THE MARCONIGRAPH

An Illustrated Monthly Magazine of

WIRELESS TELEGRAPHY

EDITED BY J. ANDREW WHITE

Volume I. SEPTEMBER, 1913 No. 12

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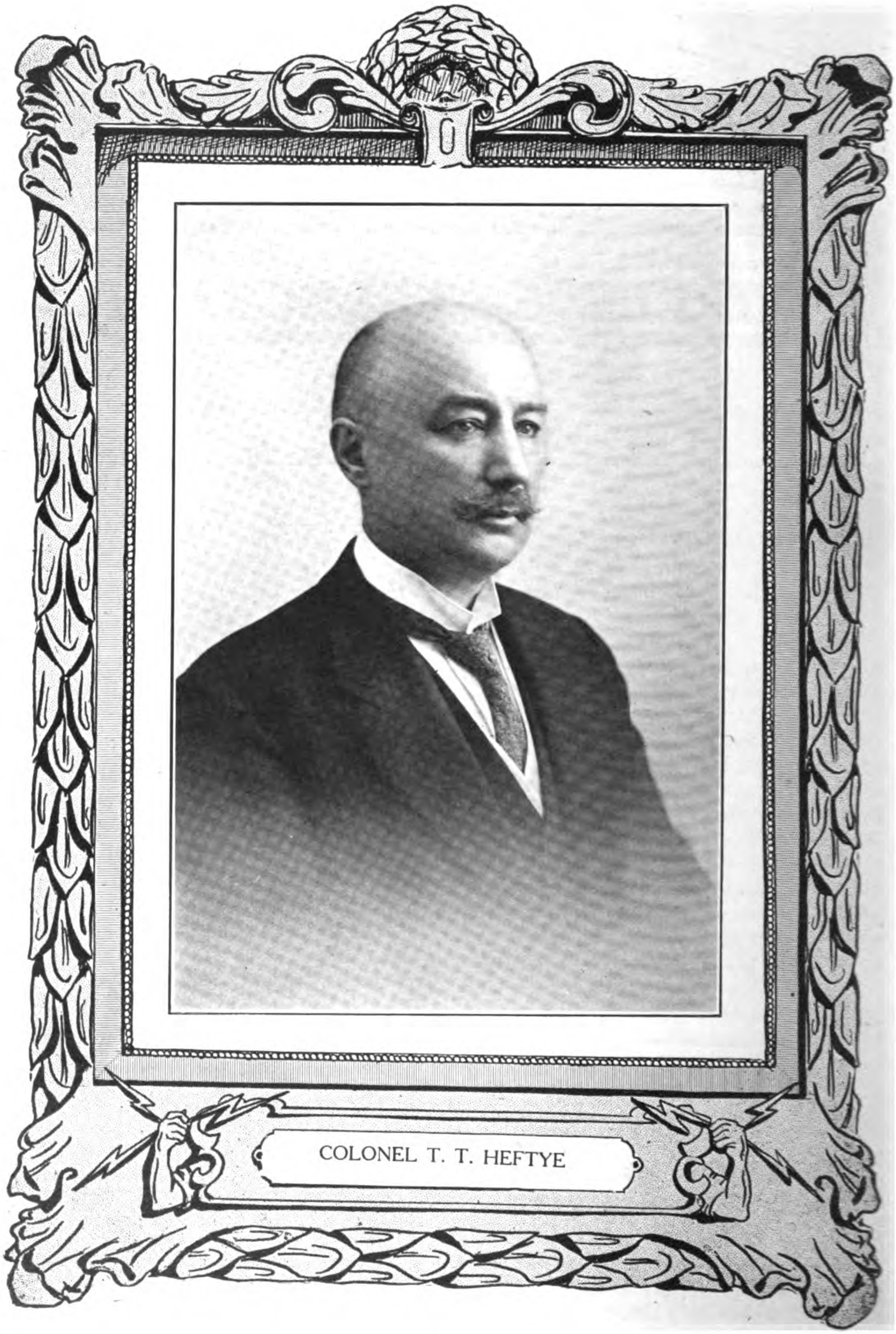
COLONEL T. T. HEFTYE

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Vol. I. **September, 1913** **No. 21** 12

THE faith of Colonel Thomas Thomassen Heftye, whose portrait appears on the opposite page, in the value to Norway of radio communication with the rest of the world had much to do with securing the ratification of the contract between the Norwegian government and the Marconi Company. Colonel Heftye is director-general of telegraphs, a post he has twice filled. He was first appointed in 1905 and had three years' experience in that field. Certain political changes resulted in his retirement. Coming to office a second time, he took up the new methods with intense interest. The great nations of the world were beginning to make use of wireless in many ways. Colonel Heftye was determined that Norway should call into her service this great ally of government and commerce. He made a thorough study of the situation and was able to secure such a presentation of the case before the Storthing that the bill ratifying the Marconi contract passed by the large favorable vote of 99, out of 115 votes cast.

Colonel Heftye has been a man of action from his youth. At twenty, he left the University at Christiania to go into business. He soon found opportunity to travel as the representative of his employers in other countries, thus adding to his university training the knowledge of varying conditions and of many kinds of men, as well as facility in the use of other languages.

In 1887 the young merchant became a soldier—though not the sort that delights chiefly in dress parade. With his constructive habit of mind, it was natural for him to find his way into the engineering corps. He rose to a captaincy in 1895, and was appointed military attaché at the Paris legation five years later.

Colonel Heftye has always taken advanced positions, in both business and politics. There is a radicalism that arises from nothing but restlessness; of quite another substance is the natural impatience which a man of action feels with reactionary bars to progress. The man we are considering is a constructive liberal. His family traditions were all conservative and his adherence to the younger party cost him something. But in time the swing of the pendulum brought his associates into power. He was twice appointed minister of national defence.

Colonel Heftye is fifty-three years old. He comes of the hardy mountain stock, his father having been a native of Switzerland. The elder Heftye, however, spent most of his life in Christiania, acting there as honorary consul for the Alpine republic. He was a successful banker and so completely won the respect of government leaders that he was at one time offered the chancellorship of the exchequer, which office he refused, from a distaste for publicity. To his son publicity is an incident, or rather, a means to the end of public service.

The Station at Stavanger

OLD TOWER AT ULLENHAUG, NEAR SITE OF TRANSMITTING STATION

Communication between Norway and America to be established on historic ground.

MR. Average Newspaper Reader, when he saw the first announcement that a station was to be built at Stavanger to connect Norway with the United States, probably said to himself, "I wonder what that kind of cheese tastes like." But if he is not too much of a provincial, he will take his encyclopedia or his book of travel and find out something about this fine old city of Stavanger, in the neighborhood of which things worth knowing about were done, something like a thousand years ago. We have no census reports of that date, but there are thirty-five thousand inhabitants in the modern town.

A mountain cart.

The new Marconi station will be erected on a hill called Ullenhaug, two miles outside of the city. Here stands an old tower, shown at the top of this page, on which is an inscription radiating across the centuries the

Making bread in Norway.

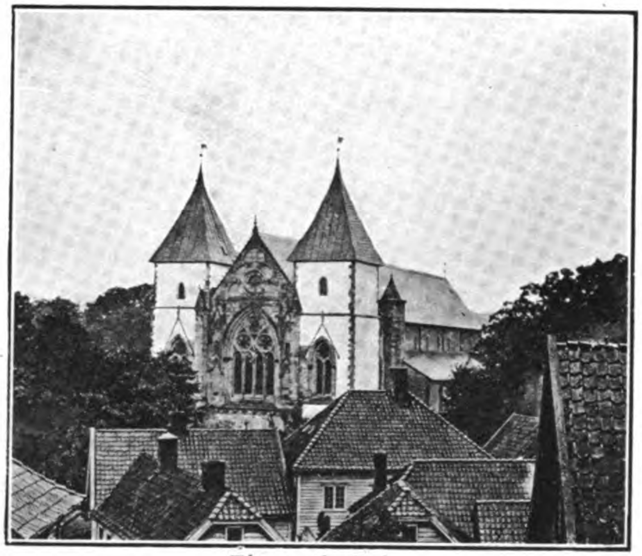
news that in 872 A. D. Harold Haarfager—the fair-haired—won a great naval victory off this coast, and became the first king of United Norway. This naval event is typical of the importance of the sea in the history of the country. What better place could be chosen for the station that is to link the ancient realm to the new world, over the water?

Last fall a provisional contract was drawn between the Marconi Company and Norway. This was ratified by the Storthing on June 28th.

There had been a change of government between September and June, but so plain had it become to the representatives of the nation that the time was ripe for radio communication between Northern Europe and America, that the plan was carried over and a newly appointed committee resubmitted the old contract with little change.

Admiral Sparre and Chairman Mowinckel, a Bergen shipowner, presented a favorable view of the contract to the Storthing. Their efforts were seconded by those of Col. Heftye, Director General of Telegraphs, some account of whom is given on another page.

The fact is, the shipping interests of Norway have been discontented for some time with their limited facilities. There were only half a dozen stations on their coast and some of these were not effective. Ships were obliged to depend chiefly on Bergen, Ingo and Spitzbergen. These are hardly enough for the needs of the country that ranks fourth in tonnage among all the maritime powers of the world.



The cathedral.

The government will equip trunk lines from all the strategic points to Stavanger, on the southwest coast. The receiving station will be at Naerbo, about seventeen miles away, connected by rail with the transmitting station, across the Ekersunds Elv.

Water power from the mountains is used to run the dynamos that supply the three-phase alternating current; the transmitting voltage is 30,000; the current will, of course, be transformed to lower power.

Passing from the newest to the oldest features of interest in Stavanger, we find that the cathedral of St. Swithin is the only example left in Europe of its architectural class, although the interior treatment is not unlike that of the Knights' Hall in Rochester Cathedral,

The town of Stavanger.

of the same period. Fire has damaged the cathedral of St. Swithin to some extent.

The town was largely rebuilt in the seventeenth century and still retains the picturesque beauty of that age. The Stolkjaerre—a two-seated car—is still in use. Tourists have brought in a certain measure of modernity.

Stavanger has some flourishing canning factories, which make a specialty of sardines and anchovies. The seaweed along the coast is utilized in the preparation of iodine.

Long Controversy Ends as Marconi Contract is Ratified

Hostile Motion Defeated and Echoes of Partisan Strife Meet With Disapproval in House of Commons

ON August 9 the House of Commons ratified the British Government contract with the Marconi Company for the erection of an imperial chain of wireless stations, after a year and a half of delay and scandal involving members of the Asquith Cabinet. In our August issue the details of the revised contract were given in full; careful study of its provisions reveal the fact that the revised contract which has just received confirmation is very nearly the same contract as the one which, owing chiefly to an error of judgment on the part of certain members in the Government—which error they themselves admitted and apologized for—plunged England into a scandal of misrepresentations and vituperation.

When the contract was first awarded, the purpose of the government was to secure a system in direct communication between Great Britain and all her possessions, to be known as the Imperial All-Red System. The first stations were to be built at London, Egypt, Aden, Bangalore, Pretoria, and Singapore, and it was hinted that the reason for this chain of stations throughout the British Empire was the ownership by Americans of the majority of cable lines.

While the contract was pending it was subjected to several vicious attacks in hysterical publications, and charges were made that several Ministers had been speculating in Marconi shares, anticipating the sharp advance following the announcement of the contract. Parliamentary investigation was ordered and after being tied up for months in red tape the accusation fell flat, as already reported in our previous issues. A few months ago the officials were vindicated by a vote of Parliament and an inquiry made into the mechanical side of wireless systems resulted in a decision that the Marconi system had been found to be the best.

Meanwhile, the Marconi Company had become impatient with the long delay, as materials were advancing in cost, and a large sum of money was tied up in the guaranty fund. They asked to be released from the original contract and after Postmaster-general Samuel had taken legal advice, he announced that the contract was not binding upon the company, for it had not been ratified and there was no way to hold the company to it. It was ended early in July of this year.

A few days later Mr. Samuel supplied the House of Commons with particulars of the new Marconi contract. By its terms the company demanded an increase of $32,500 per station over the price agreed upon in the original contract, and refused to make any reduction on the royalty from message traffic. The reader may refresh his mind as to other details by again reading our summary in the August number, which substantially covers the revised contract ratified on August 9.

The debate which preceded its acceptance was on practical business lines, in contrast to the former discussions throughout which the real issue was obscured by partisan controversy, and the majority vote stands a vindication of the position taken by the government in carrying through a project which legal advisors considered essential to the welfare of the British Empire.

The government considered the new contract a better bargain than the original one. As was expected, it was still subjected to criticism, but, with the exception of Lord Robert Cecil, its opponents avoided the personal controversies which had grown out of the investigation into alleged corruption. Lord Robert's attitude was not supported when he referred to Godfrey Isaacs as a man "who did not make a favorable impression" on his lordship's mind in his evidence before the select committee, and the House signified its disapproval.

Sir Henry Norman again appeared as one of the critics of the contract and made an able speech free from acrimony.

Postmaster-general Samuel defended the contract with characteristic skill. In a speech that lasted a full hour he quoted statements recently made by the Army Council and the Admiralty on the need of a wireless chain. "How could the Government," he asked, "ignore these representations from the authorities responsible for the defense of the Empire?" If he had followed Sir Henry Norman he would have been pursuing a mirage and would have found himself involved in a quagmire. He brushed away with scorn the extraneous personal considerations that had been introduced, and challenged a verdict on the contract on its merits.

He reminded the House that the company would give a guarantee of successful working and take all risks, and that there would be no payment until the conditions had been fulfilled. He called attention to the fact that the government will get the profit of all the company's inventions and have the great advantage of Mr. Marconi's personal experience. He clearly showed the value of this experience by stating, "If you have genius at hand, ready to your service, it would be folly to ignore it."

Cheers from all parts of the House greeted the statement that Mr. Marconi felt most deeply the way in which his name had been turned into a catchword and almost a term of abuse.

Andrew Bonar Law's criticisms were chiefly confined to the fact that the new contract contained a proviso that entitled the Marconi Company to better terms if in the interval since the signing of the first contract it should be found that the cost of materials had risen. This criticism had little effect, as everybody familiar with the terms of the new contract knows that there are corresponding conditions that if prices have fallen the government is to benefit proportionately. Mr. Bonar Law posed as a business man, which may have had something to do with Mr. Premier Asquith's remark:

"I am not a business man myself, but I have seen a great deal of business men and have had to advise them when they were in difficulties."

