THE MARCONIGRAPH

An Illustrated Monthly Magazine of
WIRELESS TELEGRAPHY

EDITED BY J. ANDREW WHITE

Volume I. JANUARY, 1913 No. 4

CONTENTS

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GODFREY C. ISAACS

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Vol. I. **January, 1913** **No. 4**

OUR portrait for this month is an excellent likeness of Godfrey C. Isaacs, Managing Director of Marconi's Wireless Telegraph Co., Ltd.

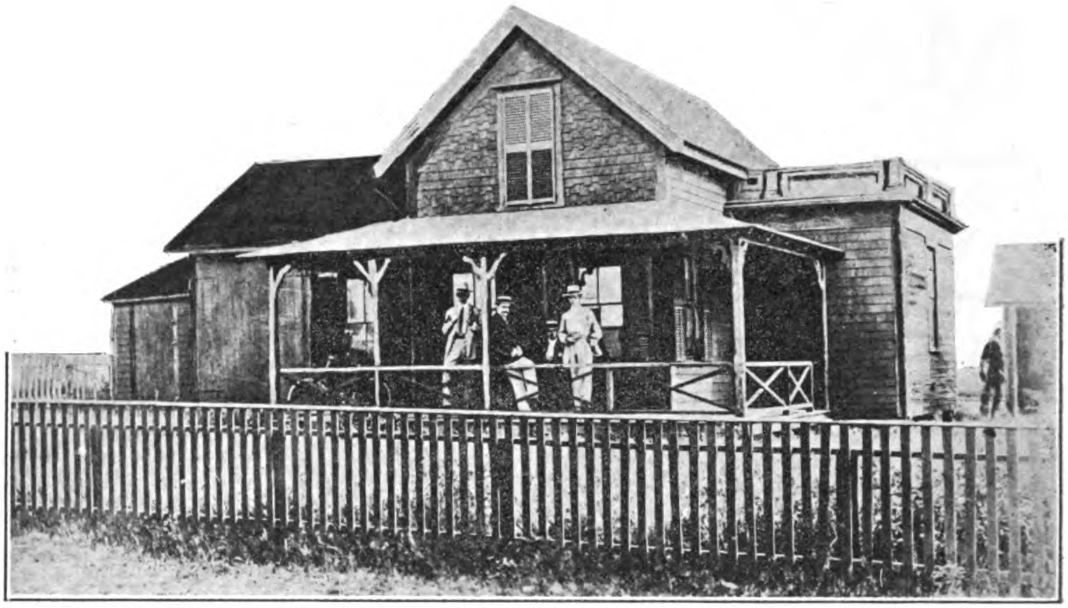
Should a world-wide search be instituted for an executive capable of directing the operations of the Marconi system in various countries, it is certain no better qualified man than Mr. Isaacs could be found. As is well known, Marconi's Wireless Telegraph Co., Ltd., is the parent Marconi company and the general policy of operations of the subsidiaries handling the wireless business in different countries emanates from the fountain head. Consequently the ideal managing director of that organization would be one thoroughly conversant with the language and customs of many nationalities. Not only does Mr. Isaacs speak French, German, Spanish and Italian fluently, his early training and extensive travel have made him a true cosmopolitan, at home in every country of the world.

His business career was begun at a very early age in the employ of his father who kept him for some months addressing and stamping envelopes. The boy, however, did not remain at the bottom of the commercial ladder very long for his close application to even this comparatively unimportant task won him speedy promotion. Once started he made the best use of his unique opportunities and remarkable linguistic powers and passed rapidly through the various departments of his father's vast business, and at the tender age of eighteen years became the manager of the great concern which he had entered as a lad. Yet young as he was, he not only mastered all the difficult questions connected with the foreign trade with which his father was chiefly concerned, but carried on the important business correspondence of the firm in the various languages of the leading customers. But even before his promotion to manager, he had, in the course of his extensive travel in all parts of Europe, exhibited great ability in dealing with leading business men of nearly all nationalities. At an age when most young men have not even started a business career he showed exceptional powers in weighing the characters of the various business men with whom he had to deal; a quality of inestimable value in carrying on the business of the various branches, the chief management of which was left almost entirely in his capable hands.

His cosmopolitan education, his painstaking study of the languages which he speaks, his great courage and resource in dealing with those matters of delicacy and difficulty which continually arise in the conduct of all large businesses—the result of valuable opportunity used to the full—left him a most able and exceptionally well-equipped man of business.

A charming manner, a most honorable character, invincible industry, a deep sense of duty and great sense of fairness alike to those with whom he deals in business and those under his control, a fine bold courage governed by firmness and a full appreciation of his opponents point of view in matters of difference, transparent honesty, and an ever-present interest in the success of his company and the well-being of his shareholders, constitute him a model managing director of the greatest, most important and progressive modern application of science to industry.

To this man belongs much of the credit for the remarkable development of commercial wireless in the past. And it seems assured that with Mr. Marconi, the genius of wireless, maintaining the supremacy of Marconi apparatus, and Godfrey C. Isaacs (a brother of Sir Rufus Isaacs, Attorney-General of England) still directing business operations, the further extension of the Marconi system will proceed with even more amazing celerity in the new year.



S'conset the Sentinel of the Sea

An Old-Timer's Impressions of the Little Station on Nantucket Island

VIGOROUS application of my coat sleeve to the window pane disclosed nothing but an irregular patch of inky blackness. Dawn had not yet come. In disgust I turned away, and as if in resentment of my temerity in veuturing to look upon Nature in her angriest mood, the storm howled with even greater fury; rain descended in bucketfuls and the wind rose to a piercing shriek. The little house rocked on its foundations, windows rattled, a door banged—ugh! What a night!

In fancy my mind ran back to a similar night, four years ago. I was sitting in that same little room, sprawled out in a wooden arm chair, lazily contemplating the smoke rings which slowly drifted ceilingward. Temporary insomnia had caused me to sit in with the operator doing the night trick and the monotonous succession of routine messages had lulled me into a state of apathy. Over by the window could be seen the broad back of the man on duty, Jack Irwin, bent forward over his key, head on hand, patiently adjusting the handles of the tuner. The minutes lagged. Suddenly a smothered ejaculation roused me and I glanced up. Everything was changed. With every muscle tense, his lips set hard and his eyes starring fixedly into space, Irwin was gripping the edge of the table in a manner that plainly showed the excitement under which he was laboring. Minute after minute I watched him, scarcely breathing for fear the message that was being whispered into the head 'phones might be lost. After what seemed hours of suspense, his hand shot forward to the switch handle and this staccato message crashed through the little room:

"MKC, MKC, MKC. What is your position?"

Nothing very startling to the layman in those few words, but with one bound I had crossed the room to the pad under his hand.

On it was scrawled:

C. Q. D., C. Q. D., C. Q. D., MKC.

I snapped the spare receivers to my ears prepared to "listen in" for further details. After a time the signals began to come in, very faint, but steady:

"*Republic* rammed by unknown steamer twenty-six miles southwest of

Nantucket Lightship. Badly in need of immediate assistance.

SEALBY."

Immediately the answer reverberated through the little room:

"O. K., old man. I will pass it along to *Baltic* and *La Lorraine,* who are now in communication and I will also give it to Wood's Hole and get them to send a revenue cutter."

Suddenly the whole station was roused to activity. The *Republic* was sinking! Zit! zang! rang out the messages, appealing, petitioning, imploring all vessels to rush to the aid of the doomed steamship. How anxiously was each meager report awaited. Hour after hour the progress of the steamers rushing to her aid drifted interminably through the buzzing headgear. Would they reach her in time?—that was the question. Then followed a terrible period of suspense. The mighty *Baltic* reported that she was within ten miles of the sinking vessel and was slowly groping her way through the impenetrable fog. Any degree of speed was impossible, the danger of collision was too great.

Ten hours after the first message was received word finally came that all but six of the precious human cargo were safe. The details of the catastrophe, the bravery of Jack Binns in standing by his key while the vessel was sinking the timely rescue of the passengers through the aid of the appealing wireless calls, are too well known to be again repeated. As you well remember, the next morning, and for many days afterward, the newspapers contained vivid descriptions of the terrible collision and devoted column after column to laudatory accounts of each man's part in the disaster.

I have often wondered if the world, while eagerly devouring these narratives, gave a thought to the men who made it possible for them to get the welcome news that all but six of those aboard had been rescued, hours before the ship that carried them to safety reached her dock. I venture to say that few, if any, of those who read the early accounts, stopped for a moment to think kindly of the men who, cooped up in the fog-bound Siasconset station, were laboring night and day with the enormous mass of press messages. With scarcely any food or sleep, nerves on edge from the constant strain these men stuck manfully to the task of relieving the anxiety of the world. Ninety thousand words of press matter were sent out of the little building, hundreds of messages to and from ships—all within 48 hours. Some would say it was their duty to do this; and dismiss the matter. Unquestionably it was, but coming down to essentials, duty ably performed under trying circumstances is the basis of heroism. Yet it is seldom that a word of praise is given to the men at land stations for noble work, nobly performed.

With the sinking of the *Republic,* the lonely station at Siasconset on Nantucket Island became an object of interest. This interest was again aroused when the *Carpathia* was steaming toward New York bearing the survivors of the ill-fated *Titanic.* A certain amount of criticism descended on the staff of the Siasconset station at that time, because, though pressed for news from all parts of the world, not a word could be obtained. Try as they

Siasconset operating room as it looks today.

would, it was found impossible to give the world the news, for, as operator Cowden says: "We were loaded down with messages, but owing to the regular operator on the *Carpathia* being completely worn out and the rescued second operator of the *Titanic* being so badly frozen, we were unable to dispose of our traffic. It was pitiful to hear those men on the rescue ship answer in semi-conscious tones; their experiences must have been terrible."

In every instance where they have been needed the men at the land stations have ably discharged their duty, at times in the face of enormous odds. All honor to these silent workers.

Little is known of the life of the men at Siasconset. Viewed at the height of the summer season the prospect of a berth at the station looks inviting—good surf-bathing, tennis, golf, shooting, fishing, riding and a bevy of pretty girls among the seventeen hundred summer inhabitants. But when old Boreas blows his chilling breath the aspect changes. In place of the pretty frocks of dainty little ladies and the immaculate white flannels of robust collegians, the eye rests on the drab and bedraggled garments of the native fisher folk. The cheery bungalows are boarded up and their late occupants gone until the next year. The

Fog, rain, snow and sleet follow each other in dreary succession.

only signs of life are in the shacks that shelter the fishermen and their families, fourteen in all. High winds pile the snow in heavy drifts, making the path to the station almost impassable at times. Fog, rain, snow and sleet follow each other in dreary succession and the operators who are filling in time between watches wear exceedingly gloomy countenances.

"That is really the greatest hardship in winter," one operator explained, "to find something to do with leisure moments. Cards, checkers and books become tiresome after a time. Occasionally, though, we get a little action when not on duty. For example, the Marconi Company maintains a land wire across Nantucket Island, a distance of more than seven miles; about a third of this line was carried away in a severe sleet storm on Christmas Eve and we all had to turn out to fix it up. It was no easy job, I assure you, for about two miles of the wire was covered with ice about three inches thick and every bit of it had to be broken away with hammers. Two days of hard work in the biting cold were required to replace the wire and put the line in operation again. Pleasant work that, I *don't* think."

"But at that, the operators welcomed the necessary activity," continued my informant. "Spare time does hang heavily on our hands; it is all right when you are on duty for then a man's mind must of necessity be very active, by reason of the heavy responsibilites that rest upon his shoulders. The everlasting thought of the dreaded S. O. S. call keeps his ears glued to the head 'phones, for right well he knows that should a distress call come and he not be there hundreds of lives may be lost. Occasionally, of course, he lays aside his receivers to stir the coal fire but you will notice that he slips back to his instruments in a hurry. Each winter this station is the means of saving hundreds of lives and a great many thousand dollars worth of property. As you know, Nantucket Sound is a great waterway for both sailing vessels and steamers bound to and from Boston and the northern ports. The treacherous Nantucket Shoals bring many a schooner to grief. We are in telephone communication with numerous U. S. Life Saving Stations who frequently send us word that a vessel is in distress on such and such a shoal. Word is immediately wireless to the revenue cutter *Acushnet,* stationed at Wood's Hole, or to the revenue cutter *Gresham,* lying at Provincetown, ready at all times to rush wherever we may direct them. During the winter it is a common occurrence to have both revenue cutters assisting schooners at a time when still other schooners are appealing for help; and often just as soon as one vessel is anchored in safety the cutter rushes off to the next. So, dreary as our station may appear from the outside, at times it is a regular beehive inside."

Aside from its occupants the Siasconset station itself is of interest. It was the first commercial wireless station built in the United States and, although little remains of the initial installation, to me, somehow, the place is reminiscent of the early days.

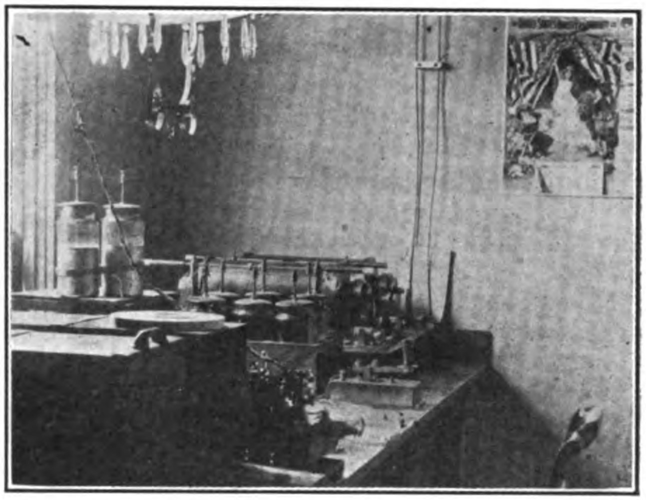
Originally built for the New York *Herald,* the first message was received at 10 o'clock on the morning of August 12, 1901. It was sent from the Nantucket Lightship anchored off South Shoals and consisted of eight words:

"Signals clear; am using plain aerial. Good luck."

What a feat that was considered! A message sent without wires over a distance of 43 miles. Could it really be possible?

To give some idea of the marvelous progress made in wireless communication during the few years that have elapsed, let me recall the remark of the manager of a great transatlantic steamship line at the time the *Herald* first announced it would place in operation, as a convenience for its readers, a system of reporting incoming vessels by wireless.

This manager felt certain that it would be "a big thing to be informed ten to twelve hours in advance. How far is it from the lightship to the shore?"



How it looked more than eleven years ago, when the first wireless station in this country was officially opened for business.

He was told that the distance was 43 miles.

"That's a pretty good stretch," he replied, slowly, 'but I am not surprised that it can be covered by wireless telegraphy."

Grave doubts, however, were entertained by the majority as to the success of the plan. Consequently, when everything went off smoothly the innovation was hailed as a triumph of modern science and journalism and all concerned were praised to the skies.

Incidentally, it was well-deserved praise for the work of installation had been filled with many difficulties and at times had been made ungracious by the pure cussedness and lack of intelligent appreciation shown by some of the agents that had to be employed. From the beginning public spirit seemed to be pleasurably aroused in its behalf but wherever it narrowed down to the individual who desired to have a finger in the particular pie, the theory of the greatest good to the greatest number was usually found to be centered in number one.

On the other hand, considerable interest and intelligence were shown by the workmen directly concerned with the tasks of building, transporting, erecting, rigging and equipping the components of the plant. The spars for the aerial were built in New Bedford, and an assertion, based upon the dictum of the oldest seagoing inhabitant, was left unchallenged—though after the sea manner doubters were looked for—that the sticks were the largest ever shaped in that port.

