THE MARCONIGRAPH

An Illustrated Monthly Magazine of WIRELESS TELEGRAPHY

EDITED BY J. ANDREW WHITE

Volume I. AUGUST, 1913 No. 11

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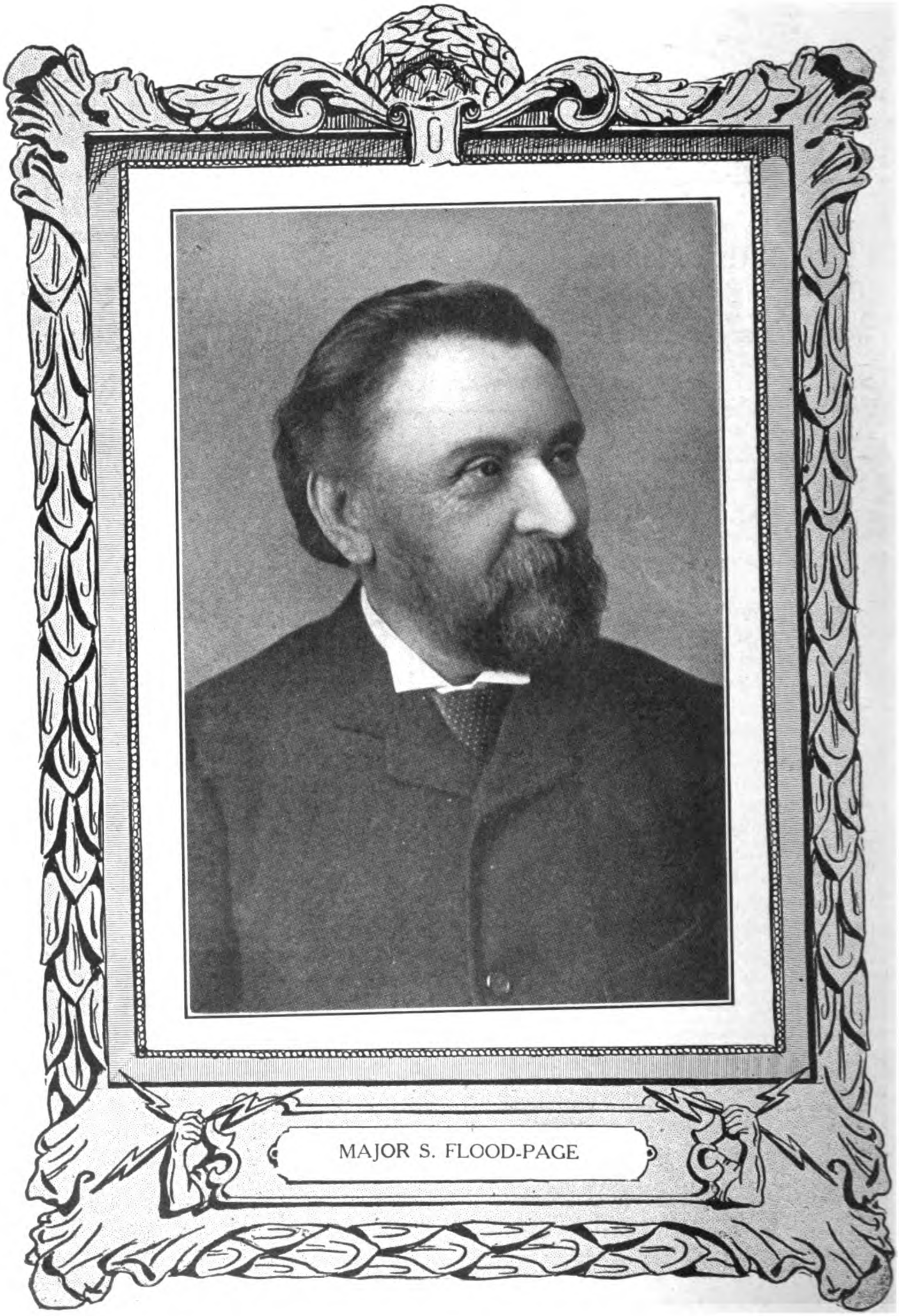

MAJOR S. FLOOD-PAGE

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Vol. I. August, 1913 No. 11

MAJOR FLOOD-PAGE, who first brought the incandescent electric light into use in Australia, is a director of the American Marconi Company. It is wholly characteristic of him to be a part of the beginning of new enterprises. This is not, however, from the mere delight in novelty that makes a child pick up a new toy, or the ordinary man stare up at an aeroplane. The Major is interested in new things because he realizes the need for them in a growing world. He does not drop them when the first enthusiasm wears off. In fact, with him it does not wear off. He pushes on to results and then to more results.

William James pointed out, not long before his death, the undeveloped possibilities of the soldier-spirit, applied to the uses of peace. The price of progress is always a fight—not with men so much as with hard conditions. Many of the leaders in commercial and professional life learned how to organize victory in the army. Major Flood-Page is one of these. He inherited the martial spirit from his maternal grandfather, the Colonel Shaw who was wounded in the battle of Quebec, in the eighteenth century. About a hundred years later, in 1855, the young Samuel was gazetted to the Second Madras European Light Infantry. He became first adjutant of the Queen's Own Edinburgh Rifle Brigade and was later made adjutant of the London Scottish. In these commissions he developed and exercised the same power of judging and directing men that makes for success in great business enterprises. For forty years he served on the council of the National Rifle Association, of which he was the first executive officer; he is now a vice-president.

The pioneering days of the use of electricity for lighting found Major Flood-Page at the Crystal Palace, one of the great centres of activity in London. No American traveler would have thought his visit to England complete without a sight of it. In 1882 the Major had become general manager.

He associated himself with Joseph W. Swan, who later attained Knighthood. A company was formed to manufacture and promote the sale of the "glow-lamp," as it was called, similar to Edison's incandescent light. The task of introducing this invention into Australasia was put in the hands of Major Flood-Page—and before he was done, that part of the world was thoroughly enlightened. He was made secretary and general manager of the Edison and Swan United Electric Light Company, Limited.

For many years the Major has been a member of the Council of London's Chamber of Commerce, where he is a leader in every movement that has to do with the applications of electricity. He became associated with the English Marconi Company in 1899 and is still a director.

Hotels and Homes at High Power Stations

PROVISIONS NOW BEING MADE FOR THE COMFORT OF THE MEN IN THE FIELD.

THE three high-powered stations for the Marconi trans-ocean scheme, which are now under construction, are located on the Island of Oahu, Hawaii, and in California and New Jersey, respectively. Each of these developments consists of a generating station and a receiving station; the generating and receiving stations being separated by a distance of twenty-five to fifty miles. All the stations are somewhat distant from a populated or built up district, so it is necessary to provide residences and living quarters for all the operators and employees, as well as the power buildings, aerials, and other equipment that will be required in the commercial operation of the wireless service. This description is intended to cover the construction of the buildings only; no mention will be made of the aerials or apparatus pertaining to wireless telegraphy.

At each generating station the group of buildings will include a power house, auxiliary operating building, hotel to accommodate about twelve men, and one or two residences for the chief engineer and assistant chief engineer.

At each of the receiving stations the group of buildings includes an operating building, a hotel for thirty-three operators, one or two residences for the chief operator and his assistant chief operator, and a lighting plant or light and heat plant, as may be required.

The design of the buildings has been controlled by a fundamental consideration of providing a permanent type of construction and minimum charges for maintenance. Fireproof buildings have therefore been designed and are being constructed throughout with materials and arrangements varied somewhat to meet the different conditions that arise through geographical location.

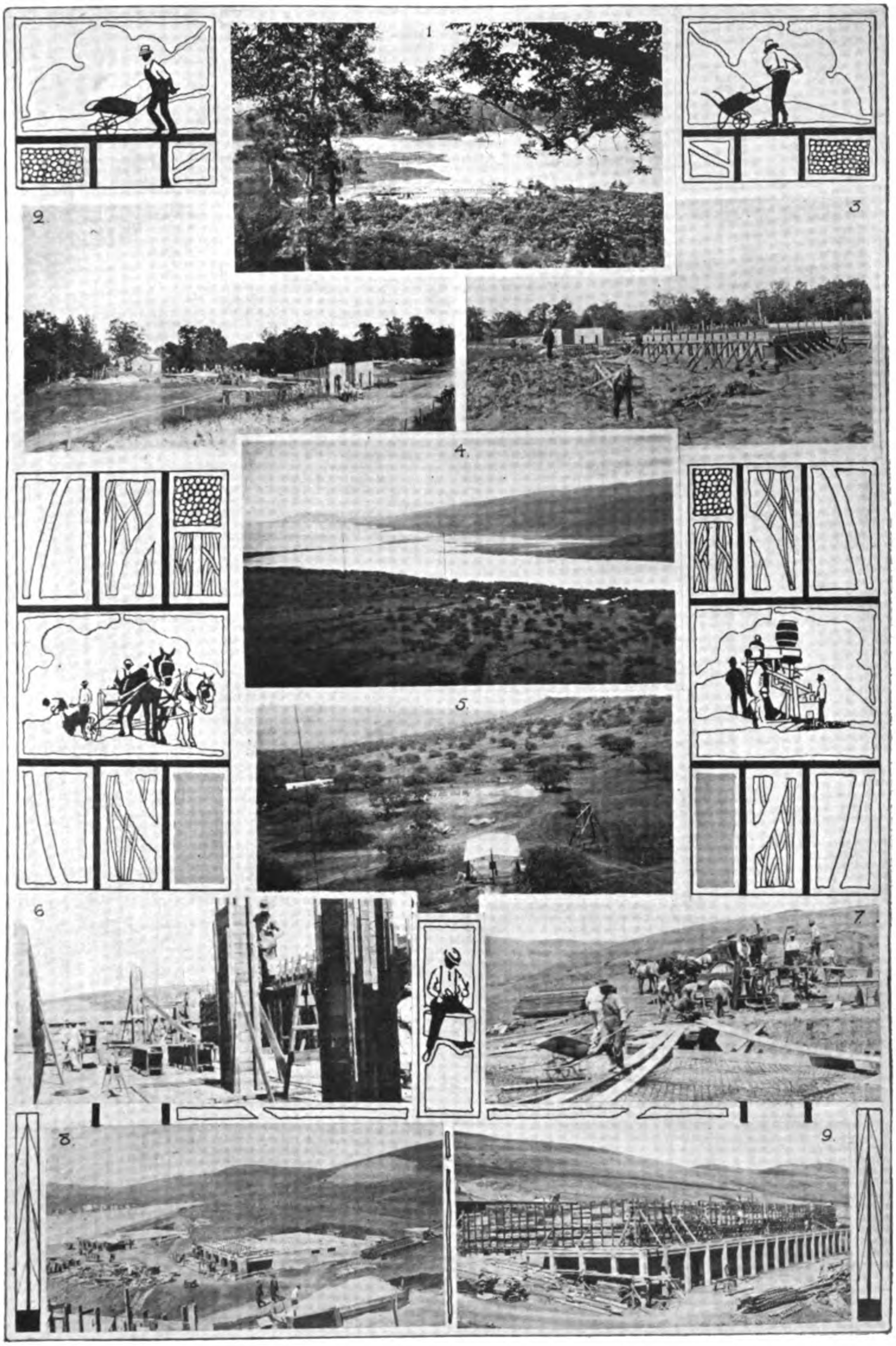
The buildings for the Honolulu and California developments are to be of concrete construction with solid concrete walls and reinforced concrete floors. The roofs are to be supported by structural steel on which will be placed red vitrified roofing tile. The buildings for the New Jersey development will have exterior walls of brick and red tile roofs. All interior partitions will be plastered on metal lath with steel studding or terra cotta partition tile, so that the only woodwork in the buildings will be found in the windows, doors, interior trim and the wood flooring which is to be laid directly on the reinforced concrete supporting floor.

The residences are of the bungalow type with five rooms and bathroom, including dining room, kitchen two chambers and bath room.

The hotels for operators at the receiving stations, on the basis of thirty-five operators, will provide a room for each man; about one-third of the rooms will be of larger size than the others, and will have private bath rooms attached. Billiard rooms, card rooms, reading and writing rooms are also provided for in these hotels.

The hotels for eleven men at the generating stations will provide similar accommodations. A refrigerating plant, cold storage room and refrigerators are to be installed in each hotel. In addition to refrigeration, these plants will be arranged to manufacture ice for domestic purposes.

The operating buildings will contain the business offices for the receiving stations, including the general office, private offices, receiving rooms, instrument rooms, etc.



1.—*Foundations of operating house at Belmar, seen from the bluff.* 2.—*Two of the engineers' cottages in course of erection at Belmar.* 3.—*One corner of the foundations of the hotel at Belmar site.* 4.—*General view of buildings at Koko Head.* 5.—*Foundations for operating building at Koko Head.* 6.—*Erecting first story of hotel at San Francisco.* 7.—*Pouring floor for operating building.* 8.—*Foundations for chief and assistant engineers' cottages.* 9.—*Exterior of hotel as it looks now.*

On account of the isolated locations, complete water supply and sewer systems are necessary, and will be provided. At the receiving station in the Hawaiian Islands the water will be obtained from a well yielding a supply which has been found to carry a small percentage of salt. This water is entirely satisfactory for general purposes, but is not potable and it has been found necessary to install distilling apparatus to provide a sufficient quantity of water for drinking purposes.

Complete and modern plumbing systems are to be installed in all buildings, and the sewer system will take care of all drainage, either by means of a sewage disposal plant or by conducting the drainage to a suitable point of natural disposition where available.

Electric lighting will be provided throughout all buildings.

These facilities make it apparent that each station will be an independent community, for which will be provided every convenience to be found in any city or suburban residential district. These features, together with the location of some of the stations directly on the shore of the ocean or bay, as the case may be, will contribute to make comfortable and attractive dwelling places and insure pleasant living conditions for the employees at the various stations.

Rapid progress is being made with the construction work, which is under the direction of J. G. White Engineering Corporation, as engineers and contractors for the American Marconi Company.

Alaska Talks With Russia

Late dispatches from Nome, Alaska, prove that direct wireless communication between America and Asia is now an accomplished fact, the United States Army Signal Corps Station having been in nightly communication with the Russian station at Anadyr, Siberia, 500 miles west of Nome.

The Russian government operates a chain of four stations between Anadyr and Vladivostok, and for the last six months the Signal Corps operators at Nome, under orders from Washington, have been trying to establish communication with the Russian stations. Washington officials say that a diplomatic agreement will be necessary before the Nome station can co-operate with Russia for the commercial use of the government station in Alaska. While it is expected that a satisfactory agreement will be reached, it is pointed out that the problem is a delicate one, involving the question of the United States granting to Russia a concession placing that Government in the field as a competitor with American companies.

Relayed Message Finds Man at Sea

George Geza, a lawyer's clerk, accused of embezzling $25,000 in Vienna, was arrested recently, in Philadelphia, upon the arrival of the Breslau, from Bremen. He will have a hearing at the immigration station, at Gloucester, when the Austrian consul receives the necessary papers from his government.

When it was learned that Geza had sailed from Bremen, the German police officials sent a wireless to Captain Mietzloff, of the Breslau, describing Geza and asking if the man were on board. They were unable to reach the Breslau, which was a week out, and the message was relayed to the Eiffel Tower at Paris, whence it was flashed to the Breslau. Word was sent back to Vienna that the man they suspected was on board. A cablegram was sent to the consul here to detain Geza. The man denied the charges.

Death of Naval Operator

An electrician employed at the Arlington government station, O. L. Clark, died in July as the result of injuries received when he fell against the spark gap disc, making 1,250 revolutions a minute.

Clark was alone in the room. The power had just been closed down but there was enough current from the disc to inflict fatal injuries. The operator was a man of several years' experience, and a valued employee.

New Magazine in October

BEGINNING with the October number, the name of this magazine will be changed from The Marconigraph to The Wireless Age and its size increased to ninety-six pages. Many new features will be added during the fall and winter. Among these will be a series of stories in which great narrative interest will be combined with a good deal of information drawn from our special field. The special aim of our fiction will be to give the technical details accurately and still keep these facts from getting in the way of the spinning of the yarn.