The Premier saw no justification in Mr. Law's objection to the provision; in fact, he extolled it as a proof of the business ability of the Postmaster-general, whose bargaining capacity Mr. Law had impugned.

Lord Robert Cecil's hostile motion was defeated by a majority of 81, and the motion in favor of the approval of the contract was carried by a majority of 72.

The London Times in an editorial on the debate said:

"The Marconi scandals have

thrown suspicion over the whole business; but to look at everything done by the company through spectacles clouded by the dust of this controversy is hardly fair. Marconi's genius and its own enterprise placed it in a position to do work no one else can do, and to a certain extent command its own terms. That does not make it a public enemy. All mechanical advances have been achieved in the same way, and the present case is one more proof that, though a State can take over complete and fully developed undertakings, it cannot run the risks of pioneering. Those who take risks are entitled to the reward."

Notes From the Pacific Coast

In the near future a five-cent rate will be declared by the Marconi Company, applying to all commercial messages on the Pacific Coast. This action is in harmony with the growth in every direction of the business in that region. A well equipped suite of offices has been taken in the Merchant's Exchange Building, San Francisco. Within the last year or so, the business of the company has increased twenty-eight per cent. Vessels of all classes, to the number of 174, have been equipped.

Many lumber schooners are in use for the coast trade, and for the trade with Hawaii and with distant ports of Australia, China, etc. The use of wireless upon these is becoming more and more general. Cargo vessels of every type are adopting the service. Every oil tank on the coast is fitted with apparatus. Many steamers are now using oil as fuel. Not long ago one of these ran out of oil over two hundred miles from port. She sent out a call and in a very short time got the nearest oil tank and was able to secure a supply of fuel with little delay. If it had not been for this help she might have drifted about for a long time, running the risk of shipwreck, and, at best, incurring a serious loss by the delay.

One manager of an oil steamer made the statement that he would not leave port without his operator, even if all the rest of his crew were on board. When a cargo of oil is being brought to the coast for sale, it is possible, before a landing is made, to send messages to the different points and find the best market at the moment. It is generally recognized throughout the commercial world that one of the most important and at the same time one of the most difficult tasks is to bring supply and demand together. Managers of these oil steamers on the Pacific Coast say that the use of wireless has solved the problem for them.

The company now maintains two schools for operators, one in San Francisco and one in Seattle. There are 280 men already engaged in the coast service. The larger part of this consists naturally in communication between shore and ships, which keep the present stations busy. The 5 K station, however, often communicates with Honolulu at night and sometimes picks up messages from the government stations of Japan. No attempt to do business at a distance has been made, but a 25 K station is now completed and soon will be opened. Messages for Honolulu will be received.

J. R. Irwin has been making a trip of inspection through Alaska. His itinerary covers about 8,000 miles and includes every important seaport town. It is his purpose to study all the possibilities in the way of applying radio communication to the uses of mines and canning factories. The need is already being recognized, and twenty stations are in operation.

Outside of the commercial field there is a great and growing interest among the amateurs of the Pacific Coast. San Francisco alone has 160 small transmitting stations.

If any rash jester of the days when the wise ones firmly believed in what they called magic had jingled his bells and said that a man could go round the world while the moon was going through its phases, the answer would have been:

"That's all moonshine."

But if John Henry Mears, representing the New York Evening Sun, has not quite clipped the moon's record, he has at least beaten all the globe-girdlers of this planet. The latest of these, Andre Jaeger-Schmidt, took over thirty-nine days for the trip. Mears finished in 35 days 25 hours 35 minutes and 4-5 seconds. The schedule published before he started was exactly that, minus the fraction, which he lost, greeting his friends at the station in New York. His rival, M. Jaeger-Schmidt in telegraphing congratulations, declared, "To do better would necessitate abandoning the ordinary routes, utilizing those of the air; it would be necessary to tour the world in an aeroplane."

Wireless room, Empress of Russia, hunting a hydroplane.

Probably the most exciting crisis of a journey that was all crisis, was the transfer by hydroplane, from the Pacific into the fog-shrouded continent of America, the other side of which had been left a month before. We will let Mr. Mears himself tell the story, in which the two most amazing inventions of the modern world play a great part:

"The last serious crisis of the trip was at the end of the Pacific voyage. I took to the yacht Maud F. off Quarantine at Victoria, being allowed to pass the customs without inspection. The yacht had been cruising about all night looking for the liner. But that night we were fifty miles beyond Quarantine in a fog so dense that the yacht had no chance of sighting us. I spent the night in the wireless house, getting messages about the fog from the Canadian weather bureau. The fog clearing, I went with the Maud F. toward Seattle and took the Christopherson's hydroaeroplane fifteen miles out from that city.

"The change from the yacht was exceedingly risky. It was made after sundown. It was not until we reached the North Pacific pier that I learned that the last man Christopherson had taken flying over Puget Sound was then at the bottom of the Sound. But it was no matter. We had a great flight.

"I crouched along the steel wires holding the canvas by the side of his seat, while I listened to the canvas give with a keen sense of the record America was to lose if the canvas gave way entirely. The first time we tried to rise from the water we sank back with an easy roll, and the next time we took to the air to fly at the rate of sixty miles an hour, while I experienced one of the most surprisingly agreeable sensations of a round the world tour, sensations that were agreeably prolonged by my making the North Coast limited."

Mr. Mears has this to say of the average daily record and of the latitude in which he travelled:

"I made on an average 587 miles a day and twenty-four and one-half miles an hour for the complete journey. The shortest day's journey was from London to Paris, 287 miles. The longest day's journey—though it took only the fractional part of a day—was 955 miles. St. Petersburg was the point furthest north on my route, 60 degrees north latitude. Shimoneseki was the point furthest south, 34 degrees north latitude. The difference is 26 degrees or 1,794 miles, the width of the belt within which my traveling lay.

"The delay at London was not important, but necessitated the elision of Moscow from my route. The Mauretania was delayed eight hours by fog. Knowing of my quandary an English aviator six times communicated with me by wireless, asking for the job of carrying me off the befogged vessel to London at the rate of a pound a mile. A pound a mile meant a sum of $1,500. Not so much the money as the risks of flying with a 'pound-a-mile' sportsman kept me from leaving the Mauretania by airship and at that it was only when my friends on board, including Mr. Marconi and the then Inez Milholland, as well as the ship's officers, pressed the opinion upon me that it was inadvisable to take up the flight after dark. We were off Fishguard at 8 p. m.

"At almost any of the most critical stages of the journey I know that had I learned the jig was up I could have sat down and laughed; for when I was still less than halfway round the world I had seen enough to keep me merry for life."

It is worth noting that Mr. Marconi, by means of whose invention the saving of time was effected on the Pacific Coast, was the counsellor of caution on the Atlantic. There's a time for twentieth century wireless and aeroplanes and a time for primeval prudence.

Early in his trip, the record-breaker secured an authoritative statement from a great shipbuilder as to the probable future speed of great ocean liners, which will have a bearing on the length of time this record will stand.

"Through the accident of my photographing two pretty little girls six and seven years old on the deck of the steamship from Dover to Calais, I learned that my record will not be lowered for many years by any improvement in steam navigation.

"The two little girls stood by the rail of the steamship as we neared our landing. They heard me snap them and they turned, laughing. But the landing was made and I had no time to chat with them.

"Then later on my way to Liege, as I paced the platform at Erquelimer, the two little girls ran up and said, 'Hello. You took our picture.' At that a gentleman stepped forward and offered me his card.

"'Are you Mears?' he asked. 'I think I recognize you by your baggage as described in the London newspapers.

My grandchildren have been much interested in your voyage.'

"The Englishman was Lord Aberconway, of 43 Belgrave Square, Bodnant, who told me he built the Mauretania and the Lusitania.

"'And probably no more ships as swift as they,' he said, 'will ever be built again. It costs too much to run them and only extra heavy subsidies from the government can make their duplication possible.'

"The Russians threaten to improve the time of the Trans-Siberian railway. This will not be for many years, if ever. Railroad time across the American continent can hardly be shortened. To throw my present record out of joint I figure that Jaeger-Schmidt or I must use the aeroplane from Fishguard to London, from Dover to Ostend, from Ostend to Berlin, from Berlin to Moscow, thus cutting off two days by making it possible to take a later steamer from New York, and this can hardly be before the aeroplane is in a much more improved state, when also my hydroplane flight to Seattle could be improved upon. Viewing the subject from all sides, I expect my record to stand for years."

Reading a wireless message on the Mauretania —Mr. Mears at the right.

In spite of his haste—or because of it—Mr. Mears had time to get a witty word from one of the most distinguished of living statesmen.

"Norton Griffiths, member of the House of Commons, desired to introduce me to Sir Edward Grey," wrote the traveller in his diary, "but found that Grey had left Parliament and was away across the square.

"'Come on, we'll catch him,' said Mr. Griffiths, and he led in a chase that would convince any one that 'dashes' are not confined to globe-circlers.

"Sir Edward, Sir Edward,' he called, and Sir Edward turned around to greet me, as I came up behind the M. P., with this obviously just remark:

"'Out of breath already?'

Another entry in that same cinematographic diary makes a New Yorker wonder if there is any kinship between the police that have been putting diners out of Healy's and their Russian brethren. In New York they don't wait till the man is drunk.

"At Ekaterinbourg I saw a drunken Russian being treated for delirium tremens. Six policemen in their gilded uniforms were tossing him up in a blanket very gravely. I was assured it was a sure cure."

Mr. Mears expressed a deep sense of gratitude to the Japanese railroad officials, notably a certain T. Mikami, general passenger agent of the Imperial Government Railways of Japan, who got his education at the University of Pennsylvania and in return helped to give America the round-the-world record. This sportsmanlike official wired Mears that he was sure to miss connections at Vladivostok and advised him to change his route. Then Manchurian Chosen Express was held eight hours, losing all its other passengers to gain the privilege of carrying a record-breaker. The Japanese Government Railways made the young American their guest. He wasn't allowed to pay any fare, an example of Oriental tyranny that is not likely to bring on war. More of the traveler's own story, as he gave it in the Evening Sun, follows:

"I left Shimonseki Wednesday, July 23, at 9:50 A. M. On Thursday morning at Ninomiya, Mikami and Kinoshita, general traffic manager of the system, also a graduate of Pennsylvania, gave me a luncheon which terminated just as we arrived at Yokohama. At every station along the way newspaper men boarded my train and rode a station or two along the route, interested, it seemed, more in my health than anything else, pressing upon me the necessity of returning their sincere bows in great numbers, interviewing me in broken but the most amiable English imaginable. Those newspaper men were the newest of the new journalists, striking in their graces, American in their quick, keen grasp of facts.

"In all I must have been interviewed more than a thousand times in the last thirty-six days, and more than a third of these I should say were in Japan.

"The Canadian Pacific steamship management, fearing I would not arrive in time for the Empress of Russia sailing, had advertised a postponement to 6 o'clock. By the grace of Mikami I arrived at 1 P. M. All my care departed, for I was ahead by a couple of hours of even the regular sailing time. This only pleased Mikami that he should have me longer on his hands, and he took me to Tokio meanwhile, where we visited for an hour and five minutes.

"On my return to Yokohama I had a ride in a jinrickshaw or Pull-man-car, as Mikami called it. The last interviewer who saw me in Japan asked me what I considered the pleasantest part of my journey, and when I said the part of it that laid through Japan, he was immensely pleased, and once more inquired concerning my health."

And the bill? Read on:

"To analyze my chief expenses: First, there was my 'round-the-world ticket,' which cost $565.28. That included the fares for all stages of the journey except those between Paris and St. Petersburg. The fare from Paris to Berlin was $22, the sleeper $6.43; from Berlin to St. Petersburg $30.12, with the sleeper there costing $8.25. Owing to my change of route from Harbin to Yokohama, there were extras amounting to $12.20, which, with sleeping car costs in the United States of $5, brought the total cost of transportation up to $662.28.

"Then there were meals—they cost, with tips, $46.38. That sounds too little? Well, remember the steamship passages include meals. You know there are men (I'm not one of them) who save money by crossing the ocean; their meals cost more in a week in New York than the fare; so they get the trip thrown in.

"The meals for the nine days on the Trans-Siberian Railway cost $30.05—the tips were $3.40. Then there was dinner on the train from Calais to Paris, $1.80; dinner on the way from Paris to Berlin, $1.65; breakfast, from Berlin to St. Petersburg, $1.05; dinner, $1.80, and breakfast, 90 cents. Add to that the meals from Chicago to New York, $4.05, with tips averaging 15 per cent., and you get a total of $46.38. If I hadn't been out record-breaking there would have been a couple of more meals, that the every-day passenger would have had to pay for, but at which I was a guest.

"The tips were mostly in the natural order of the average traveler's experience—dollars, half dollars and quarters for the services of porters at stations, etc. Then there was $14.75 for the people on the Mauretania, $7 on the Empress of Russia.

"There was one quite unusual tip—or persuasion, or inducement, or whatever you like to call it. That was the coaxing of the Trans-Siberian engineer to make up for that eighteen hours lost time. I paid him 20 rubles an hour for eight hours; that's 160 rubles, $80.

"Many Europeans expressed complete astonishment that I should attempt to get round the world in record time having the use of only one language. I did not find the lack of other languages a serious handicap, for the reason, of course, that English is spoken so widely and because of my good luck in falling in with capable linguists."

The hero of the latest circumnavigation of the globe is a club man and known widely as a good companion. He is married. Mrs. Mears and Elizabeth Mears, their daughter, went to Milwaukee to welcome him home. He is a nephew of A. W. Green, president of the National Biscuit Company, and one of the things he did the day before he left New York on his nerve-racking tour was to take part in the laying of the cornerstone of the largest biscuit bakery in the world.

He has spent a good deal of time in various theatrical enterprises. One box-office experience indicates the posssession of some of the qualities needed in record-breaking. On this occasion he had charge of the box office of a theater in a manufacturing town in the Middle West. The evening performance was about half over and the theater lobby was deserted. Mears was counting up the night's receipts when he heard a noise and looking up found himself gazing at the barrel of a revolver. held by a hand which had been thrust through the opening above the counter.

"Shove out that coin or you're a dead one!" said a gruff voice.