For the shore station three masts were required; together weighing nearly five tons; when assembled the ensign fluttered at a height of 166½ feet above the ground. It required nine days to give these masts and the lightship topmasts a fair, sailorlike shape and to get them overboard, ready for transportation; for despite a reasonable hope, the steamship company that plied between the mainland and the islands refused because of the bulk of the lower mast to carry the outfit. So a quaint little steamer, half wrecker and half fisher, was chartered in Nantucket, and after an unwarrantable delay of an entire day, towed the spars through the crooked though generally sheltered seventy-odd miles of water that lie between New Bedford and the harbor of Nantucket.

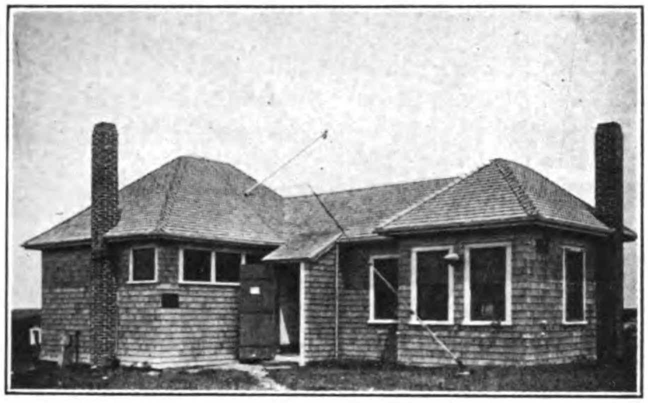
In the meantime the topmast, sprit and spare topmast for the lightship and the instruments had been sent to Wood's Hole. Here, through the courtesy of the lighthouse inspector these were taken aboard the tender *Mayflower*, and simultaneously with the arrival of the land installation at Siasconset, were received on the lightship at South Shoals—as seafaring men persist in calling the shallow water sea mark officially known as the Nantucket Shoals Lightship.

Sankaty Head, a flashing lantern erected on a high bluff some two miles north of Siasconset, had first been selected for the shore station, but subsequent examination of the government chart showed that the aerial messages seeking the nearest wire would have to cross nearly four miles of unnecessary land and that numerous telephone circuits were so placed that possible in-

Owing to the narrowness of the streets and the character of one section of the island's main road, the spars had to be sent out on timber wheels carried from the mainland.

terference might be set up.

The site finally chosen was thought to be nearly ideal and speedy and harmonious negotiations were closed for a plot of ground for the pole and a cottage for instruments and operators' quarters were secured. Once upon the ground, the riggers, in charge of a skilful boss, made a deft job of the erection of the pole. Owing to the narrowness of the streets and of the wharves in Nantucket and the character of one section of the island's main road—abnormally termed the "State Road" by the natives—the spars had to be sent out on timber wheels carried from the mainland. The drag was heavy and hard and exercised to a marked degree the skill and energy of the transporting agent. But all went cheerily and briskly and in the end—two days after the spars were landed on the hill chosen for a site—they were placed and stayed, and a day later the Siasconset station was ready for the duties expected.



Last summer the prospect of a berth at the station looked inviting.

A distinct and heartwarming sympathy was shown by the natives of Siasconset. From a critical and sentimental point of view venerable and skilled retired master mariners aided with advice and grew warm when differences arose on occult questions of seamanship. Every ancient whaler that honored the occasion by his presence and encouraged the situation by his fact and fancy had his own theory of the sole shipshape and Bristol fashion by which the stout and skyseeking poles should be handled and fitted. Many and recondite were the briny discussions over the gear and equipment, and widespread and convincing, likewise hoary and emphatic, were the traditions, the examples, the principles and precedents arrayed to show "just how, and only just how" the hooking on. the swaying up and the securing and plumbing of the spars should be done. Summer visitors were not present in any appreciable quantity; a few gathered early, but apparently became ashamed of their ignorance of matters nautical, and soon ambled away.

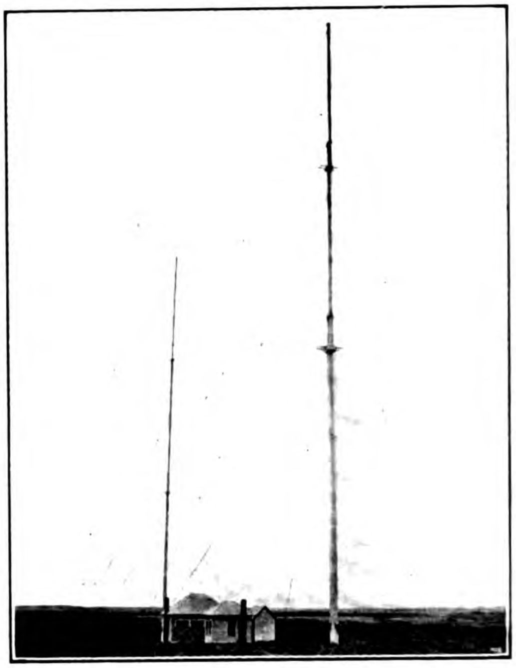
No time was lost in shipping the working party, now somewhat reduced in number, to Nantucket, and, it was hoped, to the lightship. But though the tug, chartered in Boston, arrived with mathematical precision, its master was filled with denials. First off, there was not, in his opinion, sufficient water to cross the bar; next, he declined to go to the lightship because the weather was too boisterous; then, when the soundness of his plea was questioned, the new and sufficient, also unexpected, argument was advanced that the tug did not have sufficient coal for the work and for the detention that might occur. At a season when time was so precious, this seemed to be fooling with a vengeance, so the tug was dispatched for Martha's Vineyard for fuel. When she reached there, for some reason her agents substituted a larger tug which arrived, ready for the duty demanded, the next morning.

Under the able supervision of Mr. Bradfield, of the Marconi Company, the work of equipping the lightship went forward, quickly and surely. To us on shore the hours lagged, but at last all doubts were dispelled and vexed questions answered by a sudden spirited crackling of sparks in the instrument room. The first wireless station in the United States was in operation!

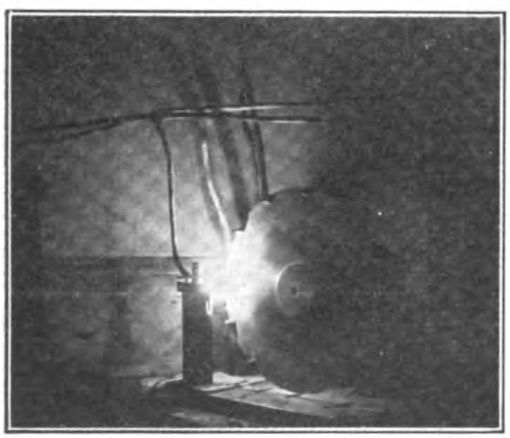
Under the *Herald* régime a 10-inch induction coil was used, worked from a set of sixteen chloride cells. The receiver comprised a coherer which operated a Morse printer. This method was not of very great efficiency, but the main object was to communicate with the lightship; "paid" business being practically unknown.

During October of 1904 the station was moved to its present site; the new building contained both engine and operating rooms, the former equipped with a 4½ h.p. Hornsby Akroyo kerosene engine belted to a 2-kw. direct current dynamo, which charged a set of 55 chloride accumulators automatically operating the motor generator, controlled from the operating room. Seven years ago two charges a week were sufficient to keep the battery supplied as business was light and few ships carried wireless equipment; at the present writing the battery has to be charged almost daily in order to supply sufficient current, several hundred messages being an average day's business.

One morning about the middle of November, five years ago, the station was destroyed by fire, the origin of which was never discovered. While the remains of the station were still smouldering the four men comprising the staff rigged up a crude apparatus and six hours after the fire started communication had been established. During the two months required for the completion of the present station regular business was carried on in a small shed.



The present-day aerials—an ether-wave landmark for operators on the transatlantic leviathans.



Siasconset's spark. This photograph was made with a 5 sec. exposure while the disc was running at 1800 R. P. M. Although traveling at a speed of more than 100 miles an hour, the studs appear to be standing still, due to the fact that the disc was illuminated only at the instant when the moving stud came opposite the stationary stud, causing the spark to discharge.

Business at Siasconset has always been conducted by a staff of four men; an officer in charge and three eight-hour-watch men who maintain a continuous wireless service. The present equipment is somewhat similar to that of 1905, except that the "disc spark" is now used, giving a high tone more easily read than the flat signals formerly employed, and the range has been increased to 300 miles.

The little station up on Nantucket Island has come to be looked upon as an ether-wave landmark, so to speak, by operators on the transatlantic leviathans. Many are the tales her antenna has told and many are the tales to come. Good old Siasconset. Long may she live and prosper!

The Progress of Wireless Telegraphy

By Guglielmo Marconi

(PART II.—*Continued from the December number*)

CONFIRMATORY tests were carried out a few weeks later between Poldhu, and a receiving station on the S.S. *Philadelphia,* of the American line. On board this ship readable messages were received by means of a recording instrument up to a distance of 1,551 miles, and test letters as far as 2,099 miles from Poldhu. The messages received on the *Philadelphia* at the various distances were recorded on tape and were exceedingly clear and distinct, as can be seen by the tapes in my possession.

These results, although achieved with imperfect apparatus, were sufficient to convince me and my co-workers, that by means of permanent stations and by the employment of sufficient power it would be possible to transmit messages across the Atlantic Ocean in the same way as they were sent over shorter distances. The tests could not be continued in Newfoundland owing to the hostility of the cable companies, which claimed the rights for telegraphy, whether wireless or otherwise, in that Colony, and for this reason the base of my experimental and practical work in Transatlantic telegraphy was transferred to Canada.

The transmission of electric waves across the Atlantic Ocean first achieved in 1901, constituted in itself a discovery which the American Institute of Engineers was the first as a scientific and technical body to notice and commemorate.

Although it may be said that no apparatus, new in principle, was used to obtain the result, still the fact of being able to transmit and receive electric waves over a distance of 2,000 miles, constituted in itself an absolute confirmation of my views to the effect that electric waves could travel over such enormous distances, and that the curvature of the earth and other supposed obstacles would not prevent them being employed in carrying on the intercourse of human intelligence over any distance separating parts of our little planet.

The generally accepted hypothesis of the cause of this absorption of electric waves in sunlight, is founded on the belief that the absorption is due to the ionization of the gaseous molecules of the air, affected by ultra-violet light, and, as the ultra-violet rays which emanate from the sun are largely absorbed in the upper atmosphere of the earth, it is probable that that portion of the earth's atmosphere which is facing the sun will contain more ions or electrons than that portion which is in darkness, and, therefore, as Professor J. J. Thomson has shown, this illuminated and ionized air will absorb some of the energy of the electric waves.

The wave length of the oscillations employed has much to do with this interesting phenomenon, long waves being subject to the effect of daylight to a very much larger degree than are short waves; indeed, in some transatlantic experiments, in which waves about 8,000 meters were used, the energy received by day at the distant receiving station was usually greater than that obtained at night.

The fact remains, however, that for comparatively short waves such as are used for ship communication, clear sunlight and blue skies, though transparent to light, act as a kind of fog to these waves. Hence the weather conditions prevailing in England, wintry fogs, and dull skies, are usually suitable for wireless telegraphy.

Recent observations, however, reveal the interesting fact that the effects vary greatly with the direction in which transmission is taking place, the results obtained when transmitting in a northerly and southerly direction being often altogether different from those observed in an easterly and westerly one.

Research in regard to the changes in the strength of the received radiations which are employed for telegraphy across the Atlantic has recently been greatly facilitated by the use of sensitive galvanometers, by means of which the strength of received signals can be measured with a fair degree of accuracy.

In regard to moderate power stations such as are employed on ships, and which in compliance with the International Convention, use wave lengths of 300 and 600 meters, the distance over which communication can be effected during daytime is generally about the same whatever may be the bearing of the ships to each other or to the land stations—whilst at night interesting and apparently curious results are obtained. Ships over 1,000 miles away off the south of Spain or around the Coast of Italy can almost always communicate during the hours of darkness with the Post Office stations situated on the coasts of England and Ireland, whilst the same ships when at a similar distance on the Atlantic from the westward of these Islands and on the usual track between England and America, can hardly ever communicate with these shore stations unless by means of specially powerful instruments.

It is also to be noticed that in order to reach ships in the Mediterranean the electric waves have to pass over a large portion of Europe and in many cases the Alps. Such long stretches of land, especially when including very high mountains, constitute, as is well known, an insuromuntable barrier to the propogation of short waves during the daytime. Although no such obstacles lie between the English and Irish stations and ships in the North Atlantic en route for North America, a night transmission of 1,000 miles is there of exceptionally rare occurrence.

These conclusions have been arrived at after careful examination of the reports of the working during the last two years of several hundred ships and shore stations situated in different parts of the world.

Although the high power stations are now used for communicating across the Atlantic Ocean and messages can be sent by day as well as by night, there still exists periods of almost regular daily occurrence during which the strength of the received signals is at a minimum. Thus in the morning and evening when in consequence of the difference in longitude, daylight or darkness extends only part of the way across the ocean, the received signals are at their weakest. It would almost appear as if electric waves in passing from dark space to illuminated space and vice versa were reflected and refracted in such manner as to be diverted from the normal path.

Later results, however, seem to indicate that it is unlikely that the difficulty would be experienced in telegraphing over equal distances north and south on about the same meridian, as in this case, the passage from daylight to darkness would occur more rapidly over the whole distance between the two stations.

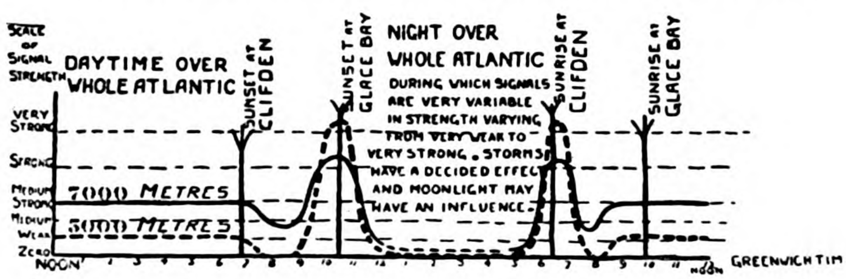


Fig. 7.

I have here some diagrams which have been carefully prepared by Mr. H. J. Round. These show the average daily variation of the signals received at Clifden from Glace Bay.

The curves traced on Diagram Fig. 7

show the usual variation in the strength of these transatlantic signals on two wave lengths, one of 7,000 meters and the other of 5,000 meters.

The strength of the received waves remains as a rule steady during daytime.

Shortly after sunset at Clifden they become gradually weaker and about two hours later they are at their weakest. They then begin to strengthen again and reach a very high maximum at about the time of sunset at Glace Bay.

Then they gradually return to about normal strength, but through the night they are very variable. Shortly before sunrise at Clifden the signals begin to strengthen steadily and reach another high maximum shortly after sunrise at Clifden. The received energy then steadily decreases until it reaches a very marked minimum, a short time before sunrise at Glace Bay.

It can be noticed that although the wave gives, on the average, weaker signals, its maximum and minimum daily variations of strength very sensibly exceed that of the longer waves.

Fig. 8 shows the variations at Clifden during periods of 24 hours, commencing at 12 noon throughout the month of April, 1911, the vertical dotted lines representing sunset and sunrise at Glace Bay and Clifden.

Fig. 9 shows the curve for the first day of each month for one year.

Variable tests have also been carried out by Mr. Austin of the United States Navy Department, regarding the ascertainment of the laws governing the relation of the decrease in strength of signals with distance.

I carried out a series of tests over longer distances than had ever been previously attempted in September and October of 1910, between the stations at Clifden and Glace Bay and a receiving station placed on the Italian S.S. *Principessa Mafalda* in the course of her voyage from Italy to the Argentine. (Fig. 10.)