It goes without saying—but maybe it will go a little farther if we do say it—that The Wireless Age will have the best technical material that can be obtained. Arrangements are now being made for single articles and several series of articles that will be eagerly read and studied by thousands of amateurs and commercial men. Our next issue will contain more definite announcements concerning this material. It might be said in passing, however, that most of it will be of such permanent value that it will be issued in book form after its appearance in the magazine. The authors are men whose work is increasingly in demand. They join to a wide practical knowledge of their subjects the distinctive and none too common faculty of imparting knowledge. They are born teachers. In consequence, the educational matter given in the magazine will be equivalent to expensive courses in the best technical schools.

News of radio activities throughout the world will continue to be a feature. More attention than ever will be paid to this field. An increase in the editorial staff and the employment of outside writers will make possible the most full and interesting presentation of the current facts in the history of wireless development.

Good pictures will be a feature of the new magazine, which will have an original cover design as attractive as it is expressive of the title. Headings and illustrations will be furnished by competent artists and the photographs will, in themselves, give a graphic presentation of progress.

The change of name is in harmony with the broad purpose of the magazine. Genuine achievement will be chronicled impartially, no matter where it may be found, the one test being that of utility and interest to the whole public. It would be impossible, and undesirable if it were possible, to record all the experiments that are being or that will be made. It is well known that serious workers are very cautious in giving out statements as to what they have accomplished, and it is often extremely difficult to secure from them facts that are legitimate news, which the public is eager to get. We shall welcome help from our readers in securing the best material. Letters of inquiry or of suggestion, too, are always helpful in the preparation of a magazine.

The advance in price to fifteen cents a copy, a dollar and a half a year, will not begin to cover, proportionately, the added value that will be found in the magazine. Our present subscribers will, of course, until their subscriptions expire, receive the added value without any extra cost. *And every subscriber now on our books who sends us one dollar on or before September fifteenth will be entered for a full year's subscription to the new magazine.*

Let no faithful reader of The Marconigraph think that any good element will be discarded, simply because of the change in name and size. Every live magazine is a development. It is more like a tree than a house, and nobody but a fool would try to make it bear fresh fruit by chopping down the old trunk. So all our present popular features will be retained and an immeasurable amount of new material added—features which will more than justify the slight increase in price.

The New Imperial Contract

ON July 16th the House of Commons again discussed the new contract with the English Marconi Company for the Imperial chain of wireless stations.

Walter Guinness, proprietor of the Outlook, professed disappointment at the answers given by Postmaster General Samuel regarding the new Marconi contract and moved an adjournment of the House to discuss "the refusal of the postmaster general to allow any other company besides the Marconi to make tenders for the erection of the Imperial wireless chain." Mr. Guinness maintained that the Goldschmidt and Poulsen systems should have an opportunity of making tenders.

Mr. Samuel said that while recognizing the fact that the Poulsen and Goldschmidt systems were genuine and promising, there was a vast difference between promising experiments and proved capacity. An expert committee had advised him two years ago that the Marconi was the only company capable of doing the required work. The situation in this respect had not changed. Mr. Samuel quoted the opinions of scientific experts who concurred in saying that no good purpose could be served by inviting tenders from the Goldschmidt and Poulsen syndicates at the present time.

MR. SAMUEL'S STATEMENT

On the motion for the adjournment Mr. Samuel made his promised statement with regard to the steps the British Government proposed to take in order to secure the erection of the stations. The changes in the contract may be summarized thus:

The royalty should be payable for each station separately, and if Marconi patents are used in some and not in others it is to be clear that the royalty should be payable not in respect of the receipts of the Imperial chain, but only in respect of the receipts of the stations where the patents are used.

While the contract should be for six stations as originally arranged, located in England, Egypt, East Africa, South Africa, India and the Malay Peninsula, the government, should at any time before the completion of the stations in South Africa, India and the Malay Peninsula or any of these three, have the option of calling upon the Marconi Company to cease work upon them should it be desired to install other apparatus. It was provided, however,

(a) that the company should be reimbursed for any actual expenditure they had incurred and

(b) that if the postmaster general desired to install some other system, he should not give preference to any other contractor if the Marconi Company could show to his satisfaction that they were able to provide that alternative system with equal efficiency and economy.

HIGH SPEED OF TRANSMISSION

It was made clear that the stations during the course of their erection and during the trial period provided for in the contract were to be available for government experiments, provided that their normal working would not be impaired.

The company had previously guaranteed a speed of transmission of fifty words a minute by automatic apparatus, except during periods of exceptional electrical disturbances in the atmosphere, and a speed of twenty words a minute by hand signalling at all times. Mr. Samuels stated that they are now in a position to guarantee a speed of automatic working of seventy-five words a minute.

It had been urged in discussion of the contract that such parts of the stations as engines and dynamos, which are not peculiar to the Marconi system, ought to have been obtained by competitive tender and had this been done the price of the stations would have been less. It was shown to be the case, however, that the Marconi Company had invited competitive tenders for such portions of the plant and the price they quoted for the stations was based upon the result of that competition. And that they had now agreed that the list of sub-contractors who had tendered estimates should be submitted to the postmaster general and that the selected sub-contractor should be approved by him.

Attention was called to Clause 11 of the original contract which provided that if the government desired to install in any of the stations erected by the Marconi Company apparatus in addition to or in substitution for others, they should "seek, but should not be bound to act upon, the advice of the company." It has been suggested that this might enable them to obtain information of inventions of their competitors which those competitors would otherwise desire to keep secret. The postmaster general, on the other hand, has stated that it was never intended, nor did the terms of the contract require, that any such secrets should be communicated to the company, and that what was actually proposed was that the nature of these inventions should be communicated to the company in general terms. It is now agreed, however, that the provision in Clause 11 should be omitted.

RIGHT OF INSPECTION

In Clause 18 of the original contract it was provided if any new stations were erected by or for the government, and not by the Marconi Company, that where the company "had reason to suspect infringement of their patents," they should have the right of inspection to ascertain whether or not such infringement had taken place in fact. This provision had been subjected to criticism on similar grounds. The company, in view of their experience with many infringements of their patents in various countries and in view of the costly litigation in which they have frequently been engaged, were unwilling to agree to the omission of this clause. So it was arranged that the provision in the new contract shall run: "If they satisfy the postmaster general that they have reason to suspect," that their patents are being infringed they shall have the right to nominate, with the concurrence of the postmaster general, an independent engineer of high standing to make the inspection.

There are also a number of minor drafting amendments embodied in the new form of contract.

OLD CONTRACT OF NO FORCE

The postmaster general in a public statement said that after the repudiation of the contract by the Marconi Company, the government did not propose to take steps to enforce its performance, and they were advised that they were not likely to recover damages in any amount worth suing for in view of the fact that the Marconi Company had repudiated the contract on account of the long delay which had taken place since it had been signed. The government had therefore no option but to acquiesce in the repudiation of the contract. They had to consider what was best to be done in order to secure the erection of these stations, which are as necessary now in the opinion of the government as they were a year ago. The government did not care to ask Parliament to take the risk of inviting open tenders for the erection of these stations, in view of the fact that they had been advised that there was no firm which would enter competition with the Marconi Company that could be relied upon to erect stations of a thoroughly satisfactory character. The report of the Advisory Committee confirmed the view, declaring that the Marconi was at present the only system of which it could be said with any certainty that it was capable of fulfilling the requirements of the Imperial chain. They had considered again whether the erection of stations on that system could be done by a staff of government engineers using patents of the Marconi Company under the Patents Act, or whether they should endeavor to arrange a new agreement with the Marconi Company. It was clear that the Post Office itself was not in a position to undertake the erection of these stations, because they had no staff which could by any possibility accomplish the work. The Board of Admiralty had been again consulted and a letter received from them on June 7 to the effect that they were unwilling and unable, without serious interference with their own work, to undertake the erection or working of the chain; for the staff of the Admiralty was fully employed and could not be diverted without serious detriment to their own work.

MARCONI ALONE HAS EXPERIENCE

The only remaining alternative to a contract with the Marconi Company was the selection of a new staff by the government and the employment of some engineer of distinction who would supervise the erection of these stations That was a possible course, but was a course which was attended by many disadvantages.

In the first place, for instance, there was, Mr. Samuels had been advised, no one in the country outside the Admiralty and the Marconi Company who had any actual experience either in the erection or the working of long range wireless stations, not even the members of the Advisory Committee themselves. If an engineer without that experience was chosen he would have to collect a staff as best he could, new designs would have to be prepared and he and his staff would have to gain experience in a most difficult undertaking as they went along.

He next dealt with costs under the Patents Acts, and considered the probability that the Marconi Company would be unwilling to supply the apparatus necessary to work the stations and that steps would have to be taken to manufacture the apparatus specially; and here it was to be noted that the history of wireless was strewn with so many failures and disappointments that the government would be indeed taking an immense risk if they were to proceed along the lines just described. Further, it was likely that the estimated cost which was now before them would be exceeded, and it must not be thought that by the use of the Patent Acts the Government would be free from payment of royalty to the Marconi Company. That was not so. Should the powers of the Crown to use the Patent Acts without an agreement with the patentee be exercised, the patentee would have to receive royalty payments as fixed by the Treasury, and the Treasury would obtain the opinion of some commissioner. The government were of the opinion that to adopt this course would involve very considerable delay when compared with the erection of the stations by the Marconi Company, who had the designs ready, the engineers available, and who could start the work immediately. Three years ago the sub-committee of imperial defense reported that on strategic grounds it was a matter of real urgency and should be taken in hand at once; the select committee who had considered the question in January last reported unanimously that it was a matter of urgency that the Imperial stations should be established. In view of the importance of the matter strategically, the government was loath to incur the risk of a long delay involved by the selection of a special staff. These disadvantages it was felt might have to be incurred if the government did not succeed in getting the Marconi Company to agree on reasonable conditions. Therefore, as the representative of the government, he had undertaken to ascertain on what terms the Marconi Company would enter into a new contract.

ALLOWANCE FOR DELAY

Mr. Samuel then made it clear that the new contract provided for the erection of the stations only, as did the old contract, and that these stations would afterwards become the property of the governments concerned, who would work them by their own staffs.

The company on being approached had asked as a condition that allowance should be made for the increase of the price of material since last July, the date of the previous contract, as they said the price of materials had since gone up. They proposed that whatever should be ascertained by agreement or arbitration to be the actual increase should be added to the purchase price, but if there had been no increase in the cost of materials, the price would be the same. As a result of the company's investigation, the additional cost due to loss of time would be about £6,000 (about $30,000) per station, though it was hoped it might be reduced to smaller proportions.

DECISION AT END OF MONTH

The company asked also, in view of the expense to which they had been put by keeping the staff of engineers twelve months, they should be paid £4,000 (about $20,000); and as money rates were now higher, they wished to change the original financial provisions by which they got nothing until the stations were completed and substitute an arrangement allowing them 30 per cent when the contract was signed, 30 per cent on delivery of the materials, 30 per cent on the completion of the work, and the remaining 10 per cent after everything had been proved to full satisfaction. Mr. Samuels reported that he had resisted this demand and the company had given way. In regard to the method of payment he advocated that nothing should be paid until the stations had been erected and approved, but as the company will be out-of-pocket for many months while the stations are being erected, he proposed to pay 30 per cent of the purchase money on the day of the contract, 30 per cent nine months afterwards, and 30 per cent on the completion of the work, and the remaining 10 per cent after the stations had been tried and the final settlement made.

The company required that the contract should not be binding on them after August 31. Mr. Samuel thought that under the circumstances, the House would agree that this was a very reasonable proposal. The company would guarantee land working under all conditions but in the present stage of wireless telegraphy it would not guarantee automatic working at high speed during temporary periods in which the atmosphere was affected by serious electrical disturbances.

The company adhered to its demand for 10 per cent royalty on the gross receipts, and said rather than make any abatement in this respect they would prefer to have no contract.

The postmaster general suggested that the House allow him to prepare a statement on the subject which would be circulated and read by those interested in the matter. Mr. Bonar Law asked if there would be an opportunity for some discussion and Mr. Samuel replied "Of course, there will be an opportunity before the contract is made for the House to consider it. I have merely made a statement, which I thought the House was anxious to hear, as to the steps which have already been taken by the government.

Government Cruiser on a Test Voyage

The scout cruiser Salem has been detached from the United States Atlantic reserve fleet, and has sailed on a voyage across the Atlantic to undertake the most extensive wireless experiments ever carried on by the Navy Department. The purpose of the voyage is to test to the limit of its capacity, if possible, the government's new high power station at Arlington, Va. An attempt will be made to keep the Salem in communication with the Arlington station practically all the time, both day and night, while she is steaming across the Atlantic. Those who designed the station did so with the idea in mind that when operating at its highest efficiency it would be able to communicate direct with London, Berlin, Paris and other European cities, and also that it would be able to establish direct communication with the great station the government is to erect on the Isthmus of Panama. Likewise, it is believed that eventually the station will be able to establish communication with any warship in the navy, using relays when the ship is at a distance of more than three thousand miles from the station.

— by R. I. Young —

SOME folks think sending messages through the air is so new that there are no "old-timers" among the operators. They simply don't know Joe Sanderson. Joe can take yesterday's newspaper and make it over into reminiscences with all the flavor of another century. When he's been on a job a week he can give you more details than his boss about the "first time" this or the other thing was done in the history of that particular business. I haven't a doubt that before he was three, Joe had all the small fry on the block sitting beside him along the curbstone, telling 'em memories of his babyhood.

Anyhow he could always be sure of an audience. It wasn't so much the story as the feeling of confidence the narrator always imparted in the historic value of what he had to tell. Whenever there was a dinner he had to respond to the same toast. The titles on the program were different, but the subject was always the same: Pioneers of Wireless, Early Days, Memories of an Operator—what did it matter?

The occasion was a spread given to the latest young steamship hero-operator. He was a modest fellow and the palaver over his saving a thousand lives had got on his nerves. The wise toastmaster noted this and appealed to Joe to start a diversion.

"We have heard a great deal about danger to the passenger," he began, "but the man at the key has his share of terrors to be endured. We have with us, gentlemen, one who knows all the comedy and tragedy of wireless, its romance and its hard reality."

He bowed gravely toward Joe, who rose to his feet and waited till there was an impressive silence. All the older operators in the service were there. Some of them indulged in a smile-up-the-sleeve at Sanderson's yarns. But they liked to hear them, and they took good care that the young chaps gave due reverence to the words of the pioneer. The lights were turned low. The situation was tuned for a tale of the sea. And this is the story:

"The steamer Kantilles left New York, March 2nd, 1909, just before the terrible storm broke over the Eastern seaboard. She had passed Hatteras when suddenly the wind started to blow with hurricane force. The mountainous seas running at the time somewhat impeded the progress of the steamer. After several hours of buffeting, the Kantilles ran into so dense a fog, that she was compelled to run at greatly reduced speed. All was going well until the skipper noticed that she had veered slightly off her course. In attempting to remedy the fault, he brought the boat directly onto a reef off Sand Key, Florida. She gave one great leap and was ashore.

