THE WIRELESS AGE

AUGUST

1915

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THE WIRELESS AGE

An Illustrated Monthly Magazine of
RADIO COMMUNICATION

Incorporating the Marconigraph

J. ANDREW WHITE, Editor — WHEELER N. SOPER, Asst. Editor

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THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

AUGUST, 1915

Railroad Wireless

An Impromptu Address by David Sarnoff at the Convention of the Association of Railway Telegraph Superintendents

An impromptu address on railroad wireless was delivered by David Sarnoff, assistant traffic manager of the Marconi Wireless Telegraph Company of America, at the annual convention of the Association of Railway Telegraph Superintendents in Rochester, N. Y., on June 24. The address was followed by a discussion during which Mr. Sarnoff answered various questions regarding the subject.

"In an organization such as this," said Mr. Sarnoff, "where all or most of the papers and discussions are about wires, and the troubles attendant upon wires, it may seem somewhat unusual to you for a man to get up and talk about wireless because it suggests the thought that you may all be on the wrong track. However, that is not my idea.

"I was interested yesterday in Mr. Lockwood's discussion of the telephone, especially when he talked about a man named Shreve, whom I happen to know personally, and who suggested some very radical ideas in connection with telephone repeaters, but whose superiors thought he was too good a man to lose to let him go ahead. I was envious of that man because my company doesn't seem to feel that way about me. It sent me here without fear of losing me. But perhaps it was influenced by my desire to come here and meet you once more.

Wireless Related to Other Subjects

"The wireless, instead of being a radical step, is, in my opinion, rather closely affiliated with most of the subjects that are being discussed at this meeting. For example, the paper on 'Induction from High Tension Power Lines' is allied, in a way, for only recently I discussed this subject with Mr. Smith of the New Haven at a meeting of the Railroad Club at which Mr. Foley presented a paper, which I had the honor to discuss. Mr. Smith asked me then whether wireless would suffer from induction caused by high tension power lines, and I told him 'No.' That is to say, it is possible to so arrange wireless stations, even though they be situated adjacent to high tension power lines, that no trouble is experienced from induction. Since that time Mr. Smith has carried on some experiments with wireless instruments, probably to see whether I was telling the truth, and found that my statement was warranted.

"Also the paper on the development of the telephone is in a measure related to wireless. Mr. Lockwood discussed the subject of telephone repeaters and it may interest you to know that even with the transcontinental speech which took place last night, there were in use wireless amplifiers, which intensify the speech and which have, to a large degree, made possible practical transcontinental wire telephony.

An Auxiliary Service

"Now, gentlemen, I wish to impress upon you the fact that wireless in railroad work can be utilized as an auxiliary service, for it has the advantage of being strong at the very point where the wire is weak, as in case of a storm, etc. That is the time, of course, when auxiliary communication is most desirable, and wireless fills the gap admirably well. Then, too, there is the possibility of the use of portable wireless equipments for field work in case of floods or other similar instances where it is necessary to get in touch immediately with different points.

"I was particularly interested yesterday in Professor Culver's discussion of wireless. His discussion was instructive to me as a wireless man, as well as to you who are more or less interested in the subject. There are, however, a few points that I should like to discuss in the few minutes that I have been granted to talk. One is his statement that wireless is an especial branch of electrical engineering, and his advice that you should not give such problems to your own electrical engineering department. While it may be true in a sense, I am afraid that a wrong impression may be left and that is what I wish to prevent.

"The determination of the proper type and power of wireless stations to be installed is a matter for consideration by those of practical wireless experience, but after that has been decided and the stations erected, it ceases to be a radio problem. It is then only necessary to maintain and operate the stations and your own staff is quite competent to do this. When the Lackawanna decided to adopt wireless, the Marconi Company designed, manufactured and supplied the necessary apparatus, determined the power required at the various points, and furnished plans and specifications to the Lackawanna, which installed the equipments under the Marconi Company's supervision. Ever since, the Lackawanna Company has been able to operate the Marconi system without any difficulty whatsoever.

High Towers in Transmission

"The professor also stated that there is no need for using high masts or towers to support aerial wires and seemed enthusiastic about the practicability of aerials a few feet above ground. Well, the use of very low aerials for reception is, of course, well known, but for transmitting radio energy at any considerable distance with such antennae no great achievements can as yet be claimed. It is significant to note that the high power stations erected and being erected by the Marconi Company, the Goldschmidt system, the United States and the British Governments all depend upon fairly high towers to support their radiating antennae.

"Professor Culver also spoke of a wireless relay that is being developed. The Marconi Company has had a long experience with relays, having been the first to use them in connection with the early Marconi coherer receiving sets. Relays in wireless are serviceable for certain particular purposes, but I believe that for the coming few years at least, general wireless communication will be conducted by the present method of acoustic reception for the reason that there is the 'human element' to be considered.

"While wireless does not suffer from induction or sleet storms, there are, nevertheles, atmospheric disturbances in the form of static electricity which is picked up by the wireless receivers. With the use of a receiving relay, these static currents may prove very troublesome, but with acoustic reception the operator can, by concentrating on the pitch or note of the spark which is musical, read the wireless signals witn ease while the static, which is of a very low pitch, can be disregarded.

On Getting Advice

"There is another matter that Professor Culver mentioned yesterday which is rather novel and that is, his caution that you should not take advice from commercial wireless companies, depending instead upon the government for advice. Being a commercial man, I suppose I am naturally biased in favor of commercial companies, but nevertheless it is axiomatic that advice given for nothing is usually not worth very much. Then, too, the government has shown quite an inclination to tell railroad people how to operate railroads, and perhaps it might also tell you how to operate the wireless. It seems to me that if I wanted to build a railroad I should seek advice of the railroad people and, similarly, if you want to build wireless stations you will, in the last analysis, have to be guided by a reliable, commercial wireless company.

"If you decide on wireless communication, it is simply a business proposition. The Marconi company will make a contract with you and will guarantee certain communication. I do not see, therefore, wherein you are required to take any risks. I said last year in New Orleans that the Marconi Company preferred to rent its apparatus rather than to sell it outright. This policy obtains in marine equipments where the wireless organization is a most important factor. Perhaps there is no other field of communication where organization is as essential as in wireless. It is obvious that the success of any particular railroad in wireless communication is the success of the wireless company that supplies the apparatus, and, therefore, it is to its own advantage to see that satisfactory service is rendered. I found during my experience last year that the railroad superintendents generally think the rental policy somewhat of an obstacle, as the railroad companies do not seem to incline towards renting anything that can be purchased outright. In view of this the Marconi Company is quite prepared to sell its apparatus outright to the railroads, and still furnish them with the benefit of our advice and assistance. We can also by means of our vast organization arrange for periodic inspections and assist generally in solving the different problems that may arise from time to time.

"This is all I have to say, gentlemen, unless you have some questions that you wish to ask, and it will be my pleasure to answer."

L. B. Foley, superintendent of telegraph, telephone and wireless, the Delaware, Lackawanna and Western Railroad, said that he assumed he had the privilege of talking for fifteen or twenty minutes if he had anything to say, but as "I haven't, and as I am very much interested in this proposition, I should be very glad to have you give Mr. Sarnoff all the time he wants."

Interest in Wireless Telephone

Mr. Keenan, the chairman of the meeting, said that "I called upon Mr. Sarnoff and told him that he could have two minutes merely in the way of a joking remark. Most of us are willing to admit now that the wireless telegraph is doing wonderful things, and practical things and all that. We want to know what is being done, and we should like to know particularly what is being done about the development of the wireless telephone so that anybody can handle it as a practical proposition. We are rightly much interested in the wireless telephone."

"There have been two great difficulties to surmount in the development of the wireless telephone," said Mr. Sarnoff. "First, to produce suitable power for the transmission of the human voice, and second, to provide suitable means for modulating the power. You will note that both the difficulties are on the transmitting end. As to the first problem, the production of suitable power, this, I believe, has been practically solved by the high frequency alternator and the other means which obtain for generating undamped oscillations, better known as continuous waves. With regard to the second problem, the modulating of these currents at the transmitter, promising advance has been made during the past year or so, but there is still a lot to be done in this connection before I can say that a practical and commercially reliable wireless telephone for distances of several hundred miles is on the market. Gentlemen, that sort of a wireless telephone is not here yet, but I'm extremely optimistic of its coming—and before many years are over.

Practical System for Railroads

"In connection with the railroad service it seems to me that the wireless telephone will perhaps have its greatest field of utility on moving trains. At the present time, however, the railroads have telegraph stations equipped for communicating between fixed points and as this important communication is subject to frequent interruption, we are urging the adoption of the wireless telegraph as an auxiliary because at the present time it is far more practicable than wireless telephony and, further, because it is a proved and tried proposition. We know that when coming before railroad superintendents we must 'deliver the goods,' and the record of the Marconi Wireless Telegraph system is, of course, well known to all of you.

"Now, it may be of interest to the gentlemen present to know some of the wireless principles in so far as the actual telegraphing is concerned. I have found in my discussion with the various telegraph superintendents that the first question asked is, 'What is the speed of wireless?' The speed of wireless is limited only by the ability of the wireless operator. As a matter of fact, the Marconi Company has recently erected a set of high power wireless stations which will be in communication with Europe and will compete with the cable companies. These high power stations will employ high speed automatic wheatstone transmission. The stations will operate at a speed considerably in excess of fifty words per minute, and they are to operate for twenty-four hours a day. When I tell you that the scheme required the investment of about five millions of dollars, you will readily appreciate that there were some definite grounds to build on before the Marconi Company proceeded with the erection of these stations. You can use automatic machines on wireless reception as well as transmission if you like. The telegraphone is quite adaptable to the wireless service. We have used it at our high power stations.

"Now, Mr. Chairman, I think that perhaps I might throw more light on the subject if the gentlemen present will ask me such questions as may be in their minds."

Mr. Hall, telegraph superintendent of the Missouri, Kansas & Texas Railway, said that he would like to ask Mr. Sarnoff concerning the weight of the portable apparatus that could be used in flooded districts.

Light Apparatus Desirable

"I have had cases," he declared, "where we could have transported a light weight set to the other side of a flooded district where we wanted to establish communication and where we couldn't float wires in any manner, there being no trees or anything to carry the wires. We were completely out of business until the flood subsided. If you have a light portable apparatus that could be taken over in a boat, it would be of immense railroad possibilities."