During these tests the receiving wire was supported by means of a kite, as was done in my early transatlantic tests of 1901, the height of the kite varying from about 1,000 to 3,000 feet. Signals and messages were obtained without difficulty by day as well as by night up to a distance of 4,000 statute miles from Clifden.

Beyond that distance reception could only be carried out during night time. At Buenos Aires, over 6,000 miles from

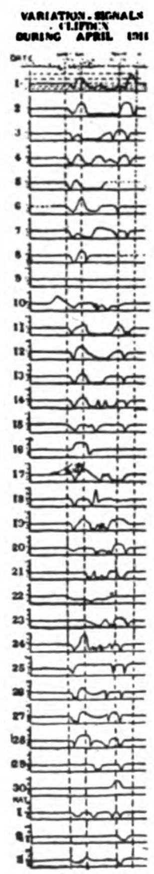


Fig. 8

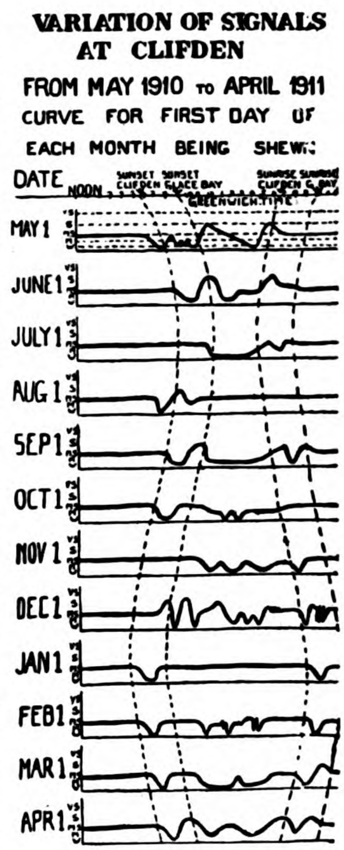


Fig. 9.

Clifden, the night signals from both Clifden and Glace Bay were generally good.

It is rather remarkable that the radiations from Clifden should have been detected at Buenos Aires so clearly at night time and not at all during the day, whilst in Canada the signals coming from Clifden (2,400 miles distant) are no stronger during the night than they are by day.

Further tests have been carried out recently for the Italian Government between a station situated at Massaua, in East Africa anl Coltano, in Italy. Considerable interest attached to these experiments in view of the fact that the

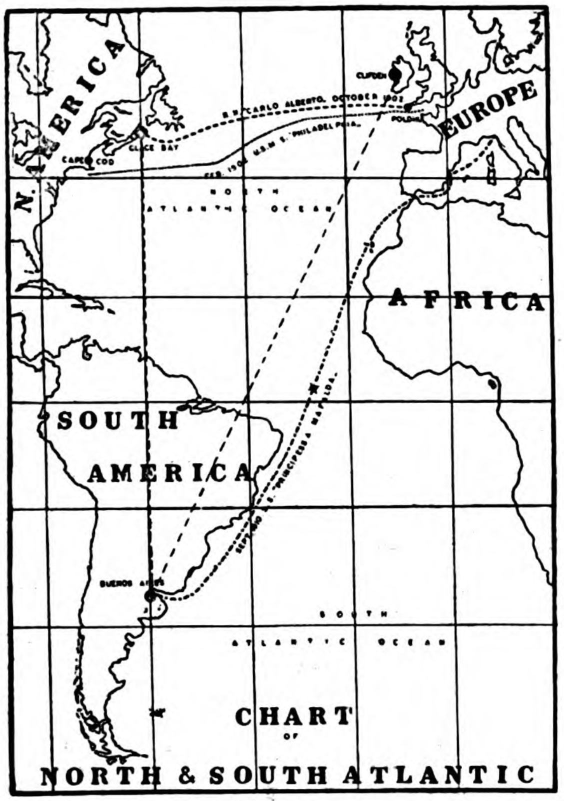


Fig. 10.

line connecting the two stations passes over exceedingly dry country and across vast stretches of desert, including parts of Abyssinia, the Soudan and the Lybyan Desert. The distance between the two stations is about 2,600 miles.

Another very curious and interesting fact has been noticed only quite recently at the wireless station at Glace Bay. It is, that when the signals from Clifden are at their minimum strength, the signals from Coltano, Italy, situated 1,000 miles further away and at the other side of the Alps are not by any means at their minimum, although the two last mentioned stations employ approximately the same wave length.

The improvements introduced at Clifden and Glace Bay have had the result of greatly minimizing the interference to which wireless transmission over long distance was particularly exposed in the early days.

The signals arriving in Canada from Ireland are as a rule easily read through any ordinary electric atmospheric disturbance. This strengthening of the received signals has moreover made possible the use of recording instruments which not only give a fixed record of received messages, but are also capable of being operated at a much higher rate of speed than could ever be obtained by means of an operator reading by sound or sight. The record of the signals is obtained by means of photography in the following manner. A sensitive Einthoven string galvanometer is connected to the magnetic detector or valve receiver and the deflection of its filament—caused by the incoming signals—are projected and photographically fixed on a sensitive strip, which is moved along at a suitable speed. (Fig. 13.) Of some of these records which I am able to show it is interesting to note the characteristic marks and signs produced among the signals by natural electric waves or other

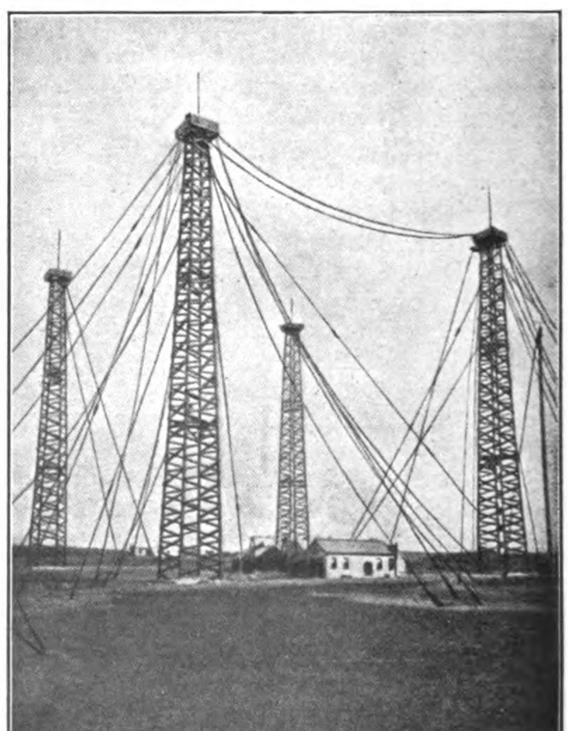


Fig. 11.

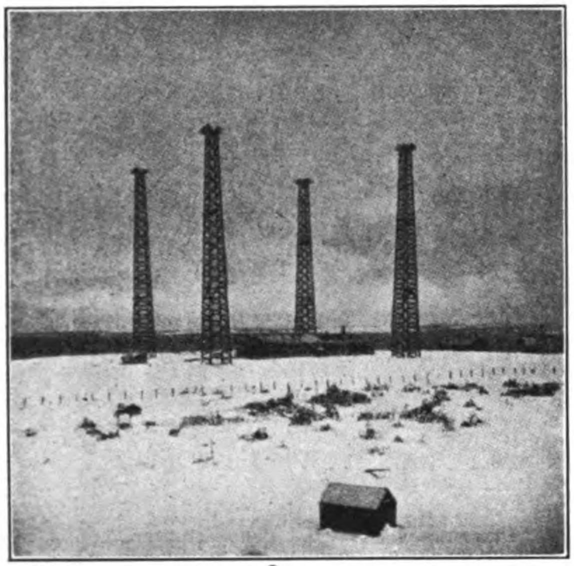


Fig. 12.

electrical disturbances of the atmosphere, which, on account of their doubtful origin, have in England been called "X's," and in America "statics."

One of the objections made against wireless telegraphy is in regard to the possibility of interference between various stations and the confusion likely to arise when a number of stations are simultaneously operated in the vicinity of each other. Although this confusion does rarely arise in practice with proper up-to-date stations and apparatus yet even with the old instruments when it did occur it was not by any means such a serious matter as generally appeared to the imagination of the public. In most countries the operation of wireless telegraph stations is subject to judicious rules tending to prevent mutual interference, and I am glad to know that the American Government intends to promulgate regulations which should greatly increase the efficiency of wireless working.

But there is a danger of governments hampering the development of this new art by the imposition of too many rules and regulations. We must not allow the waves of the ether and of space to become bound up in red tape.

Telegraph engineers know perfectly well that without proper organization and discipline serious difficulties due to interference would occur with the great majority of ordinary land wire telegraphs which work several offices by means of a single wire.

I should further say that in the case of wireless telegraphy it is often an advantage that any station should be able to pick up a message which may not be actually addressed to it. Take for instance, the case of a ship in distress calling for assistance.

Although, as I have said, wireless telegraphy can prove its usefulness even if unsyntonized, still it is clear that for commercial purposes so long as some method for rendering the stations independent of each other be not adopted, a very serious and effective limit to the practical utilization of the system would be imposed.

At present one of the most practical methods of isolating any particular receiver so as to make it sensitive only to signals coming from a certain station is to avail ourselves to the uttermost of the principles of resonance, to tune the sending and receiving circuits to exact correspondence and, where possible, avail ourselves of directive methods.

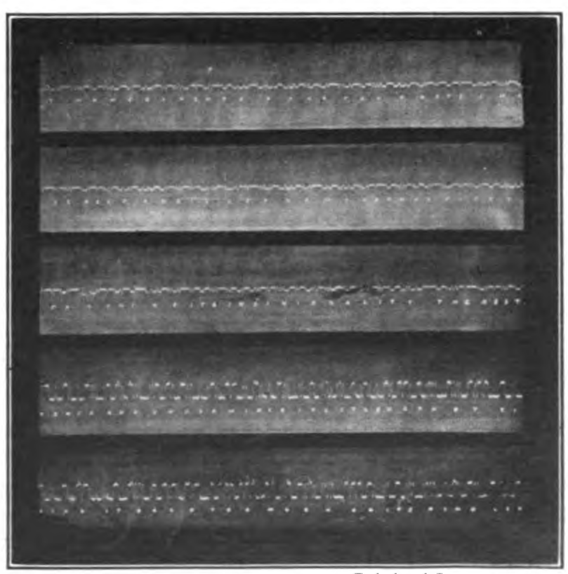


Fig. 13.

In regard to resonance the question then arises as to what it is which determines the effectiveness of tuning. If waves of one particular wave length are impinging on a receiving antenna and create signals, by how much can the wave length be varied or the tuning of the receiver changed without preventing these signals being received? It is clear that the narrower this range the more perfect the isolation of the receiver. It depends upon the form of the resonance curve of the sending and receiving circuits. If the transmitting station is radiating waves of a certain constant wave length and damping or decrement, then in the receiving circuits of all other stations within range there will be produced oscillations having a certain mean square value measurable by appropriate instruments. If a receiver is gradually brought by adjustment of its capacity and inductance into exact syntony or tune with a particular transmitter, then this receiver current reaches its maximum value and there is a definite lesser value of the receiver current for every particular degree of want of tuning or lack of resonance between the two. The curve which, by its ordinates, expresses this receiver current corresponding to each particular tuning or natural frequency of the receiving current is called a resonance curve. (Fig. 14.)

If this curve has a very sharp peak, then it clearly indicates that a slight want of tuning between the stations will render the receiver incapable of picking up sufficient current for its operation.

Peakiness of the curve depends upon the sum of the decrements of the sending and receiving circuits. By the term decrement of a circuit is meant the logarithm of the ratio of the amplitude of two successive oscillations in the train.

To obtain very sharp tuning we have, therefore, to employ either very feebly damped oscillations or—better still—undampened oscillations in the transmitter, and also receiving circuits in which there is a minimum dissipation of energy by resistance and other causes.

It is then possible to cause a change of even less than one-half of one per cent. or five parts in a thousand in the wave length of the received waves to cease to actuate the receiver. This means that we can distinguish between two waves 1,000 and 1,005 or 1,010 feet in length respectively, and that our receiver may be tuned to respond to one and not to the other.

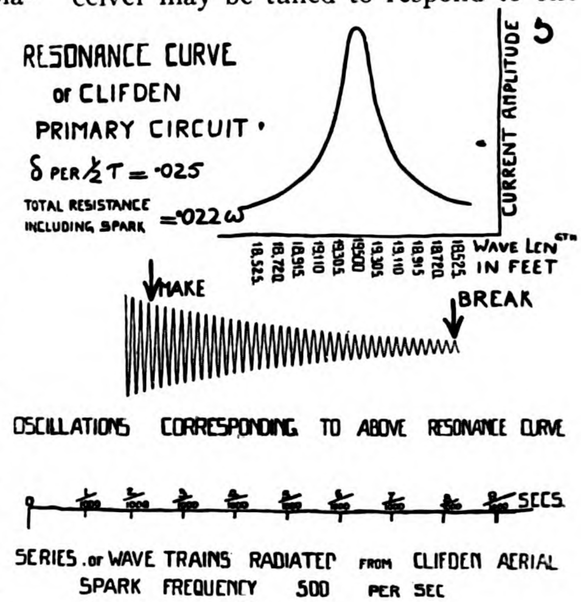


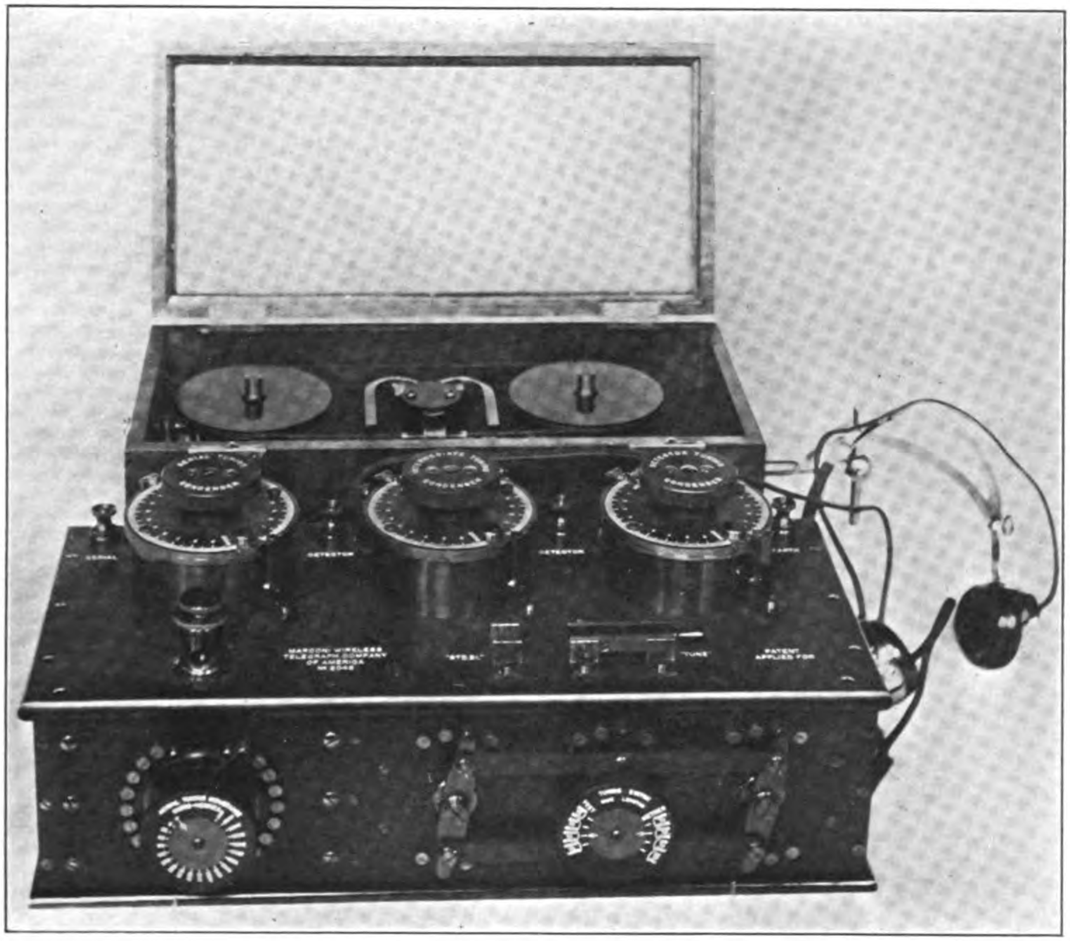
Fig. 14.