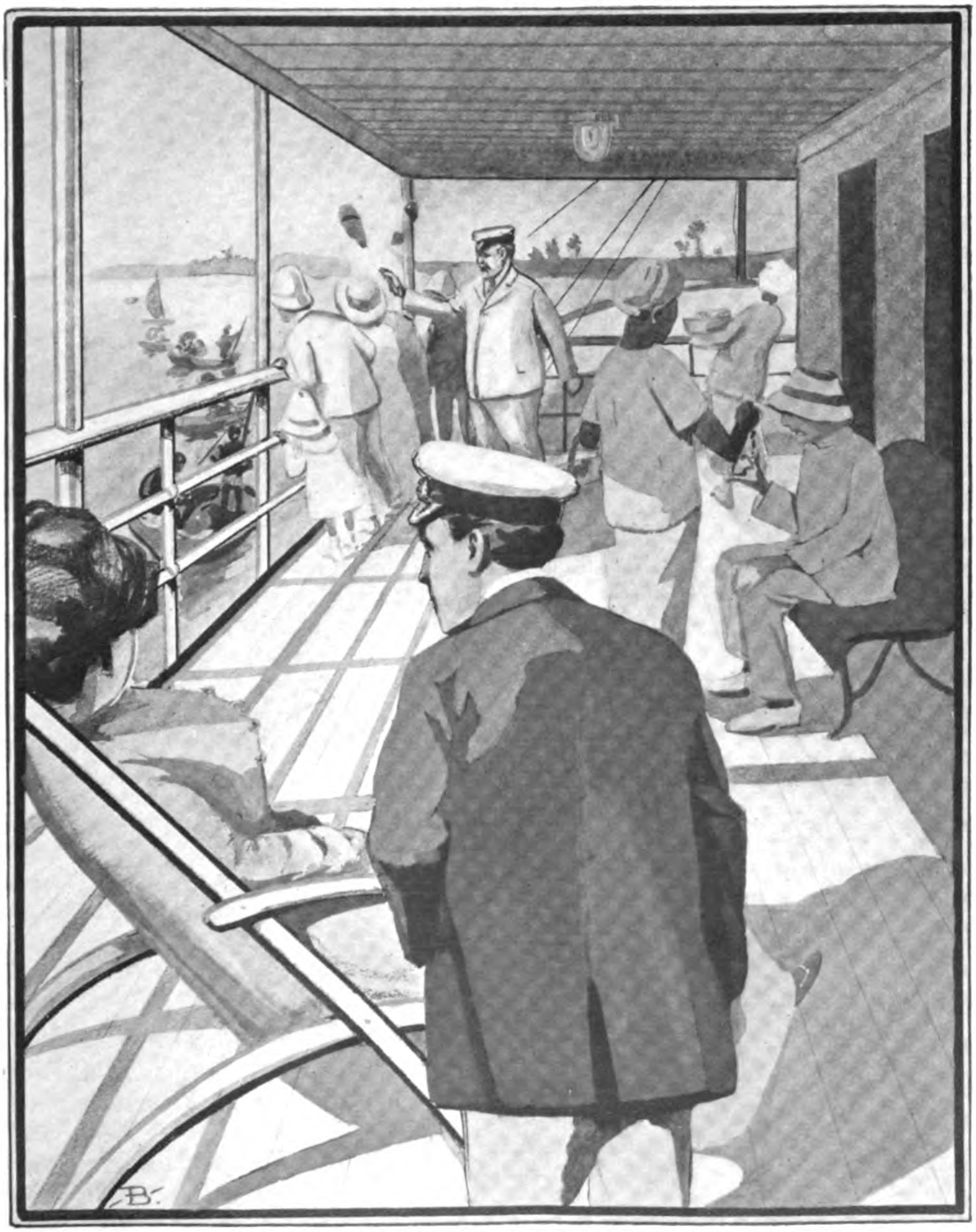
"Just at this time the fog lifted and Captain Opp hailed the Croteus, which was passing at the moment. She stood by until all the passengers had been transferred. Then the captain proceeded to give orders to lighten the ship, preparatory to having her pulied off into deep water.

"When a ship anchors in or is stranded near a port of any tropical or semi-tropical country, the surrounding waters are quickly congested with the small craft of enterprising merchants. On seeing the Kantilles in distress, some twenty or thirty boats swarmed out to offer aid. They inquired if they could be of any help and the captain, in order to rid himself of the swarthy fellows, shouted that he had a crew of three hundred men, and needed no more.

"It was this remark which caused

Wireless Operator Welbarn to sit up and take notice. He knew that the Kantilles never carried more than a crew of eighty, and consequently he asked the purser why Captain Opp had misrepresented the number of men he had on board.

"The purser, Mr. Wingerely, knowing that it was Welbarn's first trip to sea, and wishing to have a little sport with him, replied, 'Those fellows are pirates and are waiting for a chance to scuttle the ship. If they once get aboard, there is no telling what may happen. The best you can hope for is a two-mile swim. I would advise that



The captain, in order to rid himself of the swarthy fellows, shouted that he had a crew of three hundred men and needed no more.

you arm yourself.' So saying, he deftly displayed a Colt's .45 and a huge butcher knife. Welbarn was considerably agitated, having swallowed the story without a grain of salt, and demanded to know where he could obtain weapons. Mr. Dappleby, the mate, said that arms and ammunition would be given out at sundown.

"When seven o'clock came, Welbarn again appealed to the mate for protection. He said that the last revolver had been given out and that the best thing Welbarn could do would be to shut himself up in his room. In the meantime, Wingerely had concocted a scheme whereby Welbarn was to be made to think that pirates had really boarded the ship. Under his guidance, a steward was made up to resemble a fierce buccaneer.

"At eight bells the purser made a grand dash past Welbarn's door, closely pursued by the pseudo pirate. The latter made a lunge at Welbarn, but he was too quick for him and slammed the door in his face.

"Now you may believe me that Welbarn was in a genuine panic—so much so that he immediately started to send out a 'CQD' call for assistance. The steamer Comeole was the first to answer and asked what the trouble was. 'Trouble enough! We are attacked by pirates. Send us a cruiser or all is lost.' That is as far as he ever got with his instructions, for at that moment there was an ominous knocking overhead. Looking up, Welbarn saw a strange figure fearsome enough to raise the hair of an iron dog. A black, glittering face peered down at him from the skylight. But what startled him most was the fact that he was looking directly into the muzzle of an enormous horse-pistol, held within a few inches of his face.

"The purser, who was waiting outside, swears that Welbarn just naturally floated out of the room, without waiting to open the door. He never saw Wingerely but did a good twelve laps around the deck in five minutes. It was half an hour before he could be calmed sufficiently to go back to his room. The Comeole was calling furiously and sent the following:

"'Captain Opp, S.S. Kantilles: No cruiser in vicinity, gunboat on way. Nalbee.'

"On receipt of this message, the captain, who knew nothing of the pirates, asked, 'What do we want of a gunboat? What we want is a tugboat.'

"You can not convince Welbarn to this day that pirates did not board the Kantilles.

"He goes to sea no more, but occupies a snug land station far from the haunts of all pirates and buccaneers."

First Great Lake License Goes to Young Girl

Alice McConaughy, a thirteen-year-old schoolgirl, whose father is a national bank examiner in Ohio, has just been granted the first license under the new law to operate wireless on the Great Lakes. The government inspector supposed that she was eighteen years old, mistaking the "3" in her application for an "8."

"I did give them the right age," declared the seventh grade girl. "I sent for the blanks and filled them out myself."

When Alice was asked to show her skill with the demonstration set at the Cincinnati High School, she showed that she had her own ideas of such things.

"This set is too small to amount to much," she complained. "I use a quarter-inch coil, but I have the largest 'tuner' possible with an amateur set. The helix I use is also large, and instead of dry cells I have a dynamo. Right now it is out of fix, so I have used the electric light current with a transformer. I have reason to think that I have transmitted to Columbus. I got messages from as far as Xenia during the flood."

The young operator installed her apparatus six months ago. She uses an aerial fifty feet high, with four wires.

Train Dispatching by Wireless

THEY dedicated a monument, only the other day, to the man who sent the first train order by telegraph. And now the Lackawanna Railroad is beginning to order its rolling stock around by wireless. Before they put up a monument for that, we shall probably be riding on trackless roadbeds, the engines being throttled by automatic engineers, the passengers punched by automatic conductors, and packed away at night into sleepless berths. The fact is, court calendars and the business of raising monuments for great achievements are about equally far behind the facts. The sheep and the goats both have to wait. New crimes and new achievements crowd the old ones off the stage.

Our illustrations show the Scranton station of the Lackawanna, equipped for communicating with Binghamton and with moving trains. The apparatus is like that used at all high-power Marconi stations, including the new quenched spark gap. This is practically immune from static discharge interference.

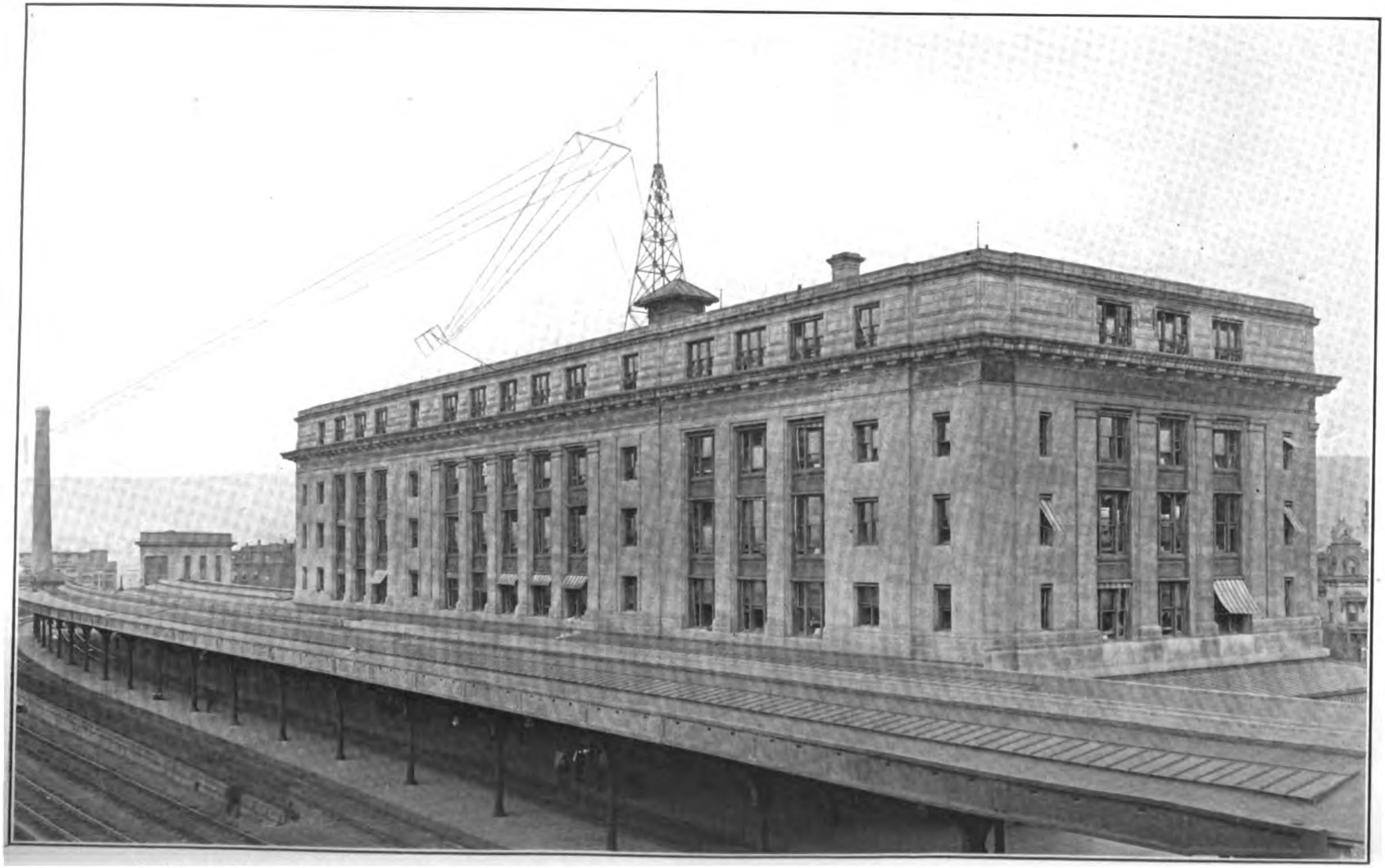
The road is beginning this month the regular use of wireless for the dispatching of trains over the section between Scranton and Binghamton.

"Of course, we are only in the stage of experiment," said W. L. Foley, Superintendent of Telegraph.. "If the plan works well, we shall go on gradually to install apparatus on other sections." Mr. Foley spoke cautiously, but he made it plain that "if" was a very small word to him.

"Have you met any difficulties in working out the new plan?" he was asked.

"None that are serious," he answered. "We can't be sure about some things till we try. For example, I don't know whether messages will be affected by tunnels or not. But even if they are, it will make no great difference. Tunnels are short and messages can be picked up at both ends."

It is not likely that any difficulty of this kind will arise. The detail was only referred to as an example of the problems that are sure to be met in a new field. But the prospect does not



A view of the Lackawanna Station at Scranton, Pa., showing the 700-foot antenna stretched to a nearby smokestack.

disturb the officials of the Lackawanna.

"I believe in the future of wireless as applied to railroad uses," said Mr. Foley. "The idea came to me two or three years ago and we have been working it out ever since."

In common with all other railroad men who have to do with telegraph equipment, he had been continually impressed not only with the great cost of keeping up the old style line, but also with the fact that it is usually out of commission during the times when it is most needed, as in cases of storm and flood. He realized also the limitations of the present service, especially in relation to safety. Every old railroad operator knows, by experience or through fear-quickened imagination, the nightmare of the man at the key—two trains headed for each other between stations and no way to stop them. Sometimes this may result from carelessness, but often it comes about in a way no man could foresee or forestall. And in such conditions wireless will prove invaluable, for by its use the dispatcher will be able to catch a train anywhere on the road.

Wireless will be of special advantage on limited trains since there is often a long period between stops. Safety will be increased and passengers will find the privilege of sending telegrams a great convenience. The added expense will be slight since one of the trainmen can act as operator.

Mr. Foley says that it happens now and then that a flagman is sent out with orders for a certain train and either he is not seen or, for some other reason, the train gets by without the orders. It will be practically impossible for a train to escape wireless orders.

"We are using the telephone now for our train service," said Mr. Foley, "and it is a great improvement over the old system. The other night there was a wreck at 11:45 and in exactly two minutes the conductor had the despatcher seventy miles away on the wire and the wreck train was ordered out immediately. We shall not give that up; the wireless equipment will simply be added to it. We need everything we can get that will help. We have been trying out a new machine that I think is a wonder. It has worked well so far. At two stations automatic typewriters are connected with the ordinary telephone wires. An operator writes a message on the keyboard of one and it is instantaneously printed in plain English on a roll of paper running through the typewriter at the other end. No Morse is used, no receiving operator is needed, and the messages don't interfere with carrying on the ordinary telephone conversations at the same time. Some of our men think that it may be possible to connect these typewriters with wireless."

If that prophecy is ever realized, the whole structure of telegraphy will be replaced, line and key. Of course, the conservatives will shake their heads, but it is no farther from the facts of to-day than the present achievements were from the facts of yesterday. To-morrow the conductor on a train going seventy miles an hour may simply read his typewritten orders as they come in from the wireless apparatus on the roof of one of his cars.

In the May issue a preliminary account of the new enterprise was given, with illustrations of a train equipped with apparatus for sending and receiving and of the brick stack at Scranton from which a 700-foot antenna has been suspended. This appears also in the full-page illustration printed in this number. The heading and the large cut show two aspects of the station at Scranton which is now fully equipped. The operator is already picking up messages from Arlington and Cape Cod. A similar installation has been made at Binghamton.

Superintendent Frank Cizek, of the Syracuse and Utica divisions is as confident as Mr. Foley of the success of the undertaking. He gives the following description of the apparatus which is now being tested.

"The power will be supplied by a special motor generator set, developing 100 volts at 500 cycles and capable of two kilowatts when using an extreme wave length of 800 meters.

"In order to maintain communication with rapidly moving trains, tuning apparatus of the most delicate construction is required to enable the operator continuously to adjust to required wave length without interfering with his regular duties of receiving and transmitting."

This is accomplished by an instrument called a variable inductance, the construction of which amounts to a large number of coils of fine wire rotated within each other by the turning of a small finger knob and the simultaneous breaking and making of a large number of contacts which tend to insert more wire of each coil into the circuit or eliminate portions not required.