"We have a portable equipment which is rated at a quarter kilowatt," replied Mr. Sarnoff. "The transmitting and receiving apparatus is contained in a suit-case which weighs about fifty pounds. In addition to the suit-case there is a motor-generator or hand-generator weighing about fifty pounds which furnishes the necessary current for the wireless transformer in the suit-case. Where direct current is available the motor generator can be used, but where no current is available the hand generator is required. In connection with the portable equipment it is necessary to have portable masts about twenty-five or thirty-five feet in height or in some cases it may be feasible to string antenna wires on trees or telegraph poles. With such an equipment, communication from twenty-five to fifty miles can be reliably conducted. Similar sets are used with success by the United States army, and also by the various European nations now at war."

"The average telegraph pole is about twenty-five feet," said Mr. Hall. "Suppose we should go on each side of the flood where the wires have not been disturbed and hook the antenna wires upon the poles. Couldn't we use them for the aerial?"

"That would be entirely feasible," replied Mr. Sarnoff.

Cost of Equipment

Mr. Caskey, telegraph superintendent of the Lehigh Valley Railroad, said that he was somewhat interested in the question of costs. He asked: "Could you give me an idea, approximately, as to the cost of a wireless set, properly equipped for railroad work, which could be extended from point to point?"

Mr. Sarnoff, addressing the presiding officer, said he would have to ask whether he could answer this question.

"Certainly, go ahead," replied the chairman.

"In order to give you a reply to your question," said Mr. Sarnoff, "it is necessary to know how many stations you would desire and the approximate distances between the stations. Conditions vary, of course, on each railroad. Just what have you in mind, please?"

Mr. Caskey had in mind a distance of 450 miles divided between five or six points.

"That means," declared Mr. Sarnoff, "that you would want six stations, one station at each of the six points, and your communication would have to be over a distance of approximately seventy-five miles. Now, it is possible to communicate over a distance of one hundred miles or so with one kilowatt of power, but so there may be a sufficient amount of power to operate successfully under the worst possible conditions over land, a two kilowatt station would be preferable, and the approximate cost of a two kilowatt station is about $3,000. This includes transmitters, receivers and all other necessary parts, but exclusive of towers, which the railroad company would, of course, have to supply. For a two kilowatt station to operate one hundred miles, it would be necessary to have two towers about 125 feet high. They cost something in the neighborhood of $300 each, but it may be possible to utilize either a smoke-stack, chimney or water tank, or any other means of support at one end of the antennae, thereby reducing the expense of towers. In your case, Mr. Caskey, the total cost would probably be in the neighborhood of $20,000."

"Can you have duplex transmission?" asked Mr. Wells.

Duplex Transmission Possible

"Yes, sir. It is possible to have duplex transmission. The Marconi high power wireless stations, which will communicate between the United States and Europe, will employ duplex operation. These stations are of 300 kilowatt capacity, and I might add that the Marconi high power stations at Glace Bay, Nova Scotia and Clifden, Ireland, have been operating duplex wireless telegraphy for the past several years and with great success."

Mr. Caskey asked: "In the case of a supposed plant of 450 miles would it be possible to have a set at each end of a different capacity to work between the extreme ends, and at the same time to operate between the intermediate station?"

"Yes, it is possible, but you would require sets at the two extreme ends of greater power. In case of 450 miles, a ten kilowatt set is a conservative estimate. I always favor having sufficient power so that operation can be maintained under the worst conditions. For ten kilowatt sets, the price would, of course, be correspondingly increased."

"What kind of power is necessary in wireless telephone transmission?" asked Mr. Van Etten.

Power for Wireless Telephone

"There are three methods of generating current necessary to produce electric waves," said Mr. Sarnoff. "The first and most common is the spark system which produces damped or discontinuous waves; the second is the direct current arc method which produces sustained or continuous waves, and the third is the high frequency alternator which also produces continuous waves. For wireless telephony the last mentioned method of generating electric waves is perhaps the best."

Mr. Lee said that he would like to ask if thought had ever been given to the production of wireless communication between head and rear of freight trains, or anything of that kind.

"A great many railroads, I believe," he declared, "have looked into the question of a telephone or signal communication between the head and rear of trains, and the thought has occurred to me that possibly wireless might be used for either the transmission of the voice or signals, whereby, no matter whether the train is broken in two or cut in two for switching purposes, they can still communicate. I believe there is a field there."

"Yes, thought has been given to this problem by the Marconi Wireless Company only recently," replied Mr. Sarnoff. "We took the matter up with one of the eastern railroads. We found it entirely feasible to install a transmitter at the rear of the train and a receiver at the head of the train, and to signal from the rear to the front."

"The distance being so short, would the expense be low enough so that it would be feasible?" inquired Mr. Lee.

"Yes, the expense of installation would be very negligible, as compared with the advantages of the instrument. A set of that sort could possibly be gotten up for somewhere in the neighborhood of $500."

"Is that transmission telegraphic or telephonic?" asked Mr. Cline.

"Telegraphic preferably," said Mr. Sarnoff. "I refer to signals. I understand what is wanted is signals from the rear to the front, not communication both ways."

Mr. Lee said that he had both in mind, but really the signal idea would carry out the purpose. There would be difficulties in voice transmission other than those attending the wireless proposition. For instance, the noise of the locomotive would be of a disadvantage in talking, while signals could easily be interpreted. That would probably answer all purposes.

Mr. Sarnoff said that he had based his reply upon that understanding. He declared that the expense would be greater for the telephone and it would hardly be as practicable as the signal system.

"I looked into the question as to telephone connection between the engine and the rear of the train several years ago," said Mr. Kissinger, "and I believe that if satisfactory telephonic communication could be arranged for long trains it would be very beneficial, provided it could be done for a reasonable sum. As I said, I looked into the question at the time. A figure was given to me of a possible wireless telephonic plant that would cost approximately $100 per train."

Advantages of Signal System

Mr. Sarnoff inquired if that estimate was for both ends, and, upon receiving an answer in the affirmative, said: "That is pretty cheap. However, with the interest displayed in this particular direction, I shall be glad to follow it up further. I have been thinking of the signal end of it all the while and that, as I've said, would not be very expensive. Telephonic communication will be a little bit more difficult on account of the noise, and I do not know whether the engineer of the train would be able to pay the required attention to the equipment, while the signal would tell him at once what he would be required to do."

Mr. Foley informed the speaker that "we will loan you a freight train any time you want to conduct further experiments," receiving the thanks of Mr. Sarnoff in reply.

The Chairman then said:

"I have been over Mr. Foley's railroad and looked into this question. He has a fine system. If Mr. Foley cares to make any further remarks now, I know we shall all be glad to hear from him."

Wireless Telephony on Railroad

"I was under the impression that I had given my time to Mr. Sarnoff," said Mr. Foley, "but I will tell you of an experience we had with the wireless telephone. About four weeks ago we transmitted by wireless telephone five messages between Scranton and Binghamton, a distance of sixty-three miles. They were copied by an operator and repeated back over wireless. We think that is a record for wireless transmission in the United States. An operator on board train has reported that particular train from the despatcher as it passed the station in the zone of forty miles, and the despatcher got the report and put it on the train sheet."

"Well, that is promising," the Chairman declared, "and along that line, I will say that with this change in the By-Laws, that you have authorized us to make, which we have called committee work, we shall always have a committee to investigate and report, and I think we have present here members of some of our committees on wireless to keep us advised. While this subject was not scheduled it has been very interesting. We had more papers offered than we can take care of. We discussed the wireless in New Orleans at the annual meeting, and we had it in New York, and it looks to me as if we would have to have it as a standing subject, because I am interested and I know all of you are, and it will be necessary for us to keep right up to date on the subject. I am sure the Association wishes to encourage Mr. Foley and the Lackawanna Railroad, as well as the Marconi Company and the other concerns."

The discussion ended with a remark by Mr. Foley, who declared that "Professor Culver gave us a very good point yesterday when he said that he did not think high towers would be necessary. That may cut down the cost of installation very much."

The president of the association appointed the following committee on wireless telegraph and telephone developments: L. B. Foley, chairman; David Sarnoff, J. F. Caskey, R. H. Carson and W. J. Kelly.

E. J. NALLY HONORARY MEMBER OF ASSOCIATION

Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, was elected an honorary member of the Association of Railway Telegraph Superintendents at the last annual convention of the association held in Rochester, N. Y. He sent a telegram expressing his thanks which was read to the convention. Theodore N. Vail, president of the American Telephone and Telegraph Company, was also elected an honorary member of the association. Mr. Nally recently returned to New York after a trip to the Hawaiian Islands and the Pacific Coast, where he inspected the Marconi stations.

THE SHARE MARKET

New York, July 21.

In contrast to conditions reported in the July issue, the close of to-day's trading in Marconis shows an activity that is gratifying, noteworthy advances in both American and English issues being recorded in the day's transactions. Canadians remain at the same level and are inactive, but both common and preferred stock of the parent British company is in demand at better values than have been quoted for months. American Marconi is unusually strong, the brokers assert, and one prominent operator reports willingness to trade in thousand-share lots. The general opinion among active traders is that the market shows a shortage and the general public demand recently aroused cannot be supplied owing to difficulties in marketing experienced by the considerable number of shareholders living abroad. It would appear that the long period of idleness has left only the professional element in the market and the buying orders now coming in from the general public must continue to be filled from the open market at the advanced prices.

Bid and asked quotations to-day:

American, 3⅜-3⅝; Canadian, 1-1½; English, common, 10-16; English, preferred, 9½-15.

MARCONI INTERNATIONAL MARINE COMMUNICATION CO.