Wireless telegraphy, like aviation, is as yet a comparatively undeveloped art, therefore, personal skill and practical ability on the part of the operators are of the greatest importance in overcoming the difficulties of the moment.

At the long distance stations situated at Clifden in Ireland and Glace Bay in Canada, the arrangements which have given the best results are based on my syntonic system of 1900 to which have been added numerous improvements.

An important innovation from a practical point of view was the adoption at Clifden and Glace Bay of air condensers, composed of insulated metallic plates suspended in air at ordinary pressure. In this manner we greatly reduce the loss of energy which would take place in consequence of dielectric hysteresis were a glass or solid dielectric employed.

(To be continued in the February number.)



The Marconi Multiple Tuner

A Description of the Instrument and its Connections When in Use as a Tuner, Wave Meter, and Distance Measurer

THE Marconi Multiple Tuner is the outcome of many years' experimental work and experience, both in regard to the scientific principles involved and the manner in which they have been carried out, the electrical and mechanical design being such that, while the instrument fulfils its many functions accurately and easily, it will stand severe climates and comparatively rough usage.

The principal function of the instrument is to "tune" the receiver or render it immune to interference from other stations, but it may also be used for measuring the lengths of the transmitted and received waves and for estimating the distance of a known station.

The design of the instrument is such that it is completely protected from all electrical discharges, and is adequately insulated wherever required, while all switches and contacts are of the most substantial character and easily accessible for cleaning. Further, it is strongly constructed, and all electrical connections are carefully soldered so that it is unaffected by the severest vibration.

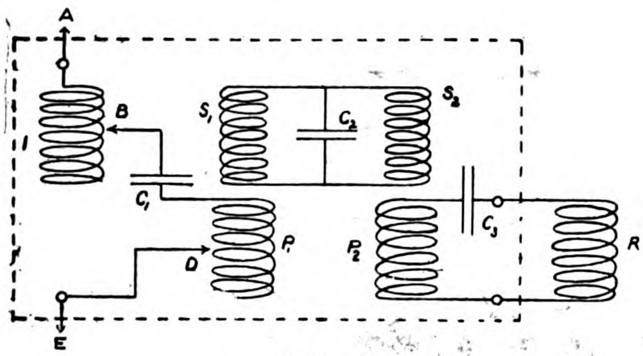


FIGURE 1

The general appearance of the instrument is shown in the accompanying photograph, and a complete diagram of the connections in Fig. 2. The whole instrument fits into a plain wooden traveling case measuring 1 ft. 9 ins. by 9 ins., by 11 ins. high and weighing 32 lbs. complete, and is suitable for all wave lengths from 300 to 8,000 feet.

The general principle of the instrument is shown in Fig. 1, in which A represents the Aerial, E, the Earth, R the Receiver or Detector, and the dotted line encloses the instrument proper.

The instrument contains three separate circuits called the Aerial Circuit, the Intermediate Circuit, and the Detector Circuit. The Aerial Circuit passes from the Aerial A, through the Aerial Tuning Inductance I, Aerial Tuning Condenser C_1 and Aerial Inducing Inductance P_1 to the Earth at E. The Intermediate Circuit consists of two equal Inductances S_1 and S_2 connected in parallel to the Intermediate Tuning Condenser C_2. The Detector Circuit consists of an Inductance P_2 in series with the Detector Tuning Condenser C_3 and Detector R.

The inductances I and P_1 are adjustable at B and D respectively, and the condensers C_1, C_2, and C_3, are all adjustable, and by means of these adjustments all the three circuits are tuned to the received wave length. The oscillations in the aerial circuit then induce (by means of P_1 and S_1) oscillations in the intermediate circuit which in turn induce (by means of S_2 and P_2) oscillations in the detector circuit.

In addition to the above adjustments, the two coils S_1 and S_2 may be moved relatively to the coils P_1 and P_2 so that the couplings between the three circuits may be varied.

The condensers C_1, C_2 and C_3, are constructed upon a new principle and are continuously variable from zero to a maximum of 10 jars (a jar being 1,000 centimeters) but the range of the instrument is increased by other condensers placed in parallel or series by means of the tuning switch.

In addition to the parts shown in Fig. 1, the instrument is fitted with a micrometer spark gap and shunt inductance (of the order of 80,000 microhenries) connected between the aerial and earth terminals to prevent the accumulation of an electrostatic charge in the aerial, with a change switch by means of which the whole of the tuned circuits may be cut out and with a tuning switch by means of which the capacity in the intermediate and detector circuits may be increased to a maximum of 30 jars, all of which parts are shown in Fig. 2.

Study of the photograph will reveal the various parts of the tuner; these, together with their corresponding letters in Fig. 2, are the following: (*a*) The "Aerial Tuning Condenser" is the left hand condenser looking at the front of the instrument. (*b*) The "Intermediate Tuner Condenser" is in the centre. (*c*) The "Detector Tuning Condenser" is the right hand condenser. (*d*) The "Micrometer Spark Gap" is the adjustable gap in front of the aerial tuning condenser. (*e*) and (*f*) The handles of the "Aerial Tuning Inductance" and of the "Tuning Switch" are on the front of the instrument. (*g*) The "Intensifier Handle" is at the right hand side of the instrument. (Not shown in diagram.) (*h*) The "Change Switch" "STD. BI." and "TUNE" is on the top above the "Tuning Switch."

In connecting up and working the

Marconi Multiple Tuner the first thing to be determined is that the primary of the magnetic detector is correct. The primary to give best results, should be of No. 36 D.S.C. wire wound on the usual glass tube, the length of the winding measured along the tube being 2 cms. If the magnetic detector primary is larger than this it can be altered by unwinding from both ends equally till the length of the winding is 2 cms. The extra length should then be cut off and the ends of the short primary soldered to the primary terminals.

The tuner is then placed on the table in front of, and close to, the magnetic detector. In this position the terminals on the tuner marked "Detector" come opposite the primary terminals of the magnetic detector, and should be connected up by short pieces of wire. The aerial and earth are connected up with the terminals of the tuner marked "aerial" and "earth" respectively. The aerial terminal, however, is not directly connected to the aerial. This is done either (a) through an aerial plunger switch, so that the tuner is disconnected from the aerial when transmitting, or (b) through the secondary of the transmitting jigger so that the tuner will always be in circuit, but this latter arrangement is only practicable when using an arrester earth terminal and telephone short-circuiting key

Next, the micrometer spark gap screw is turned until the contacts meet, and then the screw is given one complete turn back; this gives a gap of about 1/100 inch.

When "standing by" the change switch is set to the "STD. BI." position; the tuning switch is set at the first stop (300-500 ft. wave); the aerial tuning inductance at zero and the aerial tuning condenser at "SHORT."

The aerial is then connected directly through the aerial tuning condenser and magnetic detector to earth, and any station that happens to be working can be heard.

If the aerial being used is very small it will be best to "STD. BI." with some of the aerial tuning inductance in the circuit, while if the aerial is very large no inductance should be used, and the aerial tuning condenser should be set to some moderate value.

The best values of the aerial tuning inductance and the aerial tuning condenser for standing by, depend upon the aerial being used, and also on the wave length required to be received. A little experience will show what are the best values to use at any particular station.

When signals from the station desired are heard the operator adjusts first the aerial tuning inductance (keeping the aerial tuning condenser shorted) and then the aerial tuning condenser till the strongest signals are obtained. The intensifier handle is then set at 90° and the tuning switch set to the wave-length roughly indicated by the amount of the aerial tuning inductance, and the aerial tuning condenser. The change switch is thrown over to "TUNE," and then are varied together the intermediate tuning condenser and the detector tuning condenser till the best signals are obtained. It is very necessary that these two condensers should be varied as nearly as possible together; the operator varies one a little and then brings the other to the same value, and so on. He next adjusts the aerial tuning condenser to

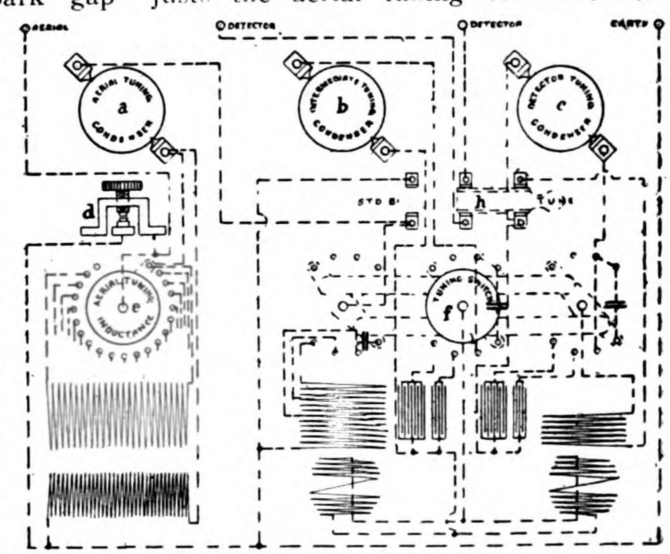


FIGURE 9

give strongest signals, and if interference is found, the intensifier handle is adjusted to a small value and the condensers adjusted again. It has been found that the further the intensifier handle is turned from 90° the sharper will the adjustments of the condensers become, and the greater will be the freedom from interference.

In using the Marconi Multiple Tuner for measuring the length of waves received at a station the tuner is set up and connected as already described, then having obtained signals with the change switch on the "TUNE" side, the intensifier handle is turned as low as possible, and the several condensers again adjusted. If the intensifier handle can be turned down to 10° the wave length being received can be read off at once from the calibration curve, or table supplied with each instrument. But if the intensifier handle cannot be turned down to 10°, the wave length indicated by the curve or table, can only be considered as approximate, and will be more accurate the smaller the angle of the intensifier handle.

In measuring the lengths of waves transmitted from a station it is necessary to erect the tuner and detector in some place out of sound of the spark. The operator connects a loop of wire from the earth terminal to the aerial terminal and proceeds with the connecting up of the tuner as earlier described, turning the intensifier handle down as far as possible. If the signals cannot be heard with the intensifier handle at 10° the size of the loop is increased until good signals can be heard with the handle in this position. It is necessary every time the size of the loop is changed to re-adjust the several condensers. When the best adjustment has been obtained the wavelength can be found from the calibration curve or the table supplied for that purpose.

The Marconi Multiple Tuner may also be used for determining the distance between stations.

The measurement of the strength of the received signals depending upon the hearing of the operator and upon conditions which are likely to vary from day to day, in addition to the details of the two stations, it is impossible to utilize it for the determination of the distance of the transmitting station. But the same man on the same day may make relative measurements of the strength of the received signals from the same station, and thus determine the relative distances between the stations at the two times, so that in the case of a boat, if he knows the distance at any time he can determine it at any other time so long as he is within range.

Marconi Wins Patent Suit

The Marconi Wireless Telegraph Company of America recently received a wireless dispatch from London stating that the French courts have upheld the action brought by its affiliated company against two wireless concerns doing business in France.

The basis of the suit was the well-known "tuning" patent granted to Marconi in several countries. Judgment was rendered against the Compagnie Generale Radio Telegraphie and the Societe Francaise Radio Electrique wherein the validity of the Marconi patent was upheld, an injunction ordered to prohibit further infringement, costs and damages awarded to the Marconi Company, and the infringing apparatus which the defendants had been using ordered confiscated.

The validity of the British patent for the same invention was upheld by the High Court of Chancery in England about a year ago, in a suit brought by the Marconi Company against the British Radio Telegraph & Telephone Company. The American patent for this invention, owned by the Marconi Wireless Telegraph Company of America, corresponds with the English and French patents and the American company confidently expect that the United States Court will reach similar conclusions in the suits now pending against the National Electric Signaling Company, the Federal Telegraph Company, and others.

Canada's Cumpulsory Wireless Act

In a recent interview J. Herbert Lauer, of the Canadian Marconi Company, made an interesting comparison of the American act to regulate radio-communication and the proposed Canadian act.

He noted that the main point of difference in the two measures appeared at first glance to be that the American act required two operators on all passenger steamers, whether ocean-going or on the Great Lakes (coming under Class A.) to maintain a constant skilled watch; with modification under Class B. that in the case of cargo steamers with crews of fifty or more, the second of the two operators might be a member of the crew certified as competent to receive distress calls, thus maintaining a constant receiving watch, with only a limited transmitting service. The Canadian bill, however, as drawn up, requires "a person" fully qualified, to take charge of, and operate the wireless apparatus. A third class is also constituted under the American act, which embraces classification of vessels voluntarily equipped with wireless apparatus.

Mr. Lauer expressed the opinion that the requirement of the proposed act of one operator only for the present was commendable, as owing to the difficulty of suddenly obtaining a large accession of skilled operators heavier demands would make it impossible to supply the number required, such operators not being available at short notice. From the point of view of the shipping companies it was also a wise provision not to make too heavy a call for operators, seeing they could not be engaged for less than $600 per annum, in addition to board and quarters.

Another important point that had been slightly discussed in Parliament was that of limiting the operation of the act to vessels plying between ports at least 200 miles apart. It was self-evident that grave casualties might frequently arise on shorter voyages. One suggestion made to meet this aspect of the case was the principle of apportioning the distances to be traversed with the number of passengers and crew carried, say, fifty or more, including passengers and crew, plying between ports more than 200 miles apart, 250 persons, distance more than 90 miles, and 500 persons distances exceeding 20 miles. Further, Mr. Lauer suggested that the "Minor waters of Canada" should be excepted from the provisions of the bill, including all rivers, lakes and other navigable waters within Canada, other than Lakes Ontario, Erie, Superior and Huron, with the Georgian Bay, salt water bays and gulfs on seacoast, including the St. Lawrence River as far seaward as a line drawn from Father Point on south shore to Point Orient on the north shore.

Mr. Lauer pointed out that while the act proposed to put into concrete form and before the public a number of regulations concerning wireless telegraphy, most of them were already in operation. Since wireless telegraphy had become universally used both in commerce and in saving life and property at sea, the various companies, and especially the Marconi Company—the most universal system—had been controlled by the regulations of the International Radio-telegraphic Conventions, meetings of which had been held in Berlin in 1907 and in London during the present year. Canada had long since given her adherence, but America had only joined this year. Coastal stations on Canada and Newfoundland shores had been strictly under control and inspection of the respective governments, and the proposed legislation simply gave public recognition to those arrangements, thus guaranteeing that the Marconi system would, as in the past, both aid navigation and protect life and property at sea and on the great waterways of Canada.

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Vol. I. JANUARY No. 4

Editorial

Mr. Marconi has fully recovered from the unfortunate accident which necessitated the removal of his right eye, and has actively resumed his labors.

On his recent return to London he expressed surprise at the credence given to the statements which have appeared in the newspapers during the past few weeks that continuous waves would in the future supersede the spark system in wireless telegraphy. Continuous wave systems were thoroughly tested by Mr. Marconi himself many years ago, exhaustive experiments being carried on during the greater part of 1907 at the Poldhu station.