"The operator is equipped with a double receiver harnessed to his head. These receivers are similar to those used by telephone operators, except that they are wound to a resistance of 3,000 ohms instead of 75. For transmission he uses a key similar to the ordinary telegraph key, except that it is much heavier. The current passing through a wireless key is so great that it would melt an ordinary telegraph key in a few seconds.

"A tower of steel nearly a hundred feet high supports one end of the aerial wires."

Promoting Safety to Life at Sea and on Shore

Two U. S. Revenue Cutters Patrolling Atlantic Reporting Icebergs. Army Officials Plan Establishment of High Power Stations in Interior to Work with Coast Equipments

SOME idea of what is being done with reference to the international conference and also in promoting safety to life at sea is given in a letter bearing a recent date from the Secretary of Commerce to Senator Duncan U. Fletcher. A few extracts from this interesting communication follow:

"After informal consultation London has been deemed the most suitable and convenient place for the assemblage of the conference, and by common consent the British Government will take the lead in determining the date, which will probably be late in the coming summer or early in the autumn.

"The subject of the efficient watertight subdivision of hulls of vessels has been under consideration now for over ten months by a committee of some of the most eminent authorities in the United Kingdom, and in Germany the excellent bulkhead and hull regulations of the See-berufs-genossen-schaft, framed after two years' inquiry following the sinking in 1895 of the German steamship Elbe, are being thoroughly revised.

"Meanwhile the Olympic, sister ship of the Titanic, has had her hull entirely reconstructed so far as bulkheads and double skin are concerned.

"Nearly 2,000,000 passengers cross the Atlantic annually to and from the United States. By far the greater part of these are either American citizens or those who seek to take up their homes here. The American delegates to an international conference must meet the most highly trained minds of Europe on the subject of ship construction, which is of direct interest to our people. I am sure, therefore, that it is prudent to endeavor to secure now the strongest possible American advisory committee on this phase of the subject.

"I wish to organize a committee on which shall be represented the American Society of Naval Architects and Marine Engineers, the American Society of Naval Engineers, and the technical schools which offer instruction in naval architecture and marine engineering, such as the Massachusetts Institute of Technology, the University of Michigan, the Leland Stanford Junior University, Cornell University, and the Stevens Institute of Technology. I have also requested the principal shipbuilding companies which build ocean passenger steamers to suggest to me names of those most competent to express the views of shipbuilders on this subject. The American passenger-ship owners of the Atlantic and of the Pacific, respectively, have been asked to name those most competent to express their views, and I have also invited Mr. William Livingstone, president of the Lake Carriers' Association, to suggest a name that will carry authority throughout the marine interests of the Great Lakes. The American Record of Shipping, generally known as "American Lloyds," has also been invited to participate, and I have also designated Mr. J. Bernard Walker, editor of the Scientific American, with whose instructive work, An Unsinkable Titanic, you are doubtless acquainted. To this committee I have asked the Secretary of the Navy to add an officer of the Construction Corps of that department, for although the hulls of battleships and ocean passenger steamships are designed to meet quite different conditions, I wish to avail myself of the high technical knowledge and standing of the members of this corps. Of course, the Steamboat-Inspection Service of the Department of Commerce will be represented. Suggestions will be welcomed from other sources, for the above list is not meant to be exclusive.

"You helped to frame the acts of Congress concerning rediotelegraphy and aided in the ratification of the Berlin and London radiotelegraphic conventions, so I need not tell you that on this subject the legislation of the United States in principle and in most of its provisions already has been accepted or bids fair soon to be accepted as the basis for the international prescription and regulation of this far-reaching agency for the promotion of safety at sea. You will, I am sure, allow me to take this opportunity to recall that the principle of a constant wireless watch on ocean passenger steamers (two operators) as a measure of Government regulation, to which there is now no dissent, was first proposed by my colleague, the Secretary of State, Hon. William J. Bryan, in November, 1911. Our own act of June 24, 1910, has been amended in accord with this suggestion, and at the international radiotelegraphic conference last June in London, 31 countries approved the principle of a constant wireless watch, at least in the case of large passenger steamers, as a measure of international regulation. The same convention also provides for auxiliary apparatus for use in event of the failure of the ship's main power plant as does our act of July 23, 1912. So far as radiotelegraphy is concerned the work from our point of view before an international conference will be mainly the adjustment of minor difference between our regulations and those which may be suggested by other powers so as to secure uniformity. To prepare for this work I have requested the wireless companies furnishing operators and apparatus for ship and coast stations and the shipowners concerned to propose the names of suitable experts who may confer with the Commissioner of Navigation and representatives of the Naval Radio Service and the Bureau of Standards.

"You have doubtless noted that the Secretary of the Treasury has already dispatched two revenue cutters to the North Atlantic to maintain alternately a patrol north of the spring and summer tracks of trans-Atlantic steamships and to give wireless notice of perils from ice—a service performed last year by two scout cruisers of the navy. During his December visit here, Mr. Baker, of the British Board of Trade, inquired informally whether our Government would co-operate in endeavors which the British Government contemplated, to make a thorough scientific study, covering several years, of ice movements in the North Atlantic and simultaneously to provide warnings, to ships, of approaching ice. The British Board of Trade and trans-Atlantic companies have already sent the Antarctic exploring ship Scotia equipped with powerful radio apparatus to give ice warnings and with a scientific staff and equipment to study ice movements and meteorological conditions in the regions of early ice appearance. The Hamburg-American line has also, in behalf of German companies, announced its co-operation with patrol work.

"Thus the way is prepared for an agreement on this subject at the international conference on safety at sea. In the meantime I have requested the Secretary of the Treasury to allow Capt. Commandant Bertholf, of the Revenue Cutter Service, who has had long experience in the Arctic, to serve on a committee on aids and perils to navigation, which will consider ice and other problems. The same committee will also consider trans-Atlantic steamship lanes, on which a British committee has already reported, and I have requested through the Secretary of the Navy the co-operation of the Hydrographic Office. The London radiotelegraphic convention, ratified by the Senate on January 22, 1913, provides for the wireless dissemination of meteorological reports, and I have asked the Secretary of Agriculture for the help of the Weather Bureau on this committee, which, under the Alexander resolution, will be requested to consider systems of reporting and disseminating weather reports and information relating to aids and perils to navigation."

At present the Atlantic and Pacific Coasts are covered by a wireless telegraph system maintained by the navy. Messages are now being flashed by the navy station at Arlington across the ocean to points in England and France.

The Pacific Coast stations frequently talk with Honolulu and the navy shore line system has been extended along the coast of Alaska. By this means Alaska is kept constantly in communication with the outside world.

Thus while small military posts in Alaska are constantly in touch with Washington, the great island state of Ohio has practically been cut off from other parts of the United States. Thousands of people throughout the country have been in agony when they could get no word from relatives and friends in the flood districts of Ohio.

Congressional leaders say the experience of this flood shows plainly that the interior of the United States ought to be cared for as well as Alaska and there is only one way—that by wireless telegraphy—to keep up constant communication with the country at large.

Officers of the War Department say the establishment of a wireless system in the interior of the country is entirely feasible. It has been considered frequently by the department in the expectation that Congress sooner or later would ask for recommendations.

The plan army officials have in mind would call for the establishment of two high-powered wireless plants in the interior. One might be located in Ohio or Indiana, close to the center of population of the United States, and the other in the Rocky Mountain region somewhere near Denver. This, army experts say, would create a wireless trunk line from Washington to San Francisco which could be picked up by smaller stations either of the War Department or private companies established in all principal interior cities.

In an interview Brig. Gen. George P. Scriven, chief signal officer of the army, said:

"With the existing naval wireless stations, the task of covering the interior of the country would be comparatively small and simple. It would require only two large wireless stations to cover the entire country and these chief stations should not cost more than $300,000 each.

"These would be of sufficient power to pick up messages from small stations in any or all of the interior cities. A scheme could be worked out between the regular army and organized militia of the states in such a way that wireless telegraphy should be made of very great benefit to the country at such times as this.

"I hope Congress will take up the subject and enact legislation that will enable us to extend wireless telegraphy into the interior of the country."

Wireless Weather Warnings

Wireless storm warnings and general weather forecasts for ships at sea is the latest innovation of the Agricultural and Navy Departments. The plan has just been put into effect by orders from Washington.

Hereafter every night a few minutes after 10 o'clock bulletins will be sent broadcast from the great naval wireless stations at Radio, Va., and Key West, Fla.

The messages will reach mariners hundreds of miles at sea, telling of conditions on the Atlantic coast from Sidney, N. S., to Bermuda and Pensacola.

Navy Has Submarine Wireless

The navy department has adopted a "submarine violin" for the transmission of messages between submarine torpedo boats and shore stations or other vessels. Exhaustive tests of the apparatus have been made on a submarine at Hampton Roads, Va., and three sets of the signal device have been ordered to be placed on as many vessels.

The mechanism is explained to be an adaptation of the violin. From one side of the submarine, project two steel stays. From the ends of these is stretched taut a piano wire. Touching the wire is the roughened rim of a wheel which, when it revolves, sets up vibrations in the wire. The wheel is controlled by a motor inside the hull of the submarine, and the motor, in turn, is controlled by a Morse key.

When the key is pressed the motor begins to revolve, the exterior wheel scraping the wire precisely as a bow agitates a violin string. The hull of the submarine acts as a sounding board. The key is used precisely as an ordinary Morse key, and dots and dashes are hummed on the wire as the key is depressed and released. About eight words a minute is the best speed so far attained. The receiving apparatus is the ordinary telephone receiver. The end under water may be connected by insulated wires to a fort, shore station, or another vessel.

The experiments at Hampton Roads showed that the vibrations may be heard clearly at a distance of five miles. Naval officers believe that the device can be perfected so that the range of mechanism may be greatly extended. Christian Berger, an Austrian, is the inventor of the submarine violin. He attempted to get the Austrian government to make tests of it, but failed. Coming to the United States, he succeeded in convincing navy department officials of the practicability of the scheme.—*Scientific American.*

Memorial Window to Lord Kelvin

American as well as English engineers and leaders in the field of electricity were represented at the unveiling on July 15 of a memorial window in Westminster Abbey in honor of the late Lord Kelvin. The fund for the purchase of the window was drawn from both countries.

It has been set in the north aisle of the nave, overlooking the burial place of the great scientist, who is referred to in the text on the window as "Engineer, Natural Philosopher." His body lies beside the dust of Isaac Newton.

In his address, the Dean of Westminster referred to the fact that forty years ago an extraordinary group of men of mathematical genius were professors at Cambridge. Among these were Clark-Maxwell (to whom Mr. Marconi recently paid tribute as to one from whom he had derived help). Adams, Cayley and Stokes were members of the circle. But William Thomson—later Lord Kelvin, who had come from Cambridge and was the friend and ally of these men, surpassed them all in the work he did at Glasgow University.

There he was great as a teacher, as a generous contributor to the work of other men and as a practical inventor. He would turn from speculation on the nature of the universe to perfect a meter, a sounding apparatus or some device for use in submarine telegraphy. He has thus been a means of binding more closely together the countries divided by the sea.

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Editorial

It is always interesting to consider the commercial possibilities of wireless telegraphy as applied to the merchant marine. One of our readers, who evidently imagined he had given this subject adequate thought, wishes to know if this field is not fairly well covered. He can see little room for expansion beyond equipping the new vessels as they come from the shipbuilders, and to quote him: "I should judge that the number of vessels built each year in this country would not exceed one hundred and fifty. This would only allow for three wireless installations a week, provided, of course, that the owners of each ship should see the advantages in having wireless aboard. Where, then, is the American Marconi Company justified in erecting its elaborate manufacturing plant with only a limited growth assured?"

The point would be well taken if our subscriber were not so far astray on his facts. The United States statistics for the latest year available accounted for 1,702 new merchant ships of all descriptions, an *increase* of 500 over the preceding year. Two years ago the merchant marine of this country comprised nearly twenty-six thousand vessels; 16,881 were operating on the Atlantic and Gulf coasts and 3,834 were operating on the Pacific coast.

Analyzing these figures, we find that 13,307 were steam vessels and 8,204 were sailing vessels; the balance being made up of barges and canal boats.

While figures themselves are dull things, in this case they answer the question of expansion decisively. The American Marconi Company, although it virtually controls the entire wireless business of the mercantile marine of this country, is operating about five hundred ships. This leaves more than twenty thousand vessels that have no wireless equipment. Equipping these vessels alone would occupy the attention of the plant for several years to come.

The question then naturally arises: Will these ships require wireless sets? Now the gross tonnage of our steam vessels is above five million tons and that of the sailing vessels totals over a million and a half tons; and since there are few very large American keels, the average tonnage must be high. It would appear that a majority of them must be large enough to employ wireless to advantage.

True, one might say, but how is it that less than one-fortieth of our merchant ships are using wireless to-day? Principally because of the large percentage of fresh-water and short-run coast keels. We do not know, and it would be well nigh impossible to approximate the number of river craft and other boats making short runs that ply our waters, but some idea of the large percentage engaged in this traffic may be had from a glance at Lloyds Register, which gives the United States second place in number of ships over 100 tons. It appears that last year American vessels engaged in ocean and lake travel of this class numbered 3,466. Statistics show that about one hundred more are added each year.

Now that we have sifted this mass of figures the fact remains that our merchant marine contains more than three thousand ships which should be, and have not yet been equipped with wireless. The law requires that passenger-carrying vessels of a certain capacity be provided with wireless sets and their owners have complied with this regulation. Many owners of cargo vessels, too, have recognized their need and have installed apparatus. Yet, in all, but five hundred American vessels of over 100 tons are carrying wireless; more than three thousand are not.

Since the law covers the passenger vessels, and sets have been installed on all of these, it is reasonable to suppose that practically all of the remaining three thousand are cargo vessels.

Let us consider the possibilities of these cargo vessels installing wireless sets. First of all, owners and masters of cargo vessels have already recognized their value to such an extent that no modern fleet is considered complete without this means of communication. It is a safe prediction that at no distant date all vessels of this class will carry full equipment. The increasing number of orders received each month justifies the belief that there is a growing realization of the need in this field.

Putting aside the humanitarian value of wireless aboard ships, which is generally the only feature considered by the layman, we find that invaluable service is rendered to shipper and owner, that in daily usage wireless telegraphy saves thousands of dollars for both. Some instances of its application, the result of actual experience of owners and masters of American cargo vessels, may be summarized thus:

The isolation of ships at sea is destroyed and should a breakdown occur a message of particulars will not only counteract a rise in re-insurance, but reduce salvage charges through the choice of assistance which can be summoned. And it is no uncommon thing for a ship owned by the same company to be available, in which case these charges are eliminated.

Messages may be sent to and from ships at almost any part of their course, many economies in embarkation and disembarkation being thus effected.

A ship's course can be changed to take advantage of market conditions, the vessel's captain being kept posted on fluctuations in price of the commodities comprising his cargo and instructed to head for the port quoting the highest figures.

The details of docking, berthing, coaling requirements, available cargo space, train accommodation, mails, time of arrival and numberless other aids to cargo transportation can be arranged in advance with an immense saving of time and money.

Safe and rapid navigation is assured by the weather bureau's reports of floating derelicts, icebergs and other menaces to shipping; weather conditions on a vessel's track are also reported to the master well in advance—invaluable knowledge during the hurricane and typhoon seasons.

Very often a handsome profit is cleared by owners who can order a vessel home at top speed after she has cleared port to take advantage of the sudden rise in freights when a prompt vessel is needed for a special cargo.

A considerable amount of valuable time, pilotage and port dues can be saved, too, by advising that bunker coal is not available at the port for which a ship is heading.

A hundred other instances of the utility of wireless will readily present themselves to any shipowner and it is only a matter of time before this means of communication will be universally adopted by all types and sizes of ocean-going vessels. One striking indication of the high position wireless has already secured in the merchant marine, is the special section of Lloyd's Register devoted to ships equipped with wireless apparatus and the quotation of considerably lower insurance rates than those allowed vessels not carrying wireless.