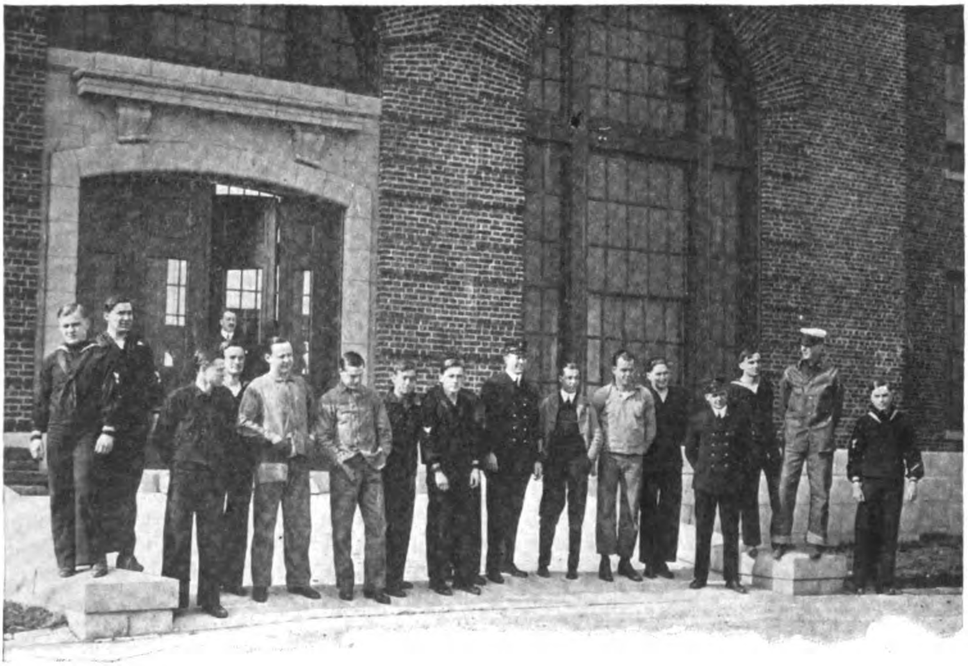
At the annual meeting of the Marconi International Marine Communication Company, held in London, July 7, it was stated that more than 4,000 Marconi operators are in the service of the army and navy. Expressions of appreciation of resource and courage displayed by the men had on more than one occasion been made by the Admiralty, said Godfrey Isaacs, chairman.

The business of the company, it was announced, had suffered through the war and during the last five months of the year showed considerable disorganization and some loss. Notwithstanding the increase of work and strain placed upon those responsible for the conduct of the business, however, substantial progress had been made, the revenue from ships' telegrams, subsidies, etc., showing a substantial increase over the amount for 1913.

Ship stations owned and worked by the company numbered 788 at the end of 1913; these increased to 905 at the end of 1914; the total to June 19 of this year showing a further increase to 970.

DINNER IN HONOR OF MAJOR RUSSEL

The Washington section of the Institute of Radio Engineers gave a farewell dinner in honor of Major Edgar Russel, chairman of that section, at the University Club in the Capital, on June 22. Toasts were given by Captain Bullard, U. S. N.; Mr. Cram, Dr. Austin, and others. Major Russel is soon to take up duty at Honolulu before being retired at an early date



Arlington's crew: reading from left to right they are: J. C. Ferree, H. Yahnel, H. R. Miller, C. D. Palmer, D. J. Burke, E. P. Jett, L. C. Corbon, W. Kweder, C. V. Deforest, J. W. Scanlin, Lieut. R. B. Coffman, U. S. N., P. A. Tracy, G. C. Hildam, N. E. Eoson, G. L. Bain, L. R. Bailey and H. L. Pitts. The author, Mr. Pannill, is standing in the doorway

NAA

The Naval Station at Radio, Va.

By Charles J. Pannill

Commercial Traffic Superintendent.

MANY of the loyal and steadfast citizens of these justly famed United States think of Virginia as the locality wherein were produced Blue Ridge Mountains, beaten biscuit, hospitality and six other presidents besides George Washington and Woodrow Wilson. On the other hand, others of us think of it mainly in terms of time signals and weather reports. For, taking it from this magazine's viewpoint, something like ten thousand—or maybe fifteen or twenty thousand—Americans regularly each night attune wireless equipment of various sizes, shapes and powers to the electrical voice of NAA, and, listening a moment, snap watch cases shut with the feeling of satisfaction that comes with knowledge of an accurate timepiece.

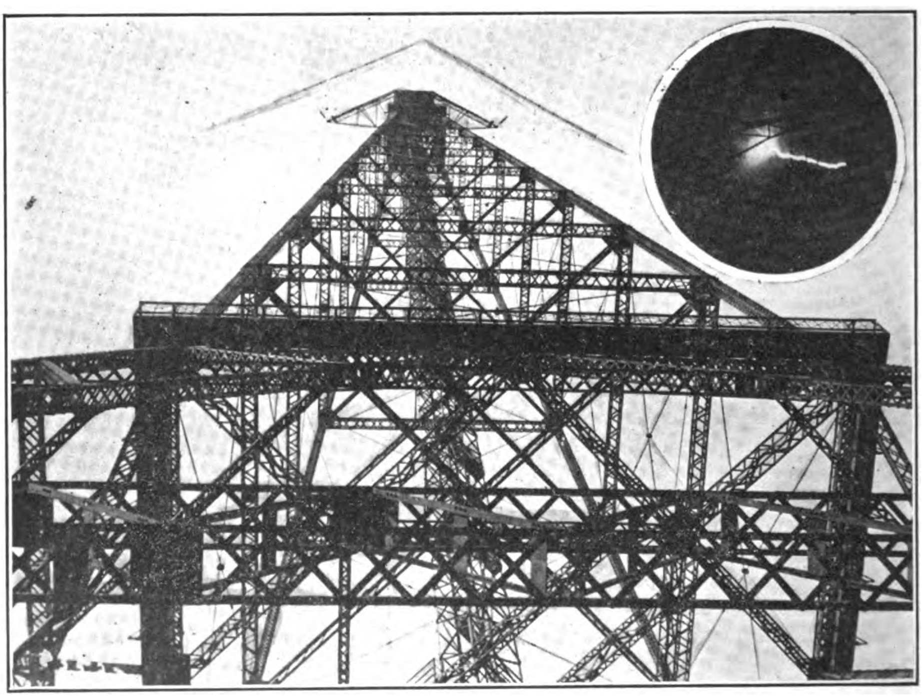
But, aside from this and the matter of adding further distinction to the state which holds them, the tall towers of Arlington take on added interest through marking the spot which concretely expresses twentieth century progress in a single word or name.

Three years ago, when it was decided that there should be erected the premier wireless station for government use, it was decided that the local names of Fort Myer and Arlington, expressive enough in the vicinity, did not fit the spirit of the project; so early in 1913 was created the township of Radio, first of the name in the United States, and duly and forthwith dignified with a post office. Political patronage held no part in this action, let it be said in anticipation of questioning voices; the postmaster appointed was none other than the clerk to the officer in charge of the wireless station, a petty officer in the naval service and by coincidence fully qualified to handle the job. Further recognition of the township was promptly added by the railroad changing the name of its station from St. John to Radio.

All over the country wireless groups and individuals watched with interest when it was announced in the latter part of 1912 that the now familiar brick building was completed. About the same time the last bolt was driven in the towers and the high-swung aerial sent its first disturbance into the ether. Reports from distant points told of signals received, so to definitely determine the station's range the new Naval Radio Service department ordered the U. S. S. Salem to proceed to sea and conduct a series of tests.

Results indicated that good communication could be had over 2,000 miles, with greater distances spanned at night under favorable conditions.

Since then tests have been made between Arlington—to use its more familiar designation—and Paris, determining by radio signals the difference in longitude between Paris and Washington. These tests lasted several weeks, both governments detailing a board of officers to aid in their conduct. Later an improved outfit replaced the former equipment and Arlington established direct communication with the Pacific Coast, more than 2,000 miles overland, in daylight operation. Following this the naval station at Darien in the Canal Zone was completed, and constant communication



Looking upward from the base of the 636-foot tower; in circle, a bolt of lightning headed for the aerial kept up even during the summer in daylight, the signals being easily read when standing several feet away from the receivers.

Each day at noon and 10 p. m. valuable information for shipping in general is forwarded by NAA, including time signals obtained from the Naval Observatory at Washington. The clock at the Observatory is connected by relay with the 100 k. w. spark set at Arlington which automatically transmits the time signal dots. In this way not only the ships at sea, but others, including a large number of jewellers on shore, keep their time pieces accurate.

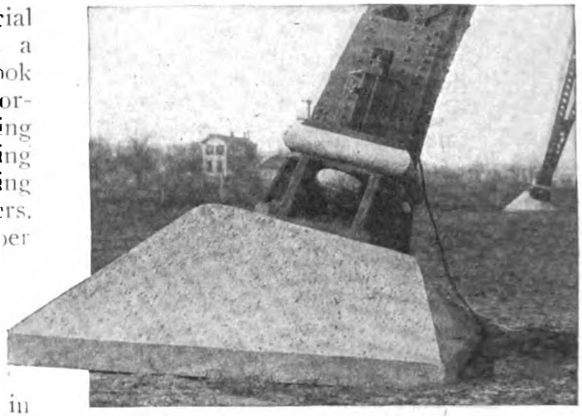
Arlington is well equipped with transmitting apparatus, all of the most improved style, a large outfit using a spark for signals to ships at sea while a small spark set is used for close range work with naval shore stations.

The 100 k. w. outfit was thoroughly tested at Brant Rock in 1912 and it was then decided by the Department to transfer the set to Arlington. It is from this set that storm warnings, time signals, etc., are sent.

The towers are of the self-supporting type, one 636 feet in height, and two 420 feet in height. A very interesting illustration is shown in this article, a view taken from a point at the base of the 636 foot tower, looking upwards. The base insulation shown in another picture has since been short circuited, as it was found that better results could be obtained with all of the towers grounded. A third picture shows the staff of the Arlington station, which includes Lieutenant R. B. Coffman, U. S. N., officer in charge, and sixteen electricians and operators.

Proof that among thousands of amateurs, NAA has an interested audience every night. This group learns with relief what weather can be expected on the morrow

In November, 1912, the Navy Department appointed a Superintendent of the Naval Radio Service, with headquarters at Radio, Va. The Superintendent was directed to organize the service and make the necessary traffic agreements with the various commercial operating companies for exchange of traffic as well as organize the proper system for handling the Government traffic in the Naval Radio Service. That the superintendent and his staff succeeded in overcoming these obstacles is evidenced by the successful operation of the Naval Radio service to-day and the ease with which traffic is exchanged with the hundred and odd controlling factors concerned in handling of Government and commercial work throughout the world. As a courtesy the Naval Radio service took over the handling of accounts for foreign traffic and is to-day the clearing house for all such accounts, collecting the tolls from the various controlling administrations, including shipowners, and passing them along to the proper systems.