As a result of these experiments he learned the advantages and disadvantages of continuous waves and eventually arrived at a compromise between the continuous wave and spark systems and combined the best points of both. This resulted in material changes in his system for long distance work and the improvements, patented some five years ago, are mainly responsible for the progress since made in long distance wireless telegraphy.

Scientific men have been more or less amused at the way the public has received the so-called discovery by alleged inventors that the spark system is to make way for the continuous wireless waves, for it is a matter of common knowledge that in the lectures delivered by Mr. Marconi at the Royal Institute of Great Britain in 1908 and again in 1911, in the Nobel Prize Lecture at Stockholm in 1909 and in the address to the New York Electrical Society on the occasion of his last visit to this country, he fully explained the use he was making of continuous waves, semi-continuous waves and the elimination of the spark.

* * *

It is an indisputable fact that wireless telegraphy owes everything to Marconi. It is an equally well-known fact that most of the other men who have claimed credit for alleged discoveries never did anything of note in the wireless field. It was left for Marconi to perfect his inventions while the others were still theorizing and then to place Marconi apparatus in commercial operation. Real scientists give Marconi the recognition he deserves; the real heroes of the laboratory are today modestly offering the fruits of their labors toward the expansion of radio-communication. And they do this without the blaring of trumpets that characterizes an alleged discovery by one of the many charlatans who are constantly endeavoring to get into the limelight.

Just a very few weeks ago the newspapers printed column after column about some rising young genius who had evolved a method of transmitting pictures by wireless. The public was properly impressed and amazed. Several people asked us why Mr. Marconi had not discovered that this could be done. They could not conceive that anyone could get ahead of the genius of wireless. Curiously enough, they struck the keynote of the whole situation. Mr. Marconi has known for many years that this could be done, but, as is the case with truly great scientists, he did not immediately call a conclave of newspaper reporters when he made the discovery.

We venture to say that scarcely one among our readers can recall the modest announcement that appeared in a New York paper one June morning more than *eleven years ago,* stating that a device called the telediagraph had been fully tested, and that several sketches had been successfully transmitted through an eight-inch brick wall. The Marconi system had accomplished this marvelous feat and it was believed that a new field had been opened for wireless in the rapid transmission of important sketches.

According to this, the ambitious young man who recently covered himself with newspaper notoriety was hardly the discoverer of the art of sending pictures by wireless.

There are any number of these cases. Almost every day some hitherto unheard of person bobs up serenely with an alleged wireless discovery. But Mr. Marconi still pursues the even tenor of his way, pausing occasionally perhaps to smile at their claims, but for the most part he is too busily engaged in perfecting his system to give these a second thought.

* * *

A peculiar and sometimes amazing thing is the long arm of coincidence. At the very moment of writing this editorial a newspaper clipping was brought to our attention by one of the staff. It is truly too amusing to be passed over. Many exaggerated claims have come under our notice in the past, but this aspirant for scientific honors must certainly be awarded the palm.

The trifling discovery that he proclaims is a method of communication in which all electrical apparatus is dispensed with. Hillis is the worthy gentleman's name. One who has studied the methods of Mr. Hillis reports this of his discovery:

The telepathist stands still, takes a hitch in his trousers, fixes his mind intently on the message he wishes to communicate, and the person whom he wishes to communicate with, and presto! 'tis done; the message has winged its way through space, hundreds or thousands of miles of it, perhaps, and safely lodged in the brain of the person for whom it was intended.

Marvelous! We gasp for breath on reading this. All honor to Mr. Hillis, whoever he may be. Too bad, though, he did not notice the one defect in this telepathy system. There seems to be no opening for business. There is no convenient point between the sender of a message and the receiver at which the small boy should appear with his bill for transmission. The inventors who have not made an opening for business have not, as a rule, made a lasting impression on the public mind. Sir Isaac Newton staggered the scientific world of that period with his discovery of the real reason why apples fall to the ground when the wind blows, but it took the world a long time to put faith in the existence of a law which did not enable the discoverer to profit by his discovery.

Telepathy may in time be ranked as a science, but from the present point of view it seems more or less intangible. Strange to say, we feel that there might be some difficulty in identifying the minds which are, or think they are, in communication with each other, and in verifying the messages promptly enough to make them of practical value.

The day is fast approaching when all of these so-called inventors, along with their exaggerated claims, will have been relegated to the background.

In any event, among those who know, Marconi and wireless are still synonymous words.

* * *

The Phillips *Titanic* Memorial Committee are to appear before the Mayor of New York to ask permission to erect a fountain in Battery Park. No doubt their request will be granted.

In addition to the fountain there will be a tablet at the side with the names of Jack Phillips, of the *Titanic* and other wireless operators who have stuck to their posts and gone down with their ships.

The American Marconi Company and the traveling public using the coastwise ships donated the greater part of the substantial fund collected by the committee. Only a portion of the total amount will be spent on the memorial, the residue is to be applied to starting a fund for wireless operators.

The Share Market

NEW YORK, January 10th.

While the cumulative weakness of the general stock market is still apparent, the bugaboo of scarcity of money in Wall Street and the exorbitant rates of interest charged at the time we went to press with the last issue have been effectively routed by reason of the support given to the money market by the more powerful financiers.

The state of the market still leaves much to be desired, however, as is indicated by the low figures at which the standard industrial stocks are quoted. Although the character of the general stock market is still uncertain, notwithstanding the great ease toward which the money market is pointed, it appears that we need no longer fear a continuation of the decline with which the new year started. Rallying strongly from the raids of the aggressive bearish faction, American Marconi stock is pointed toward a continuous upward trend. The excellent contracts recently secured by the Canadian company will, within a short time, become more widely known, and should result in a full recovery before the month is out. To the manner in which the uninformed have received the news of the postponement by the select committee of the ratification of the agreement between the Government and the English Marconi company may be attributed the slight decline in that company's securities. Those better acquainted with the true situation see nothing ominous in this *ad interim* report, since it merely suggests further inquiry as to the merits of rival systems. Such investigation is, and always has been, welcomed by the Marconi interests, secure in the knowledge that no competing concern has the experience, apparatus or means to carry out the continuous service over long distances required by the British Government.

Bid and asked prices to-day:

American, 6⅜—6¾; Canadian, 4—4⅝; English, common, 21—22½; English, preferred, 18—20.

Ship Operators to Receive Bonus

With the object of promoting better communication between ships at sea and increasing the earning capacity of its wireless telegraph stations on ships the American Marconi Company, on the first of the year, placed in operation a system of distributing a gratuitous bonus among those operators who in the opinion of the management shall have displayed uncommon zeal, proficiency and care in the performance of their duties.

This bonus is to be paid in addition to the regular salaries and will amount to 10 per cent. of the wireless tolls on all fully paid messages sent from Marconi ship stations to the shore stations of the company. The bonus will be payable at the end of every three months to those operators who shall have been in the employ of the company during that period.

As no message will be considered to have been correctly accepted, transmitted, received and delivered unless it adheres strictly to the regulations issued by the company the efficiency of the service will no doubt be materially increased. That the scheme is to be given a thorough trial is indicated in the announcement that it will continue in force for one year and if it is found to have produced more work better done it will probably be adopted permanently.

Under the new conditions a still more efficient wireless service than the present day high standard is confidently expected for the operators realize that it will be possible to earn a larger bonus on some ships than on others, and will work for promotion to the better paying stations, awarded in accordance with industry, ability and general good conduct of the telegraphists.

An order has just been issued to Marconi operators that their auxiliary sets are not to be used except when vessel is in distress, or upon written authority from Government Inspector.

Wireless Liquidating Further Delayed

That there has been a further delay in the distribution of the American Marconi stock held by the Wireless Liquidating Company is regretted by the officers of that concern, who state that the work of allotment has been again impeded by the injunction suit entered by a Brooklyn public school principal, Joseph V. Witherbee; who in his affidavit complains that the reorganization committee, while ostensibly formed to untangle the affairs of the bankrupt United Wireless Company, have schemed to accrue preferential profits for the benefit of a favored minority of the stockholders.

Concerning the actions of the ten defendants, comprising the reorganization committee, Witherbee, through his attorney, charges that their alleged stock-juggling was for the purposes of "acquiring the assets for their own benefit and advantage, and to exclude from the benefit of the sale to the Marconi Company, all stockholders situated as is Mr. Witherbee."

According to the answer of the reorganization committee Mr. Witherbee's charges of unfairness arise from what he calls the inaccessibility of stockholders.

The defendants admit that while there were a few holders of what is understood to be legitimate United stock who were not readily accessible, owing to inadequate adresses and other causes, that Witherbee was not among these. They maintain that holders of large numbers of shares of the United Company which the committee believed to have been fraudulently issued were presented for acceptance and were rejected, on the ground that the stock was invalid, without notice; but that the few cases of belated applications from bona fide shareholders were laid before the Wireless Liquidating Company at a special meeting called for that purpose and the question of admitting these to the reorganization was unanimously negatived by its stockholders.

The defendants state that they have no knowledge sufficient to form a belief whether Witherbee's stock are valuable and lawful shares and they allege that in their belief he deliberately neglected and refused to come into the plan of reorganization until he could satisfy himself whether it was likely to be successful or not, refusing to take the risk which was involved at the time set for coming in.

Mr. Witherbee has an ambitious plan for the dispensation of justice. He believes that stockholders who lacked the pecuniary means to comply with the terms of the reorganization plan should not be shut out, but that the 140,000 shares of American Marconi stock be distributed pro rata among all the stockholders of the bankrupt concern.

The defendants in the suit do not agree with him. They maintain that only those who paid their assessment while it was still doubtful whether the plan could be successfully put through are entitled to participate in the distribution. They allege that Witherbee, and all other persons represented in the action, were well informed of the plan, knew of the circular notices, but with that knowledge declined and neglected to make the contribution of fifty cents a share until long after the time for coming in had expired. Therefore, if Witherbee and other persons sat by and waited to see what the outcome would be and at the expiration date were not sufficiently satisfied of its successful outcome to make their contribution, they are not entitled to equally share with those who took the risk.

The case is expected to come to trial within a few weeks, meanwhile the distribution of the Marconi stock to participants in the reorganization is further delayed.

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

Consulting Engineer of the Marconi Wirelss Telegraph Company of America

CHAPTER I.

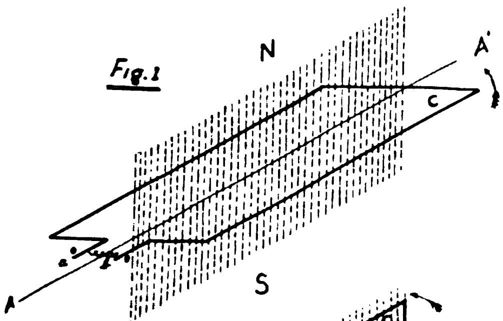
ALTERNATING CURRENT.

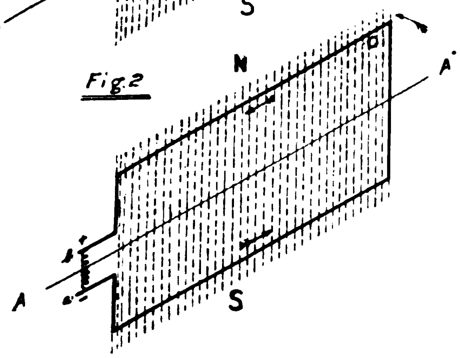
If a coil or loop of wire be revolved about its axis, in its plane while in a magnetic field, an electromotive force (E M. F.), or potential will be generated between its ends. This E. M. F. will be zero when the loop lies across the magnetic field, that is when it encloses the greatest number of magnetic lines of force. These magnetic lines are called the *flux*.

In Fig. 1, C is the loop, *a* and *b* its ends. The dotted lines represent the flux, considered as passing from N (North Pole) to S (South Pole.) A A' is the axis about which it revolves and the arrow shows the direction of rotation.

In this position the E. M. F. is zero because the loop is moving in line with the flux and not across it.

In Fig. 2, the loop has rotated 90° or one-quarter revolution. Its plane now lies with the flux. In this position the E. M. F. is a maximum, because the loop is moving across the flux at a





maximum speed. In this case *b* will be *plus* (Positive) and a *minus* (Negative). If *a* and *b* are connected together so a current can flow, it will flow from *b* to *a* indicated by the arrow along side the loop. The E. M. F. has passed through all values from zero to its maximum, that is, the E. M. F. has had a different value for every change in position of the loop. These values are called instantaneous values, and will be discussed later.

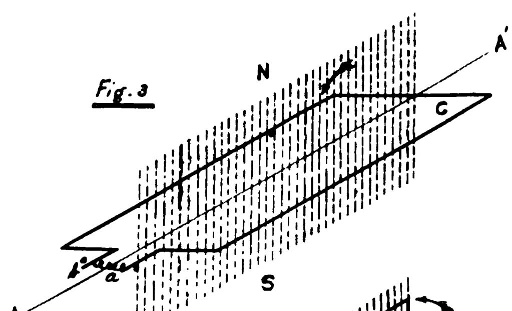
In Fig 3, the loop has rotated through 180° or one-half revolution. Its plane now lies across the flux and E. M. F. is zero again. The E. M. F. has passed through all values from its maximum to zero in the reverse manner in which it increased from zero to its maximum.

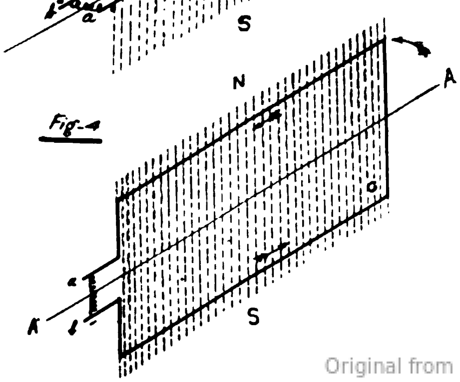
In Fig. 4, the plane of the loop again lies with flux and the E. M. F. has a maximum value. The loop has rotated through 270° or a three-quarter revolution. The E. M. F. has passed through all values from zero to its maximum, but has changed its sign, *a* is now positive and *b* negative. This is due to the fact that the loop is now cutting or passing through the flux in the opposite direction.

In rotating from 270° to zero or completing its revolutions, the E. M. F. decreases from its maximum to zero while passing through all intermediate values. Thus it will be seen that during a complete revolution of the loop the E. M. F. has increased from zero to its maximum, decreased from its maximum to zero, changed its sign or direction while again increasing to its maximum, and again decreasing to zero. This process is called a *cycle* and the number of cycles per second the *frequency*. The time required to complete the cycle is called its *period*.

If the coil has its ends connected together so that a current can flow, the E. M. F. generated will cause a current to flow through the coil, whose value depends on the E. M. F. and the resistance of the circuit—except when modified by self-induction, to be discussed later. This current is called an *alternating current* and the E. M. F. an *alternating E. M. F.* As an alternating current is produced by an alternating E. M. F. it is necessary to consider this E. M. F. as well as the current produced by it.

As in the case of direct current the E. M. F. is proportional to the rate which a conductor cuts the magnetic lines of force or flux. In the case of the coil or loop the rate at which the conductor cuts the flux varies with the





position of the coil. When the plane of the coil is at right angles with the flux the change in number of magnetic lines through the coil for a given angle of rotation of the coil is a minimum, hence it gives a minimum E. M. F. This is true when the coil has turned to 180°. When the coil has turned to 90° the change in magnetic lines is greatest, hence a maximum E. M. F. This is also true when the coil has turned to 270°, but the E. M. F. is of opposite sign from that when the coil was at 90°. If the E. M. F. is plus when the coil has turned to 90°, it will be minus when at 270° and vice versa.