Cargo vessels are only one among

several possible classes. A number of private yachts, lightships, cable-laying vessels, whalers, sealers and Arctic fishing boats are already equipped and wireless has firmly established its place in these fields.

When it is considered that four years ago wireless telegraphy had passed through nearly half a decade of development work and only 125 ships of the mercantile marine were fitted with Marconi apparatus, whereas to-day these number well over 1,500, it should not be long before the remaining three thousand American ships are equipped.

That in itself would be a fair sized contract, and what with orders in hand for auxiliary sets, land station apparatus and portable stations, it does not look as if the American Marconi Company's new factory will be idle. It is more likely that its size will be increased.

* * *

The development of the great commercial service between the constantly moving ship stations and provision for their increase in numbers has required one of the most carefully devised organizations in the country and what amounts to practical standardization of Marconi apparatus. Engineers of long experience are constantly making inspection trips not only aboard the ships, but to all parts of the country where land stations are located.

Prominent among the problems that these men have been dealing with is the elimination of the static disturbances which have interfered with communication in certain sections of the country. One of the inconsistencies of nature is to allow a certain locality all the necessary advantages in geographical position and formation so that it may grow into a flourishing shipping centre and then hamper its operations with adverse atmospheric conditions. A notable instance of this kind is the prevalence of static in the region of the Gulf ports.

The company's chief inspector has just returned from a trip through this section and reports that the effect of these disturbances has been reduced to a minimum and they no longer interfere with message transmission. Improvements in the design of apparatus have been responsible for this desirable condition, the importance of which may be best illustrated by a glance at the work in progress at the Gulf ports.

New Orleans, which few of us realize is a port second only in importance to New York, is to have one of the most powerful stations in the country. It is being erected for the United Fruit Company and forms a link in their service chain located at Swan Island, Santa Marta and San Antonio, Cuba. The stations are located about eight hundred miles apart and have two 25-kilowatt sets installed which can be coupled together at times when higher power is needed. The New Orleans station is about completed and the Swan Island installation will be in operation within a few weeks, when it will become the principal relaying point of the chain, working with San Antonio, Cuba. Communication will also be had with New Orleans, which the static formerly prevented. Santa Marta, the site of the station completing the chain, is an important port for the United Fruit Company, for here are some of the largest plantations. Its station is completed and working.

On the roof of the Grunewald Hotel, in New Orleans, two 125-foot towers are being erected in place of the small masts formerly employed and a new and improved set is being installed. This station is perhaps the most important of the Gulf land stations engaged in ship to shore traffic and with its new equipment will not be hampered by static disturbances.

The Share Market

NEW YORK, July 30.

Transactions in unlisted securities today are somewhat irregular and the general level of quotations is lower than that of the first of the week. Several adverse influences have kept sales in industrials down and the curb trading is restricted almost entirely to the new bond issues. Nearly all price changes show fractional declines. Up to noon no sales in Marconis had been reported on the curb, but several private transactions were consummated at the following bid and asked prices:

American, 4—4½; Canadian, 2¼—2¾; English, common, 16¾—18; English, preferred, 13¾—15.

Panama Canal Station Authorized

The United States Navy Department has authorized the Panama Canal Commission to begin the construction of a power house, an operating building and employees' quarters for the Darien wireless telegraph station. The buildings are to be put up in Caimito, in the center of the Canal Zone. When completed the Darien station will be the most powerful in this part of the world.

The American Marconi Company has requested permission of the Panama Government to establish a station on the island of Taboguilla, twelve miles from the mainland in the Bay of Panama.

News From Antarctic

Dr. Douglas Mawson, leader of an Antarctic expedition at Adelaideland, has reported by wireless that all the members of his party are in good health and that they have been confined to their quarters because of a heavy blizzard, during which the wind reached a velocity of 200 miles on hour. He reports that the hut and meteorological observatories have escaped serious injury and that the wireless mast is weathering the storm better than had been expected.

New U. S. Army Station on Mexican Border

Three sets of wireless apparatus are being installed by the United States Army Signal Corps at points west of Nogales, Arizona.

The wireless is intended to facilitate the transmission of messages between troops of the border patrol on duty along the Sonora-Arizona line.

New Stations in Indo-China

The most powerful wireless telegraph station in the East has just been opened at Bac-Mai, near Hanoi, Indo-China. This is one of a chain of stations of which three others are already in operation, and which will be joined to the central station at Saigon, work on which has already begun.

The station at Bac-Mai has complicated antennae with a length of 1,500 feet and covering a surface of 50,000 feet.

With only a third of its power employed, this station has made its signals heard at the station of St. Jacques, Cochin China, 750 miles away across the mountains. Its day signals have been received by ships 1,600 miles distant. Its range by night is not yet determined; it will probably be 2,500 miles.

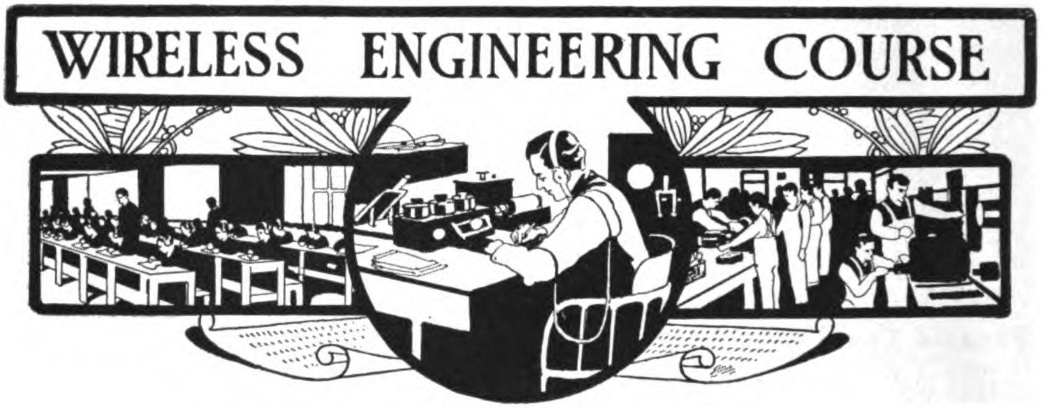
Wireless Brings Aid to Governor of Massachusetts

Governor Foss of Massachusetts was recently taken from a boat which had grounded near Boston, after a wireless message had made the situation known. With members of the State Militia the Governor was making a trip around the harbor aboard the United States torpedo boat Rodgers. They were near Nix's Mate, not far from the outer harbor. The amateur jack tars and the Governor and his party had been aboard the Rodgers several hours and had watched with interest the various evolutions of the vessel's crew, when suddenly there was a bumping and grinding and a futile churning of the screws as the craft came to a final halt.

The engines were stopped, and a hurried investigation showed no damage had been done, but the craft was certain to remain where it was until high tide.

A wireless call was sent to the navy yard and the tug Iwana was dispatched to stand by.

The channel about Nix's Mate is shifting constantly, and threads a network of dangerous shoals and sandbanks. Vessels frequently run aground there at low tide.



By H. Shoemaker

Research Engineer of the Marconi Wireless Telegraph Company of America

CHAPTER VIII.

Measuring Instruments

Instruments for measuring alternating current differ from those in general use for measuring direct current. While most alternating current instruments will measure direct current correctly, the direct current instrument will not measure alternating current. Direct current measuring instruments which depend on the reaction between the current and a permanent magnetic field are not adapted to measure alternating current, as the torque or force tending to move the system is continually reversed. It is therefore necessary to have the alternating current pass through both the fixed and movable systems so that the torque will be constant.

There are three general classes of alternating current instruments, viz.: electro-magnetic, electro-static, and thermo or heat instruments.

In the electro-magnetic instrument there is always a solenoid or coil carrying the alternating current which either acts on a small piece of iron or on a small coil carrying the alternating current. This iron or coil is mounted on pivots so as to be movable. The pointer or indicator is mounted on this coil or movable system. A vane or plate is also carried on the pointer, which by friction with the air causes the system to come to rest quickly. Instruments which have a moving system that comes to rest quickly without swinging back and forth are said to be dead beat. Some instruments have magnetic means to dampen the swing.

Fig. 30 shows the construction of one of the simplest forms of alternating current instruments. C is the coil with terminals T & T. I is a small iron wire carried on the pivot, a, which is adapted to be pulled into the coil, C,

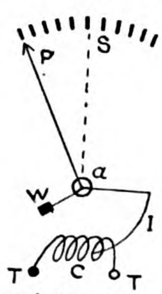


Fig: 30

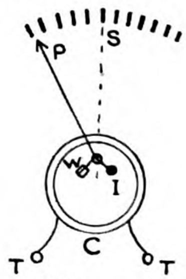


Fig: 31

when the current flows, the amount of pull or torque depending on the value of the current. The pointer, P, and the small weight, w, are also carried on the pivot, a. The weight is adjusted to bring back the pointer to zero, when no current flows through C. A scale which indicates the value of the current is represented by S. A small spiral spring can also be used to bring the pointer to zero position.

Fig. 31 shows another type of instrument in which iron is used in the moving system. C is the coil through which the current passes. I is the small piece of iron which should consist of thin sheets or a bundle of fine wires. This, together with the pointer, P, and weight, w, are fastened to the pivot, a. When the pointer, P, is at zero on the scale, S, the iron, I, is out of the centre of the coil, C. When the current flows through the coil it produces a magnetic field which is densest at the centre of the coil. The iron, I, then tends to move into this part of the field. The force exerted on the iron depends on the strength of the current. The restoring force can be either a spiral spring or the weight w.

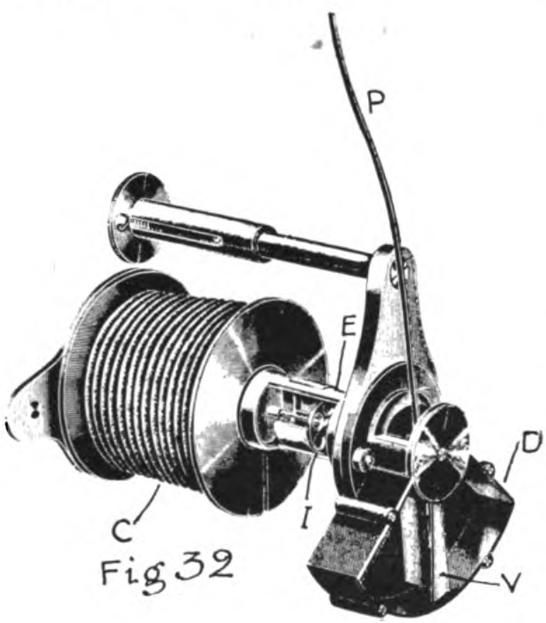
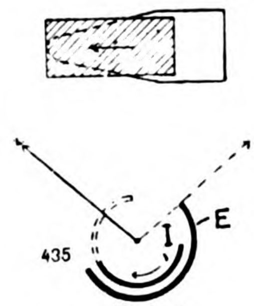


Fig 32

Fig. 32 shows another type of instrument using iron in both the moving and fixed system. C is the coil. E is a hollow iron core with part of its end cut away as shown in the illustration. I is a thin piece of iron fastened to the pivot. P is the pointer and V is a vane that swings in the dash-pot, D, rendering the instrument dead beat.

When there is no current flowing in the coil, I will have the position shown in 32-a. As the current increases it will take the position shown by the dotted lines. This is due to the fact that the magnetic field is stronger where E is cut away.



32a

Fig. 33 shows the inclined coil instrument which is now used to a great extent in light and power stations; e and e are the pivot screws holding the pivot which carries the thin iron plate, I, and the pointer, P. The coil, C, has its axis inclined about 45° to the pivot. The piece of iron, I, is also set on the pivot at an angle of 45° so that when turned in a certain position it lies in the axis of the coil C. The spiral spring, S, holds I away from this position when no current flows. When the current flows through C, the force acting on I tends to bring it into a position parallel with x y.

All forms of these instruments will measure either direct or alternating current, but must be calibrated for the desired frequency as they will not be independent of frequency.

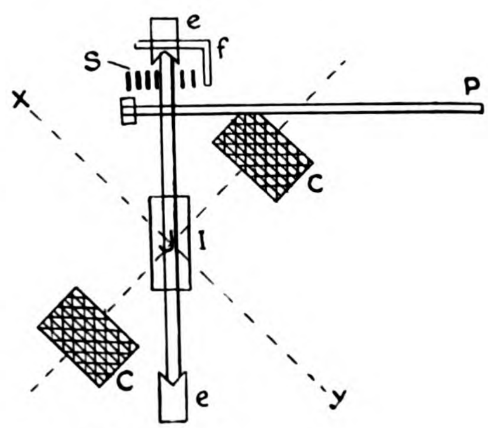


Fig: 33

Fig. 34 is a circuit diagram of the wattmeter. The wattmeter is one of the most useful instruments and is used for measuring the actual power consumed in a circuit. It is a magnetic instrument depending on the mutual action of a fixed coil and a movable coil.

C and C are two fixed coils in series; they are separated from each other so the movable coil, m c, may be mounted in pivots so that its axis coincides with that of the coils, C and C. The coil, m c, carries the pointer, P, and its position is controlled by two spiral springs (not shown in the figure), which also serves to carry the current into m c. In series with this coil is

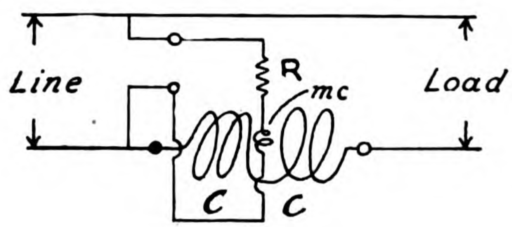


Fig: 34

a non-inductive resistance, R, which is so great that the flow of current is controlled by it and not by the inductance of m c. The strength of the magnetic field in m c then depends on the voltage applied at the terminals. The current also will be in phase with the voltage as there is not enough inductance in the circuit to displace it.

The current through C C and the strength of the magnetic field will depend on the character of the load. If the load is non-inductive, then the current will be in phase and the force acting on the movable coil will be a measure of the product of the voltage and current or the watts.

The magnetic force between these two coils tends to cause the axis of the two coils to coincide.

If the current through C C is not in phase with the voltage, as is the case when the load is inductive, then the current in m c and C C is not in phase and the force acting between the two coils is decreased by an amount depending on the phase angle. When the phase angle is 90° the force acting between the coils is zero, and the wattmeter shows zero deflection.

In connecting a wattmeter in a circuit it is necessary to connect the voltage or movable coil across the line in such a manner that the pointer will move in the right direction. The fixed coil is always connected in series with the load so that the whole current passes through it. Sometimes a shunt is used which carries most of the current while only a small portion is carried by the fixed coil in the instrument.

With the exception of the watt-meter all the instruments described have been ammeters. The voltmeter is an ammeter designed to operate with small current and has a high non-inductive resistance in series with it, so that the current flow through it depends on the voltage. It is always connected across the line of which the voltage is to be measured. The series resistance should be as high as possible and the inductance of the instrument as low as possible so that the current flow depends on the resistance. This makes the instrument independent of frequency.

Electro-static instruments are used to measure voltage and are not adapted to measure current. They are independent of frequency over wide ranges and are best adapted to measure high voltages, as the force between the movable and fixed plates depends on the voltage and the number and size of the plates. When the voltage is low the number of plates required increases so that the movable system becomes too heavy to support in pivots.

They are made to measure as low as 25 volts. In these instruments the plates are suspended on a wire and it is necessary to have a solid foundation or pier to set the instrument on.

Fig. 35 shows a type of electro-static voltmeter used for high voltages. The movable plate swings between two fixed plates. These plates are so shaped that when a different potential is applied between the fixed and movable plates the movable plate is attracted and moves between the fixed plates; the force so acting shortens the electrostatic lines.

The movable plate passes between the poles of a permanent magnet which damps out the swing and makes the instrument dead beat.