Mr. Mears could see part of the crouching figure in front of the window. There wasn't much doubt that the assailant was a desperate character.

"There's not much here, but you're welcome to it," he answered, pushing a stack of bank notes toward the opening.

The robber withdrew his armed hand and reached in with the other to snatch up the money. Mears grabbed the wrist, jerked the entire arm through the window and bent the arm down over the edge of the counter so that it could not be withdrawn. The robber's revolver was useless, since his own shoulder and chest filled the entire aperture and there was no other opening through which he could fire.

Mr. Mears called for help and attendants and men in the audience came to his aid and had soon made the would-be highwayman a prisoner.

Automobile Men Employing Wireless Aid

Wireless supplied news to the steamer City of Detroit, cruising from Detroit to Cleveland, on which the semi-annual meeting of the Society of Automobile Engineers was held. The Goodyear Tire Company has installed a set in order to gain quick communication with the factory at Akron, and in order that the service would never be impaired. During the recent flood the Goodyear factory remained in close touch with Detroit.

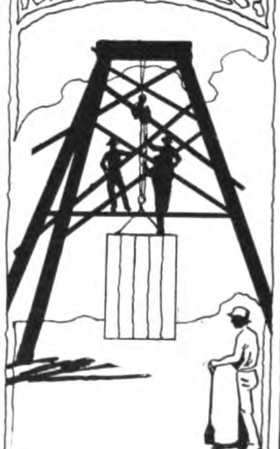
During the terrific wind storms on the lakes, the Marconi tower used by many boats out of the Detroit port, was offered to the D. & C. Company, who were enabled to keep in touch with the many boats of their line.

The use of the wireless is a comparatively new idea in business, but its practicability has been proved in so many crises and specific instances that it seems safe to predict that this form of communication will be adopted by more and more of the large manufacturers operating branches all over the country.

With the Marconi Engineers

ON THE BEACH ~ shortly after the mast sections were brought ashore

MR BALCH placing the first bolt in the first mast erected



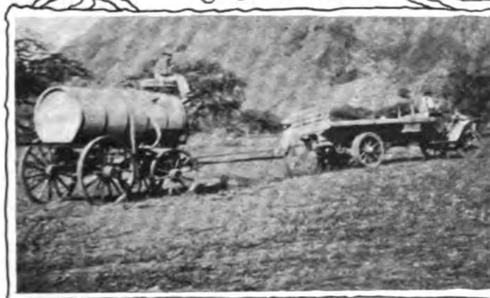
Preparing to set the second cylinder
The cage of the base had drifted four miles out to sea when the scow bringing it ashore sank

OFF FOR HONOLULU ON SATURDAY NIGHT
when the men return on Sunday afternoon a large Tally ho is hitched to the truck

at Honolulu High Power Stations

Seventy five feet from this clump of cactus almost on top of Koko crater the self supporting mast will be erected

After a heavy rainfall the roads take on this appearance This picture involved a sound soaking for the photographer



A lone convert to the ranks of water wagon riders, an institution that penetrates all climes

One of the Engineers' congenial companions: A member of the family Testudinidae

Features of the New Magazine

In our August issue announcement was made of plans for the enlarged and improved form of this magazine, which is to appear in October under a new name, "The Wireless Age." Every publication worth reading is the result of development and it would be impossible to describe all the features that will mark the coming year. To attempt to do so would be to limit the situation. We can, however, announce positively and with great enthusiasm several series which would go a long way to make any magazine popular in the best sense.

Manuscript is already in the hands of the editors for the early chapters of a series on Engineering Measurements of Radio Telegraphy, by Alfred N. Goldsmith, Ph.D., R.E. The material prepared for these chapters has never been available in this form, and that is not because it has not been needed or desired. Commercial men and school instructors have hunted high and low for text books of the kind, and have had to dig out what they could from many sources. A number of them have declared that Dr. Goldsmith was the man above all others in this country best fitted to do the work. He is known as a teacher and experimenter, who combines the knowledge usually possessed only by men who devote their whole time to books with the ability *to make things work.* He has all the curiosity and enthusiasm of the newest boy amateur. He takes a broad view of the whole field of radio activity throughout the world and is wholly free from prejudice. The two things he is after are truth in statement and effectiveness in practice. While his articles are specially intended for readers of some experience, there will be many passages having a wider appeal, such as description of apparatus. His explanations are so clearly worded that they may be followed by any one. The series will be fully illustrated with photographs and diagrams. A summary of the course follows:

These articles should appeal to the experimenter because they tell him how to measure everything connected with radio apparatus, *so that he will not need to guess* as to what prevents the apparatus from giving efficient results; how to set up the circuits, *exact* information and circuit diagrams being supplemented by clear photographs of the actual apparatus arranged for each measurement. Even those who are not specialists in the radio field will find no difficulty in getting exact measurements of their station equipment by following carefully the detailed directions given.

The articles are of value to commercial operators and inspectors because the methods of measurement and formulae which are given enable them to clear up such questions as: why a certain antenna gives extremely satisfactory results with one type of set but not with another; why one set is so much more efficient than another which apparently closely resembles it; why certain pieces of apparatus are not being suitably employed.

In brief, the articles are intended for electricians, electrical engineers, naval radio electricians and operators, radio engineers, and investigators in the radio field. A knowledge of the chief electrical laws and of commonly used electrical machinery is very desirable, though not absolutely essential. Only *practical* methods of measurement which can be carried out in the usual commercial laboratory or in regular stations will be given. The aim of the entire series is to supply exact methods of experimenting with commercial apparatus.

The quantities which will be considered in this series of articles are capacity, inductance, wave length, damping, and measurements on special types of apparatus such as transformers, motor generators, detectors, couplers, arcs, spark gaps, antennæ, ground connections, and various other parts of radio sets. It is intended to make this set as complete as modern knowledge permits.

Perhaps the announcement that will best please our amateur readers is this: A. B. Cole, author of various instruction books and one of the most widely known writers in this field, has agreed to furnish a series of practical articles. These will be of special interest to boy scouts. For example, there will be plain descriptions of portable sets which may be made at home and taken to camp. Mr. Cole never writes without giving all kinds of helpful hints. Every amateur in the country will want to read this series, which will be illustrated with photographs and diagrams.

With Dr. Goldsmith and Mr. Cole as regular contributors, the magazine will have in every number something of definite interest to every one who gives the slightest attention to the subject of radio communication; and even for the general reader who likes to become intelligent on the great activities of his time, there will be plenty of good material.

The wireless news of the world, from small paragraphs up to long illustrated articles, will appear more fully than in any other publication. All the departments will be enlarged. Perhaps no feature has hitherto proved more acceptable than the "Queries Answered." This will be continued.

Among the features that ought to be very popular will be prize contests in which small amounts of from $1 to $10 will be offered for the best examples of experimental work.

* * *

Fiction has sometimes been compared to the dessert after a good dinner, and the proof of a good story is in the reading as that of the pudding is in the eating. We believe that our readers will "eat up" the fiction and wish they could have a second helping every month. We might add that as much of the solid information given in current literature comes in the guise of fiction so practical men may get some hints from the entertaining yarns they find in these pages. But after all a story's a story and that's enough.

Lord Kelvin Memorial in the Abbey

We are glad to be able to present this month a reproduction of the design of the memorial window to Lord Kelvin, the dedication of which in Westminster Abbey was noted in August. The cost was over sixteen hundred pounds. This amount was contributed by almost as many subscribers, showing the wide interest in the project throughout England and America.

Grounding System for New High Power Stations.

ONE of the essential parts of the long distance stations is an effective grounding system. An idea of the importance of a thorough ground connection may be had by noting the extent of the system adopted by the Marconi Company and the precautions taken to get the best possible earth connection.

In selecting the sites for the erection of the stations a number of elements had to be considered carefully. The location required for the transmitting site and receiving site had to be more than twenty miles apart and co-related in such a manner that a line connecting them would be at right angles to the direction of desired transmission. The sites had to be chosen on low, marshy land on the coast, or near some waterway that would afford a direct electrical connection with the ocean.

These two essentials to location were difficult to find in the sites available, so where it was not possible to get the whole property in a marshy location it was necessary to have the land around the power house at least damp and moist. Then, by burying a network of copper wires and zinc ground plates a good electrical earth connection was possible.

With the middle of the oscillating circuit as a center, wires radiate to a circle of zinc plates at a radius of 100 feet. This circle is continuous, all the plates being bolted together, and buried vertically in a trench so that the radiating wires can be led down to the ground and soldered to the upper edge of the zinc ring. From the center of the system about two hundred and twenty-four copper cables, made up of stranded copper wire, are led from two sides of the building through insulators to the top of eight poles set on a circle of eighty feet radius. From the insulators on the top of these poles the cables are separated and led down to the earth and soldered to points along the circle of zinc plates. The location of the eight poles and the separation of the cables is so arranged that the length of each cable from the center of the system to the point it enters the ground is approximately the same.

Radiating from the ring of zinc plates there are about one hundred and twelve copper cables soldered to the ring at equal distances. Each of these cables extends about three hundred feet beyond the zinc ring and terminates in a zinc plate thirty inches by eighty-four inches, buried vertically. From these outer plates, on the side of the circle under the aerial wires, extends a further grounding system parallel to the aerial and extending under its full length and a little beyond.

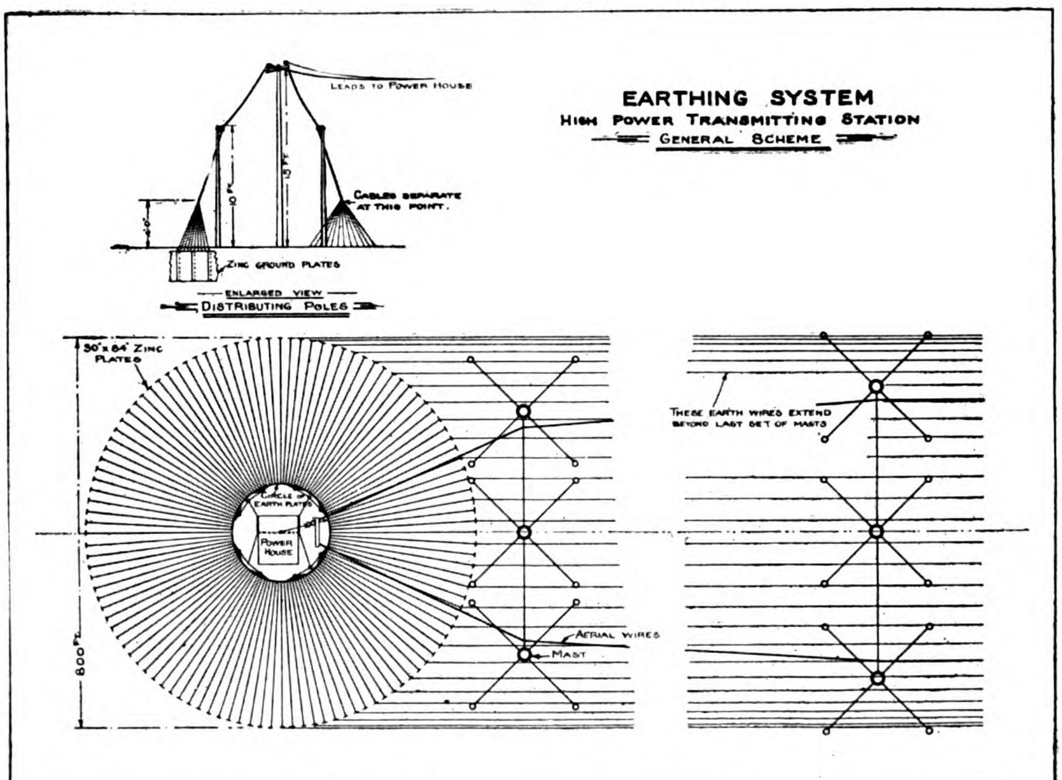
The foregoing description applies to the transmission stations in general, but in each particular case local conditions usually make it necessary to alter the arrangement slightly to obtain a grounding system equally effective. Thus the location of the power station at New Brunswick, New Jersey, is situated in a swampy meadow and bounded by the Delaware and Raritan canal on the northeast side. Running beside the canal is a stream connected to the Raritan river by culverts under the canal. In view of this condition it was deemed advantageous at this station to straighten out one side of the circle of zinc plates and bury a large number of plates in the bed of the stream, by this means assuring a good electrical connection through the Raritan river with the ocean.

At the receiving stations the grounding system follows the same general arrangement as at the transmitting stations, but its scope is not nearly so extensive. The circle of ground plates is made with a fifty foot radius, with the receiving room of the operating house as the center. The only wires extending beyond the circle of zinc plates are a number of cables radiating from the center and extending in a marsh or waterway near which the operating house is situated. These lines each terminate in a zinc plate as at the transmitting site.

A precaution which is essential in the construction of the power house and the running of all power and lighting circuits, is to run all lines in iron conduit and thoroughly ground the conduit at frequent intervals. If this precaution is not taken considerable difficulty might be caused by the current induced from the high frequency oscillating circuits. Wherever possible all circuits are carried underground, and especially the main power supply in stations where the power is supplied by a commercial power company. The supply is run in conduit underground for about half a mile and approaches the power plant in a direction at right angles to the direction of the aerials.

Woman Operator Marries

Miss Nellie O'Farrell, of San Francisco, who has gained considerable notice as one of the first women wireless operators in the world, has retired from the operator's field. She was married recently.



Wireless as a Commercial Fact

An Unedited Narrative From the Inventor's Testimony in the United States Court in Brooklyn*

GUGLIELMO MARCONI.

II.

AFTER conducting experiments on my father's estate in 1895, I proceeded to England—to London—where I carried out some further experiments, and applied for the first patent on the subject, which was filed on the second of June, 1896. I showed the invention in operation to several of my friends in England, and also in Italy before I left. Some of these persons are living at the present day.

In my experiments in Italy in 1895, I used the Morse recorder and also a telephone in series with an imperfect contact or coherer, and in some cases was able to use it without having to employ a tapper to shake the filings, because some early forms of imperfect contact were self-restoring; that is, did not require a tapper.