When a conductor cuts 10^8 (100,000,000) magnetic lines per second, or the rate of change of the lines is 10^8 per second, 1 volt E. M. F. is produced. If the conductor is closed it is called a loop or coil. It may, however, have several turns; in this case the number of magnetic lines cut per second is the increase or decrease of lines per second through the coil. If the coil has N turns the rate of cutting is N times that of one turn. The rate of cutting the magnetic lines depends on the speed or number of revolutions per second of the conductor around its axis as in Figs. 1, 2, 3, and 4. This rate may be uniform as in direct current machines, or it may vary as in alternating current machines. Where the change of magnetic lines is not uniform the product of number of turns of the coil times the change in flux per second gives the average E. M. F.

In the case of the loop as shown in Figs. 1, 2, 3, and 4, the total flux passes in the coil twice and out twice during one revolution or during one cycle. If we had 10^8 magnetic lines and the coil revolves once in a second we would have 10^8 magnetic lines thrust into the coil twice and withdrawn twice. This would be equivalent to 4×10^8 lines thrust into the coil in one second, in this case the E. M. F. in volts would be 4×1 turns $\times 10^8/10^8$, which would be 4 volts. If there were N turns then the E. M. F. would be N times as great or $4\ N\ 10^8/10^8$. If we substitute the symbol Φ (Greek letter Phi) for the number of magnetic lines or total flux, and n for the number of revolutions per second then we have the general formula E. avg. $= 4n\ N\ \Phi/10^8$ or $4n\ N\ \Phi\ 10^{-8}$.

This is the fundamental equation used in dynamo machine design. It must, however, be modified to meet practical conditions. In alternating current dynamos or generators, the average E. M. F. is not important, but the maximum and effective values are. The instantaneous values, or values at any instant are also of importance in plotting curves representing the E. M. F. or current.

To properly understand the derivation and use of the formula used in this work it will be necessary to understand the simple trigonometric functions. For the benefit of those who are not familiar with these functions, the following explanation will enable them to fully comprehend them:

RECTANGULAR CO-ORDINATES.—It is very often convenient to represent a quantity which varies in value by means of a curve. To construct such a curve it is first necessary to locate a number of points (with reference to a line or lines) which represent different values of the quantity. This can be readily done by the use of rectangular co-ordinates.

Let the lines X X′ and Y Y′ be drawn at right angles, intersecting at

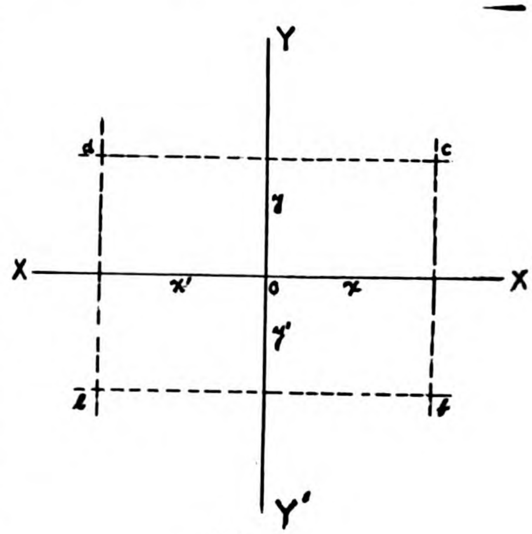


Fig. 5.

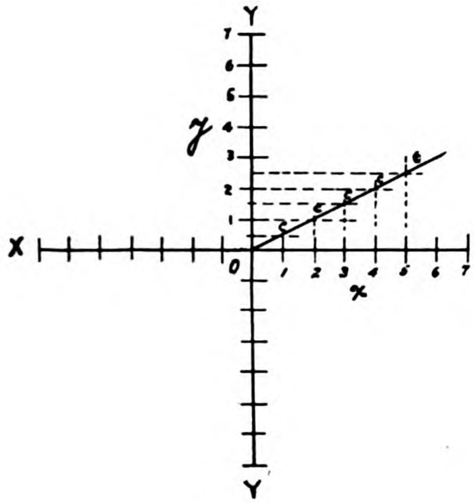


Fig. 6

O. These lines are called the *axes of reference*. The point of intersection O is called the *origin*. Any lines drawn parallel and at right angles to these lines are called rectangular co-ordinates or, briefly, *co-ordinates*. All lines at right angles to X X′ and parallel to Y Y′ are called *ordinates*. When they extend above X X′ they are considered positive and given the (+) sign; when they extend below X X′ they are considered negative and given the (—) sign. All lines at right angles to Y Y′ and parallel to X X′ are called *abscissas*. When they extend to the right of Y Y′ they are considered positive and given the (+) sign. When they extend to the left of Y Y′ they are considered negative and given the (—) sign. These co-ordinates represent distances or quantities by their length.

In Fig. 5, x is the abscissa of point c, and y is the ordinate. The ordinate of the point d is y and the abscissa is x, and is a (—) quantity. x' is the abscissa and y' the ordinate of the point e, both being (—). x is the abscissa and y' the ordinate of point f, x is (+) and y' is (—).

From the foregoing it will be seen that by observing the signs of the co-ordinates the exact position of the point can be determined, with reference to the lines X X′ and Y Y′. Very often the value of the ordinate depends on the value of the abscissa or vice versa, or the value of one may change with a change of value of the other. They are then said to be *functions*. When a quantity depends on another for its value it is said to be a function of that quantity.

Suppose that for every value of y, (Fig. 6) x had a different value, then x would be a function of y. If a point was constructed for each of these values and a curve drawn through these points, then the curve would represent variation of some quantity. This curve is called the graph of a function. A curve may also be represented by an equation.

Let $y = \frac{1}{2} x$.

Then for every value of x, y will have a value of $\frac{1}{2} x$.

If $x = 1 \quad y = .5$
$x = 2 \quad y = 1$
$x = 3 \quad y = 1.5$
$x = 4 \quad y = 2$
$x = 5 \quad y = 2.5$

To construct the curve or *graph* of this equation lay off on X X′ the values of x and Y Y′ the values of y (Fig. 6.) Draw a line $o\ c$ through points of intersection of the ordinates and abscissas. This line will be the graph of the equation.

The equation of a curve may have many different forms as

$y = x^2$
$y = x^2 + x - 1$
$y = x^3 - 1$, etc.

Example $y = x^2$

If $x = 1 \quad y = 1^2 = 1$
$x = 2 \quad y = 2^2 = 4$
$x = 3 \quad y = 3^2 = 9$

If we lay off these values in co-ordinates we shall have a graph of the form shown in Fig. 7.

The practical use of the co-ordinates will appear later and the reader should thoroughly understand their use. By writing a number of equations of different forms and constructing their graph, he can become familiar with them. Ordinary cross section paper will be found convenient for this purpose.

TRIGONOMETRIC FUNCTIONS. — Can be represented graphically in the most simple manner.

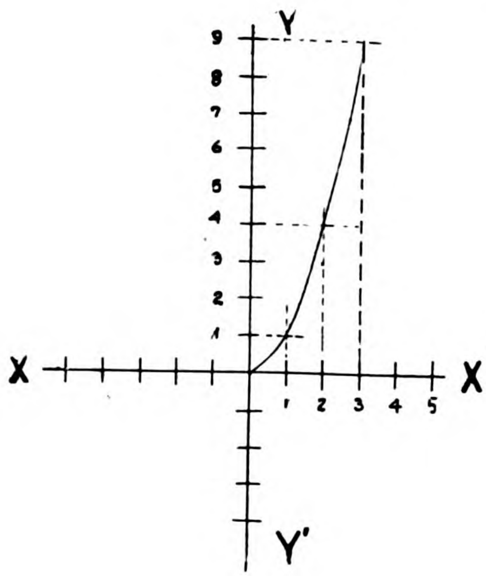


Fig. 7

Around the point O describe a circle and consider its radius as unity. Draw X X′ through the centre O and Y Y′ through O at right angles to X X′. These two lines divide the circle into four equal parts or *quadrants*.

The upper right one is called the first quadrant, the upper left one the second quadrant, the lower left one the third quadrant and the lower right one the fourth quadrant. Each of the angles formed by the intersection of the lines X X′ and Y Y′ are right angles or 90°. Let the point P lie anywhere on the circle in the first quadrant, connect P and O by the line *a*. As *a* is the radius of the circle its value is 1. Let the angle formed by *a* on X X′ be called θ (Greek letter Theta). Then *b*, the perpendicular from *p* to X X′, will be the *sine* of the angle θ. This written $b = \sin \theta$. The sine θ is also equal to *b/a* and is written $\sin \theta = \frac{b}{a}$. This formula holds true for a radius of any length and it is not necessary to consider it as unity, so long as both *a* and *b* are measured in the same units.

The angle θ will always be proportional to its sine. When $\theta = O$, the sine will be O and when $\theta = 90^\circ$, the sine will be unity or equal to the radius O P, that is $\sin 90^\circ = \frac{b}{a} = \frac{1}{1} = 1$. It will be seen that the sine can never exceed unity in value.

Let *c* be the distance from *b* on X X′ to O, *c* will then be the co-sine of θ. The co-sine, of an angle is the sin of the complement of that angle, or sin 90°. It is also equal to *c/a* and is written $\cos \theta = \frac{c}{a}$. The co-sine is inversely proportional to its angle. When the angle is O, the co-sine is unity and when the angle is 90°, the co-sine is O.

The signs of these functions change in the same manner as that of the co-ordinates. In the first quadrant they are all positive. In the second quadrant the sine is positive and the co-sine negative. In the third quadrant the sine and co-sine are both negative. In the fourth quadrant the sine is negative and the co-sine positive.

When θ is greater than 90° and not over 180°, the sine is less than unity and is numerically equal to the sine of $180^\circ - \theta$. It lies in the second quadrant and is positive.

If θ is greater than 180° and not over 270°, then the sine of θ equals the sine of $\theta - 180^\circ$ and is negative, as it lies in the third quadrant.

If θ is greater than 270° and not over 360°, sine of θ will equal sine of $360^\circ - \theta$ and will lie in the fourth quadrant.

Also if θ is greater than 90° and not over 180°, the co-sine of θ will equal the co-sine of $180^\circ - \theta$ and lies in the second quadrant.

If θ is greater than 180° and not over 270°, the co-sine will equal the co-sine of $\theta - 180^\circ$ and will lie in the third quadrant.

If θ is greater than 270° and not over 360°, the co-sine will equal the co-sine of $360^\circ - \theta$ and will lie in the fourth quadrant.

The reader should familiarize himself with these functions and fully comprehend the change of value of the sine with a change of the angle. The importance of this will appear later when we take up the question of instantaneous values of alternating E. M. F. and current. There are numerous textbooks on this subject which also have tables giving the numerical values of

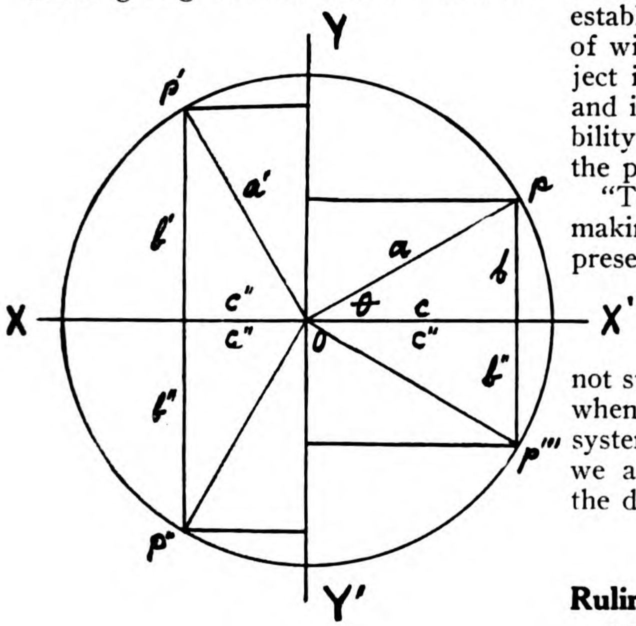


Fig. 8

the sines and co-sines of all angles. The reader should provide himself with one of these textbooks.

NOTE.—The other functions of an angle are the *tangent, co-tangent, secant* and *co-secant*. These will be treated in the next issue.

(To be continued.)

(This course commenced in the December, 1912, issue.

Wireless Telephony Coming

That he will soon be able to talk from his experimental station at Gloucester to Washington by wireless telephone is the belief of John Hays Hammond, Jr. Mr. Hammond, who is the son of the mining engineer, has been experimenting several years with wireless telephony. He believes that ultimately telephoning without wires will take the place of the present system.

"Within a few months," he states, "I shall no doubt be talking daily with the Government experimental station in Washington.

"To my mind, wirelesss telephony offers a wider and more practical field of endeavor than wireless telegraphy, but in this connection I wish to sound a note of warning. The public should be somewhat chary of accepting as an established fact the commercial status of wireless telephony. The whole subject is in an experimental stage as yet, and it will be many years in all probability before wireless takes the place of the present system.

"The General Electric Company is making an apparatus for me at the present time which I propose to use in connection with certain inventions of my own, and I shall be very much disappointed if we do not succeed in talking with Washington when it is installed. The particular system of wireless telephony which we are using here at Gloucester was the discovery of Dr. Leon Chaffee."

Ruling on Government Supervision

After several preliminary conferferences, it is finally announced that the Interstate Commerce Commission has ruled that, under the act making telegraph and telephone companies common carriers, it has jurisdiction over wireless messages from a commercial station in the United States to a ship at sea, whether a United States or a foreign ship, but that it has no jurisdiction over message between two American ships at sea. The effect of the ruling is that the Commission may determine, in the event of complaint, whether charges are reasonable.

Noiseless Music

Mr. Marconi, at a dinner in Newport, was once seated beside a lady who, confusing him with his compatriot, Mascagni, said:

"Oh, I'd so love to hear you play your beautiful 'Intermezzo.'"

"I'll do it," the inventor answered, promptly, "if you've got a wireless piano."

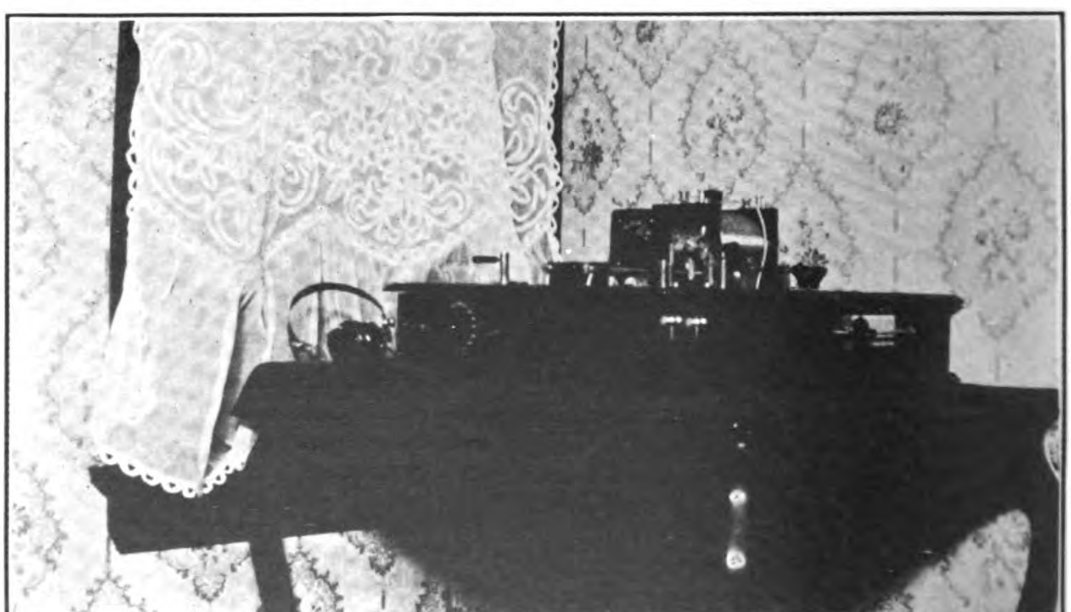
In this department the affairs of the various wireless clubs and associations will receive attention. Believing that all amateurs are interested in the experiments and research work of others the publishers plan to give readers each month distinctive items on the progress made by club members, thus offering 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.