This type of instrument measures the root mean square value of the alternat-

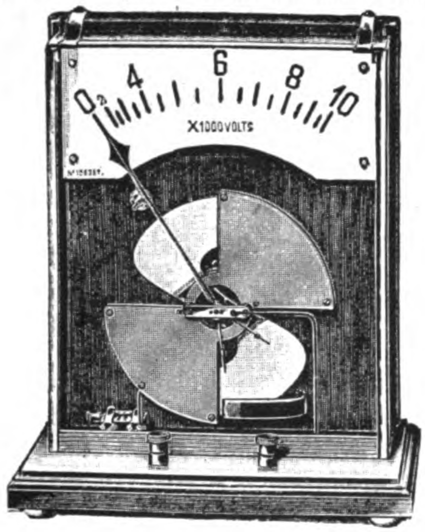


Fig 35.

ing current voltage and can also be used to measure direct current voltages.

Thermal instruments are, as the name implies, instruments which indicate the current strength by means of the heat produced by the current. There are two important kinds, viz., the hot wire and thermo instruments. In the former the current is passed through a small wire which is heated and expanded. The expansion of the wire causes the pointer to move over the scale. In the latter type the current passes through a wire which is heated, this in turn heats a thermo junction which is connected to a galvanometer.

Instruments of this class can be constructed to operate on high frequencies, in fact, they are made to be independent of frequency and will measure correctly on direct current and frequencies of the order of one million.

Fig. 36 shows one form of the hot wire meter. H V is the wire which the current passes through and heats. It is suspended between a fixed terminal, y, and adjustable terminal z. The adjustable terminal permits the taking up of the sag of the wire so as to hold the zero position of the pointer, P. This pointer is carried on a pivot which also carries a thin metal disc revolving between the poles of the magnet, M, to damp out the swing. W is a very fine wire or silk fibre, fastened to the hot wire as shown in the figure, and to a fixed point; another fibre is fastened to the middle of w and passes around the pivot to the spring, S. When the wire, H W, is heated it sags, causing w to sag. The spring, S, takes up this sag and causes the pivot to rotate. The amount of rotation and movement of the pointer depends on the tempera-

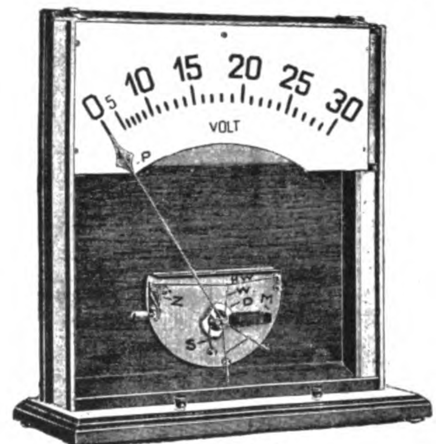


Fig 36.

ture of the H W, which in turn depends on the square of current flowing through it.

If the wire, H W is of small diameter so that its high and low frequency re-

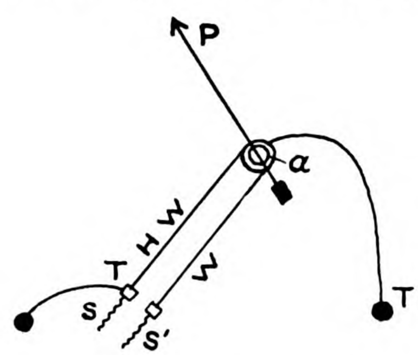


Fig: 37

sistance are the same, then the instrument will be independent of frequency.

Fig. 37 shows another type of hot wire instrument which has inherent means for keeping the zero position of the pointer constant. P is the pointer which is mounted on the pivot, a. A wire, w, and H W passes from spring S, around the pivot, a, to spring S'. The current flows through terminal T, through H W and terminal T. No current flows through w. The current heats and expands H W which causes the spring, S', to take up the sag. This causes the pivot, a, and pointer, P, to rotate. Any change of temperature which affects both wires alike will not cause rotation of a.

When hot wire instruments are used to measure voltage the wire H W is of small diameter so that a very small current will heat it. A series resistance must also be used so that the voltage to be measured will not cause too much current to flow through the wire, H W.

If the series resistance is non-inductive the whole instrument will be non-inductive and the current flow through it will be independent of frequency. Wattmeters are constructed, using the hot wire system just described; and having no internal self-induction, they are independent of frequency.

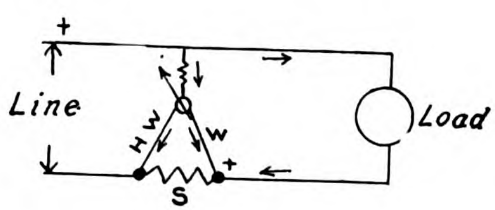


Fig: 38.

Fig. 38 is a diagram of such an instrument. H W and w are both working wires in this case. R is non-inductive resistance of such value as the line voltage will require to keep the current at proper value. S is a shunt resistance which will carry the maximum current required and of such resistance as to give the required potential across its terminals. This resistance is connected across the terminals of H W and w.

When there is no load on the line the current through S will be zero and there will be no difference of potential across the terminals of H W and w, and no flow of current through them.

If there is a voltage across the line then current will flow through R which will divide equally in wires H W and w, causing them to expand equally. There will not be any movement of the pointer over the scale. If current flows through S then there will be a difference of potential between its terminals causing current to flow through H W and w, which heats them alike.

If both voltage and current operate simultaneously then the wires H W and w will not be heated alike, for a difference of potential between the terminal of shunt S exists. Let the arrows indicate the direction of current flow and the + — sign the polarity of the different parts of the circuit. The voltage across the line causes the current to flow through H W and w in the direction shown by the arrows, thus allowing equal heating.

The difference of potential across S causes the current to flow in the opposite direction in w and the same direction in H W. This causes H W to be heated more than w, which in turn causes the pointer to move over the scale.

If an alternating current is flowing through the instrument and the load is inductive, then the difference of potential across S will be out of place with the potential across the line. This so modifies the difference of current flow, in H W and w as to measure the true watts consumed in the load.

Thermo meters will be treated in the next issue.

New Wireless Courses in Glasgow

The governors of the Royal Technical College, Glasgow, have inaugurated a course of study in wireless telegraphy, under the guidance of Mr. Andrew Gray, chief of the technical staff of the Marconi Co., and an ex-student of the college. There has been installed at the college a standard 1½-kilowatt Marconi marine wireless telegraphy equipment, with an aerial 325 feet long, at an elevation of 116 feet, and other equipment.

CHAPTER II.

Marconi Auxiliary Set—Figure I clearly indicates the circuits of a Marconi auxiliary set as used in conjunction with the power set previously described.

The set is essentially divided into three parts.

1.—Chloride storage cells of the portable type (8 to 16 in number).

2.—A 10-inch Marconi induction coil.

3.—A slate switch board on which are mounted:

(*a*)—A D. C. switch with fuses.

(*b*)—An underload circuit breaker.

(*c*)—A double pole double throw switch.

(*d*)—4 series resistance coils.

(*e*)—A battery voltmeter.

(*f*)—An enclosed fuse in series with the discharge circuit.

Object of the Set—The object of this apparatus is to furnish an auxiliary equipment which will enable a vessel in distress to communicate 100 miles or more independent of the ship's dynamo.

The Induction Coil—The induction coil consists of a primary winding of coarse wire wound over a soft iron core (marked primary).

This is covered with an insulating tube and over it is wound a great number of turns of very fine wire (marked secondary).

To make this clear in the sketch the iron core has been shown between the two windings; in reality both are wound around it.

The Interrupter—The interrupter in the primary circuit is indicated by the spring F on which is mounted a piece of soft iron B. A platinum contact is fastened to spring F. The circuit through the primary is completed through the adjustable platinum contact A.

In its normal position the spring F causes the platinum points to be in electrical contact with one another.

When the double pole, double throw switch is in the position shown, the antennae switch pressed down and the transmitting key depressed, current from the storage cells enters the primary coil via contacts H and A, the magnetic field thus produced being augmented by the presence of the iron core. Immediately the core becomes magnetized it attracts the small piece or iron, B, which opens the contacts H and A, interrupting the primary circuit.

As the current has stopped there are no magnetic lines of force to hold the spring with the result that it flies back again, closing the circuit through H and A.

This process is repeated several times per second, resulting in the production of rising and falling magnetic lines of force, which intersect and cut through the turns of fine wire in the secondary winding, inducing currents of very high potential or voltage.

A condenser of large capacity is connected directly across the break of the interrupter. This not only serves to eliminate the spark at the interrupter contacts, but also assists in demagnetizing the core after each break of the

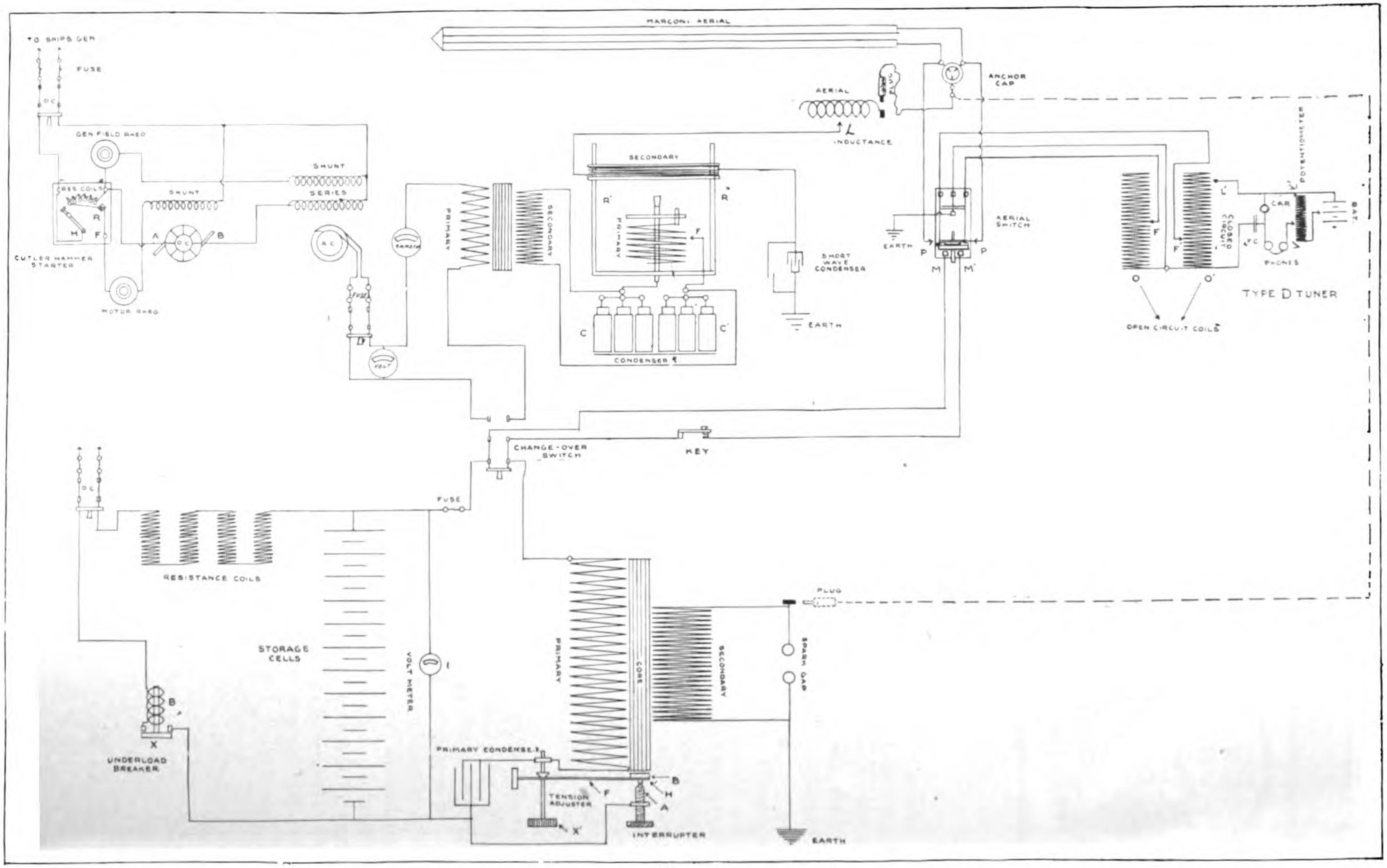

MARCONI AERIAL
TO SHIPS GEN
FUSE
D.C.
GEN FIELD RHEO
SHUNT
SERIES
CUTLER HAMMER STARTER
MOTOR RHEO
A.C.
PRIMARY
SECONDARY
CONDENSER
AERIAL
INDUCTANCE
ANCHOR GAP
SHORT WAVE CONDENSER
EARTH
AERIAL SWITCH
CLOSED CIRCUIT
PHONES
POTENTIOMETER
BAT.
TYPE D TUNER
OPEN CIRCUIT COILS
CHANGE-OVER SWITCH
KEY
RESISTANCE COILS
STORAGE CELLS
VOLT METER
UNDERLOAD BREAKER
PRIMARY CONDENSER
TENSION ADJUSTER
INTERRUPTER
CORE
PLUG
SPARK GAP

Fig. 1.

circuit with the result that a more rapid change of magnetic flux in the primary core is secured giving a greater effective current in the secondary windings.

The Spark Gap—The terminals of the coil are connected directly to the spark gap. This gap is also connected in series with the antennae.

Since the antennae possesses capacity in respect to the earth, it is therefore capable of being charged, and when high potential surgings are produced in the secondary of the coil, an electrostatic charge is maintained on the antennae, which finally becomes of such value that a discharge takes place across the spark gap, producing high frequency oscillations.

These oscillations are said to be highly damped owing to the fact that they must traverse the spark gap which is of high resistance.

The surgings produced by these high frequency oscillations result in the production of electro-magnetic waves.

The Double Pole Double Throw Switch—It will be noted that the same telegraph key and antennae switch are used for both the power and auxiliary sets.

When the double pole, double throw switch is down, in the position shown in the drawing, the sending key interrupts the primary circuit of the induction coil.

When thrown in the opposite direction, the key and the antennae switch are thrown in series with the primary circuit of the alternating current transformer.

Voltmeter—The voltmeter E is connected across the storage cells and upon depressing a strap key indicates the combined pressure or voltage of the cells.

The Storage Cells—The storage cells are indicated in the drawing and are of the portable chloride type. Each set may consist of two or more trays or boxes, each tray containing 4 cells.

The Charging Circuit—Since the cells are charged from 110-volt circuit, a certain amount of resistance must be connected in series so as to allow a definite current to pass through the storage cells and give the drop of potential necessary so that the charging voltage will be a little higher than that of the combined voltage of the cells.

The series resistance coils are four in number and are mounted behind the slate switchboard previously referred to. The coils indicated are of such value that about five amperes will pass through the cells while being charged.

Underload Circuit Breaker—The underload breaker is indicated at B. It consists of a solenoid with a plunger X carrying a copper contact plate. When the plunger X is pushed up, current flows in the turns of wire surrounding it, magnetizing the solenoid which holds the plunger in place and causes the charging circuit to the cells to be closed.

It will be readily seen from the connections that if the D. C. main line switch were opened at a distant point, the solenoid would lose its magnetism, allowing the plunger X to drop downward, thereby automatically opening the circuit to the cells. (The circuit being opened at the contact points on the breaker.)

This plunger X will also drop if the charging voltage falls below a certain value. This affords protection to the cells and also to the charging generator, for instance, if the generator which is supplying the current should be stopped without opening the line switch to the batteries and there was no breaker to open the circuit, the batteries would discharge through the generator and very likely reverse its polarity, besides being rapidly discharged.

It will be noted, when referring to the diagram, that the batteries can be charged while being used for the operation of the induction coil.

Charging the Cells—When the battery is to be charged, extreme care should be taken that the positive terminal of the battery is connected to the positive terminal of the charging circuit. (The positive terminal is marked POS.)

This is exceedingly important, for if they were connected in the opposite way, very serious damage to the plates would be done.

If, for any reason, the batteries are disconnected for inspection, etc, and the polarity of the wires is forgotten, it can easily be determined by dipping the two terminals of the D. C. charging circuit into a glass of water. Bubbles will appear at the negative terminal. This wire should be connected to the negative side of the battery.