After I filed the application, in 1896, I was asked by Sir William Preece, the engineer in chief of the British Post Office, to give a demonstration to the government authorities in England, who were much interested in the problem of transmitting signals without wire; especially in regard to communicating with lightships and lighthouses on the coast of England. Some preliminary tests were done on the building of the English Post Office in London and then some further tests were carried out at Salisbury, at a distance from London. In these tests which took place in July, August and September, 1896, a distance of one and three-quarter miles was covered. In other words, the results I had obtained in Italy before were repeated or confirmed.

In 1897, I continued my experiments in England. I carried out further tests at Salisbury, in which the distance was extended to, I think, about four miles, and then in May, on behalf of the post office I carried out further tests across the Bristol channel, where by using greater heights of elevated conductors or longer vertical wires—in other words, reaching to a higher elevation—a distance of nine miles was obtained. A report of those tests with maps and diagrams is published in the Engineer, of London, in the issue of June 18, 1897, the report being taken from a lecture delivered by Sir William Preece before the Royal Institute, of England, June 4, 1897. As evidence that I transmitted intelligible messages across the Bristol channel, I have in my possession some of the original tapes which were received on a Morse receiver and some of these, if I remember correctly, are signed by the war office representative who attended those tests. Representatives of the post office, of the navy, of the war office, and of the Italian government visited the British channel experiments; also a representative of the German government, Professor Slaby, was present at all the tests, his intervention having been asked for by the German Emperor.

During that year, I proceeded to Italy and carried on some tests for the Italian government, first in Rome, and then at the naval port in Spelzia. The tests at Spelzia showed that communication could be obtained up to a distance of twelve miles, the tests being carried out between warships and between ships and a station which had been erected on the coast of Italy. An official report was made by the officers who witnessed the tests, and this report was published in an Italian technical and naval review, called Rivista Marittima, which goes into the results obtained, and points out features of the apparatus employed, and its practicability.

*Chapter I appeared in the July issue.

In the summer of 1897, I returned to England and some further tests were carried out there by the post office in the autumn. I think in December, a station was erected in the Isle of Wight for communicating with the coast of England, a distance of about fourteen miles. The station on the coast was at Bournemouth. These stations were installed and in working order by the beginning of 1898.

The Italian navy adopted my system in 1897, and they have used it ever since. I think at present every ship is equipped with my apparatus. I think it is easier to transmit intelligible messages over water than over land, although perhaps the difference is not so great as believed by some.

In the year 1898 the tests were continued and experiments were tried between these stations in the south of England, to which I have already referred, and I think the first real commercial application of wireless telegraphy was made in 1898, when it was used for reporting the yacht races at Kingstown, in Ireland, for a newspaper called The Dublin Daily Express. The reports of the races were telegraphed to the shore, and published in the newspapers at that time. The system as shown on that occasion kept working up to about twenty-five miles. My invention was also adopted at certain stations in the north of Ireland for communicating with certain outlying islands and the shore at Lloyd's stations, and it was also installed on lightships on the English Channel, communicating between one lightship and another, and also between a lightship and the shore. The working of it was referred to in a speech made by Sir George Vivian, who was the executive chief of the department which controlled lighthouses and lightships in Great Britain.

In 1899 the most important thing I did was to establish communication across the English Channel, between England and France, over a distance of thirty miles. In 1899 my system was tried on a large scale by the British Navy, and communication was established up to forty miles, I think, between battleships. Negotiations were at once commenced by the English Navy in regard to its adoption.

In the fall of 1899, in the United States of America, important international yacht races were held at Sandy Hook. My inventions were used on behalf of the New York Herald. After this commercial use, official tests were carried out by the United States Navy off New York, and a report of those tests was published in the proceedings of the Naval Institute. The warships of the United States Navy used on these tests were the New York, the Massachusetts and the Porter. The tests lasted about a week or ten days. I personally conducted those tests.

In 1900 numerous tests were carried out with the British Navy, and a contract was entered into between the British Navy and my company for the installation of my apparatus on thirty-two warships and shore stations.

English Marconi Co. Prospers

The annual report of Marconi's Wireless Telegraph Company, Ltd., has just been issued.

In spite of controversies which might have been unfavorable to the company's affairs, the gross and net profits show very large increases. The same dividend of 17 per cent as for 1911 has been declared, while $500,000 has been placed to the reserve. The amount carried forward is $731,630, which is more than the whole net profit of the previous year.

New Orleans Station Open to Public

Wireless service to the public has just begun at the New Orleans station built by the American Marconi Company for the United Fruit Company. This is the most powerful station in the United States, excepting the government station at Arlington. The plant has been in operation since May 15, but up to the present only company business has been handled. While business is handled to all points, the principal stations are in Central and South America.

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The Editor will be pleased to receive original articles of timely interest pertaining to Wireless Telegraphy and Telephony. Articles accompanied by good drawings and clear photographs especially desired. If accepted, such articles will be paid for on publicaton, at regular rates.

No manuscripts will be returned unless return postage is enclosed.

Vol. I. SEPTEMBER No. 12

EDITORIAL

What is static?

That question has been coming from all sides during the past few days. We feel indebted to you who have asked for enlightenment on this subject. It is comforting to feel that our readers are carefully absorbing the contents of our pages and do not hesitate to ask for information when they know of, but do not understand certain wireless phenomena. We like to answer these questions. But you who have asked this one, might have picked out something easier.

For no one knows exactly what static is. Combining long observation and careful study with a lot of hearsay evidence, it would appear that charges of electricity gather on the outside of particles of dust and water and in this condition these charges are static —they are standing still. Then the particles of dust and moisture come together, forming a cloud, the outside of which is not of course as great as the sum of all the outsides of the particles. Not having as much room as before, part of the condensed electricity jumps off to the earth or to another cloud. In this form it is known as lightning.

This electrical current, which does not always appear as lightning, sets up powerful electro-magnetic waves in the ether as it flows to the ground or to a cloud, or back and forth. The waves strike the antennæ of the wireless station and the unusually powerful currents are heard in the operator's head 'phones.

That is about the best explanation we can give. Maybe someone else can give a better one, but it must include the fact that static seems to have some relation to lightning. Rapid changes in the vicinity of the station, such as heavy winds, rain, and approaching storms also influence the currents and static has appeared when there was a blue sky overhead.

Many inventions have been brought forth purposing to eliminate static, but the majority of these have cut down the signals also. While there is probably a handsome reward awaiting the man who can devise a practicable static preventer, little is feared from atmospherics in these days of vastly improved wireless sets. Where static formerly interfered with and often temporarily suspended communication, the present day operator looks upon it only as an annoyance, overcome by the application of more power and employing a higher musical note which can be heard above the atmospheric disturbances.

* * *

What a lot of garbled versions and queer statements appear in the newspapers when anything of importance happens. If the ambitious reporter verified his details—as he would in a murder or burglar case—the public would not be so confused as to the present status of the greatest discovery of the age.

To be sure, there is no harm in articles such as those that reported an English editor's address to his contemporaries in which he painted a striking picture of the news gatherer of the future. "News will be collected by wireless telephones," he predicted, "and a reporter will always have a portable telephone with him with which he will communicate with his paper without the trouble of going to a telephone."

If the man that made this statement had taken the trouble to learn even the most elementary principles of radiotelephony, we think the prediction would not have been made. The first picture that presents itself is the reporter with a current supply strapped to his back, or distributed about his clothing. Fancy interviewing some society somebody or a giant of commerce, presenting such an appearance!

A pocket 'phone that may receive messages is distinctly a possibility, but it looks to us as if the wireless reporter will always have to hitch his apparatus to a more substantial current supply than one which could be contained in a pocket or two.

We hear the Innocent Bystander ask: "Why not have such stations distributed about the city?" Right now, we have telephone stations supplied with current from a few generating plants and why couldn't the wireless 'phone be attached to certain current distributing boxes, or something of that nature? There could be a number of them so the reporter would not have to ——

There is your answer, we interrupt here. What's the use? Our large cities already have wonderfully efficient telephone service and a public telephone can be found within a dozen steps in any neighborhood.

In a word, we don't agree with our journalistic cousin across the water. The perforated radiotelephone, when it comes, will have many uses, but we certainly doubt its application to reporting.

As we said before, this type of newspaper article does no one any harm. In some ways it does a lot of good, it tends to stir the imagination of the younger readers, and imagination is one of the greatest assets a young man possesses.

But there is the type of news item that discredits the wireless art with the careful reader of newspapers. A Middle West newspaper was responsible for the statement that, "the dumbfounding speed of ether signals are said to be fast enough, could they be timed, to average up a speed sufficient to encircle the globe half a dozen times in one second."

From the general tone of the article it was clearly seen that the reporter had secured his information from some small boy amateur and had not taken the trouble to look up his office records, in which he would have found that the Academy of Sciences determined by exhaustive tests that wireless messages travel 20,622 miles a second. Which, as everyone knows, is less than the circumference of the globe.

Another reporter was told by someone that signals travel further at night than in the daytime. He called it a "remarkable discovery" that had been brought to light less than two weeks ago, and gave the credit to some obscure local experimenter.

To our own personal knowledge this fact has been printed more than a thousand times, long before the alleged "discovery."

Barely two weeks ago a writer known to most everybody declared in an uplift article—in boldface type, incidentally—that "A man named Marconi guarantees to deliver messages to ships three thousand miles from shore."

He doesn't. He never did anything of the sort. The high powered stations for trans-ocean work which communicate across the acean have guaranteed ranges. of course, but when it is seen that there is no point in the Atlantic or Pacific where a ship could be three thousand miles from a shore station, such a guarantee would be ridiculous. And besides, the guarantee was never given.

One of the most sincere workers in the wireless field, an engineer of highest standing, told us the other day that he had reached the point where amusement was his only sensation when he read newspaper accounts dealing with wireless. He didn't say that about The Marconigraph, which we deemed a compliment, for we do our best to be accurate in every department of our work.

The Share Market

New York, August 19.

The brokers report exceptional activity in Marconi shares after a long period of market stagnation. The trading here has been principally in American Marconis, which show a slight advance since the payment of the dividend.

The English issues advanced with the announcement of the substantial surplus revealed in the company's balance sheet and the market's reaction carried. Canadian issues made fractional advances.

From all indications the buying comes principally from London, and stockholders in this country are loath to part with their holdings.

The brokers are unanimous in the prediction that still higher prices may be looked for.

Bid and asked quotations today:

American, 5½—5⅝; Canadian, 3—3½; English, common, 20¾—21¼; English, preferred, 16¾—17¾.

First Message to Colombia

The first wireless message ever sent from this or any other country to Colombia, consisting of congratulations to the president of our sister republic, was dispatched on August 8. Through the courtesy of Secretary Daniels, the message was transmitted from Arlington by way of Key West and Colon, to the new station at Cartagena, Colombia. The sender was Senor Julio Betancourt, Colombian minister at Washington. The communication had reference to the anniversary of the battle of Boyaca, which insured the independence of the South American republic.

Tampa Operators Successful

An entire new set of instruments has been placed in the Marconi station at Palmetto Beach, Tampa, Florida, within the last few weeks, making the station one of the most effective on the Atlantic and Gulf coasts of the United States.

This equipment, sent to Tampa from New York, was installed by the two operators in charge of the station. A job of this kind, owing to the complicated wiring, usually demands the presence of an expert electrical engineer, but the two operators, equal to the emergency, did the whole job alone, a performance that is looked upon as somewhat of a feat.

A government wireless station inspector was in the city recently and inspected the local station, pronouncing it the best that he had seen.

The two young men in charge are now preparing to make the station more effective, arranging to lengthen the southern aerial pole to its former height. This pole was broken off in a storm two years ago, leaving it a little more than half the height it was formerly. After erecting the new section, an entire set of aerials will be substituted for the old.

This station has a night range now of 1,450 miles. During the day, it works to a distance of over 500 miles.

Besides handling usual business, the Tampa station is one of the greatest news dispensers on the eastern coast of the country. At night are secured the afternoon major league baseball results, and the station sends these out to ships in the South Atlantic Ocean, the Gulf and Caribbean Sea, where the reports are received with the greatest of interest. Uncle Sam's vessels in range also "take" the results.

Every morning the operators "cull" the most important items of the Associated Press report which is briefed and sent out to ships running between ports, the vessel's operators using the short message in their daily paper gotten out on board ship by the aid of a mimeograph.

Revision of Standard Book

Wireless Telegraph Construction for Amateurs. By Alfred Powell Morgan. New York: D. Van Nostrand Company, 1913. Price, $1.50 net.

The popularity of this work, which made its first appearance three years ago, has necessitated a new revised and enlarged edition, the third. Embracing practical information for those who wish to build their own sets at a reasonable cost and to comply with the law, the new edition also deals with the number of small changes and improvements which have recently increased the efficiency and selectivity of experimental apparatus.

The author has omitted the history of the art and the unimportant details, devoting himself to concise explanations of the functions of the different instruments and, briefly, the elementary theory of wireless and a few practical hints for saving labor and cash. Efficient instruments that are by no means toys are illustrated by drawings with construction details clearly shown, and instructions for the adjustment of the apparatus have been added.

Several new types of detectors are described and an added chapter is devoted to illustrating the apparatus required by law.

Important Engineer Shot

C. R. Guertler, superintendent of the J. G. White Engineering Company, of New York, in charge of work on the Marconi Wireless Telegraph Company's new station, at Honolulu, was shot at a beach resort by J. W. Marshall, superintendent of the Waiihole Water Company, and died afterward in a hospital.

Collision and Fire Try Operator's Mettle

Arthur Ridley, of Ridge Hill, Mass., has been undergoing some trying times since he has been Marconi operator on the steamer Millinocket. Following the collision of his steamer with the Persian on the night of July 24, he did not remove his receivers for four days and three nights and was continually at his key sending and receiving messages. Not until the vessel was at her dock in New York did he leave his operating room, even his food being brought to him.

Following the collision his power was weak; the firemen and stokers had left their work expecting the boat would sink. Threats and force were necessary to get them back to generate steam for operating the wireless to assist the rescuers in finding them. Only a thin bulkhead protected the engine room from the open sea. At times the Millinocket was like a submarine, the sea passing over her. The arrival of a tug and a lighter relieved the fright of the crew and Ridley was able to generate electricity enough to send dispatches and keep the owners in touch with conditions.

About two months ago he was obliged to operate with the floor of his room so hot he could not step on it on account of a fire in the hold and then another race was on for a landing. Within a short time fire was discovered aboard six times and it developed that one of the crew was deliberately setting the boat on fire.