One of the most efficient of the amateur stations scattered throughout the eastern states is the one owned by Alfred J. Seeley, of Philadelphia.

This young man has been able to copy the U. S. naval stations at Colon in the Canal Zone and at Key West, Fla., under favorable conditions; and many times he has heard the Marconi station at Cape Cod, Mass.

The antennæ of his station, a photograph of which appeared in our last issue, consists of four 7/22 stranded hand drawn copper wires, 125 feet in length, 86 feet high at one end and 2 feet at the other.

His set comprises a Murdock loose coupler, Marconi potentiometer, Navy type 'phones, two perikon, one carborundum combination silicon and galena iron pyrites detectors, a 21-plate variable condenser operating with fixed condensers by means of a fan switch; loading coil, 3-inch diameter and 18 inches long, would with double silk covered copper wire, all the wiring be-



The efficient amateur station of Alfred J. Seeley, Philadelphia.

ing concealed in a mahogany cabinet case.

An excellent view of the instruments is shown in the accompanying illustration.

A Warning to Amateurs

Irresponsible amateur wireless operators, the bane of the commercial radio stations on all similar occasions, interfered materially with the wireless work between the *Turrialba* and the shore stations, when that vessel was grounded on the south end of Brigantine shoals in the heavy snowstorm of Christmas Eve. During the entire afternoon and night the amateurs kept the air filled with their messages, sometimes trying to call the *Turrialba,* and at others "jamming" the stations, attempting to work by sending messages to each other.

The commercial operators, who were attempting to clear the *Turrialba's* business, were severely handicapped by the interference of the amateurs, finding it extremely hard at times to do their work. The station at the New York Navy Yard also suffered by interference of amateurs.

Since the invention of wireless stations attempting to work with disabled vessels have always been bothered more or less by those pirates of the air, some of whom seem to "jam" the air out of malicious mischievousness. This was in evidence more than ever in the *Turrialba's* case, and all of that certain clique of amateurs who bother the commercial stations about New York City were hard at work. So bad was the interference on the day of the wreck that for three hours the New York Navy Yard station was absolutely unable to read one connected message from the disabled ship.

Under the new wireless law, which went into effect December 13, all amateur wireless stations are limited to a wave length of 200 meters. A number of amateurs in the neighborhood of the city who have high powered stations have made no attempt to comply with the law, and some of them have not applied for the license, which, under the law, is now necessary to operate a station.

W. D. Terrell, radio inspector of the New York district, as soon as news of the accident to the *Turrialba* became known, sent out a wireless warning to all stations, notifying amateurs to keep out entirely and commercial stations to minimize all business as far as possible until all matters connected with the steamship were cleared up. A number of amateurs paid absolutely no attention to Mr. Terrell's warning.

Mr. Abrahams, radio operator of the *Seneca,* when the revenue cutter arrived in port, said, concerning the interference: "While we were alongside of the *Turrialba,* and all Tuesday night, I could hear several amateurs who have high power stations blocking the transmission of messages between the steamship and the shore, and by the manner in which the shore messages came out to us, I could tell that they were being seriously bothered at the New York end."

Officers of the *Seneca* said that the interference reminded them of the occasion that started the legislation against amateurs. On Christmas night, 1909, the *Seneca* was lying in Boston harbor, with a fierce northeast gale raging outside. Suddenly a call was received, stating that two vessels had just been in collision and asking for help. The message said that the ships were some distance outside. The *Seneca* at once started to get under way, in the teeth of the gale, when the Boston Navy Yard called them, stating that the operator there knew the spark, which was that of an amateur in that city. This is only one of the many occasions when the S. O. S. call for help was used by an amateur with deliberate maliciousness.

If this occurs again, the old rule of "third and last" time will no doubt be carried out by Uncle Sam. Serious students of the art will do well to discover the identity and suppress further activities on the part of the addle-pated youths concerned in this outrage—and do it before the Government cuts off the entire body of amateurs for all time.

Map of World's Stations

A novelty in the way of maps has just been issued by Marconi's Wireless Telegraph Company, Ltd., consisting of a chart showing the principal wireless telegraph stations of the world. A number of scarcely known places are shown to be in radio communication, many of these being dignified by scarcely euphonious names to our anglicized ears. Notable among these might be mentioned: Mushagak, Antofagasta, Dakar, Swakopmund, Mogadiscio, Nicolaiewsk and Fukkikaku.

Railroad Requests License

The Union Pacific Railway has made application to the Department of Commerce and Labor at Washington for a license to operate and maintain a wireless telegraph system along its lines. The company wishes to install a technical experiment station and the Government is requested to give permission for such a station, the second of the kind in the country.

Several wireless stations, it is announced, will be constructed when the license is issued.

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, 300 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, 303 Price St., Savannah, Ga., secretary.

ILLINOIS

CHICAGO — Chicago Wireless Association: John Walters, Jr., president; E. J. Stein, vice-president; C. Stone, treasurer; F. D. Northland, secretary; R. P. Bradley, 4418 South Wabash Ave., Chicago, Ill., corresponding secretary.

CHICAGO — Lake View Wireless Club: E. M. Fickett, 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 Association: 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—Forest Park School Wireless Club: W. S. Robinson, Jr., president; William Crawford, R. F. D. No. 1, Springfield, Mass., secretary.

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

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 — 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.

NEW YORK—Plaza Wireless Club: Paul Elliot, president; Myron Hanover, 156 East 66th St., New York, 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.

No One to be Visible in Battle

"War on Land and Sea Without a Man on the Scene of Hostilities" was the subject of an address by B. E. Blanchard, an electrical expert, to the Electric Club of Chicago. He called attention to the application of wireless telegraphy in the directing of boats from a station on shore, and said it is possible that fleets of warships, without a man on board, may meet in battle, piloted by wireless operators on the shores. The guns can be aimed and discharged in like manner, he believes.

When the airmen have perfected their art to such an extent that their craft are possessed of automatic equilibrium this extraordinary method of waging war may be applied to the air, according to Mr. Blanchard. Operators on terra firma may direct the unmanned battleships of the air and may fire the guns and direct their courses in pursuit or retreat.

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.

C. L. V., Newark, N. J., writes:

The wave length of my antennae is 200 meters. However, when I couple it to the transmitting set a wavemeter indicates that two wave lengths are emitted, one 280 and the other 188. Does this comply with the Government Regulations?

Ans.—No; it does not. The law states specifically that no one of the emitted waves shall be more than 200 meters, consequently to comply you will need to reduce the coupling at your station.

If you are using inductive coupling draw the two helices apart until the wavemeter indicates but one wave length. If you would excite your antennae with an induction coil your emitted wave would be 200 meters and would comply with the law. This single radiation is due to the absence of coupled circuits. As long as you use coupled circuits you will need either to use very loose coupling or with "tight" coupling you must cut down the length of your antennae so that none of the emitted waves will exceed 200 meters.

A. H. K., New Orleans, asks:

Is it possible to use a quenched spark gap on a small ¼ kw. closed core transformer, 60 cycle, transmitting set. If so, are any special adjustments necessary?

Ans.—The general accepted opinion regarding this is that it is not possible to use a quenched spark gap on a 60 cycle set, but those who hold this opinion are entirely mistaken, as the writer used a quenched spark gap on a set of these proportions and found that it tripled the radiation from the antennae. You will find that you will need considerable less capacity than you would use with a plain spark gap; as a matter of fact, you will probably be able to cut the condenser capacity to one-half. The only special adjustments necessary for maximum efficiency comprise a certain degree of coupling, which must be used between the antennae and condenser circuits. You must use either inductive or direct coupling, bpt a certain coupling is necessary to secure maximum radiation. You will have to find this through experiment.

S. R. W., New York City asks:

What instrument is used to measure damping?

Ans.—Any wavemeter can be arranged to make this measurement but an instrument built especially for this work is known as a Decremeter.

Carelessness Kills Operator

What is believed to be the first case on record of a wireless operator being killed at his post occurred a few days before Christmas at Norddeich, the great German wireless station near the North Sea. The operator, a man named Muller, must have carelessly come into contact with the wires employed for the creation of electric waves, which are charged with such powerful voltage that death comes instantaneously to anybody touching them.

One of the military operators stationed at Paris, informs us that it is his belief that the Arlington station is not equipped with such powerful machines as the Eiffel Tower and, in consequence, though it may receive messages from a long distance the antennæ power will not transmit a reply.

Notable Patents

Lee De Forest, of New York City, has evolved a system of duplex wireless transmission, whose object is to provide a simple and efficient means whereby messages may be received and transmitted simultaneously, and at the same time to eliminate the effect of irregularities due to the action of the oscillator.

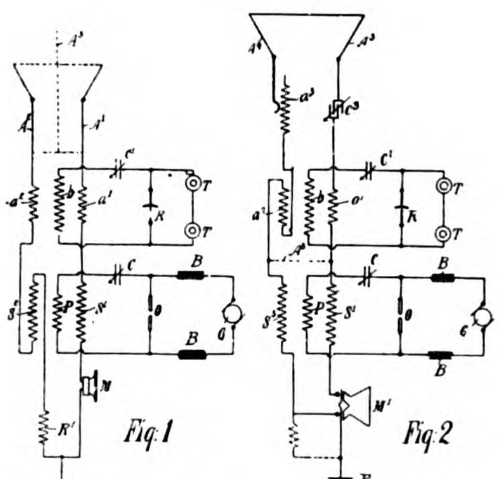
The inventor's specification states:

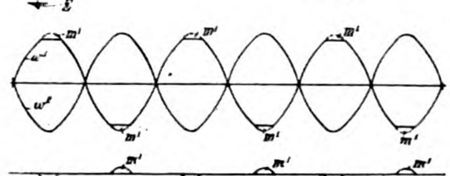
Referring to the accompanying drawings, and to the various views and reference signs appearing thereon: Figure 1 is a view in diagram illustrating one form of arrangement embodying the principles of my invention. Fig. 2 is a similar view illustrating modified arrangements embraced within the scope of my invention. Fig. 3 are wave diagrams illustrating the action of the arrangements shown in Figs. 1 and 2. Fig. 4 is a view similar to Figs. 1 and 2, showing another form of transmitter and arranged in accordance with the principles of my invention. Fig. 5 gives wave diagrams illustrating the action of the arrangement shown in Fig. 4. Fig. 6 is a diagram similar to Figs. 1. 2 and 4, showing still another arrangement embraced within the broad scope of my invention. Fig. 7 is a detail view, showing means which are simple and efficient for simultaneously, and to the same or reciprocal degree, varying the mutual inductance of certain of the parts in attaining a balanced condition and relation of circuits in accordance with the principles of my invention.

The same part is designated by the same reference sign wherever it occurs throughout the several views.

Various systems for simultaneously receiving and transmitting electro-magnetic wave signals have heretofore been proposed, but none, so far as I am aware, have proven successful in practical operation on account of latent defects in the systems or other causes. For instance, it has been proposed to base such a system on a definite relation and physical separation through a definite distance of the receiving and transmitting antennæ, the receiving antenna being located in a plane midway between and in the planes of two transmitting antennæ. Such an arrangement is commercially impractical, however, since its utility is confined to the receipt of signals transmitted from a fixed point, and, moreover, require a distance of separation of the order of one half a wave length, which is very seldom possible.

Again, in wireless system generally, more or less irregularities due to the action of the oscillator are encountered, which disturb the signals transmitted and impair the efficiency of the receiver This is especially true in the case of the wireless or radio telephone, the noises and other sounds produced by the arc or other form of oscillator impressing their effect and influence on

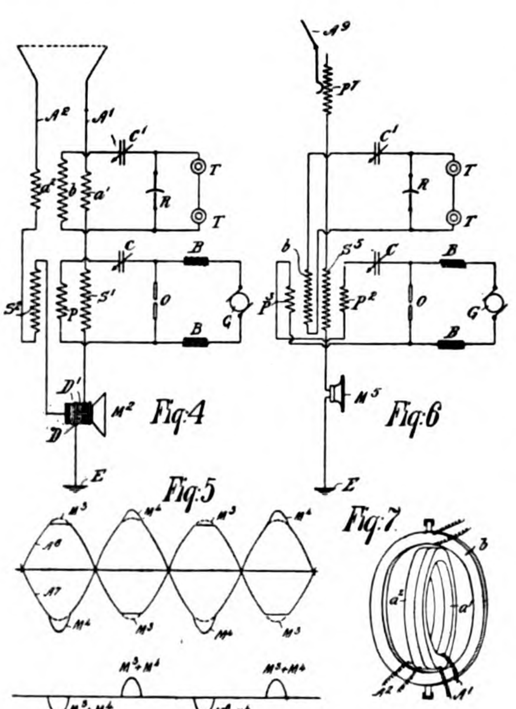




the transmitted electro-magnetic waves, and being reproduced at the distant receiving station they more or less seriously interfere with the receipt of the message.

It is among the special purposes of my present invention to provide a system of wireless transmission and reception of electro-magnetic waves in which the above and other objections and difficulties are avoided and eliminated; wherein signals may be simultaneously transmitted and received without the necessity of employing switches to vary the circuit connections; wherein a differential balance of circuits is maintained; wherein the antenna and the transmitting and receiving systems are preferably coupled up in series, the antenna serving as the connecting link between the transmitter and receiver; wherein any special relation or physical separation of the antenna is unnecessary, and wherein other features of improvement are embodied and other advantageous results are obtained.

Referring to the drawings, and particularly to Fig. 1, reference sign A^1 and A^2 designate antennæ or aerial



conductors, which, as is common in the art, may consist of one or several wires. These may be independent of each other, or, and as indicated by the dotted line 3^3, they may be different legs of the same loop antenna. These conductors are both grounded, as, for instance, at E.

Associated with both aerial conductors by any suitable method of coupling is an oscillating circuit for the generation of electro-magnetic waves. The oscillating circuit includes one or other form of oscillator, O, a condenser C, and an inductance coil P. The oscillator may be of any desired form such as is employed in this art for the purpose. I have found an arc oscillator to be best adapted for the purpose, the arc being supplied with current from any suitable source, preferably a source of direct current, as, for instance, a direct current generator indicated at G. This arrangement which I have selected to illustrate the principles of my invention results in the production of a practically continuous train of electro-magnetic waves, and I have found such a system best adapted for my purposes. The leads of the current source may contain choke coils B, in the usual way. The inductance coil P, in the oscillating circuit, in accordance with the principles of my invention as embodied in the arrangement shown in Fig. 1, is coupled inductively with coils S^1, S^2, oppositely wound with respect to each other, and respectively arranged in the aerial conductor systems A^1, A^2. The coils S^1, S^2 and P should be so relatively proportioned, wound and arranged as to enable the same inductive effect to be created in each of the coils S^1, S^2, by coil P, but in opposite phase relation. By this arrangement the oscillations of the oscillating circuit produce exactly equal electro-magnetic vibrations in each of the aerial conductor systems, but of opposite phases, or phases of 180 degrees apart. Also associated with both aerial conductors by any suitable method of coupling is a receiving circuit. In practice, and as shown, the receiving current includes an inductance coil *b*, a variable condenser

C^1, and a receiver, which in the exemplification I have selected for illustration purposes, comprises an ordinary head telephone T. And connected across this circuit is a detector R, which may be of any suitable or well known type, such as an audion, a perikon, or other construction well known in the art. The coil *b* is, in this form of my invention, associated inductively with coils a^1, a^2, and in such relation as to be influenced in exactly the manner and to the same degree by both of said coils, a^1, a^2. When the aerial conductors A^1, A^2, are arranged in parallel, that is, to act in unison, then the received oscillations, to be detected in the receiving circuit, cause the coils a^1, a^2, to act additively, as contradistinguished from differentially, upon the coil *b*, that is, the received oscillations act in the same phase relation, provided the aerial conductors are not too widely separated, and hence an amplified effect is produced in the receiving circuit.

