this shunt circuit may either be electrically connected or disconnected between the receivers and the detector, so as to either short circuit or cut out the receivers or leave this shunt circuit long and cut in the receivers. The preferred means for accomplishing this cutting in and out of the receivers is combined with the means which move the detector block and point toward and from each other, so that when the detector block and point are separated preparatory to sending a message the receivers will be cut out at the same time, while upon engaging the detector block and point with each other preparatory to receiving a message the receivers will be cut in circuit. This is preferably accomplished by constructing th slide Q and wedge of metal and providing this slide with a bridge contact U which engages at one end permanently with a shunt contact *u* on one side of the receivers while its opposite end is movable into and out of engagement with a shunt contact u^1 on the opposite side of the receivers. For convenience the connections of the shunt circuit include binding posts *v*, v^1 on opposite sides of the receivers, which posts are preferably connected with the contacts *u*, u^1, respectively, and arranged on the other corners of the base.

The finger piece or handle *q* preferably passes through a slot *w* formed in the shunt contact *u* in line with the slot q^1 in the base. When the slide Q is pushed backwardly to permit the detector block to engage the point, the bridge contact U is withdrawn from the contact u^1 and only engages the contact *u*, thereby cutting in the receivers. But when the slide Q is pushed forward so as to disengage the detector block from the detector point, then the bridge contact engages both of the contacts *u*, u^1, whereby the receivers are cut out or short circuited and injury to the detector and receivers is prevented.

In adjusting the detector, the detector point is shifted approximately to the desired position by raising and lowering the arm D on the post C or raising or lowering the sleeve F in the socket E. The fine adjustment of the detector is effected by raising or lowering the point G in the sleeve F, for which purpose the screw threads between said point and sleeve are made finer than between the said sleeve and its socket. By raising and lowering the point the pressure of the same against the detector block may be varied, inasmuch as the spring N is strained more or less, thereby enabling the detector to be adjusted to obtain the best results under different conditions.

When the detector block is lowered during the time of sending a message the same can be again restored exactly to its former position for resuming listening at the receivers and taking a message without necessitating readjustment of any parts of the detector.

Instead of employing a needle G and a block H as the detector terminals or elements the lower terminal may consist of a piece of ore H^1, which is secured in the holder J by means of the screws *j* and the upper terminal G^1, which engages with the lower terminal, may also consist of a piece of ore which is held by screws f^1 in a cup-shaped holder f^2 on the lower end of an adjusting rod F^1, as shown in Fig. 8. My invention is also applicable to an electrolytic detector in which the lower terminal consists of a carbon cup H^2 secured in the holder J by spring jaws K and containing a quantity of acid *h*, the upper terminal consists of a needle

G^2 mounted on the rod F^3 and dipping at its lower end into the acid within the carbon cup.

In the construction shown in Figs. 8 and 9 the lower terminals are disengaged from the upper terminals when cutting out the receivers and engaged when cutting in the receivers.

Personal Items

Mr. A. Mowat, manager of the Marconi station, at Tampa, Fla., has been promoted to the position of Superintendent of the Gulf Division, with headquarters at New Orleans, La. W. F. Wilcox formerly occupied the position.

Mr. N. E. Albee, manager of the former Marconi station at Norfolk, has been placed in charge of the station at Tampa, Fla.

Mr. C. W. Watters has been placed in charge of the Marconi station, at Mobile, succeeding R. H. Turner.

A Humorist's View of Wireless

George Fitch, who has given the world at large many hearty laughs, recently drew a breath between puffs of his quaint conceits on the mechanical aspect of gasoline engines and penned the following impression of wireless telegraphy. George Mathew Adams immediately copyrighted it, so, bowing very sweetly to Mr. Adams, we turn to Mr. Fitch and learn:

Wireless telegraphy consists of letting a current of electricity climb a high mast and then compelling it to jump across to another mast.

Electricity is the greatest little jumper in the world, and electric currents are now making thousand-mile leaps and not feeling as important about it as the man who jumps 24 feet in the Olympic games.

About 15 years ago Marconi of Italy succeeded in persuading electricity to make its first feeble jump, and soon afterwards trained it to carry and retrieve messages. This invention has proved of vast benefit to the world, and has enabled the tired billionaire to watch the stock market in mid-ocean with relentless care.

Twenty years ago when a ship went out to sea it left the world behind it and had to wallow across the ocean without news of any kind. Nowadays passengers bet on the baseball score in mid-ocean and engage hotel rooms while still 900 miles from Fire Island.