Arthur Ridley resides with his parents at Ridge Hill when at home and is about 21 years of age. Few, if any of the wireless operators have had such trying experiences in so short a time. He has been highly complimented for his courage and accuracy by his captain and the owners.

Charlestown to Take Messages for Explorers

The Charlestown Navy Yard is to be a transmitting station for wireless messages from members of Crocker Land Expeditions in the Arctic regions to Washington, according to instructions issued in August. The Crocker expedition which left for the North in July for Greenland is to establish a wireless station at latitude 79-10 and west longitude 78.

WIRELESS ENGINEERING COURSE

By H. Shoemaker

Research Engineer of the Marconi Wireless Telegraph Company of America

CHAPTER IX.

Thermo Meters

THIS type of current measuring instruments is much more sensitive than the hot wire instruments and is used to a considerable extent in making accurate measurements of high frequency currents. It can be constructed so as to be entirely independent of frequency.

There are two general types in use at present. One type, developed by W. Duddell, consists of a coil or loop suspended between the poles of a perminate magnet so that it is free to swing around its axis. The terminals of the coil are brought out at the lower end of the coil and connected to a thermo-junction, consisting of a small block of antimony and bismuth soldered together. Below and close to the thermo-junction is placed a small conductor or coil which is heated by the current and in turn heats the thermo-junction. This causes a current to flow through the suspended coil, making it swing or rotate about its axis.

This type of instrument is a combination of the well-known D'Arsonval galvanometer and a thermo-junction. The great advantage of this combination is due to the absence of leading-in wires, which introduce resistance in the circuit. The potentials developed by the thermo-junction are very small and it is necessary to eliminate all unnecessary resistance to get the desired current flow.

TABLE OF APPROXIMATE SENSITIVITIES SCALE DISTANCE 1,000 MM.

Resistance of heater ohms	Current to give 250 mm. deflection micro-amperes	Current to give 10 mm. deflection. micro-amperes	P.D. to give 250 mm. deflection milli-volts	P.D. to give 10 mm. deflection milli-volts	
About 1000	110	22	110	22	heater close to junction.
" 400	175	35	70	14	heater close to junction.
" 100	350	70	35	7	heater close to junction.
" 40	550	110	22	4.4	heater close to junction.
" 10	1100	220	11	2.2	heater close to junction.
" 4	1750	350	7	1.4	heater close to junction.
" 1	3500	700	3.5	0.7	heater lowered away from junction.
" 1	10000	2000	10	2.0	heater lowered away from junction.

Two types of Duddell instruments are made, viz., the thermo galvanometer and the thermo-ammeter. The former, which is extremely sensitive, has its coil suspended on a quartz fiber; while the latter has its coil suspended on pivots. The amount of current necessary to deflect the instrument over a given range of course depends on the resistance of the heater or the amount of energy converted into heat per second. The thermo galvanometer must have its deflections read by means of a telescope or reflected beam of light, in the same manner as the ordinary reflecting galvanometer. The table on page 556 gives the approximate sensitivities of the Duddell Thermo Galvanometer, manufactured by the Cambridge Scientific Instrument Company of Cambridge, England.

Fig. 39 shows the finished instrument and Fig. 40 shows the moving system and its relation with the perminate magnet and heater. In Figure 40, Q is the quartz suspension fiber, M is the mirror, G is a glass stem fastened to the loop of silver wire L. Bi is a block of bismuth soldered to the wire L and to the block of antimony Sb. The heater is placed below and close to the junction of Bi and Sb. N and S are the poles of the perminate magnet.

The temperature of the heater will be proportional to the square of the current, times the resistance of the heater. The potential developed by the thermo-junction will be proportional to the difference of temperature of the heated junction of thermo couples and the cooler junctions or the junctions with the silver wire. Therefore if the resistance of the heater is constant the potential developed by the thermo junction will be proportional to the square of the current through the heater. The current through the loop and the deflection of the loop will be proportional to the potential developed by the junction. Consequently the deflection of the instrument will be proportional to the square of the current through the heater. The heater is constructed of very thin metal, such as gold leaf laid on a mica plate or platinum deposited on mica.

It is desirable to keep the mass of the heater small so that its temperature rises rapidly. The mass of the thermo-junction should be kept small for the same reason.

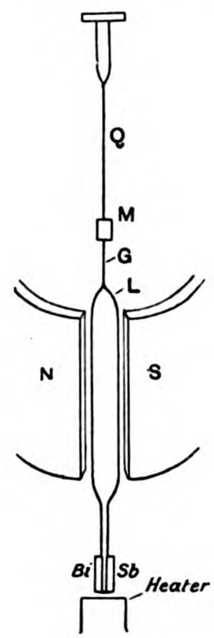


Fig. 40.

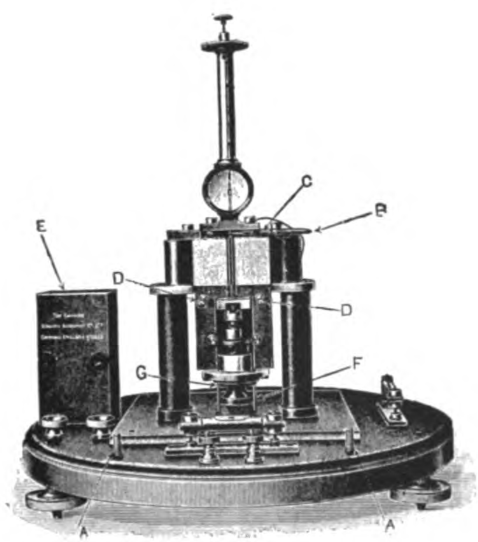


Fig. 39.

Fig. 41 shows the portable type of instrument and 42 its internal construction. With this instrument a full scale deflection is given by a current of 100 milli-amperes (.1 ampere) with a heater of 1.5 ohms. It only requires .015 watts to give a full scale swing.

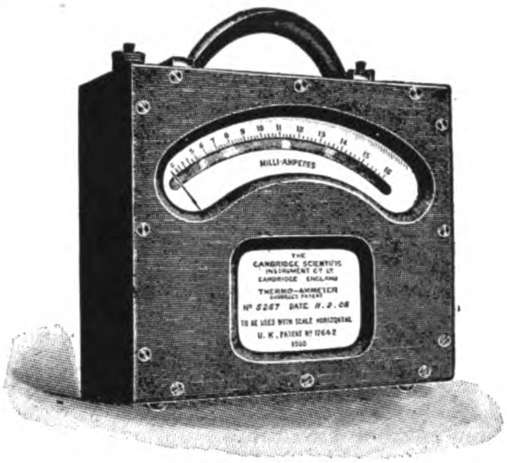


Fig. 41.

These instruments can be used either as voltmeters or ammeters. If used as voltmeters their resistance should be high, while for current measurements the resistance should be low, or a shunt should be used, and if used for high frequency currents

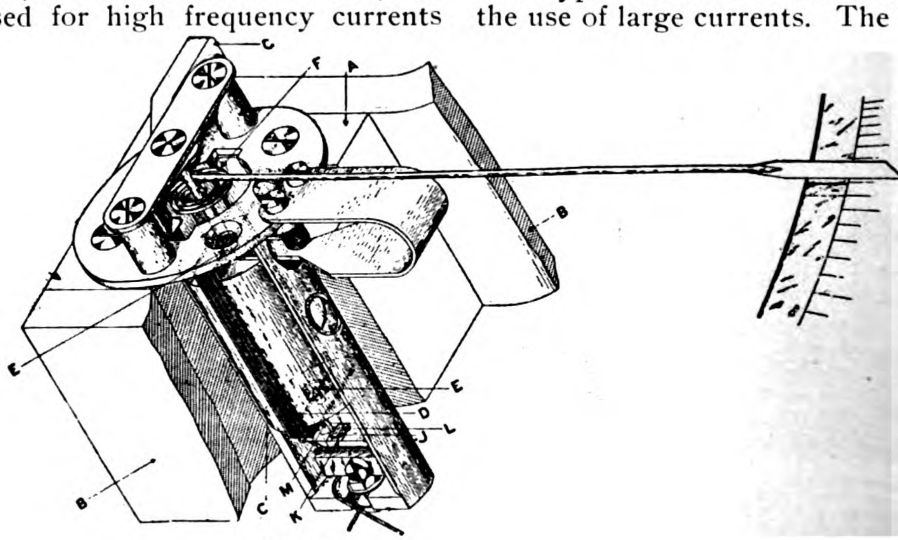


Fig. 42.

the heaters and shunts should be constructed so that the resistance remains constant for any frequency.

Another type of thermo-ammeter, developed by J. A. Fleming, which is used to a great extent for high frequency measurement, has the thermojunction and heater constructed in one unit and is used with a sensitive

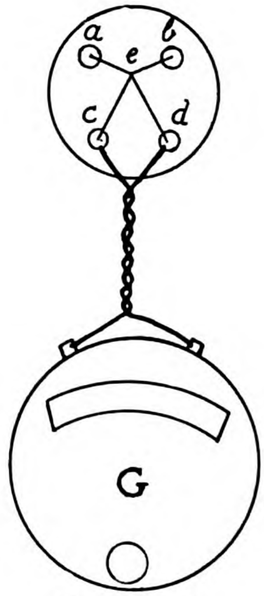


Fig 43

galvanometer which indicates the rise of temperature of the junction. This type lends itself more readily to the use of large currents. The heater can also be constructed for constant resistance with less difficulty.

In Fig. 43 the heater wire is stretched between a and b. Two wires, c e and d e, have their ends at e twisted together and soldered. These wires are of different metals or alloys, having high thermo-electric power. Iron and nickel can be used to advantage, as they can be drawn to a small diameter so as to reduce the mass to be heated. To the terminals c and d is connected the galvanometer G, which should have a low resistance (about 5 ohms).

When current flows through the heater wire, the junction i is heated, which causes a current to flow through the galvanometer. The galvanometer deflections will be proportional to the square of the current. The complete instrument can be calibrated by use of a direct current through the heater, which in turn can be accurately measured.

When it is desired to measure large currents, several heating wires can be connected in parallel to carry the current, while one thermo-junction in contact with one heater wire can be used to measure the rise in temperature. This instrument when properly constructed is entirely independent of frequency. The thermo-junction and heater wire should be enclosed to protect it from injury and draughts. If exposed, its reading will not be constant. If the above instruments are calibrated with direct current, they will give the effective (or root mean square value) when used with alternating current.

With accurate current and voltage measuring instruments and a non-inductive resistance, which can be varied over wide ranges, most measurements required in practice can be readily made. The resistance values should be carefully determined if great accuracy is desired.

The following are some of the measurements which can be made with the above apparatus, employing alternating current of a known frequency. To measure resistance it is necessary to measure the current flowing through the apparatus and the voltage at its terminals. If the resistance is low, the current should be large, while with higher resistances the current can be reduced.

If the resistance is inductive, then direct current should be used instead of alternating.

By Ohm's law,

$$\text{current} = \frac{\text{voltage}}{\text{resistance}}$$

$$\text{and, resistance} = \frac{\text{voltage}}{\text{current}}$$

also, voltage = current × resistance.

If any two of the above quantities are known, the other can be found by the above equations.

To measure inductance, it is first necessary to measure the resistance of the inductance with direct current. Alternating current of a known frequency is then passed through the inductance and an ammeter which gives the current value. The voltage across the terminals of the inductance is also measured while the current is flowing.

By formula given in the preceding articles:

$$\text{Impedance} = \frac{\text{volts}}{\text{current}}$$

$$\text{and Impedance} = \sqrt{R^2 + (2 \pi n L)^2}$$

Where R is the resistance in ohms, L the inductance in henrys and n the frequency.

Substituting, we have

$$\sqrt{R^2 + (2 \pi n L)^2} = \frac{V}{C}$$

Where V is the volts and C the current in amperes. The value of L can be found by substituting the known values in the above equation, put in the form,

$$L = \sqrt{\frac{V^2 - C^2R^2}{C^2 \ (2 \pi n)^2}}$$

The quantity $V^2 - C^2R^2$ is the voltage due to self induction alone, and C^2R^2 is that due to the resistance. If the resistance is negligible, then

$$L = \frac{v}{C_2 \pi n}$$

To measure capacity a sensitive ammeter is required, as the current will be small in most cases. The resistance of the ammeter should also be known, as it will be necessary, in this case, to measure the voltage across the ammeter and capacity. If measured across the capacity by a voltmeter, the current through the voltmeter will, in many cases, be larger than the current through the condenser, or so large that it will affect the accuracy of the measurement.

If the resistance is negligible, the capacity K in farads will be

$$K = \frac{C}{2 \pi n V}$$

If resistance is present, then

$$\frac{V}{C} = \sqrt{R^2 + \frac{1}{(2 \pi n K)^2}}$$

The capacity K can be determined by substituting the known quantities.

Where standards of capacity and inductance are available, measurements can be made by comparison. Those who desire to go further into this matter will find that either the Hand Book for the Laboratory and Testing Room, by J. A. Fleming, or Electrical Measurements, by Carhart & Patterson, covers this subject completely.

President Wilson Sends Cipher Message to Mexico

Modern magic of the wireless message aided a President a few weeks ago for the first time in American history in securing information in a delicate foreign situation. Sound waves displaced the old-fashioned mounted courier and halting telegraph key in the new diplomacy.

Although thousands of miles from the seat of trouble, through the aid of the wireless President Wilson was kept in almost instantaneous communication with John Lind, his special peace envoy to Mexico.

The secret cipher message came through the air from Vera Cruz to Guantanamo, Cuba, and thence to Arlington through the wireless station at New Orleans, the more powerful station at Key West, Fla., being temporarily out of commission.

Messages From Germany Received

The report that the Goldschmidt messages have been received from Germany has recently been confirmed by Emil Mayer, chief engineer of the plant at Tuckertown, N. J.

The messages were sent from the company's 800-foot tower in Neustadt, near Hanover. They came in clean cut three times a day, with hardly a missing word in the whole lot. They were sent at a slow rate.

Dr. Goldschmidt's radiograms, all of which were short, were acknowledged by cable. They were in the form of greetings and were in cipher.