The base of the towers, showing the insulation which has been short circuited, better results being obtained with all towers grounded

The Superintendent is also responsible for the proper operation of the radio service during time of peril, being now in charge of censoring radio traffic in the United States and the operation of the Tuckerton and Sayville transoceanic stations operated by the Naval Radio Service in the interest of the public. The Superintendent and his staff include the following: Captain W. H. G. Bullard, U. S. N., Superintendent; Lieut.-Commander S. W. Bryant, U. S. N., Assistant Superintendent; P. A. Paymaster J. H. Knapp, Disbursing Officer, and Charles J. Pannill, Commercial Traffic Superintendent, formerly Superintendent of the Southern Division of the Marconi Wireless Telegraph of America.

The field of the Naval Radio Service also covers the radio service afloat, in that all naval ships report regularly to the Superintendent the traffic handled. The Atlantic and Pacific fleet each have a Fleet Radio Officer who is responsible to the Commander-in-Chief for the proper radio operation. When the Atlantic fleet was first given a Fleet Radio Officer, the honor was bestowed upon Lieutenant S. C. Hooper. He was placed on the staff of the Commander-in-Chief. Together with Captain Bullard this officer laid the foundation of successful operation; both officers through hard work and constant devotion to this duty have worked wonders for the improvement of the radio service in general. For when Captain Bullard and Lieutenant Hooper took hold of the work the commercial radio service of the various companies was practically without government jurisdiction; the high standard of both the naval and commercial radio service to-day is due in a great measure to the fact that these two men were able to bring about proper co-operation between the commercial concerns and the government for the betterment of all concerned. The few verses which follow were written by one familiar with Mr. Hooper's connection with the fleet work:

In olden days—those were the golden days——
Would you hold converse with your friend "YE"
At Washington, you let the Fleet rave on,
And chatted gayly with him at the key.
Not caring to disregard all scheme or plan,
You opened up with "Here's a note, old man";
But wireless to-day runs on a different plan.

It's Hoops, Old Hoop,
He changed those easy ways.
Order rescinding order keeps us in a daze.
If you want to know what gink
Put social wireless on the blink
It's Hooper, old Hooper, he's the goop.

Time was when, on a battleship, thoughts tender might intrude
Of sweethearts, even wives, who wept ashore.
"Just ask the Chief at NAM to phone this up for me,"—

This was the password, but it is no
 more.
The Postal Clerk computes the station
 charge—and gets it wrong,
The C. O. then endorses it, and maybe
 before long
Marconi condescends to forward love's
 eternal song.

It's Hoops, that's why,
Who other could it be?
He is the man who owns the copyright
 on QRT
If you really want to know
Who put "I owe" in "Radio"
It's Hooper, old Hooper, he's the guy.

The conning tower thru its narrow
 eyes surveys the scene
And feels itself sunk to a storeroom's
 state.
With switchboards, relays, tuners, keys,
 in all availing space,
There seems no chance for things of
 lesser weight.
Such minor apparatus as control of
 helm or speed,
A super-Hooper-dreadnaught of course
 could never need.
Install! Install! There yet is room!
 Prove, prove, the Newer Creed.

It's Hoops (You knew it?)
'T is his the scheme, of course.
Should not the brain have full control
 o'er bowel-hidden force?
On, on to Victory!
Press, press, the fluent key!
And Hooper, old Hooper, HE will do it.

When Giant and Athletic meet before
 a countless throng
To battle for a name—and many yen;
When from the far-flung bleakness of
 Cape Cod the whisper comes
Of tiny happenings in the world of
 men,
Whose hand directs the order that bids
 tactics bide apace,
As inning after inning flings its record
 into space,
Or T. T. tells the outcome of the 1916
 race?

It's Hoops, he did;
The C. in C. may sign,
But when the bets are paid in coin,
 cigars, or even wine,
Well, well, the wardroom knows
To whom the credit goes.
It's Hooper, old Hooper, good old kid.

When on the dim horizon line a mighty
 warship lies,
Then moves, responsive to a hidden sign,
Harmonious with her sister ships that
 dot the distant deep,
To form as one in one manoeuvered
 line,
Whose years of earnest effort made
 such ordered actions show,
And prove by demonstration the worth
 of radio,
Till even the prejudice of years must
 needs admit it so?

It's Hoops! His ways
At last have gained their goal.
The flagship reaches out across the
 waters to control.
In unity complete
The Ship yields to the Fleet.
And Hooper, old Hooper, deserves the
 praise.

POWER OF BROWNSVILLE STATION INCREASED

The government wireless station in the control of the army at Brownsville, Tex., has been increased to nearly double its former capacity and now can communicate with vessels at sea 800 miles from the station, it is asserted in a dispatch from San Antonio, Tex.

The station handles a large portion of the military messages from the border patrol along the lower Rio Grande to the Army Department at Fort Sam Houston in San Antonio.

NEW STATION AT POINT ISBELL

The United States collier Jason arrived at Galveston recently and discharged a complete 5 k.w. wireless set, including masts, to be shipped to Point Isbell, Texas, on the Rio Grande, where the Navy will erect a station to communicate with the battleships off Tampico and Vera Cruz.

Captain William H. G. Bullard, who was detailed to take over the Sayville station

The Seizure of the Sayville Station

Plant Now Conducted by United States Government in the Interest of Its Owners

FOLLOWING the application of the owners of the Sayville wireless station for a license to operate a "new sending set" as a private commercial station in transmitting messages to Germany, the United States Navy Department announced on July 9 that in the future the plant will be conducted by the government in the interest of its proprietors. This action was taken to preserve the neutrality of the United States in accordance with President Wilson's order of August 5, 1914.

William C. Redfield, secretary of commerce, made public a memorandum which contains the reasons for the refusal of the government to grant a license. Robert Lansing, secretary of state, concurred in the opinion of Secretary Redfield, and their joint recommendations were accepted by President Wilson. The memorandum is as follows:

"I beg respectfully to advise as follows concerning the reported erection by the Atlantic Communication Company of new radio apparatus at Sayville, Long Island, N. Y., for the transmission of message to and from Nauen and Eilvese, Germany:

"The Atlantic Communication Company, per H. A. Metz, president, and Dr. K. G. Frank, secretary and treasurer, has applied for a license for the operation of what it calls in its application of June 17, 1915, 'the new sending set of the Sayville station.' The formal application for a license was dated April 27, 1915, and action thereunder has been deferred pending the completion of the station, which is now substantially ready for operation.

"There are features in connection with this application which make it seem to me inadvisable to grant the desired license. These are as follows: The Atlantic Communication Company is owned by the Telefunken Company of Germany, which is itself owned by the Siemens and Halske Company and the Allegemeine Electrizitats Gesellschaft of Germany. The Siemens and Halske interests, together with the Allegemeine group, are the controlling German electrical interests. Dr. Karl George Frank, who signs the communication from the Atlantic Communication Company as secretary and treasurer, is the representative in New York of the Siemens Electrical Companies. These German interests own the entire stock of the Atlantic Communication Company, save a few shares sufficient to qualify Mr. Herman A. Metz, its president, to act as such officer. Mr. Metz is the representative in this country of prominent German dyestuffs interests.

"The German stations appear now to have a duplex management, the military features controlled by the military authorities and the commercial features by the Imperial Post Office. These stations, thus controlled, are those with which the Sayville apparatus directly communicates.

"The department is further advised that Professor J. Zenneck, who is a captain of marines in the German army and who has been during the present war serving in the trenches in Belgium, was brought to this country as a witness in a wireless patent suit pending in our courts between the Telefunken company and the Marconi company. This suit has been put over until autumn, and on the ground that it is impossible for Captain and Professor Zennick to return to Germany the Atlantic Communication Company is retaining him at Sayville to make experiments with a view to overcoming difficulties of static atmospheric conditions experienced in receiving messages from Germany at Sayville. In a written statement, copy of which is attached, dated June 17, 1915, Captain and Professor Zennick states the duties he will thus assume.

"It is an unquestioned fact that the station for which the license is now asked is in all its part new since the war began; that the machinery has been manufactured in Germany and shipped hither, and the towers, aerials and other apparatus are new; that, in short, what is now asked is not a license for the continuance of a station heretofore existing, but one for the operation of a station just coming into service.

"It is the opinion of this department that to grant a license for a new station erected since the war began with German apparatus, avowedly under German ownership and control, communicating avowed with stations known to be under the control of the Imperial German Government, and having least the semblance of acting in a measure under the instructions of the German Post Office Department, having as scientific assistants, if no more, an officer of the German marine corps and the representative in this country of prominent German manufacturing and scientific interests, would be an unneutral act. This department therefore purposes to decline to grant the licenses asked under existing conditions.

"It is noteworthy in this connection that the Marconi company, which connects with stations in Poldhu, in Cornwall, and Clifden, Ireland, is not undertaking to operate its transatlantic stations and has asked no licenses for them, stating in this connection to this department that its European stations named, being under the control of the English government, it does not think it best to attempt communication with them.

"This department, however, deems it important for commercial reasons that opportunity be extended for the assured neutral use of the Sayville station for communication with Germany and Austria, which the Atlantic Communication Company say in their application of the 18th of June 'depends largely on the efficient operation of the Sayville station.'

"It therefore repectfully suggests for consideration whether equity to all concerned would not best be secured by having the Navy Department of the United States operate the Sayville station, turning over the fiscal proceeds of such operation to its owners and securing them and the government of the United States, alike, against all question of improper use while providing for both the valuable service which this station is fitted to render."

Captain William H. G. Bullard, superintendent of the United States Naval station at Arlington, was detailed to take over the Sayville plant, the greater number of the operators employed by the Atlantic Communication Company being replaced by enlisted men of the United States Navy under the command of Lieutenant George R. Clark. Messages will be sent and received subject to strict censorship. Professor Zenneck left the station after the government had taken possession.

In a statement issued by the company it is declared that "simply for the purpose of protecting its legal and financial and commercial rights, the company has formally filed protests against the Navy Department's action with the President, and with the State, Navy and Commerce departments." It is also pointed out that "the company being a public service corporation had no discretion in refusing or accepting messages. As a matter of fact, the station, on account of static conditions, and also on account of lack of power, was unable during the summer months to communicate with Germany for more than one or two hours during the night. This difficulty will now be overcome by the operation of the new transmitter. Communication has been possible for the past few months only when it was night in Germany and night in the United States, which has been, as heretofore stated, only for one or two hours each night."