If the ship breaks down it turns loose its wireless electricity and asks everything within 500 miles to come over and help out. Wireless telegraphy saved 750 passengers from the *Titanic* last spring, and if there had been more wireless telegraphy mixed with a little higher grade of brains, another thousand might still be paying premiums on their life insurance.

Wireless telegraphy is still in its infancy and in a few years a man will be able to whisper in his own ear via Hong Kong for a few dollars a word if he is an extravagant cuss. Wireless telephones will soon be in general use and the man who carries a telephone set in his pocket will be able to telephone home to his wife while falling off a 78-story office building, without first calling central. But wireless politics are still in the dim and uncertain future.

Pathway to Stars, Their Quest

"To find a pathway to the stars by wireless" is one of the ambitions of the Society for Electrical Development, Inc., represent eight billions of dollars invested in electrical enterprises, which concluded its initial conferences with a banquet at Delmonico's.

At these meetings the society planned to spent about $1,000,000 in advertising. Its members say that it is the wealthiest incorporated body in the world, and that it will hasten civilization by doing away with hand labor.

Don C. Seitz, the first speaker of the evening, concluded by saying that "it is not too much to believe that some future Edison will find a pathway through electricity to the planets."

This remark was received with applause and cries of "We are the people who will do it." "That is no idle dream either."

William C. Campbell, of Pittsburgh, president of two electrical companies, scribbled "A pathway to the stars" on a ménu. He said it would be a good motto for the new society.

Hertzian Waves to Locate Ore Bodies

Wireless telegraphy for locating precious ores is now being carefully tested by German scientists, with enough success to give hope of eventual practicability. The use of the Hertzian waves for exploring the earth's interior originated with Professor O. Trustredt, a noted metallurgical engineer, and experiments are being conducted at the Freiberg School of Mines by Professors L. R. Beck and Zimmerman.

The Hertzian waves readily penetrate the ground until checked by metals, water or similar materials. As is well known, the wireless waves are not electric, but a form of oscillations or waves set up in the ether by the discharge of electric sparks. These oscillations readily penetrate paper, porcelain, sands and clays. But should a metal plate be encountered they are "reflected." It is on these well demonstrated principles that the use of wireless for exploring the earth's interior is based.

In practice two instruments are employed, the oscillator or sender, and the coherer or receiver, substantially of the same nature as those used in wireless telegraphy. Each of these instruments is placed at the focal point of a parabolic metal reflector. In exploring the earth the oscillator and coherer are so adjusted that the waves emanating from the former are reflected so that if no obstacle were interposed they would strike the mirror of the latter in parallel lines, and therefore converge on the coherer at its focus.

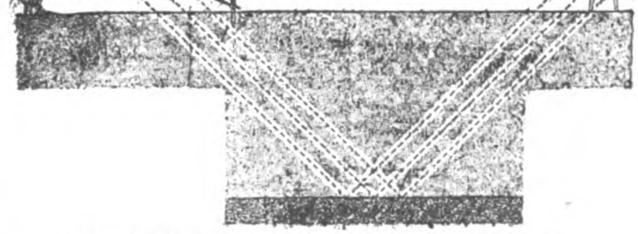
But in the path of the rays from the transmitter to the receiver is placed a metal plate which prevents the passage of waves to the receiver and reflects them obliquely into the earth. The waves pass readily through comparatively dry strata of sand and clays, much as light penetrates glass, but when an ore body or water course is encountered the rays are deflected upward through the earth as a mirror casts back sunlight.

The waves in their upward flight are arrested by the reflector of the receiver and the angle to which the receiver's reflector must be turned in order to catch and focus them on the coherer, and the distance between the center of the interposed reflector plate and the focal point of the receiver's reflector furnishes a means to calculate the depth and position of the ore body or water course. An electric gong inserted in the power circuit of the receiver gives the alarm when rays pass from the oscillator to the coherer.

It is apparent that the greatest obstacle to be conquered is the penetration of damp surface strata, but by using powerful transmitters it is believed this difficulty may be overcome.

With an ore body located, its area may be approximately determined by taking several observations, with the transmitter and receiver placed at various points. The character of the body must, of course, be determined by drilling.

This use of wireless for detection of valuable metal deposits is naturally only in an experimental stage and many obstacles remain to be overcome, but the future is freighted with interesting possibilities. The results following the experiments may eventually revolutionize the mineralogical world and open treasuries of wealth dwarfing all hitherto found.



How wireless is employed in finding ore.