The transmitting device may be of any suitable form such as is common in wireless systems. In the particular arrangement shown, I employ a microphone transmitter indicated at M for wireless telephoning. The transmitter is preferably arranged in series in one of the aerial conductor systems, as, for instance, the aerial conductor A^1, and preferably in the earth connection thereof. In the other aerial conductor system I place a resistance R^1, adjusted to approximately the average resistance of the microphone or other transmitter M.

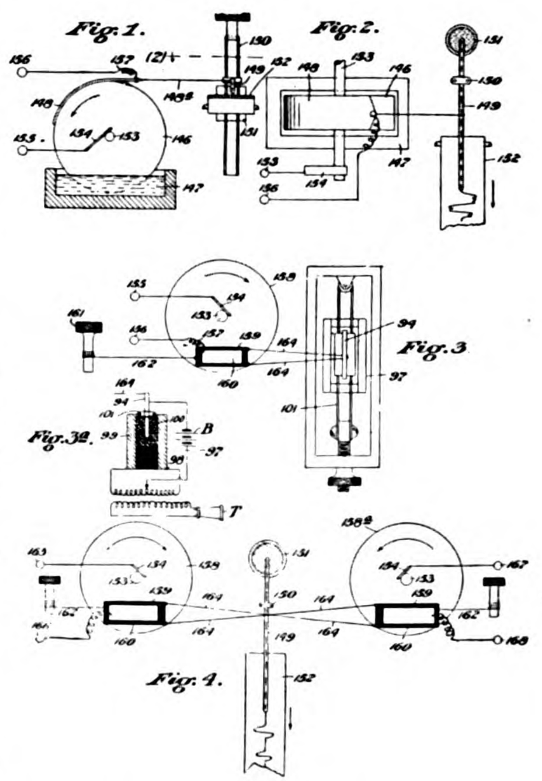
From the foregoing description it will be seen that I provide an exceedingly simple system of wireless communication wherein a differently balanced circuit relation is maintained, thereby enabling electro-magnetic wave signals to be simultaneously transmitted and received at the same station and without the employment of switches to cut in or out either the transmitting or receiving apparatus according to whether messages are being sent or received.

* * *

Prof. Reginald A. Fessenden has been granted a patent on a receiving device for wireless telegraphy described as a division of his application filed June 16, 1908.

He describes the present invention thus:

In the accompanying drawing Figure 1 is a side view of a receiver for producing a visible signal, and Fig. 2 is a plan of the same. Fig. 3, shows a side view of a modified form of electrostatic receiver producing a change in a local microphonic circuit. Fig. 3a is a partial vertical section and dia-



gram of an amplifier or relay. Fig. 4 is a similar view of a modified form in which pressure effects are balanced and operate differentially to produce a more sensitive instrument.

A static telephone receiver as described by Dolbear in his United States Patent No. 350,299 of 1882, has been used in various forms, with the diaphragms made of sheet metal either plain or covered with an electrified dielectric, or else made of a dielectric with a metallic coating on the side next the fixed plate. These types of receiver, however, have been insensitive and have not come into practical use. I have discovered, however, that by the use of certain improved constructions and methods of operation, static receivers can be made extremely sensitive, and I here show a form of such receivers.

For example, I have found that if a thin conducting film such as gold leaf, be coated with insulating material and kept in relative motion in contact with another surface, the friction is greatly altered when the conducting film is electrified. Therefore as shown in Fig. 1, I make use of this phenomenon by providing a wheel 146 with a conducting surface such as finely burnished nickel steel or platinum iridium, which may be driven by any convenient means at uniform speed, and in revolving dips into a bath such as a tank of lubricating oil 147, whereby the lubricant is carried over the wheel and forms a thin film thereon. A light film of aluminum or gold 148 rests thereon. (For use with aluminum I found milk to be a suitable lubricant). This gold or aluminum leaf 148 is connected by a filament 148ª to a siphon arm 149, supported in any convenient way as by bifilar suspension 150, dipping into an ink well 151 and its discharge end resting on traveling paper 152 driven by pulleys or in any other usual way. It will be understood that the axle 153 of the wheel 146 is electrically connected as by a brush 154 to a terminal 155 connected with an oscillating circuit while the other terminal 156 may be connected by a flexible lead 157 to any convenient point on the leaf 148.

In operation, the impulses received from an antenna or other circuit at one of the terminals 155, 156, charge the leaf 148 and the wheel 146 through the medium of the separating film of lubricant. This charging produces an increased frictional drag between the relatively moving parts, (probably on account of increased pressure between the surfaces, in part, though it appears that there are other obscure causes unnecessary to mention). The increased friction of course acts to move the leaf 148 and therefore moves the pointer of the recorder 149, making a written signal as shown in Fig. 2.

In the modification shown in Fig. 3, I use a disk 158 rotating in a horizontal plane, and resting on it is a thin film of mica 159, made as thin as possible and covered with gold foil 160 over the whole area except the edges. As before, the terminals 155 and 156 are connected respectively to the disk and the coating on the mica leaf. The position of the mica leaf is controlled by a fine fiber 162 which is mounted for adjustment of tension on a bolt 161. The other end of the mica leaf may be connected by fine filaments 164 to a plate 94 which is mounted pivotally on wires 101 and has one end dipping into a trough 97 containing granules of carbon 100 and having electrodes 98 and 99 connected to a local signaling circuit, the whole device forming a relay as indicated in Fig. 3ª,—it being understood that the battery circuit has one terminal connected to the plate 94. Thus the movements of the electrostatic leaf 159, 160, will move the plate 94, vary its position and pressure in the trough of microphonic carbon and thereby vary the current in the local battery circuit and effect the telephone T, as will be evident to those familiar with the art. Of course, any other form of amplifier or relay could be used in place of that shown in Fig. 3ª, or any other device for making apparent the movements of the electrified leaf 160, but I have found this form of relay extremely sensitive.

In Fig. 4, I have shown a modified form of receiver and recorder in which I employ two revolving disks 158 and 158ª, each having a mica strip and gold leaf as in Fig. 3. This being as before connected to live terminals 165, 166, on the one side, and 167, 168, on the other. The leafs are supported as before by filaments 162 and 164, but in this case all the filaments 164 are connected to the arm of the siphon recorder 149, as in Figs. 1 and 2. By this means, I get a differential effect by the balanced tensions of the traction elements by adjusting the phase of the oscillations through the two circuits to act oppositely and this results in making the device much more sensitive.

* * *

On the same day another patent was issued to Prof. Fessenden, described by the inventor as a further division of the improved receiving device more especially designed to make use of electrostatic effects in their construction.

The inventor's specification states:

In Fig. 1, I show an antenna 105 grounded at 115 and having in circuit the primary 106 of a transformer whose secondary is 107. In circuit with the secondary is an adjustable inductance 118, and an adjustable condenser 119. The leads 128 and 127 are connected to two extremely fine wires of filaments 121, 122, which are mounted in a glass vessel 120 in any convenient way. They are preferably made of aluminum or else of quartz with a silver coating. Their tension may be adjusted by means of an armature 123 which is pulled down by the effect of the electromagnet 124 excited by battery 125, whose current may be adjusted by the resistance, 126. In proximity to the wires 121, 122, I place parallel larger conductors 129 and 130, adjusting their distances from the wires very carefully, since I have found that there is a certain critical distance at which the apparatus is very sensitive, while the sensitiveness falls off if these larger conductors are either closer or farther away than the critical distance. These conductors 129, 130, may be connected to a local exciting circuit containing a high frequency dynamo 131. Resistances 132, 133, form an adjustable potentiometer for regulating the voltage to which conductors 129, 130, are raised, while a variable condenser 134 is used to also modify the intensity and at the same time alter the phase. I provide switches 138, 139, to operate the device and it will be understood that when electromagnetic waves pass through the primary 106 they will generate oscillations in the secondary circuit 107, 118, 119, and the wires 121, 122, will by the electrostatic effects be

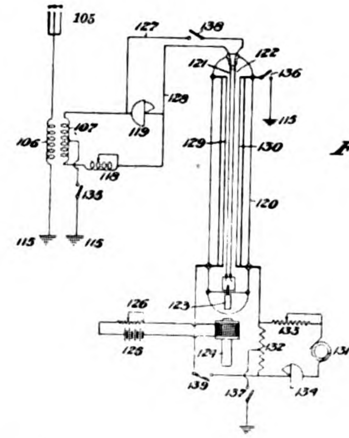


Fig. 1.

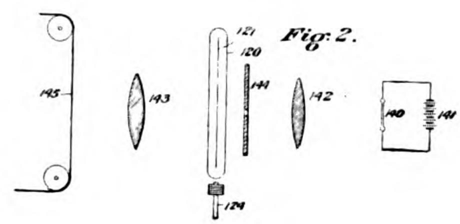


Fig. 2.

caused to change their relative position. Such change of position may be either observed or recorded in any convenient or obvious way. It will also be noted that if the wires 121, 122 are continuously given a certain rate of electrostatic charge in the neighborhood of the periodicity of excitation of the wires 129 and 130, beats will be produced of audible or otherwise recordable frequency, according to my well-known "heterodyne" method. This static charging with neighboring frequency to produce beats, may be called heterostatic charging. By use of the switches 135, 136, and 137, the circuits may be grounded as indicated, while by switches 138 and 139 one or more of the sides of the circuits may be opened. I have found that by suitable use of these switches the effect of atmospheric electricity may be cut out.

In Fig. 2, I show a convenient form of recording apparatus for making a permanent record of the signals received as above described. The diagram represents a Nernst glower at 140 excited by a source 141 and by means of lenses 142 and 143 projecting a ray of light on a moving strip of photographic film 145, this ray of light passes through a perforated diaphragm 144 and casts an image of the wires 120 and 121 of Fig. 1, so that the signal is recorded by relative change of position of these wires as above described. For example, if the received oscillations formed beats with the oscillations locally produced by the heterodyne circuit of Fig. 1, such beats will be of low enough periodicity to easily record on the photographic film.

Devises New Wireless 'Phone

Assistant Professor G. W. Pierce, of the department of physics at Harvard has devised a new wireless telephone which gives promise of materially advancing the progress of long distance communication.

Professor Pierce was the guest of John Hays Hammond, Jr., at his Gloucester laboratory at Fresh Water Cove recently, where a series of experiments were conducted with the new apparatus.

The wireless power was concentrated about fifty feet above sea level. By means of the new instrument Professor Pierce got into communication with the Harvard Wireless Club, thirty-two miles away, and talked with several of the club members for a space covering fifteen minutes.

New Aircraft for Scouts

A special type of aeroplane will be demanded by the War Department this year in purchasing machines for military purposes.

Notices have been sent to American aeroplane manufacturers giving the requirements which the aviation experts of the Signal Corps have requested, and bids have been invited for machines built according to the desired design.

Features of the new type will be torpedo-shaped bodies, affording protection for the aviator and observer, in monoplanes, and windshields, while the machines must be equipped with the latest models of radio-telegraph apparatus for use in aeroplanes.

Book Reviews

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Principles of Wireless Telegraphy. By George W. Pierce, A.M., Ph.D., Assistant professor of Physics in Harvard University. New York: McGraw-Hill Book Co., 1910. Price, $3 net.

Although originally published three years ago, the demand for this book has been so great that it is now in its third edition. The reprint, with corrections, effectively covers all the scientific data which the average specialist desires to know in a manner that clearly demonstrates the intimate knowledge of wireless telegraphy gained by the author through years of practical observation. Designed to present the course of reasoning and experimentation that led to the conception of electric waves, as well as the general principles and methods of electric-wave telegraphy, the book includes a comprehensive history of the application of electric waves to wireless telegraphy and a full discussion of the merits of some of the earlier forms of apparatus, giving clear explanations of the reason why these have been discarded, thus revealing to the reader the merits which enabled present forms to survive. The thoroughness of treatment of the properties of electric waves and oscillations should make this work an invaluable aid to those who are at present engaged in operating and constructing wireless apparatus.

Scientific American Reference Book, edition of 1913. New York: Munn & Co., 1913. Price, $1.50 net.

To the intelligent inquiring man who has frequent need for exact information regarding the vital factors in the world's material and scientific progress, who wishes to be fully informed on the problems that are engrossing the attention of scientists, engineers, inventors, chemists, astronomers, explorers, in fact, any of those who are adding to the knowledge of the world to-day, this book will prove an invaluable aid. Covering a wider range of subjects than is usual in works of this class, it constitutes an invaluable reference book for every day use by those requiring informative, accurate information on technical and scientific subjects other than formulæ. No adequate idea of the mass of data contained in its 608 pages could be given without a lengthy dissertation, but a striking example of how reliable and up to date is the volume is shown in the chapter on wireless telegraphy, which includes the range, power and wave length of the principal stations now in operation, and message rates for transatlantic ship and shore communication, corrected up to November, 1912, together with a great deal of information that can be found nowhere else. Albert A. Hopkins and A. Russel Bond, who compiled and edited the book, are deserving of immeasurable credit for a particularly comprehensive reference work.

Wireless Telegraphy and Wireless Telephony. By Charles G. Ashley and Charles B. Hayward. Chicago: American School of Correspondence, 1912. Price, $1 net.

In this recent addition to the literature on radio communication, the authors have logically carried out the development of the wireless telegraph from the early forms to the latest adaptations of the most important systems, including application to the aeroplane and dirigible. Originally designed to aid instruction in the correspondence school, this volume has been made an excellent text-book. The chapter on wireless telegraphy treats very clearly of the inception of the art and carries the reader through the early attempts to accomplish the transmission of articulate speech without employing wires, covers Bell's radiophone, selenium cell, the photophone, "light telephony," the use of Hertzian waves and the various present day systems of radiotelephony.

Plans and Specifications of Wireless Telegraph Sets. Part I and Part II. By A. Frederick Collins. New York: Spon & Chamberlain, 1912. Net price, 25 cents each.

These booklets describe and illustrate wireless sets so clearly that any one having a little knowledge of electricity can successfully make them. Part I contains complete and detailed instructions for the construction of two sets, one intended for laboratory experiments, but which will work a mile under favorable conditions, and another designed to cover distances of from one to five miles. Part II offers the choice of a five to ten mile set or one with ten to twenty-five mile range. The instruments described in both booklets are designed and constructed in accordance with recent practice, making these volumes a valuable addition to the literature especially prepared for wireless experimenters.

Telephone and Telegraph Engineers, Handbook and *The Mariners' Handbook*. Scranton: International Textbook Company, 1912. Special net price, 50 cents each.

As pocket memorandas, these little books are of inestimable value to commercial wireless operators at ship and shore stations. In many cases, commercial operators of land stations are required to keep in repair the land lines connecting them with central points; in case of emergency, the data provided in the first mentioned book for the location of faults and the application of the needed rules and formulas will come in very handy. The ship operator, whether in the merchant marine or naval service, will find much that is useful in the way of nautical information in the mariner's book; both terrestrial and celestial navigation are included; the standard methods practiced by navigating officers are explained in every case by examples, and include the latest international rules for preventing collisions at sea. Both ship and shore operators will be better prepared for any emergency by mastering the contents of these books.

Need Wireless in Rebellion

Toy balloons are being employed by the rebels in northern Mexico to give information regarding the movement of federal soldiers.