Naval Reserves Pleased With Set

When the U. S. S. Gopher, with more than 100 naval reserves aboard, returned to her moorings from Bark Bay, Minn., the "jolly tars" had passed the day in various drills, boat practice and maneuvers of warfare. Commander Guy A. Eaton and Executive Officer Kelly both praise the work accomplished by the reserves during the cruise and the seamanship displayed. The Gopher was 20 hours at sea.

During the first and second watch out a dense fog and heavy seas were encountered and the lads were afforded a real taste of the sort of weather they may expect to experience on their annual cruise.

The Marconi wireless system, recently installed aboard the Gopher, was given a thorough test during the trip, displaying its ability to cover a radius of 400 miles. Operator C. O. Zuck pronounced the new equipment perfect in every way.

To Evade the Law

One way of beating the United States radio law compelling steamers with a crew of 50 to carry a wireless is for foreign ships on Puget Sound to send away a portion of the crew in British Columbia and reship the men before proceeding to sea, says Shipping Illustrated.

OPERATORS' INSTRUCTION

IF during the operation of a motor-generator set a short circuit should be experienced, it may be readily located. The trouble may be caused by electro-static induction from the high potential circuits of the transmitting apparatus, causing an excessive difference of potential between the various windings of the machine and between the windings and the frame. This charge may become of such value as to puncture the windings. When such punctures take place a path is made for the low voltage in the windings and may result in a complete short circuit.

As already described, these differences of potential are neutralized to some extent by means of carbon resistance rods which are shunted across the circuits, the middle point being connected directly to ground.

While these troubles are seldom experienced it is well for the operator to be thoroughly familiar with the test necessary to locate the difficulty when such conditions arise.

If the windings of the motor-generator set are "grounded" to the frame of the machine at only one point, no harm will result; yet if "grounded" at two places a path for the low voltage current is formed and a complete short circuit results.

Simple tests can be made to determine the exact location of the difficulty. Figure 3, a complete representation of a Robbins and Meyers motor-generator set, gives the actual connections of the various circuits to the binding posts, and it wll be observed that some of the binding posts have several connections to the various circuits.

Suppose for example a short circuit has taken place through the frame of the machine, it is then to be determined which of the windings are defective. This can only be done by individualizing the circuits; that is to say, the shunt fields of the motor should be disconnected from the D. C. armature, and the shunt field windings of the generator from the binding posts, the terminals of all principal circuits remaining free and having no connection one with the other.

An ordinary 16 c. p. 110 volt lamp in series with the D. C. line can be used as a testing circuit, and the terminals of this circuit are applied to one connection of any of the windings, and the other side to the frame. This is indicated in Figure 3, where the shunt fields of the motor have been disconnected from the binding posts and the test applied to note whether or not it is "grounded."

The circuit which is actually "grounded" will be noted by a full or partial glow in the lamp. A voltmeter can be used to make this test.

If when this test has been applied, it is found that the generator fields are "grounded" to the frame, it is then to be determined which of the field-coils is at fault. This is done by disconnecting the field coils from

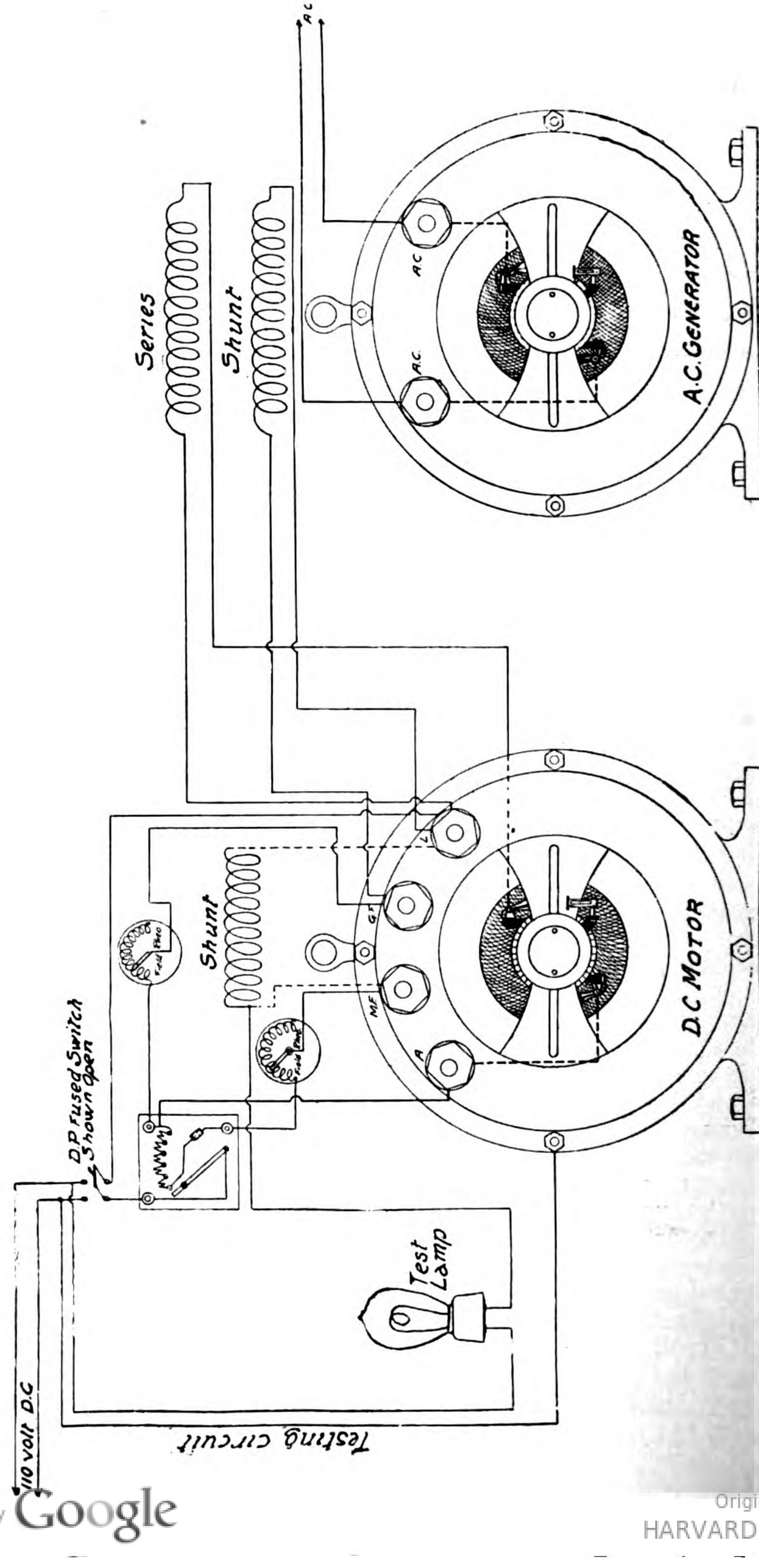
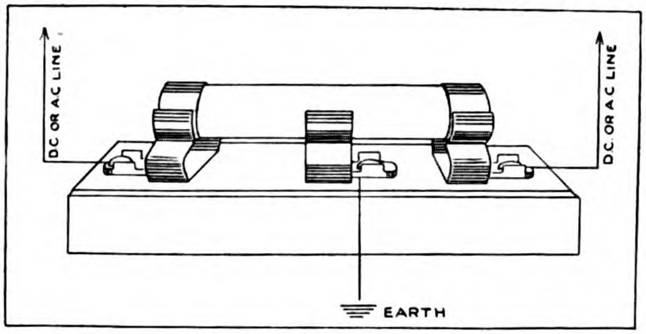

Series
Shunt
A.C. GENERATOR
A.C.
D.C MOTOR
Shunt
D.P. Fused Switch Shown Open
Test Lamp
Testing circuit
110 volt D.C.

Fig. 3.

one another and applying the test individually to each coil. Between each set of field poles there will be found two wire connectors bolted together; by disconnecting these each field coil is isolated from the one next to it. After the faulty field coil is located it is then removed and repaired. Generally speaking, such "grounds" or short circuits are not on the inside of the coils, but near the surface of the windings.



PROTECTIVE RESISTANCE RODS

Fig. 4.

As stated before, there must be two "grounds" to the frame in order to effect a short circuit, and if it is found that the D. C. armature is "grounded" the operator will find it difficult of repair, for, generally speaking, repairs on an armature are beyond the skill of the wireless operator of average experience.

If, however, the other "ground" that is causing the short circuit is located, it can be remedied without disturbing the armature. This statement does not refer to short circuits in the actual windings of the armature or at several points in the armature from its windings through the frame. Under such conditions, the armature would be out of commission, the machine being made entirely inoperative.

A possible point to look for trouble would be the insulation around the studs which support the brush holders. These may have become punctured or carbonized to such an extent that a complete short circuit is effected. The before mentioned test can here be applied, that is to say, the brushes are removed from the holders, one side of the 110 volt circuit with the lamp in series to the brush holder studs, the other side to the frame of the machine. When the one at fault is located the insulation can be temporarily repaired by means of rubber tape or paper washers. The test can be applied to any type of motor generator used in wireless work, provided operator is thoroughly familiar with the circuits and bears in mind the fact that the circuits must be absolutely isolated. The one at fault is then readily located.

In emergency, a battery and head phones can be used to test these circuits in place of the lamp.

Protective Devices

All Marconi transmitting sets, particularly the motor generator, are protected by non-inductive resistance rods, as in Fig. 4.

These are shunted across

1. The primary of the transformer.
2. The A. C. armature terminals.
3. The D. C. armature terminals.
4. The terminals of the blower motor.
5. Across the generator fields.
6. Across the motor fields.

The midddle point of the rode is directly connected to the earth. Thus currents due to electro-static induction are led to the earth, eliminating injury to the insulation of the low potential circuits.

As these rods are of high resistance a very small amount of the low potential current is allowed to pass, but the resistance to the high potential currents is negligible, therefore the induced currents are readily led to the earth.

In some cases two condensers of 1 M. F. capacity are connected in series and the middle point grounded to the earth and the entire unit shunted across the circuits in the same manner as the protective resistance rods.

Non-Synchronous Spark Gap

A number of Marconi installations,

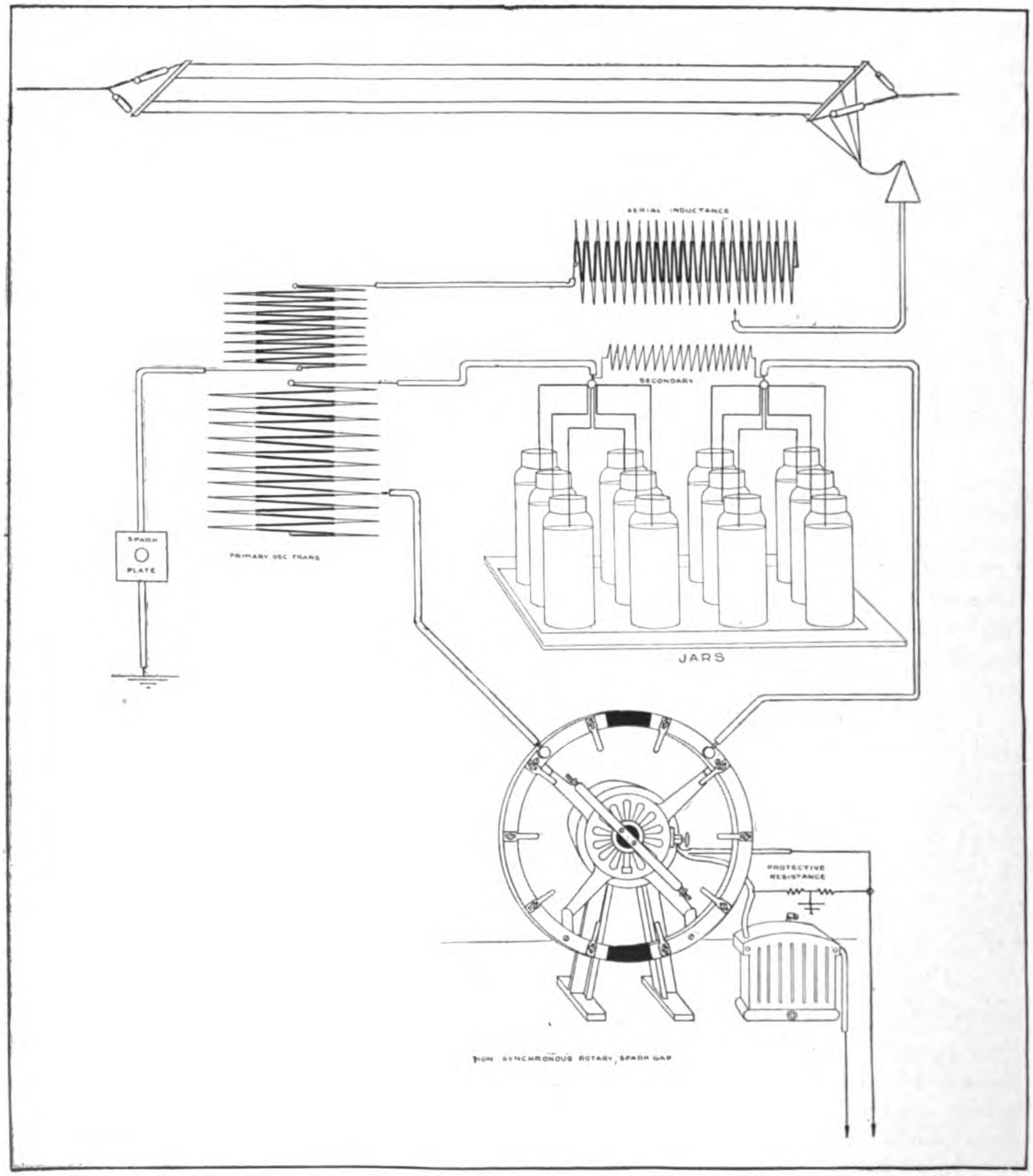


Fig. 5.

particularly the 60 cycle equipments, are equipped with non-synchronous rotary spark gaps as shown in Figure 5. This device is inserted in the closed oscillatory circuit at the same point when the ordinary spark discharger is used.

The design of the gap is unique in that cooled surfaces are constantly presented in the path of the spark discharge. It will be observed that the arm with spark points at either end is mounted on the shaft of a direct current motor. This arm revolves between two halves of the circular rim which supports the stationary spark electrodes. In order to maintain the same length of lead for each discharge of the spark, both connections must be made at the top or at the bottom of the circular rim.