President Wilson said in his Executive Order that "Radio stations within the jurisdiction of the United States are prohibited from transmitting or receiving, for delivery, messages of an unneutral nature and from in any way rendering any one of the belligerents any unneutral service," and it is desirable to take precautions to insure the enforcement of said order, in so far as it relates to the transmission of code and cipher messages by high-powered stations capable of transatlantic communication." The Hague conventions say it is an unneutral act to permit the construction by belligerents of wireless stations on neutral territory after a declaration of war.

War Incidents

WHILE the United States was standing aghast at the attack made on J. P. Morgan by a fanatic of the war, known as Erich Muenter, alias Frank Holt, who also exploded a bomb in the capitol in Washington, information was obtained indicating that the dynamiter had planned to blow up a ship at sea. Following the disclosure of Muenter's assertion that "a steamer leaving New York for Liverpool should sink, God willing, on 7th (July), a general warning was dispatched broadcast over the Atlantic Ocean by wireless, among the vessels which picked up the message being the Atlantic transport liner Minnehaha. The marconigram was received on the Minnehaha, which carried a cargo for the British forces, soon after midnight on July 7. Late in the afternoon of the same day an explosion occurred. A fire followed, the members of the crew being compelled to fight the flames for two days and nights. The wireless was called into use again on July 12, when additional warnings were flashed warning commanders of ships to be on the lookout for bombs.

A letter written by Muenter to his wife induced the suspicion that he had planned to destroy ships. One paragraph read as follows:

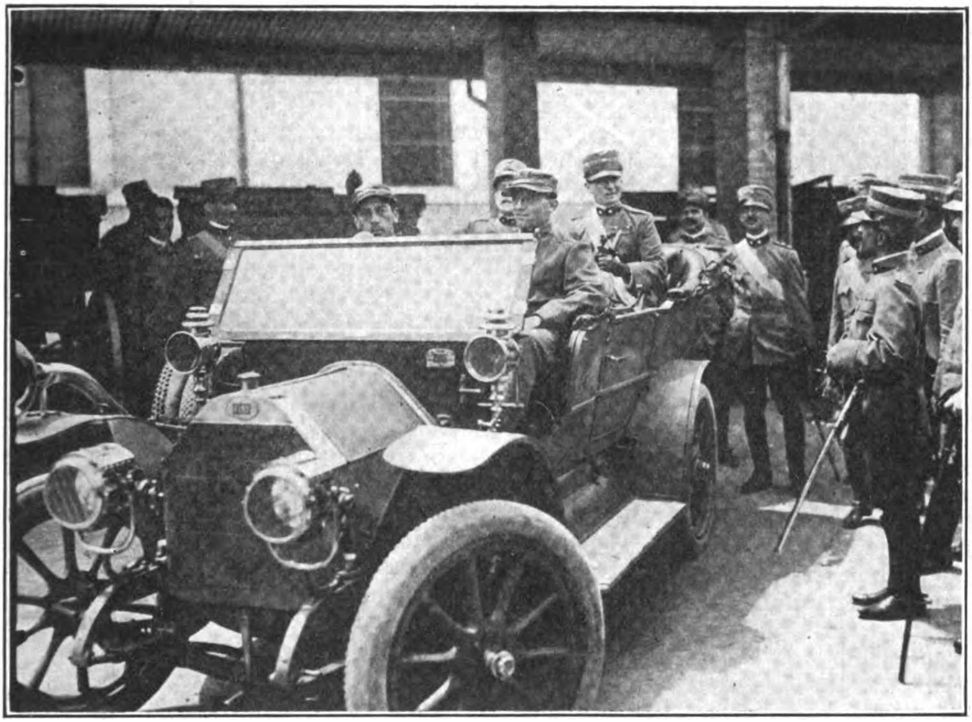
"A steamer leaving New York for Liverpool should sink, God willing, on 7th. It is the Philadelphia or the Saxony (Saxonia), but I am not sure, as these left on the 2nd or 3rd."

Immediately after this revelation had been communicated to officials in Washington a warning was flashed by wireless. The Minnehaha was only a few days out of New York Harbor, bound for London, when the message was received. Captain Claret, the commander of the vessel, ordered the small boats swung out so that they could be ready for use in the event that the explosion occurred. The ship's fire hose was also prepared for an emergency and a search of the cargo was begun. The search was still under way late in the afternoon, the explosion occurring while the members of the crew were trying to make sure that there were no bombs aboard.

The explosion shot off a hatch cover, carrying two sailors into the air with it. One of the men was slightly injured. Then the fire was discovered, the flames spreading so rapidly that it was decided to point the prow of the Minnehaha toward Halifax. She reached that port on July 9th.

The Saxonia of the Cunard Line and the Philadelphia of the American Line

Photo Underwood & Underwood.



Guglielmo Marconi, officer in the Italian army, leaving headquarters for inspection of wireless stations at the front. He is seated on the right in tonneau of automobile

sent prompt answers by Marconi wireless in response to the message of warning. The following marconigram was sent by Arthur R. Mills, commander of the Philadelphia:

"Thorough search made. Everything on board identified."

E. G. Diggle, commander of the Saxonia, replied as follows:

"Search made. Nothing found."

A letter signed "Pearce," the writer describing himself as a partner and intimate associate of Muenter, was sent to a New Orleans newspaper on July 11. The letter, which contained threats to destroy by bombs British ships clearing from American ports, was considered important enough by Washington officials to warrant the sending of a wireless message of warning to all ships on the Atlantic, especially the steamships Howth Head and Baron Napier. All ships were requested to communicate with these two vessels. The Howth Head and the Baron Napier both left New Orleans on July 9th with cargoes for the Allies. The Baron Napier, which is equipped with Marconi wireless, is bound for Avonmouth, England. The Howth Head cleared for Belfast and Dublin, but was scheduled to put in at Norfolk en route. The Arlington station sent the warning to the naval station at Key West, to be flashed to the ships.

A despatch from London says: Guglielmo Marconi, who as a Lieutenant of Engineers in the Italian Army, is in London buying war equipment for the Italians, in an interview spoke hopefully of the Allies eventually winning the war. Marconi, bronzed from his trip to the Italian-Austrian firing line, says the spirit of the Italian troops is vivid with the persistence to smash the enemy. Italy has thrown her whole energy into the war, he said, and is ready to fight on until her flag is victorious, no matter how long the war endures.

"It's inspiring to see the Italian troops in action, with their undaunted courage and undoubted skill," he said. "They have not the slightest doubt that they will vanquish their Austrian foes. The Italians have nearly everything they need in the way of equipment. I'm in London merely to buy a few things that they lack. As to ammunition, Italy is well supplied, having steel works going day and night making shells and guns. Before going into the war she made sure she was able to carry it on upon a gigantic scale, and she'll not suffer from lack of ammunition.

"The whole populace of Italy is imbued with the same spirit that dominates the army, the nation in its entirety being bent on pushing the war to a successful end. People are ready to make any sacrifice to aid the government. Already plans are working out for rigid economy in Italian households so there will be no waste of foodstuffs or of money. The people of Italy realize a long war means privation and strained finances. They know Italy must likely borrow heavily to conduct the war and they're already offering their savings. If the time comes that Italy will be obliged to seek outside financial aid the people will back up the government in whatever it does and be ready to assume a heavy tax to pay back after the war.

"That's the sublime spirit that inspires Italy today, and there will be no lessening of it while the war lasts. The impression throughout Italy is the war will last at least another twelve months, although that naturally is only a guess. If Russia could get the ammunition she needs the idea prevailing is that the eastern fighting could be brought to a quicker conclusion.

"It undoubtedly would help if Italy joined the Allies in the attack in the Dardanelles, but Italy hasn't brought itself yet to the point of war against Turkey. Whether it will come is hard to say. The Dardanelles operations with all they mean to Russia are regarded in Italy as a wonderfully strategic stroke. The way the Allies can push it through, as it appears to us in Italy, is to keep on pouring hordes of men onto the Peninsula and to use ammunition lavishly. Its phases and outcome are being watched eagerly in Italy as well as the rest of the world.

"One feature of Italy's war that will tell heavily I believe as the war goes on, is the splendid equipment of aeroplanes and dirigibles. Italy has skilled men to handle them and in a short time I am sure they'll give an heroic account of themselves. In dirigibles we're better off than Germany.

"A feeling of absolute security prevails among Americans in Italy, of whom there are quite a number in Rome, Milan and other parts. They haven't the slightest idea of leaving Italy, having explicit confidence in the ability of the Italian Army to keep the foe out. The progress of the Italian Army on Austrian soil encourages this feeling, besides giving the whole of the Italian population a thrill in Italy's getting back territory that Austria took from her."

Mr. Marconi witnessed the fighting on the Italian-Austrian lines and was deeply impressed by the daring initiative of the Italian soldiers. He will stay in London ten days and then return to Italy.

An example of how Marconi men are conducting themselves in the European war is contained in accounts of the sinking of the Leyland liner Armenian by a German submarine off Trevose Head, Cornwall, on June 28. The Armenian's officers sighted the submarine early in the evening, the latter craft firing two shots across the bows of the English vessel. The Armenian showed her heels, however, and the submarine followed, shelling the merchantman unceasingly.

"The ship suffered heavy damage and there was considerable loss of life," said one of the Armenian's officers in describing the occurrence. "The first shell found its mark, bursting on our starboard side and killing ten men outright. Another smashed the Marconi cabin, but the operator stuck to his post till the last, sending the S O S signal until the apparatus was smashed."

Advices from Rome declare that the Italian fleet has destroyed the Austrian wireless station on the Island of Lissa, off the Dalmatian coast.

IN THE SERVICE

SHORE-TO-SHIP DIVISION

The life of John R. Irwin, superintendent of the Northern District, Pacific Coast Division, of the Marconi Wireless Telegraph Company of America, has been made up of one adventure after another. Two wars in South Africa gave him his first opportunities to figure in pulse-stirring events. Following his experiences in the veldt, he took a flight in an airship which was wrecked. Then he planned another aerial voyage which was also ill-fated. These occurrences and others, including his activities in sending aid to the victims of a wrecked steamship, were crowded into about a third of the number of years he has lived.