When the battery is charged, the height of the liquid should be noted. If it is below the plates, enough *pure* water should be added so that the plates will be covered about one-fourth to one-half of an inch.

Series connections are used in these trays and it is important that the operator note particularly that the positive terminal of one tray is connected to the negative terminal of the next tray.

Charging Rate—Various cells have different charging rates, meaning that a certain number of amperes should be allowed to flow through them during the charging period. It is not safe to go above this amount. This rate, which is given with each cell, is known as the normal rate, and if a heavier current than the normal rate were applied the chemical action in the cell would become too violent, causing excessive gassing and abnormal rises in temperature with consequent damage to the plates.

Voltage Output—When the full charge is given, new storage batteries should show from 2.4 to 2.6 volts per cell with the charging current flowing, but as the plates become aged the maximum voltage may be considerably less; there is, however, no fixed definite value.

For example, if a ship set contained three trays each consisting of 4 cells, a full charge 12x2.5 or 30 volts for the combined set should be expected, that is, when the cells are on charge. However, on open circuit neither charging nor discharging, the battery will read on an average 2.08 volts per cell.

Discharge—When the cells are being used or discharged, the voltage should not be allowed to drop below 1.8 volts per cell as indicated when the key of the auxiliary set is closed and the coil is in action.

In the example mentioned, when the voltage drops below 12x1.8 or 21.6 volts, the cells should immediately be placed on charge.

Cells should never be allowed to stand discharged for any length of time, but should be immediately charged to their full capacity.

If the battery is not to be used for some length of time it should be charged at least once every month, and thep lates kept covered with the electrolyte, the voltage being raised to the maximum amount as consistent with the following paragraph:

Length of Charge—When the voltage of the battery has been reduced to its lowest safe value and it is necessary to recharge, the charging switch should be thrown in, the circuit breaker closed, and the current allowed to flow two house after the voltage has ceased to rise. For instance, if the pointer of the voltmeter rises slightly for a period of 4 hours, and then stops, the charging should be continued for two hours more, and the cells should all be gassing freely.

Electrolyte—The liquid in the storage cell is known as the electrolyte and in the case of this particular cell it is made by mixing pure sulphuric acid and distilled water in the proportion of one part acid to six and one-half parts water by volume.

It should be understood that during the process of evaporation, the water, not the acid, evaporate, and it is usually only necessary to add water from time to time to keep the plates covered.

Specific Gravity—Certain liquids compared with pure distilled water are said to have a certain density, in other words, they are said to have a certain "specific gravity."

The specific gravity then is the density of the electrolyte and is measured by the hydrometer.

The Hydrometer—The hydrometer is a small glass instrument for testing the specific gravity of the battery solution. It floats in the solution and sinks to a depth according to the density. It has a graduated scale, and the reading of the scale where the glass emerges from the solution is the specific gravity of the electrolyte.

The proper specific gravity of the electrolyte falls while discharging and rises while charging. The hydrometer reading should only be taken when the battery is fully charged.

If the hydrometer reading then is too low, it shows that the density of the liquid is not enough and new electrolyte should be added to the cell, but if the density be too great, a portion of the electrolyte should be removed and *pure* water added to the cell.

The normal specific gravity of the electrolyte for the cells used with the auxiliary sets should be between 1.205 and 1.215.

Operators in the Marconi service are not expected to take hydrometer readings of their cells. This is attended to by the company's authorized inspectors in various ports. The operator relies on his voltmeter to note as near as possible the condition of the cells.

When the cells are fully charged the battery should be carefully wiped with an old piece of cloth or waste; it is then ready for use.

In General—To repeat; operators should note particularly that they may determine that these cells are *discharged* when the key of the auxiliary set is held down and the voltage per cell is 1.8 volts. *The voltage on open circuit,* that is, when the batteries are neither being charged or discharged, *does not show the true condition of the cell;* the voltmeter might indicate 2 or 2.1 volts per cell, yet the cell would be lacking in capacity or amperage. When charging, the voltage of each cell with the charging current flowing, will rise to as high as 2.5 or 2.6 volts or perhaps a trifle more.

And again, when the cells are being charged and the voltmeter gradually rises, the charging should be continued for a period of two hours beyond this point. The cell is then said to be fully charged.

Serious defects (which are not liable to arise) are attended to by the inspector in port. If the ship is equipped with three trays of cells, the operator should know that should any trouble arise with one of the trays it can easily be removed from the circuit and the remaining two used, which will be sufficient to operate the coil. Also, a single cell of any one tray may be disconnected from the circuit, but care must be taken to connect UNLIKE poles together.

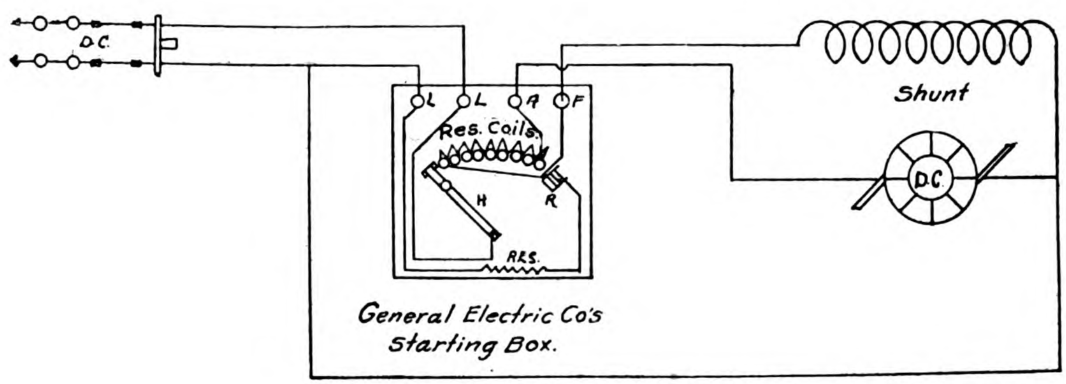


Fig. 2.

General Electric Company's Hand Starter—Figure 2 gives the circuits of the General Electric Company's starter connected to a simple shunt wound motor. The particular point of difference between this starter and the one previously described in connection with the wireless set, is that in this type the release magnet R is connected in shunt with the D. C. line rather than being in series with the shunt wound field coils.

A resistance coil is connected in series with the release magnet R to cut down the consumption of current. In all other respects the fundamentals and operation of the starters are identical.

Care and Operation of Radio Set—In regard to the complete wireless set just described, the following facts with respect to the care of the apparatus and possible troubles should be observed.

Motor Starter—In manipulating the motor starter, care should be taken not to pull the handle over too rapidly. If this is done the fuses will blow, owing to the excessive current taken by the armature. On the other hand, if the motor is started too slowly the series resistance coils which are gradually cut out by the handle are apt to burn out, for these coils are only made for temporary duty.

The Motor Generator—The motor should be carefully inspected from time to time to see that the oil rings which dip into the oil basin are carrying plenty of oil to the motor shaft.

About every six months this oil basin should be flushed out with kerosene and fresh oil supplied.

The oil gauge should be watched from time to time to see that the oil supply is not running too low.

Thrust Bearings—The Robbins and Myers machines are equipped with thrust bearings on either end to prevent oscillation of the armature in a heavy sea. Care should be taken that these thrust or "take ups," as they are sometimes called, are not screwed up to such an extent as to force the motor armature out of its magnetic field, which will cause excessive sparking and pounding.

The Brushes—Both the generator and motor brushes need careful attention; a great mistake made by many operators is to clean the commutator and not the brushes.

As the machine is used the tips of the brushes gradually become filled and coated with copper dust, so much so, that copper will soon be in contact with copper, causing excessive wear on the commutator.

The brushes should be cleaned from time to time with fine sandpaper and care should be taken to sandpaper the brushes so that they will conform to the shape of the commutator and give good contact; it should be understood that in all machines the brushes are intended to bridge two commutator segments at one time.

If the commutator becomes badly grooved there will be excessive sparking and the only way to eliminate this is to place the armature in a lathe and turn down the commutator to smoothness. If this cannot be done and it is necessary to equip the motor with a new set of brushes, an effort should be made to file the new set of brushes so that they will conform to the groove, otherwise there will be terrific sparking.

Very little difficulty is experienced with the alternating current armature brushes but they should be cleaned from time to time to insure perfect contact.

Sparking—Sparking of the brushes may be due to any of the troubles enumerated, or to the fact that the rocker arm which supports the brushes has been shifted so that they are not in the neutral field.

If the neutral field is not indicated by corresponding marks on the rocker arm and on the frame of the machine, it can soon be ascertained by a little experimenting, shifting the brushes one way or the other until the sparking is at a minimum.

The Transformer—Very little difficulty is experienced with the transformer except as regards insulation. In damp and tropical climates the insulators and the lids of the secondary of the transformer may start leaking current with the result that the cover is finally carbonized.

This leakage can be eliminated by removing the cover until the home port is reached, where it will be replaced.

Condensers—Care should be taken to keep the inside contacts of the leyden jars clean to avoid sparking.

The insulators in the lid of the condenser rack may burn out from dampness; if so, they can be temporarily removed.

If one of the leyden jars should puncture, it should be removed and a fraction of a turn of inductance should be added in the closed circuit to bring the wave length up to the point to which the set was originally adjusted.

Spark Mufflers—The spark muffller should be watched from time to time to ascertain if there is any leakage on its walls. If leakage is found, the muffler should be wiped out carefully and the difficulty will then no doubt be eliminated.

If, however, it is still experienced, the upper spark gap electrode can be removed from the cover and the electrode temporarily supported by a piece of dry wood until arrival at the home port. In the later types of apparatus this difficulty with spark gap mufflers is not often experienced.

The Helix—The insulation on the helix and its supports should also be carefully watched to ascertain if there is any leakage.

Anchor Gap—The anchor spark gap should be cleaned from time to time and an effort made to keep the spark gap length down to the minimum. It should not be more than 1/64 of an inch.

Roof Insulators—The roof insulators should be inspected from time to time to note whether leakage is taking place.

Earth Connections—The earth connections of the transmitting and receiving apparatus should be frequently inspected to see whether there is perfect contact.

Protection from Dampness—An attempt should be made at all times to protect the wireless telegraph set from damp air or ocean spray. This is particularly important as salt spray is conductive and will cause leakage across any insulators with which it comes in contact.

Should the radio cabin become wet with salt water, the apparatus should be carefully gone over with kerosene or oil which will effectively remove the salt deposit.

Sliding Contacts—An effort should be made to keep all sliding contacts clean and free from dirt, grease and oil, in both the transmitting and receiving apparatus.

The Adjustment of the Auxiliary Set—Adjustment of the auxiliary set should not be attempted until the antennæ and earth conections are on the coil, as the adjustment of the interrupter for maximum voltage without the capacity of the aerial across the secondary, is not the same as when the aerial is connected to it.

The spark gap length varies with the size of the ship's antennæ; it cannot be definitely stated in advance just what length should be used, but it should be widened out to the point where the spark is free and clear from flame. This will be found from 1 inch to 2½ inches in length, or in the case of smaller ships, possibly more.

Particular regard should be given to the spring tension adjustment X^1, by which the rapidity of the interruption can be varied, and the efficiency of the spark increased as a whole.

Antennæ Insulation—When the auxiliary set is in use it is imperative that the insulation of the antennæ be perfect in every respect because, in addition to the high frequency oscillations which traverse the antennæ, a low frequency high potential current from the secondary of the induction coil is superimposed on the same circuit.

This low frequency, high potential current is difficult to insulate, and if by any means the insulators become carbonized by soft coal smoke deposit it will be found very difficult to secure a spark on the auxiliary set.

Where this is experienced it can be temporarily eliminated by inserting a leyden jar in series with the antennæ. The short wave condenser might be used for this purpose and it will then be found that an oscillatory discharge is produced at the spark gap, even though the antennæ insulators are leaking. While the set would not be quite as effective in transmitting range under these conditions, it will enable the operator to signal in case of emergency, where otherwise it might be impossible to obtain a spark. In fact, there is no better test for the insulation of the antenna than to apply the secondary terminals of the induction coil to it in the regular manner.

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.

St. Louis Gets Time by Wireless

Municipal clocks in St. Louis will be set daily at accurate time, to be received by wireless telegraph from the United States Government station at Arlington, Va., if the plans of J. McD. Johns, Superintendent of the Police and Fire Alarm Telegraph, succeed.

A wireless receiving station is now being constructed on the city hall of sufficient power to receive wireless flashes from the Government observatory 800 miles distant.

Railroads are considering the construction of wireless receiving towers at Union Station, where correct time may be received to regulate watches of trainmen.

Government time from Arlington is now being received at 9 o'clock every night at the St. Louis University observatory, Grand avenue and Pine streets, the largest wireless station west of the Great Lakes. Steel towers 150 feet above the ground have recently been installed.

Henry L. Dahm, a twenty-year old student, is in charge of the wireless station. He is co-operating with Johns in the installation of the municipal receiving station.

With four or five wires placed in a spare room it is possible, according to Dahm, to set accurately each day all of the clocks in St. Louis residences and business houses.

The wireless time service was suggested by many requests for fire alarm signals in St. Louis County, which would be too expensive to install with wire connections.

Wireless in Scout Camp

The Brooklyn fellows of the Boy Scouts of America who have established Camp Leeming, at Southfields, New York, for the summer, have not quite cut themselves off from the rest of the world. Under Camp Master Oxenham a number of wireless experts have rigged up an apparatus with which they can keep in communication with home. Every day they get in touch with the city and receive weather reports and baseball scores.

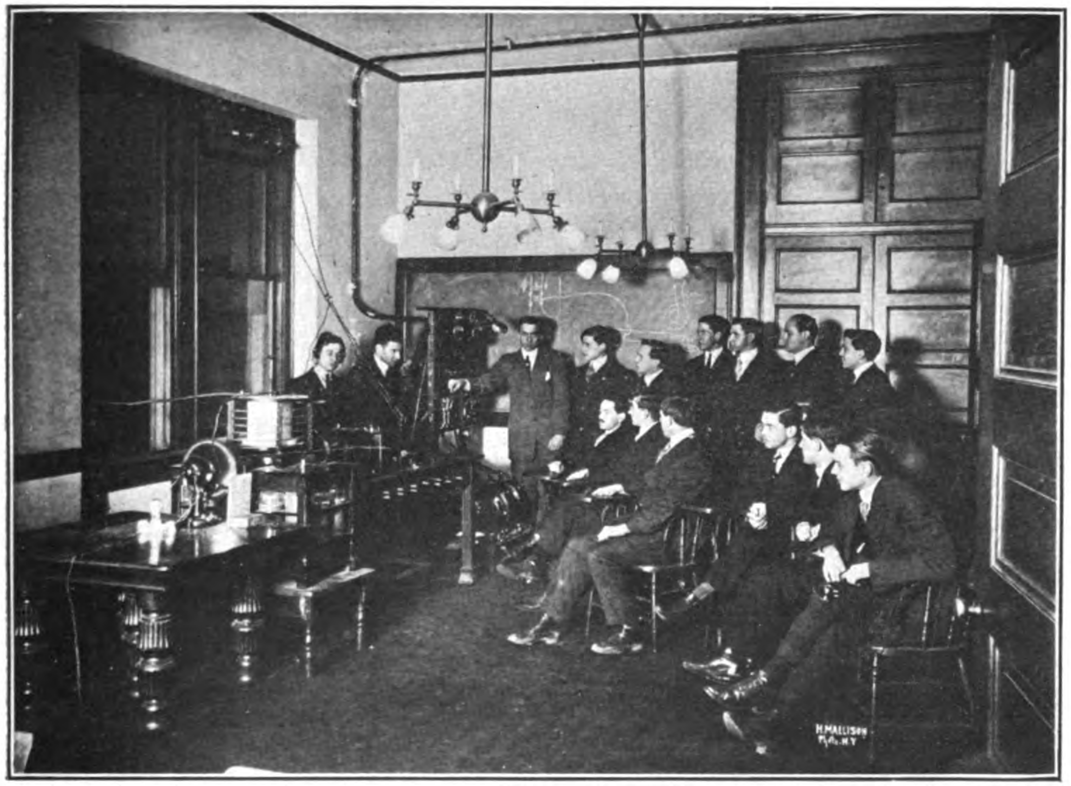
Filling the Demand for Young Operators

One of the many ways in which the Young Men's Christian Association is proving its usefulness is helping men to find work—not just "anything," but the right work for them. If they show capacity in a certain field, but need more training, the Association supplies the training. Its vocational schools cover almost everything, from plumbing to aviation. Naturally it was among the first agencies to take up the training of wireless operators. The results were so good, and the demand for instruction so keen, that an extensive course has been worked out by the East Side Branch in New York. Among the instructors are: E. E. Butcher of the Marconi Company, A. B. Cole of the Manhattan Electric Supply Company, Lewis Vanderbilt of the Western Union Telegraph Company, and Joseph Halka, who was operator on the Alabama during its trip round the world. The subject is treated under the divisions of elementary electricity and magnetism, the theory and the various technical aspects of radio telegraphy and practical laboratory work. The day course takes three to six months, the evening course six to nine months.