The moving points are cooled by constant rotation, the spark discharge taking place at various points around the circle. In effect, the condenser appears to be discharged simultaneously at every point around the circle, but in reality the discharge is taking place from one side of the circular rim through the revolving electrodes to the other side, the spark shifting from one set of stationary electrodes to the other shown in the sketch.

A variable resistance is generally included in series with the motor, permitting speed variation of the gap as desired. In action the gap emits a musical tone which is slightly irregular, but which enables the signals to be read more easily during atmospheric discharges.

The speed of the rotating member is generally 2,400 revolutions per minute. Since there are usually ten spark points on the rim, and the rotating member makes 2,400 revolutions per minute, then in one second of time there will be 10 X 40 or 400 sparks, which is the equivalent of a 200 cycle synchronous spark set.

Adjustment for Best Results

A mistake made by many operators using this type of gap is in widening out the spark gap in order to produce a more perfect note. This is entirely wrong. For best results the distance between the movable electrodes and stationary electrodes should be the smallest possible, not more thna 1/32 of an inch.

In adjusting the note, it will be found that the speed of the arm should vary with different condenser capacities; a little experimenting will determine the speed that develops the clearest note or that gives the best results. In some cases the gap may seem to give out a very rough, irregular note. but it will be clear and musical when heard at a distant receiving station, consequently when adjusting the speed the operator should put on the receiving head phones of his receiving apparatus, throw off the shunt switch of the detector, and listen to the note of the spark, adjusting for clear tones.

The reason why such irregularities from the gap are obtaned lies in the fact that the spark does not discharge synchronously with the charging current and consequently the condenser is discharged at different values, i. e., currents of greater or less value; consequently an absolutely pure note cannot be expected. But the note composed of tones and overtones which is secured is highly pleasing.

In order to overcome these irregularities, operators frequently widen out the gap to half an inch or more. This not only breaks up the regularity of the note, but makes a terrific noise which is very disagreeable to the passengers. This is entirely unnecessary, for when the spark points are closed up as they should be the gap is not abnormally noisy and its effectiveness in transmitting is considerably increased.

It is found that the points burn up by constant use and the gap gradually increases. It will then be necessary for the operator to readjust all stationary points or, possibly, the points on the moving arm, so that the original normal gap is secured.

In addition to speed adjustment it will be found that the note is also a function of the voltage applied to the primary terminals of the transformer, and it will be observed that the correct voltage will enable the operator to secure a satisfactory musical note.

Figure 5 shows very clearly the non-synchronous spark gap in use with a standard 1 K. W. set where the condenser consists of twelve leyden jars in series parallel. The high frequency oscillatory circuits including the antennae, oscillation transformer, aerial inductance and the earth connections are also indicated.

Figure 5 will be of value to the student and should be carefully studied, for it shows clearly the high frequency circuits of a modern wireless telegraph installation. The short wave condenser is not shown, but its place is in series with the earth lead of the open oscillatory circuit.

(To Be Continued.)

Wireless on Bicycle

A resident of Nottingham, Eng., has mounted a wireless telegraph plant on his motorcycle and has received messages as he was moving over the roads.

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.

My Experimental Station

The seventy-five foot tower shown in the illustration is placed in an ideal location, being over a hundred yards from the nearest tree and still farther from the road with its troublesome telephone wires. It is about a mile and a quarter from my home and outside the city limits. I am not bothered by children, autos, line induction, street cars, or arc lamps. Last, but not least, I have a license, and being careful to keep within the rules, I am not bothered by the government.

I spent a good deal of time experimenting with aerials and finally decided on an umbrella, consisting of six 7/22 phosphor bronze wires, each 100 feet long. I leave their ends open.

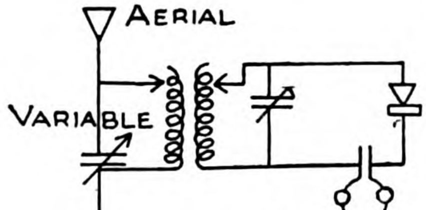


Fig. 1.

Receiving circuit.

It is highly important that all wires be the same length. I take my leads at *right angles* from the *lower* end where I get best results. For my ground I buried a lot of wire and then later drove a pipe about seven feet in the ground which improved my station fully fifty per cent.

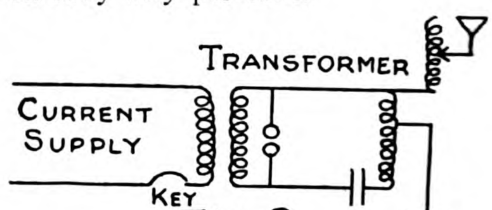


Fig: 2

Transmitting circuits.

Here is a brief description of my apparatus:

Clapp-Eastham Co. loose-coupler (both types).

Clapp-Eastham Co. Ferron detector (private use).

Marconi magnetic detector.

Marconi valve detector.

Murdock silicon detector.

Murdock variables and one Murdock fixed.

Brandes 3,200 ohm 'phones.

Electro Importing Co. 2,000 ohm 'phones.

Western Electric 2,000 ohm 'phones.

Clapp-Eastham variable (Blitzen).

My small transmitting outfit is of the Telefunken type.

In my experiments with transmitting, I use all necessary auxiliary apparatus, which consists of a wave meter capable of measuring up to 6,000 meters and a decremeter and a hot wire meter.

My transmitting set is capable of working only eight and ten miles, although I have a ¼ kw. transformer capable of doing forty miles. This I use in my main sending tests.

I spend most of my time receiving. It is very rarely necessary for me to read much out-of-town news in the papers, since I can depend on the Sayville, L. I., and Cape Cod stations for my news. I have been able to copy successfully messages all along the coast as far as Cuba and Cape Cod, and inland as far as Port Huron, Mich.

I would advise all amateurs who are able to do so to experiment with an umbrella type aerial; it astonished me to see how much better it is than the other types with which I have worked.

Norman Snyder's tower.

Schoolboys Entertain Camp Fire Girls

One of the finest amateur wireless stations in the country has just been erected at the Glenolden school at Darby, Pa., by several young students under the direction of Everett McConnell, a fourteen-year-old boy who has been very successful in his studies in this art. The school board granted permission to allow the wireless to remain in the school until the end of summer.

The aerials for the station, consisting of over 600 feet of wire, have been strung from the flag pole to a mast on the new annex, a distance of over sixty feet. The receiving and sending station is located in the school library. Messages have been heard from League Island, Brooklyn Navy Yard, Washington and ships on the coasts.

Everett McConnell was assisted by William Kidd, aged 16 years, a student at the Lansdowne High School, Charles E. Lee, 16 years, and Robert Ferry, 15 years, all of whom are interested in wireless telegraphy.

The young men arranged to give the public an opportunity to inspect the station when the Camp Fire Girls recently held a bake in the school yard. Ned McCaskey, of Darby, a licensed operator, sent the messages on these nights.

Youth Demonstrates New Invention

M. Bernays Johnson, of St. Louis, Mo., a youthful inventor, recently exploded a mine in Forest Park by means of a wireless spark sent from a wireless tower a mile away. The test showed the possibility of the use of the wireless current to destroy a fort or battleship.

Johnson planted the mine and connected it by wire with a pint can filled with gunpowder. This can was connected with a receiving instrument. When he pressed the key of the wireless the wave passed to the receiver and a spark ignited the gunpowder, exploding the mine.

Experts say this was an entirely practical demonstration of firing a mine by wireless.

Rochester Militia Want Operators

An effort will be made by officers of the Naval Militia to get the government to co-operate wtih a private institution in Rochester for the establishment of a wireless station, as soon as more wireless operators enlist.

"There are openings for six wireless operators in the Fifth Division of the Naval Militia," said Lieutenant-Paymaster W. B. Zimmer. "We know there are several good operators among the young men of Rochester, but none seems to wish to enlist, something hard for us to understand.

"A wireless operator ranks as a petty officer and, when on duty, draws pay above that of the ordinary enlisted man. As soon as we get properly equipped with operators I believe we shall be successful in getting a government station of the highest type.."

Recently the wireless equipment was removed from the Sandoval, the Naval Militia gunboat on Lake Ontario, for the reason that when the boat was on a cruise there was no way of communicating regularly with the land on this side. The apparatus on the Sandoval was of the highest type, had been installed only two years and was little used.

"The Mechanics Institute has a fine wireless equipment," said Lieutenant Zimmer, "but it is devoted to use by students and is not in operation at night. To be of any use to the Naval Militia a wireless station would have to be manned at all hours when a cruise was on.

"A Buffalo newspaper has a good wireless station and there is one in Toronto and one in Montreal. All are within our range. Those in the Canadian cities are upon department stores and, I understand, are privately owned."

"There is no reason why there could not be a station both for commercial and government use in Rochester. Probably the best location in Rochester would be the Eastman Building. The government has a contract with the Marconi people whereby there could be a station here under such conditions.

"We have considered the matter at Summerville and experts have gone over the ground. It was decided that we could not operate there because of the high tension cables of the Railway and Light Company.

"What we want first are operators among the young men of Rochester who know wireless."

Progressive Amateurs

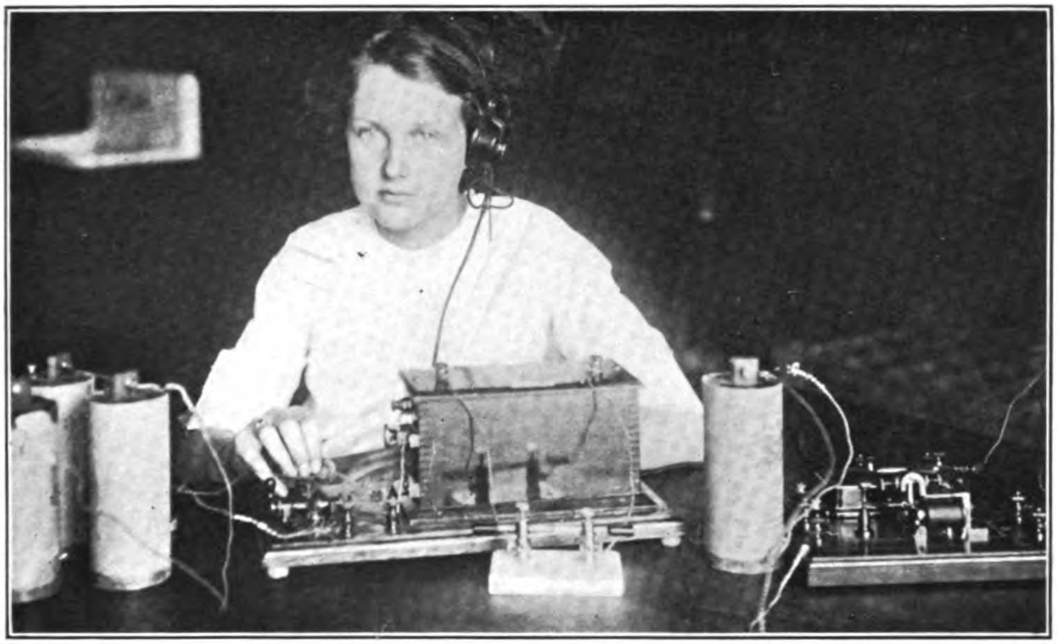
That Lafayette, Ind., is not far behind the times in wireless telegraphy, compared to other cities, has been daily proven by the discoveries that have from time to time been worked out by wireless operators there. This city is said to be an ideal location for a radio station, with its extensive hills, suitable soil and weather conditions, all of which are claimed to be important factors in working long distances with the use of wireless instruments. One operator says he has found that no two stations will work exactly the same, neither can each respective outfit work to the same distance every day of the week, for sometimes an operator will work better with a given set to-day than he will with the same set to-morrow, while the other station may be in finer tune one day than another. It has also been proven that signals or waves travel much further in a north southerly direction than they do in an east westerly one.

Telegraph Club to Use Wireless

The high school boys of East Douglas, Mass., telegraph club have voted to disband and to disconnect the telegraph line from their homes. All the homes of the members are connected by telephone and the members are going to study wireless telegraphy.

President H. W. Rowly has a wireless station in his home, and they will study there. The telegraph club was organized April 12, 1911, by Napier Scribner, Harry W. Rowly and Julius Seder.

The line is of all steel wire and runs about a mile through the woods.



Photograph by Underwood and Underwood.

Alice McConaughy, holder of the first license, under the new law, to operate on the Great Lakes. (See MARCONIGRAPH *for August.)*

Minneapolis Student Now Inspector

V. Ford Greaves, of Washington, D. C., first became interested in wireless telegraphy while a student in the Minneapolis public schools, and is now an engineer of radio inspection of the United States Bureau of Navigation, enforcing the new federal laws governing the use of wireless telegraph.

After graduating from Central high school of Minneapolis, Minn., Mr. Greaves entered the United States naval school of wireless telegraphy and later was chief electrician to Admiral Robert Evans, and for four years had charge of experimental work in wireless telegraphy at Harvard University. He has patented numerous electrical devices. The United States wireless station at Guantanamo, Cuba, was erected under his supervision and he was only recently advanced to his present post.

"More than 1,700 professional and 2,000 amateur operators," says Mr. Greaves, "have been examined and licensed under the new laws. Amateurs are subjected only to regulations to prevent interference with government and commercial radio service. The few arrests that have been made show that the new laws are regarded as reasonable and intended simply to insure order in the exchange of messages."

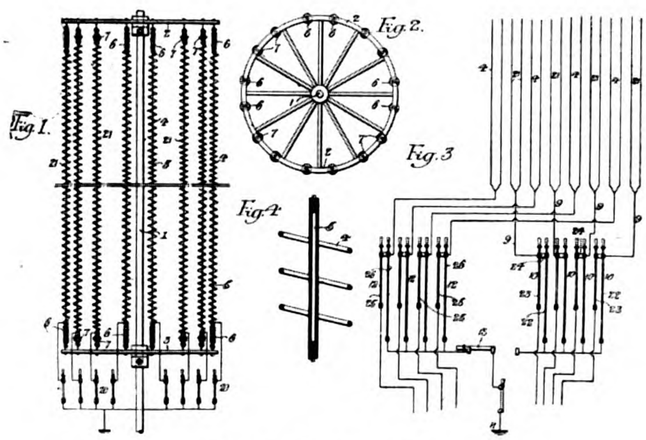
Mr. Greaves says the government soon will issue a directory of licensed operators, including amateurs, together with their call letters, addresses and other information, and the book will be similar in arrangement to that published at Berne, Switzerland, containing all wireless stations in the world.