Echuca, a town and river port of Victoria, Australia, is the birthplace of Irwin. His early experience included employment in the West Australian government telegraph service and in 1900, soon after the outbreak of the South African war, he found himself taking part in the hostilities. At that time he was nineteen years old. He served throughout the struggle, and afterwards entered the Transvaal government telegraph service. He was destined to see more of warfare, however, the Zulu rebellion providing him with the opportunity to become active in another conflict.

But even wars and excitement must end, and, South Africa having resumed its normal state, Irwin decided to trek. Retiring from the service under what was known as the retrenchment scheme, he made his way to New York, He entered the service of the American Marconi Company in 1907.

He was on duty at five o'clock in the morning in the Siasconsett station two years afterwards, when he picked up an S O S from the steamship Republic, bound for the Mediterranean. The Republic, which was off Nantucket, had been rammed in a fog by the Floride. Irwin immediately got into communication with the Baltic, and she turned back, feeling her way through the fog to the wreck by means of directions sent by the Marconi man at Siasconsett. Woods Hole, Mass., was also told of the wreck by means of a land line message sent by Irwin and a revenue cutter was dispatched to the scene. As a result of Irwin's prompt action no lives were lost.

Irwin was in the Marconi office in New York one day when a message was received asking for a volunteer among the wireless operators to go on the voyage of the Wellman airship. He asked for the detail and obtained it. The craft collapsed near Bermuda, however, and it became necessary to throw all superfluous weight into the ocean, including the wireless set. Irwin, undaunted by this handicap, signalled the steamship Trent by flashlight and the members of the expedition were rescued. Following this experience he appeared in vaudeville and on the lecture platform. He afterwards re-entered the Marconi service, but when the Vaniman airship expedition was undertaken he planned to go on the flight. He abandoned the project, however. The members of the Vaniman expedition were afterwards killed during a trial flight.

The Wireless Age in a Revolution

Its Part in Hostilities in Mexico

By Fernando Urcelay

Fernando Urcelay

THIS is the story of how THE WIRELESS AGE earned a new distinction—that of taking part in a revolution. It has been my fortune to serve under two leaders of warring factions in my native land—Mexico—although I am only twenty years old. Yet I have not a single scar to show that I am a veteran of the wars; notwithstanding I have vivid recollections of what it means to be in the proximity of booming cannon and flying bullets. This statement seems somewhat incongruous when I recall that the scene of the trouble to which I refer is Merida—a city which is remarkably peaceful as far as appearances go. Regularly built, with attractive streets and squares, Merida in my opinion excels other cities in Mexico which have been more highly praised. For the information of those who are not familiar with the place, it should be stated that it is the capital of Yucatan, located on a plain twenty-five miles from the Gulf of Mexico.

Perhaps my opinion of the place is somewhat biased, due to the fact that it is my birthplace and I still call it home. However, a considerable number of Americans have found it an attractive city in which to live, as well as a profitable headquarters for business enterprises. Large quantities of hemp are sent from Merida to the United States. Other exports include brandy, sugar, salt, indigo and hides, while among its manufactures are straw hats, soap, leather and cotton goods. This brief description will give the reader some conception of the scene in which my story is set.

The advantages of Merida were not sufficient to prevent me from leaving for the United States at an early age, however. I had planned to become a student at Valparaiso University in Indiana, but wireless was in my thoughts and I entered the Marconi School of Instruction in New York. My stay in this country did not last a long time; in fact, I had not been in the Marconi School more than five months when I received a letter from my mother asking me to return to Merida. A revolution was in progress and our property was in danger. So I hurried back home.

On my arrival in Merida I found that Precileino Cortes, then governor of Yucatan, was the leader of one of the forces, while the opposing army was headed by Carranza men. I shouldered a musket and fell into the ranks of the governor's men. But Cortes' power was short-lived, the enemy overpowering our forces and taking possession of the city without great trouble. Thus ended the Cortes regime.

But the Carranza forces were not destined to remain long in control, their Nemesis being at hand in one Abel Oritz Argunnedo. Originally a clerk, his personality and soldierly qualities made him a leader of men. He was chosen to command the army formed to battle with the Carranza troops, the latter at length finding themselves driven from Merida and Argunnedo in the chair of the governor of Yucatan.

Argunnedo's men were not well equipped with wireless, although they had two portable sets, these being in use by the troops which were making a stand outside Merida. The governor made his headquarters in the city, which was entirely cut off from communication with the outside world. He was anxious to establish wireless communication with other places, but there was no station in Merida, two electrical engineers whom he had detailed to the task of building a set being utterly at sea regarding the work. At this juncture one of my friends informed him that I was able to construct a station. So it came about that I was asked to consult with the engineers as to the steps to be taken.

I had continued to read The Wireless Age during the revolutionary troubles—no small tribute in itself to the magazine. And now that a real problem in wireless had come up—one in which practical knowledge was essential—I congratulated myself on my good judgment in choice of periodicals. Fresh in my recollection of the articles which had appeared in the magazine was one of the series on "How To Conduct a Radio Club," in which details of the construction of a receiving set were given. For directions regarding how to build a transmitter I examined other numbers of The Wireless Age, at length finding in the "Queries Answered" department the information which I sought.

With the clearly defined directions before my eyes I found little difficulty in building a station. Between the towers of the Catholic school and the Cathedral, which are separated by the space of a block, we stretched the wires of the antenna, using three wires placed two feet apart. The transmitting set was built in the tower of the school, the power being obtained from the power house that provided electric light for the city. Our equipment was 1½ k.w.

The work having been completed, I got into touch with several distant stations and was highly gratified at the results. I was able to receive about 800 miles during the daytime and 1,500 miles at night. Among the stations which I heard were New Orleans, Arlington and Campeche, the latter being the capital of the province in Mexico of the same name. I also communicated with ships at Progresso, which is about thirty miles from Merida. The news of the war in Europe which I picked up was eagerly received, the governor being much pleased with the successful operation of the equipment. From time to time I sent various messages for him and frequently obtained valuable information transmitted from the station at Campeche which was in the possession of the Carranza men.

One day I picked up a message from Vera Cruz, saying that 4,000 men were en route to join the Carranza forces. The next day our troops and the Carranza men engaged in a pitched battle at Poboc, twelve miles outside of Merida. Argunnedo's men were afterwards compelled to retreat to Blanca Flor, the news of the defeat being transmitted to the city by means of a portable wireless set. On receipt of this information the governor, realizing that it would be hopeless to remain to defend Merida, fled to Progresso, whence he made his way to New York.

His action was sufficient notification for me that it would be discreet for me to make myself as inconspicuous as possible in view of the fact that the arrival of the enemy's troops in the city seemed inevitable. Therefore I cut the wires of the antenna and secreted the various parts of the wireless apparatus. When Carranza's men arrived I had disguised myself as an Indian and was working in the fields. And in this disguise I remained till I found an opportunity to leave Merida for New York.

On my arrival in the latter city I had opportunity for reflection on the events in which I had figured, chief among my thoughts being the following: That I had cause for congratulation over the fact that Carranza's men were not gifted with vision keen enough to penetrate my disguise. Also that the leaders of every revolution should keep copies of THE WIRELESS AGE at hand.

FIRST WIRELESS COMMUNICATION BETWEEN JAPAN AND AMERICA

THE high power wireless station of the Imperial Japanese Government is approaching completion. It is located at Funabashi, about ten miles east of Tokio. Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, has just returned from Honolulu where he arranged for the preliminary tests between the Marconi Company's high power stations at Kahuku and Koko Head, on Oahu Island, and Japan. These tests were started on July 26th, and the following messages were exchanged:

TOKIO, July 26, 1915.

Edward J. Nally, Vice-President and General Manager, Marconi Wireless Telegraph Company of America, New York City, U. S. A.:

Availing myself of this opportunity I have the honor to offer to you and Mrs. Nally my sincere congratulations upon this first communication.

(Signed), JIRO TANAKA,
Director General, Ministry Communications.

NEW YORK, July 27, 1915.

Hon. Jiro Tanaka, Director General, Ministry Communications, Tokio, Japan.

Mrs. Nally joins me in congratulations and thanks for the first wireless communication between Japan and America, and also in the fervent wish that this most wonderful of all inventions will still further bind the two countries in peace and progress.

(Signed), EDWARD J. NALLY,
Vice-President and General Manager, Marconi Wireless Telegraph Company of America.

When both stations shall have been fully tried out, the trans-Pacific service of the Marconi Company, in connection with the Western Union Telegraph Company, which has been in operation between this country and the Hawaiian Islands since September 24, 1914, will be extended to Japan, and at rates at least one-third less than the existing cable rates. From Japan connection will be made through the Japanese Imperial Telegraph System with all points in the Orient.

Enthusiastic Reception for Marconi

Guglielmo Marconi began his duties as lieutenant of aviation in the Italian army on June 27. A dispatch from Rome says that he received an enthusiastic reception at the barracks when introduced to his brother officers by Colonel Morris. Lieutenant Marconi said: "I am convinced that we shall work splendidly together for the protection of country and King."

Mr. Marconi in the uniform of a second lieutenant of engineers has been visiting electrical works in and near Milan in connection with the systematic organization of factories of all kinds for State purposes. In each place he had an enthusiastic reception.

At Melzo the mayor and other notables with a large number of people welcomed him, and children presented flowers. Mr. Marconi expressed his appreciation of the reception, saying that he was proud and glad to return to his native country to serve her.

At Sangiovanni, where he visited an electrical establishment, workmen crowded around him, shouting, "Viva Marconi," and expressed their admiration of the inventor.

How to Conduct a Radio Club

Article XVI

By E. E. Bucher

IT is an interesting phenomenon of radio-telegraphy that when certain precautions are observed, signals may be received on a wireless telegraph aerial placed but a few feet above the surface of the earth. An available substitute for this form of aerial is the barbed wire fence which, if it is not extremely long, will permit the reception of signals from certain hign-power stations within a distance of several hundred miles. Owing to the proximity of the earth the natural wave-length of such an aerial may be greater than its linear dimensions at first sight would indicate; consequently a short wave condenser becomes an essential part of the receiving equipment.