The New York Times printed a description of the work of the school, from which the following account is largely taken:

Many of the manipulators of the crackling spark are recruited from city youths who earn only a few dollars a week at office or shop work. Others come from the farms, where they have not been overburdened with pocket money. To a youngster of either class, it is profitable as well as pleasant to earn his living at wireless telegraphy and circle the earth while he is doing it, at a salary of $30 a month and expenses. For the expenses include his board and lodging and transportation, so that his salary has only to cover his clothes and spending money. And the $30 a month is not all he draws, for if he is on a passenger ship he gets a percentage of the tolls on all messages.

But it is not necessary for ambitious wireless operators to wait for that time to get higher pay. Plums are in their reach now, and the more progressive among the young men



Class demonstration at the East Side Branch, Y. M. C. A., New York.

are stretching out their hands for them. A wireless inspector in the employ of the Bureau of Navigation of the Department of Commerce starts at $1,800 a year. It is his own fault if he fails to go higher in a short time. There is said to be little doubt that the Government will increase largely the number of such inspectorships, and it is believed the pay will be increased to meet the larger demand which that expansion will create.

Wireless operating aboard ship is far from drudgery. Under the new law of last July every vessel equipped with wireless is compelled to carry two operators. The operators on most ships are permitted to divide their work to suit themselves. All that is required of them is that one of the two shall be on duty all the time and ready for work. Sometimes the men arrange their hours on a basis of six hours on and eight off, taking turns on the short and long tricks. Others prefer twelve on and eight off. Others again like eight hours on and twelve off.

Few, if any, ships now carry three operators. Some did so for a time after the Titanic disaster, but it has been decided that two men meet all the requirements of safety. The Lusitania and Mauretania, each of which had three Marconi men until lately, have reduced their forces to the two required by law.

The young man who makes his way around the world as an operator has abundant leisure. One youth, for example, whose ship plies between Atlantic and Mexican waters, has fourteen days off in Mexico on each voyage, the same number in New York, and seven days in Philadelphia.

Although the ages of Marconi operators range from 16 to 55 years, the average age at which men enter the service is 20. The students are drawn from grammar school, high school, and college, as well as from youths already in business. Most of them are Americans. Among the recruits are messengers, office boys, clerks, electricians' helpers, and even ribbon salesmen. Among so many Americans many are found ambitious enough to take correspondence courses in electrical engineering and other lines. Wireless work gives a boy a fine start for almost any employment calling for technical knowledge.

There is another advantage in putting in a few years as a wireless operator. Not only have the manufacturers of the United States gained at least a small part of the South American trade, but they are reaching out for more with increasing eagerness as the years of this progressive century roll by. It is safe to say that the youth who serves for a couple of years in South American waters, learning Spanish and Portuguese and acquiring intimate knowledge of the commercial customs of the peoples, will find a good place awaiting him in an export house when he is ready to settle down in New York. Export agents and manufacturers are always on the lookout for men familiar with conditions in the Latin-American republics, particularly if those men are Americans.

The United States Navy trains its own wireless men, but that does not mean that an operator cannot get into that branch of the service. A naval wireless man ranks as a radio engineer. There are four grades, ending with the place of radio chief at $77 a month and all living expenses.

Vincent Astor Sends Wireless Welcome

Vincent Astor greeted his mother. Mrs. John Astor, and his sister Muriel, on their return from Europe, with a wireless message from his yacht Noma, using the Marconi outfit installed some time ago.

Young Astor steamed down New York Bay on the Noma to meet the Olympic, on which Mrs. John Astor and Miss Muriel Astor were passengers. But long before the steamer reached her pier Mr. Astor was in communication with them.

When the Olympic arrived the reunited family proceeded to Newport.

Notable Patents

Valdemar Poulsen describes his receiver, on which an American patent has recently been issued, in this manner:

In the majority of transmitters now employed in wireless telegraphy, the oscillations are not only rapidly damped, but also have a comparatively long interval between each interruption, and it is the common practice to use in the receiving system a coherer or magnetic detector, which is permanently connected in the receiving circuit. In such a system, however, it is impossible to obtain the highest degree of resonance, since the dampening of the oscillations and the intervals between them tend to prevent resonance. In order to obtain the highest degree of resonance it is desirable to use a transmitter comprising an interrupter of some character that is capable of sending out the waves continuously and uniformly. Such interrupters have been devised, but have not been generally put into use. In this class of interrupter I may refer to the Wehnelt interrupter, the Cooper Hewitt mercury interrupter, and the Duddell interrupter, described in British Patent No. 21,629 of 1900. Transmitters employing interrupters of this character tend to produce vibrations in the receiving device of a tuned system, of the highest amplitude. But in experiments with such apparatus, I have found when the coherer or wave detector is permanently in circuit with the resonant circuit, that it interferes with the action of the resonance, preventing the circuit from retaining or continuously building up its resonance. This is due to the fact that the resistance of the coherer is not controllable and the iron of the magnetic detector tends to dampen the vibrations.

The object of the present invention is, therefore, to provide a system in which by the use of a transmitter capable of sending out continuous waves the highest possible resonance is obtained in the receiver, and is not interfered with by other devices or apparatus forming a part of the tuned receiving system.

The invention comprises means whereby the wave detector forming a part of the receiving system is only intermittently connected with the receiving system proper or resonant circuit, whereby the intervals of disconnection will afford time for the vibrations to build up to the highest amplitude undisturbed by the coherer or other wave detector.

In carrying out my invention, a terminal or the terminals of the wave detector, is, or are, alternately connected with the resonant circuit, and the relay circuit by means of an ordinary vibrator similar to that used in an electric bell.

Fig 1

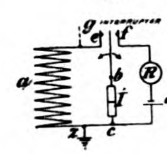


Fig 2

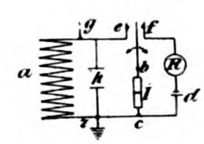


Fig 3

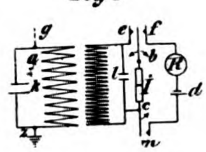


Fig 4

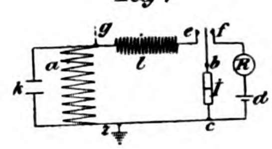


Fig 5

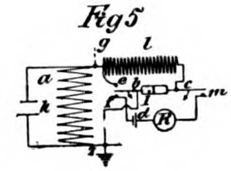
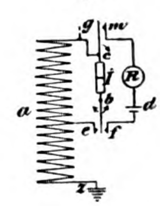


Fig 6



Referring to the accompanying drawing, Figures 1 to 6 illustrate diagrammatic examples of the arrangement of a receiving system according to my invention.

The various figures show modifications in the manner of connecting up the various apparatus, all covered within the scope of the invention.

g indicates the antenna, *a* the receiving coil or resonance, *z* the earth connection, I the coherer or wave indicator or detector, either chemical or any other sort, having the terminals *b* and *c*; R the relay in the local circuit, which also includes the battery *d*.

e and *f* are respectively terminals of the receiving coil *a*, and the local or relay circuit R.

The invention comprises means more particularly hereinafter described for alternately connecting one or both of the terminals *b* and *c* of the detector with the receiving coil and the local circuit. For instance, in Fig. 1, the terminal *b* is extended into a vibrating blade which plays between the contacts *e* and *f*. Its motions are made at approximately from 8 to 15 vibrations per second depending upon the operation of the vibrator or circuit controller that is used for the purpose. It is understood that the vibrations of the device *b* are extremely slow in comparison to the vibrations of a wave oscillation circuit, while at the same time extremely fast with respect to signals of Morse or other code. The oscillations of a wireless receiving circuit are at the rate of from 200,000—30-000 a second, so that the circuit closing positions of the device *b* at each terminal amount to quite a long circuit closure when considered from the standpoint of the wireless waves. On the other hand, the vibrations of the device *b* are so rapid in comparison to Morse code signaling that each Morse dash amounts to a very long circuit closure in comparison to device *b*. In case a tapper is employed with a detector having been filings, the same considerations apply.

Fig. 2 is the same as Fig. 1, except that a condenser *k* is inserted to increase the capacity of the coil *a*.

In Fig. 3, the vibrations in the coil *a* induce other vibrations in the coil *l*, the structure being a transformer and a condenser *k* being used as before to increase the capacity. In this arrangement also the terminal *c* of the coherer is intended to be connected with the contact *m* of the local circuit simultaneously with the connections of *b* and *f*.

In Figs. 4 and 5 a coil *l* of fairly high inductance is electrically connected with the coil *a*, the other connections being in Fig. 4 the same as those of Fig. 1, and in Fig. 5 the same as those of Fig. 3. This coil serves to raise the potential in a well-known manner, which in itself forms no part of the present invention.

In Fig. 6 the arrangement is such that the contact *e* with which the indicator I makes connection can be adjusted to connect with that part of the coil *a* which simultaneously possesses the maximum of tension with opposite signs, and the coil *a* can act either in connection with an antenna as receiver or be electrically connected to the receiver proper. The coil *a* of Fig. 6 constitutes an ordinary auto-transformer.

Plan for Safety Signals

W. L. Cummings, the young inventor of Salt Lake City, who was arrested for threatening to kill a young woman by exploding dynamite in her room by a wireless impulse, claims that his machine has many good uses. Tests that have been made seem to bear out his claim. Electricians took the machine into a steel and concrete vault in an office building. Another part of the contrivance, on which was mounted a bell and an incandescent globe, was placed in a closed room across a hall. Then the electric current of the machine was turned on. On the unattached box in the other room the bell rang and the lamp glowed brightly.

Cummings said the attachment could be installed in locomotive cabs, where it would give a positive signal if a train ran past a closed block signal. In war, he said, mines could be exploded without wire attachment.

Queries Answered

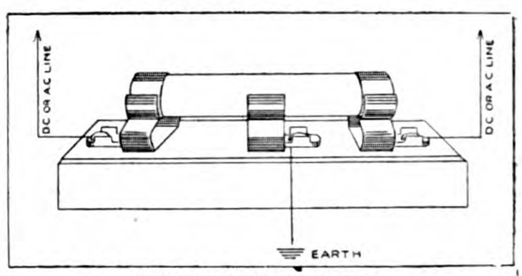
Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all 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.

The inquiries that come in to our Question and Answer Department are all most carefully read and every effort is made to give the most helpful answer possible. We ask only that our readers make their questions clear and exact. For example, if a condenser is referred to, the dimensions in square inches or square centimeters, as well as the thickness of the dielectric, should be given. If the question has to do with the helix, give its complete dimensions. The point is that no correct answer can be given unless the question is complete. The details that are often omitted may be the very ones that determine the answer. These questions are referred to experts, but many of them require a good deal of looking up. Sometimes they refer to matters of general information which the questioner could get as well as anybody else. Sometimes they are such as nobody can answer. Nevertheless, we are glad to get them if only as evidence of genuine interest. And every now and then they give opportunity for such answers as will be helpful to everybody. All questions and answers should be read thoughtfully each month.

E. H. S., Columbus, O., writes:

Kindly favor me by giving information regarding kick-back preventers. Are there any on the market guaranteed to prevent kick-backs? If so, who manufactures them? They are to operate on 220 v., 60 cycle A.C. The Columbus Railway & Light Co. refuses to give us service until we can show them a device guaranteed by the maker. We have shown them the condenser type with micrometer gap, but they claim this will not always work. The club's success and future development rests upon this, and I will greatly appreciate any information that will help us out of our predicament and to satisfy the electric company so that we can put in some kind of sending station. At present we have direct current.

Ans. We assume that by "kick-back" preventers you mean a device to remove high potentials induced in a power line by electrostatic induction from a wireless telegraph transmitter. The condenser protection which you refer to is sufficient and has been adopted by the U. S. Navy as a standard and if the power company has turned it down they apparently are not familiar with this device. The



PROTECTIVE RESISTANCE RODS

Fig. 1.

Marconi Standard is shown in figure 1. It is a carbon or graphite rod of about 1,000 ohms' resistance, the middle point of which is connected directly to earth. If this is shunted across the neighboring light circuits and low potential power lines it will neutralize + and — static discharges set up and conduct them to earth. Very likely the power company has had previous experience with amateur stations in the vicinity and may have good reasons for insisting on such protection. It is always advisable not to erect a wireless telegraph antenna in a manner that is likely to induce dangerous potentials in near-by power circuits. This same effect can be caused by a very long ground lead from your transmitter; that is to say, if the earth lead is abnormally long it will induce destructive potentials in power circuits in proximity.

* * *

H. Hersh, Medical Springs, Ore., asks:

(1) Why are all oscillation transformers made with the coils side by side instead of putting them inside of one another? Wouldn't it be better, and why?

Ans. Without reflection one would think that more energy would be transferred into the antenna by having the secondary of the oscillation transformer directly inside of the primary, but if this is done the magnetic flux of the primary and secondary will react on one another and produce two separate and distinct periods of vibration in your antenna, giving two wave lengths. Inasmuch as the energy is then radiated in two wave lengths the device is inefficient, consequently the two helices are drawn apart to reduce the coupling so that the energy is radiated on one wave length, or very nearly one wave length. You will find by experiment with the ordinary type of oscillation transformer it is unnecessary to have the primary and secondary coils concentric. If they are so constructed that the coils can only be placed close together this will generally be sufficient to transfer energy if a loose coupling is desired.

(2) What do you use in soldering aluminum wire, that is, to make it hold?

Ans. We do not know the formula for solder for aluminum wire, but an excellent preparation known as Richards Aluminum Solder can be purchased from Kemp & Company, 165 Spring street, N. Y. City. Possibly you may be able to secure it from some local supply house.

Service Items


E. T. Edwards.

Of great interest to wireless men was the wedding of Emma Louise Vallance to Ernest Thomas Edwards, which was quietly celebrated at the home of Mrs. Charles Kingsley, of Bar Harbor, Me., on the morning of August 1. Mr. Edwards, whose bride is the daughter of Abram Vallance, of London, was promoted to the position of manager of the operating department of the American Marconi Company about a year ago and will continue in that capacity upon his return from the honeymoon.

Joining the operating staff of the English Marconi Company eleven years ago, Mr. Edwards was shortly afterwards loaned to the Belgian Company for service on a ship chartered by the Russian Government for service in the Baltic Fleet. Later he represented that company at Hamburg, ultimately returning to England. His engagement with the American company dates from the re-equipment of the steamer New York, at Belfast, in 1904; after several trips aboard this vessel he was transferred to the station at Siasconset, Mass., of which he became manager, and later he was placed in charge of the station at Sea Gate.

Mr. Edwards is a member of the exclusive Sea Gate Association and being a property owner will probably make his future home on Norton's Point.

* * *

W. A. Appleton left Montreal a few weeks ago for Labrador, in order to open the system of stations there for the coming fishery season.

* * *

J. J. Collins left Heath Point for Labrador, where he will act as inspector during the coming season.