Highest Amateur Tower in District

A pole, 112 feet high and fitted with scores of wires, has been put up at Vancouver, Wash., and will be used to receive wireless telegraph messages by two high school boys, Walter Cates and George Sturley. This is the highest wireless towner in Southwestern Washington.

The boys have had several smaller wireless stations and have become adept in receiving messages, many times from vessels on the Pacific.

Notable Patents



H. L. Falk's aerial.

Figure 1, is a side elevation of the preferred form of my aerial; Fig. 2, is a plan of the aerial shown in Fig. 1; Fig. 3, is a diagrammatic view illustrating the electrical connections of the various parts of the device, and Fig. 4, is an enlarged vertical section illustrating the detail construction of one of the receiving or transmitting elements of the aerial.

A patent covering a new form of aerial has been granted to Hilbert L. Falk, of New Orleans. The inventor gives the following description of his device:

One object of my invention is to provide a novel form of aerial which shall have its various parts so arranged as to permit of the efficient reception of the Hertzian or other electro-magnetic waves employed in wireless telegraph and of their transmission to the various instruments employed in detecting their presence; it being especially desired that the device shall be capable of properly performing its functions without transmitting the objectionable effects of static electritcy.

Another object of the invention is to provide an aerial by means of which it shall be possible to locate the direction from which a series of electro-magnetic waves are received, and at the same time, when used in connection with a suitable transmitting apparatus, of emitting trains or series of waves in definite predetermined directions to the exclusion of others.

I further desire to provide an aerial which shall be of simple, substantial, and relatively light construction, in combination with controlling switches whereby I am enabled to conveniently utilize the device.

In carrying out my invention, I provide a suitable supporting framework, which, in the present instance, consists of a wooden or other non-conducting pole 1, at the top of which at attached the hub of a wheel-like structure 2, while a second similar structure 3 is mounted on said pole at a suitable distance below the top thereof in a plane substantially parallel to that of the top element.

Extending between the circular rims of these top and bottom members of the frame are a number of helical coils 4 and 21 of bare wire through each of which an insulated wire 5 extends axially without being in electrical connection with the coil in which it is mounted. All of said inner wires are, however, connected to switches 20 whereby any of them may be grounded. Suitable high potential insulators 6 and 7 are mounted between each end of the various wire coils and the circular rims of the top and bottom members 2 and 3 of the frame, so that each of said coils is electrically insulated from all of the other coils, except that as shown in Figs. 1 and 2, the coils are arranged in pairs the individual members of which are connected.

For convenience of illustration I have shown certain of the coils are provided with long insulators 6 and others as provided with shorter insulators 7 and while the form or size of said insulators is actually immaterial so far as their performance under operative conditions is concerned, it may be noted that the coils 4 having the insulators 6 constitute the sending members of the aerial, being connected to the sending or transmitting apparatus; while the coils 21 having the insulators 7 are connected to the receiving instruments. For this purpose I extend conductors 9 from each pair of wires 21 to switches 10; there being in this instance four pairs of such receiving wires and hence four of the switches 10. By means of these latter it is possible to connect at will any one of the wires 9 and hence any pair of the wires 21 to the ground indicated at 11 or to one of the four lines leading to the receiving instruments. It is noted that each of the switches 10 includes two blades 22 and 23, of which the first is considerably longer than the other; both blades, however, engaging the jaws or clips of the contact block 24 connected to one of the aerial wires. The blade 23 is pivoted to a suitable supporting structure of insulating material considerably below the corresponding pivotal support and terminal of the blade 22 so that when it is in its open position all grounded parts of the switch are at a considerable distance from the said blade 22 and its associated parts. The pairs of wires indicated at 4 are similarly brought down to a set of switches indicated at 12 being connected to double jaw terminals of said switches, which like the switches 10, are provided with short blades 25 respectively connected to the transmitting instruments, and long blades 26. A double throw switch 13 may be provided whereby either of the sets of switch blades 22 or 26 may be connected to the ground at will.

Under operating conditions it is possible, and usually advisable, to ground any or all of the wires of the aerial except that particular pair or pairs which it is desired shall be employed to receive a message and it is to be noted that by so grounding said wires the wires in use are in effect shielded on all sides except for a certain segmental space in front of and extending outwardly from the aerial. By this means it is possible to reduce the effect of a relatively near or powerful station from interfering with or preventing the reception of messages by the apparatus connected to my improved aerial, since by grounding the various wires 4 and 21, except those on the side of the aerial from which the message is to be received, I avoid to a great extent the disturbance which would otherwise be caused. Similarly, by means of the arrangement of parts shown I am enabled to direct the trains of electro-magnetic waves by causing them to be emitted in a certain limited and definite direction to the exclusion of all other points of the compass, and for this purpose I ground all of those wires on that side of the aerial opposite the nearest the receiving station.

It is, of course, obvious that more than two wires may be employed in each of the sets connected to the various transmitting and receiving wires. However, by the system described the objectionable effects of static electricity are almost entirely avoided and by the arrangement of the switches shown, any danger of the current jumping from one part of the apparatus to another part which is grounded is likewise prevented.

In the event of there being heavy static discharges from the atmosphere as during electrical storms, I may ground any desired number of the elements of aerial while employing one or more of the other elements in connection with the instruments for receiving messages. I have found that by this means the objectionable effects of static electricity are reduced to a minimum.

The various interior wires 5 are particularly useful in leading to ground static discharges and especially in protecting the aerial and the instruments from lightning. If desired, said wires may be permanently grounded, although as there may be times when it is desirable for them to be insulated from the ground, I have provided the switches 20.

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.

L. C. B., Hackettstown, N. J., writes:

(1) My coil is 1-inch, ignition type, condenser 8 sq. in. window glass coated on both sides. Antenna is inverted L type, 120 feet long, 50 feet high, 4 strands and 100-foot lead-in. Ground wire 20 feet. My wave length is about 240 meters, and the inspector says it must be under 200. What is the best way to do it? What would be the size of a series condenser to lower wave length to 200?

Ans. You state that the flat top portion of your antenna is 120 feet long with the lead-in 100 feet long, making a total linear length of 220 feet. We should say off-hand from the dimensions you give, that your antenna wave length would be more than 240 meters, somewhere in the vicinity of 290 meters; however, if the inspector says it is 240, his calculations must be right. Inasmuch as it is more interesting to receive wireless signals than to send them we would suggest that you do not change the antenna but insert a series condenser for securing the 200 meter wave. This condenser should have a capacity of .0005 M.F., which you will observe is very small. Since it is impossible for you to arrive at the 200 meter adjustment by guesswork, we suggest that after you have inserted a condenser of this capacity have the government inspector call and make the necessary adjustments for you. You can consider this an answer to Questions Nos. 1 and 2.

(3) Would a helix improve the efficiency of set, and if so what would be proper dimensions?

Ans. With such a small coil we do not think a helix would increase the efficiency. The government laws require, however, that a helix be used as it produces an emitted wave of a lower decrement. The dimensions should be about 10 inches long with a 5½-inch diameter, and wound with turns of No. 10 insulated wire, the turns space 1 inch apart.

(4) What would be the approximate range?

Ans. About 8 miles.

(5) Does NAA send time signals at 10 p. m. on a shorter wave length than 3,800? I get him while tuning to about 900.

Ans. NAA sends time signals at 10 p. m. on a wave length of 2,500 meters. It is possible that you use very tight coupling in receiving, and it may appear that you may hear his signals or what is apparently 900 meter adjustment, but please remember that when you tighten the coupling you also increase the effective wave length of your receiving set.

* * *

Harry Hong Sing, Chicago, is evidently a progressive member of his race. He asks:

(1) What is my sending wave length; aerial proper, 4 wires, 2 feet apart, 70 feet long, 100 feet high, lead in 50 ft., helix, ½ k. w. transformer coil, rotary gap and a 17 plate condenser, plates 8 x 10 with 5 x 7 tin-series multiple?

Ans. Please remember that all wave length calculations of antennae from linear dimensions are only approximations. The natural wave length of your antenna is in the vicinity of 287 meters.

You do not give the dimensions of your helix, which, by the way, may be 6 feet in length or 18 feet; but assuming that it is a normal size helix it will add about 100 meters to the open circuit, making it 387 meters. If you had given the frequency and voltage of your transformer and the thickness of the glass plates in the condenser, we could have advised you whether your capacity was correct, and further, if the wave length produced thereby in the closed circuit is sufficient to bring it in resonance with the helix and antenna. Inquiries of this kind should be more specific.

(2) Why is it I hear the commercial stations loudest with my sliders at positions indicated on separate sheet, almost at extreme ends? I have never heard any amateur stations yet.

Ans. We cannot answer this question definitely. We would have to know all about the tuning coil, its inductance in centimeters and capacity and natural wave length of the antenna. It occurs to us that your tuning coil is so small, or has inductance of such small value, that you are unable to tune to 600 meters (the standard wave length of the commercial stations) without using the entire coil.

(3) When I move slider "A" why does it not make any difference to the incoming signals?

Ans. We are sure we do not know. It certainly should make a difference provided all the circuits in your instruments are properly connected up.

(4) What would be my receiving wave length with antenna and lead in same as above, one three slide tuning coil, fixed condenser, and 2,000 ohm phones? The tuner is wound with No. 20 enameled wire for a distance of 10 inches. I use a galena detector.

Ans. With a tuning coil 12 inches in length (you do not, however, state the diameter) wound with No. 20 enameled wire, you should be able to receive wave lengths up to 2,000 meters.

(5) Why is it I hear my buzzer with my detector in and out of adjustment while the buzzer is not connected to my set in any way whatever? How can I remedy it?

Ans. Looking over your diagram on page 4 of your inquiry, we are satisfied as to the cause of the inductive effects in your headphones. When the buzzer circuit is closed fluctuations of direct current take place in the power line leading to the buzzer. These fluctuations cause rising and falling magnetic lines of force which in turn give rise to inductive effects in the receiving circuits. Since these currents are of the same frequency as the interruptions of the buzzer, which by the way are not very rapid, your headphones will readily respond regardless of the adjustment of the crystal detector. We would suggest that you discontinue operating the buzzer from the power line, supplying current to it from two or three dry cells.

* * *

H. M. R., Auburndale, Mass., writes:

(1) Where can I purchase a good reliable book upon the life of Mr. Marconi and his labors?

Ans. We do not know of any such publication, but the Year Book of Wireless Telegraphy and Telephony, which may be secured through the Marconigraph, has valuable information regarding his early experiments and work in radio telegraphy. This is the only authentic information in book form which we know of.

(2) Have I the correct formula for finding the capacity of a sending condenser?

$$C = \frac{2248 \text{ Ka}}{D \times 10^{10}}$$

Ans. Your formula for finding the capacity of a sending condenser is correct but your explanation is not.

$$C \text{ (in microfarads)} = \frac{2248 \times K \times A}{D \times 10^{10}}$$

where C = capacity in microfarads
K = the dielectric constant (which varies with various dielectrics).
A = the actual area in square inches of the overlapped surface of the dielectric; that is to say, if one surface were 8 inches square and the other one 6 inches square the smaller surface would be used in the calculation and the effective

condenser area would be the 36 square inches of the smaller plate and 36 inches of the larger one.

D = the average thickness in inches of the dielectric.

(3) I am about to construct an oscillation transformer of brass ribbon ½ inch in width. It is to be used in connection with a 1 inch spark coil. How many turns should I have on the primary and secondary if they are 6½ inches and 5 inches in diameter respectively?

Ans. No special advantage will be obtained by winding a small transformer with a brass strip although it does give better conductivity than the size of wire used by the average experimenter. If the primary is 6½ inches in diameter we would suggest that you wind ten turns of this strip, each turn separated from its neighbor by about half an inch.

* * *

L. H., Hayward, Cal., expostulates and then inquires:

(1) I have an aerial 65 feet long, 6 wires, aerial lead 25 feet, ground lead connected to water pipe, and is 8 feet long. Will this aerial come within the law for sending purposes, and what is its natural wave length? It is 50 feet high.

Ans. The natural wave length of your antenna is approximately 160 meters.

(2) How can I give a simple test to tell if my aerial is grounded outside of my station?

Ans. The best method of locating a grounded antenna is to connect in series with it a spark gap in turn connected to the secondary of an induction coil. If there is any leakage in the antenna you will not secure a spark gap, as the current from the secondary of the transformer will pass through the leak making a complete circuit through the earth.

(3) Which is the best for sending purposes? An aerial with 6 wires 80 feet long, 50 feet high, or a 4 wire aerial 65 feet long, 50 feet high?

Ans. The longer antenna would carry the best, provided proper resonance is secured.

(4) What distance would I be able to receive using one aerial 85 feet, 6 wires 50 feet high and one aerial 65 feet, 4 wires 50 feet, connected together using a Murdock loose coupler, very sensitive galena and silicon detectors, Murdock fixed condenser, and 200 ohm Brandes phones? My station is situated on a hill 150 feet high and my aerials are higher than any other objects within 1,000 feet. Give night and day range.

Ans. Your location seems to be good and as Hayward, Cal., is situated near the ocean you should be able to receive 1,000 miles at night with your aerial.

(5) How far would a 2 inch spark coil send with the smallest aerial described in the above question?

Ans. If your earth connection is good you should be able to send 10 to 20 miles with a 2 inch coil, assuming that the local conditions are agreeable to wireless transmission.

* * *

H. B. L., Kingston, N. Y., gives us a very long description, too long to print in full. He states that he has a first-class receiving set and fair antenna, a very sensitive detector and is only able to hear 400 miles. He would like to know if we have any suggestions to make.

Ans. Inasmuch as you have not shown us a hook-up of your receiving set we cannot make any suggestions as to reconnections, etc. We have observed the map and find that Kingston is considerably up New York State and is shielded by mountains. Your receiving outfit is doing very well under the conditions, and you are to be congratulated. As a matter of fact, it could easily be imagined that you would not be able to do that distance. You must remember that in our zone of the world you are only able to do long distances during the night, and from the latter part of April to the 20th of September you should not expect long distance receiving. During the remainder of the year you may be able to hear stations as far as 2,000 miles.