For receiving apparatus, electrical connection is preferably made to the uppermost wire, which should be thoroughly cleaned and scraped at the point of contact. The earth connection may consist of a piece of gas pipe fifteen feet in length, driven into the earth as far as possible or, if feasible, the barbed wire of a second fence may be used as a counterpoise. It has been shown by experiment that when the receiving aerial is thus brought near the earth the directional characteristics are increased; hence it becomes important that the fence bear a definite relation to the sending station or signals will not, in some instances, be received.

Tests May Be Necessary

This type of aerial is in the main suited for the reception of the longer wave-lengths only and accordingly the receiving apparatus described in the article of this series which appeared in the July issue of The Wireless Age should be employed. A circuit diagram of the apparatus referred to was also published in the July issue. A series of tests may be necessary to secure results and the experimenter will be relieved of much anxiety if he will determine in advance the transmitting schedules of stations in his vicinity. It has been reported that a certain well-known wireless experimenter has received signals from across the Atlantic Ocean with an aerial of this type and the results compared quite favorably with a fair-sized standard aerial of considerable height.

Wireless in the Summer Camp

This is the season of the year when the average inland lake or river in the northern part of the United States is dotted with a number of summer camps under the direction of various boys' organizations. Among the members of these colonies there are invariably one or more wireless enthusiasts, and it is difficult to devise a better recreation for them than the installing of an amateur wireless telegraph set—particularly if another camp in the neighborhood possesses a radio equipment. The installation if employed to send invitations to entertainments, may become a useful feature in the social life of the neighborhood. Then, too, a well located station could be fitted with an especially sensitive receiving set capable of receiving press despatches during the night schedules of certain high power stations employed specifically for this service. The news thus received could be passed on from camp to camp until the folk for miles around were fully informed of the important events of the day. No matter how far from the bounds of civilization such camps are located, the foregoing suggestion is practical, provided certain phases of the wireless telegraph art are thoroughly understood.

In establishing communication between stations of unlike characteristics, some junior experimenters not thoroughly familiar with the fundamentals of the art, ignore the necessity for complete resonance between the transmitting and receiving apparatus. In support of this assertion the following incident is related:

The barbed wire fence can be used as an aerial

An aerial of small dimensions, having a total length of not more than thirty feet, was erected on two temporary twelve-foot masts fitted to a rowboat on a lake. It was intended to establish communication with the corresponding shore station in the tent of a certain summer camp. The aerial for the latter station was suspended in the trees and had such dimensions as to have a natural wave-length of about 300 meters. The wave-length of the boat equipment could not possibly have been more than forty meters.

A number of preliminary tests were made to ascertain the maximum distance that might be covered, but the results were anything but pleasing—in fact, the greatest distance at which the shore station could be heard was a half mile. At this point the sounds of the spark of the transmitting set at the shore station could be fairly distinguished, almost obviating the necessity for a receiving equipment.

Now, an aerial having a natural period as low as forty meters cannot be boosted by the addition of inductance to a value of 300 meters without a great sacrifice of efficiency; and by the reverse argument a 300-meter aerial is entirely unsuitable for the reception of signals from a forty-meter transmitting set. To redesign the aerials at both stations was, therefore, the only course open.

At this stage of development the writer arrived on the scene and, having been asked for advice, the following compromise was suggested:

Increasing the Range

The wave-length of the boat aerial was to be raised by a "loading coil" to approximately eighty meters and a second small aerial erected at the shore station to have, if possible, a similar wave-length. It is needless to say that when the suggested changes were effected the maximum range was increased to two and one-half miles, much to the satisfaction of all. By this and other experiments it is demonstrated that the phenomenon of electrical resonance in a wireless equipment is too vital to be ignored.

The simple wireless equipment installed in the rowboat was employed at a later period in a novel manner. A section of the lake referred to was well known as an excellent fishing ground, but like many members of the finny tribe, the appetites of the creatures of the water could only be tempted at certain periods, the latter being governed largely by the prevailing winds. The fishing ground was located about two and one-half miles from the summer mecca and it was customary for one or more of the local guides to row to the former each morning and, if possible, determine the degree of hunger shown by the fish. If conditions were favorable for fishing it was customary for the guides to hurry to camp at once and notify the anglers. It was not unusual, therefore, to see a variety of small craft headed for the fishing grounds.

Practical Amateur Wireless

It occurred to the owners of the wireless telegraph equipment that the installation could be used to good advantage in reporting to the summer colonists information regarding the prevailing conditions for catching the fish. Accordingly, after negotiations with the leading guides, the radio equipment was transferred to the master guide's boat. The experiment proved successful, the campers being promptly informed regarding the appetite of the fish. In a short time the little tent containing the wireless station became extremely popular, for in addition to the fishing service, nightly press bulletins were taken from a high-power station 300 miles away and distributed to all campers who could be reached.

This story should not be concluded without reciting the details of the capture of a fish in which radio telegraphy figured. Early one morning two junior members of the camp—the owners, by the way, of the wireless equipment—proceeded to the fishing grounds. Neither was experienced in the use of the rod and line. By a prearranged schedule a third member was to remain behind and to listen in at fifteen-minute intervals for wireless reports concerning their success or failure. At about the sixth the following message was received at the shore station: "Send Bill out quick—got big one—think it is a whale."

Bill, an expert angler, hastened to the fishing grounds, where the tugging and pulling on the line, coupled with the vigorous splashing of the water, indicated that a fish of unusually large size had taken the bait. The reel was transferred to Bill and finally the coveted prize was landed. The catch proved to be a thirty-two pound German carp, which, as one of those present said, ordinarily could be "landed with a club." The fisherman agreed, however, that the carp owed its capture indirectly to the wireless telegraph set.

If the summer camp is located on an inland lake surrounded by mountains, the more adventurous members of the colony frequently wish to explore the wilder regions or perhaps climb the height of a distant peak. However, there is always the danger of being lost or of unforeseen circumstances preventing the return to camp. If the latter is equipped with an amateur wireless telegraph equipment and, furthermore, if one of the campers can be induced to remain to operate it the members of the exploring party may take a portable equipment with them and report to their companion.

Transportation Suggestions

The wireless telegraph set of an amateur exploration party need not be cumbersome, bulky nor difficult to transport. For example, the complete equipment should be made up of several individual units which may be divided between the members of the party. Thus A carries on his back the aerial which, by the way, consists of two coils of aluminum wire, each 150 feet in length, fitted with simple porcelain cleats to serve as insulators. He also carries sixty square feet of galvanized "chicken wire netting" to act as an earth connection or counterpoise. B takes a three or four-inch spark coil strapped to his back and on account of the weight of same it is shifted to other members of the party at certain intervals. C carries six dry cells for operation of the coil, while D carries a similar number. To E is entrusted the care of the receiving equipment, which, if properly designed, will have little weight. He also carries the head telephones and the transmitting key. It need not be added that much of this equipment may be placed in the ordinary duffle bag of the explorer, care being taken not to injure the more delicate parts of the equipment.

Aerial in Trees

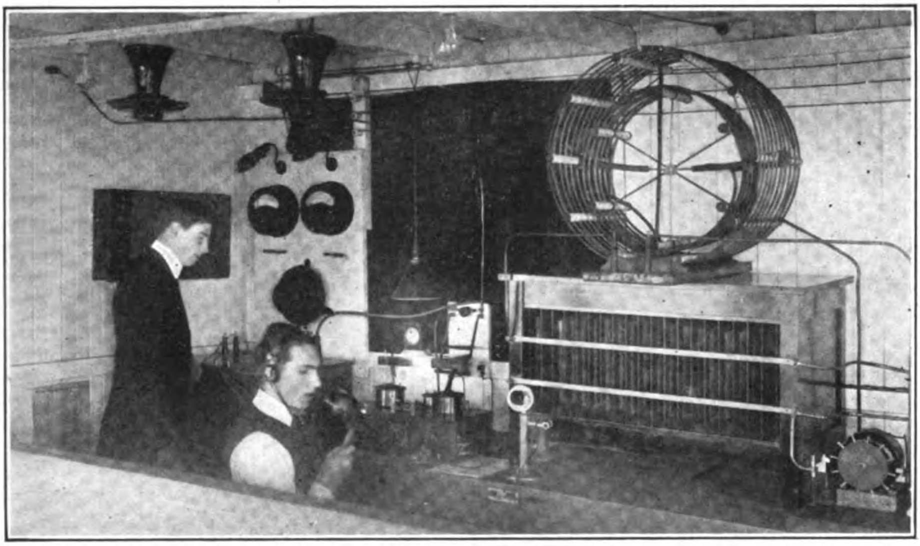
The aerial of the party should be strung in trees, selecting those which are located in a clear space and having a generally unobstructed view in the direction it is desired to transmit. If possible a counterpoise may be thrown in a creek, thus making a more perfect earth connection. To balance matters up it is further recommended that the receiving station at the camp be fitted with a sensitive vacuum valve detector in order that the distance of a few miles may be covered with ease.

One of the most obvious errors of the amateur is manifested in the design of a receiving tuner for the shorter range of wave-lengths which often, while primarily intended for amateur receiving work, will upon measurement show a possible wave-length adjustment of 3,000 meters. The natural period of such a winding may be in the vicinity of 2,000 meters, and consequently a good portion of the available energy is lost in the dead-ends.

A receiving tuner for crystalline or vacuum valve detectors should be so designed that for a given wave-length inductance predominates in the secondary winding and the capacity in shunt is at a minimum value. This line of argument, however, cannot be carried out indefinitely because at very long wave-lengths the resistance of the coil may offset the benefits of increased inductance; but within the range of wave-lengths amateurs ordinarily employ the capacity of the secondary condenser should never exceed 0.0001 microfarad and is preferably smaller. Another error often observed is that the used turns of the secondary winding when adjusted to 200 meters cannot be placed in close inductive relation to the used turns of the primary winding.

(To be continued)

With the Amateurs



Earl Hanson and Hadys Hancock in their station at Venice, Cal.

An accompanying photograph shows Earl Hanson and Hadys Hancock operating the amateur wireless telephone and telegraph station on the pier at Venice, Cal.

Particular interest is attached to this amateur station, for it was here that Lawrence A. Prudhont, the hero of the wreck of the steamship Rosecrans, whose name will be reverenced as long as the Marconi Tradition, spent many hours sending and receiving messages. A considerable knowledge of the technique of radio communication was his before he left to attend the Marconi school.

A 5 k. w. closed core transformer is installed in this Venice station, but to comply with the law only one k. w. is used. The rotary gap, condenser and oscillation transformer is wired with copper tubing to carry the high frequency currents efficiently. The receiving set is a combination set for short and long wave reception.

The aerial is composed of stranded 7-22 phosphor bronze, is 300 feet long and 100 feet high for receiving and the earth plates are plunged in the ocean beneath the station. A 200 meter wave is used for transmitting.

A large picture of Lawrence Prudhont still hangs in this station.

An interesting amateur equipment in New York is the one which the owners term the Atlantic Radio Station, but is known to the government and wireless public as simple 2GT. Its interest lies mainly in the long record of service, and the apparatus used. All apparatus was built and designed by three young men. The receiving cabinet is of the latest

Marconi type, made entirely of hard rubber. The measurements are: Length, 19½ inches; width, 10½ inches, and height, 13 inches.

The loose coupler is an efficient and simple piece of apparatus. The secondary moves on wheels and is controlled by a knob on the face of the cabinet. The coupler can tune up to 5,000 meters alone. All taps, primary and secondary, are on the face of the cabinet. These taps also indicate the number of turns being used. The

Station 2GT, which has an excellent record in the amateur field

primary coil is so arranged that 1, 2, 3, etc., turns can be used. With the use of the loading coil the set can be tuned up to 8,000 meters.

Two variables are used. These condensers are made of brass, one in series with the ground to reduce the natural wave length of the aerial to that of the amateur wave. The other condenser is shunted across the secondary. These condensers can be placed at any angle and will stay in the position desired.

The detectors are three in number—silicon, antimony and valve, the two former being switched into the circuit by a single pole double throw switch. The valve is operated by two telephone switches, one to light the filament and the other to restore the circuit for the crystal detector. The high voltage batteries are switched into circuit one at a time by a switch on the cabinet. All batteries, buzzer tester, etc., are in the separately constructed compartments of fibre.

The aerial is of the inverted L type, 250 feet long, three wires, spaced three feet apart. Phosphor bronze wire of seven strands is used, 90 feet high on the receiving end and 125 feet on the free end. With this set all the Navy stations down NAX can be heard and also some of the Canadian stations.

Many amateurs have trouble in getting alternating current to operate their sending sets; this station uses a rotary converter of the four pole type, started by a rheostat. The speed of the converter is controlled by a resistance in the field circuit. The normal speed is 1,800 r.p.m., but with the resistance in the circuit the speed is 3,000 r.p.m. The rate is under control of the operator, and the generator is usually run to get 240 cycles. There is a Packard closed core transformer type giving 13,000 volts. A safety gap is used to protect the condenser, which is of the flat plate type containing 24 plates. There is no brush discharge as in the rack type. The gaps are rotary, quenched and straight gap, the rotary disc having 12 plugs of zinc. The quenched gap consists of 7 copper plates separated by mica rings, operating the transformer on 240 cycles; it emits a steady pitched sound similar to that of escaping steam. A pair of Weston volt and ammeters are constantly in the circuit and notify the operator when he is near the danger point of overloading the line.

For the past four years this station has been doing excellent work to the great satisfaction of the three young men who are joint owners and builders of all the apparatus.

Seeing Ourselves as Others See Us

My words cannot express my appreciation and praise for your most excellent magazine and I earnestly recommend it to everyone interested in wireless communication. Wishing the paper everlasting success, I remain.

C. W. H., *Ohio.*

I would not be without THE WIRELESS AGE and look forward to same every issue.

W. O. H., *Tennessee.*

I like THE WIRELESS AGE very much. I think you have the best magazine I ever read.

S. L. H., *Michigan.*

I have taken THE WIRELESS AGE for the last few years and I think it is the only magazine on wireless that I would bother to read.

H. J. M., *Connecticut.*

I think THE WIRELESS AGE is the best magazine going, and do not know what I would do without it.

E. G., *New York.*

Your publication contains so much "good stuff" that I find when I lend an issue out, it seldom comes back. And if it does come back, it is in such a dilapidated condition that it is necessary to send for another copy.

J. E. B., *California.*

I could not get along without THE WIRELESS AGE at all. Best wishes for continued growth.

C. M. B., *Pennsylvania.*

I am a constant reader of THE WIRELESS AGE and think it high authority on wireless. THE WIRELESS AGE and I will be friends in future years.

H. W. H., *California.*

I am sending my renewal subscriptioin for THE WIRELESS AGE. Please send me the July number, because I do not care to miss any numbers. I get more real pleasure from it than any other magazine I read.

A. C. W., *Iowa.*

Every new issue solves the question I intend to ask.

R. V. M., *New York.*

From and For those who help themselves

Experimenters' Experiences.

The editor of this department will give preferential attention to contributions from amateurs covering the design of transmitting sets, wave-meters, etc. There is an over-supply of material on receiving tuners, particularly "loose-couplers," the designs for the majority of which present nothing new or original.

FIRST PRIZE, TEN DOLLARS

Primary Switch for the Inductively Coupled Receiving Tuner

I recently designed a new form of switch for variation of the inductance in the primary winding of a receiving tranformer which possesses many advantages, the principal one being that it allows very quick and accurate tuning, doing away with the necessity for manipulating two switch handles which are generally used on these tuners. The general details of construction are apparent from the drawing (Fig. 1), from which it will be observed that a single handle controls both the "units" and "tens" switch by means of gears having a certain definite ratio.

In the particular type of construction shown, the larger gear is ten times that of the smaller one, so that when the "tens" switch is moved one point the "units" switch covers the ten points, which are connected to ten individual turns. Thus, by giving the handle a complete turn any number of turns of the primary winding from 1 to 100 may be included in that circuit. However, if gears of different ratio are used the switch may be constructed to include any desired number of turns.

A cross section of the large switch is shown in Fig. 3, the small one being left out to avoid confusion.

Dimensions of the details of this apparatus are not given, as each amateur will, without doubt, have his own ideas regarding the matter. If the proper size gears are not readily obtainable, with a little patience they may be constructed out of a piece of sheet brass with a file.

The contacts of the larger switch are made by dividing a brass ring ¼ of an inch in width and 1/16 of an inch in thickness into ten equal parts. They are then sawed off. A hole is bored and countersunk into each contact so that the flat-headed screws will just come flush with the contact.

The taps from the coil may be placed through holes in the board and connected under each contact. However, if flat-headed machine screws are used this will not be necessary. A good plan is to bore all the holes, marking their position on the board before sawing off the contacts, as it may be difficult to arrange them properly afterwards, particularly if the holes are not bored accurately.

The smaller switch has the contacts ordinarily employed in switch construction. The switch blades may be made of thin brass, the larger one having a small dent near the end so it will not touch two contacts at a time.

The handle may be of any material desired, but I prefer one of a large piece of hard rubber.

The bearings for the large switch should be of ⅛ inch brass set in the board, as shown in Fig. 3. Washers of ample size are placed under the handle and gears. One of the gears should be insulated from the shaft; otherwise the primary winding will be short-circuited.

A complete wiring diagram is shown in Fig. 4. The first ten turns are connected, one at a time, to the small switch ("units" switch) and every successive tenth turn to the large switch. One switch blade is connected to the aerial and the other to the ground.

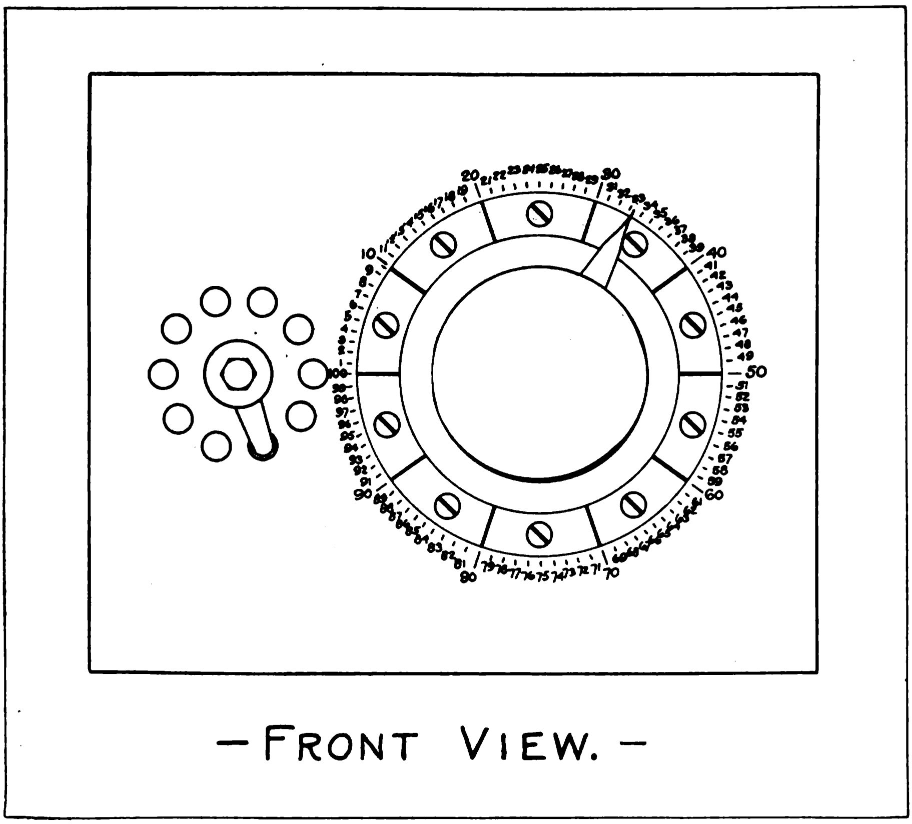


Fig. 1, First Prize Article

In conclusion I might mention that before assembling the gears both switch blades should be on contact No. 1. A suitable scale may be constructed for this switch.

If the general directions are followed the entire apparatus may be constructed at small cost and I am sure will be found entirely practical in operation.

C. HAROLD MCCULLOUGH, *California.*

SECOND PRIZE, FIVE DOLLARS

An Efficient 200-Meter Transmitting Set

In this article I present to the readers of THE WIRELESS AGE the description of an amateur wireless telegraph set with which I have obtained very gratifying results. The drawings are, to some extent, self-explanatory, but will probably become clearer from the following explanation:

The transformer should be mounted in a wooden case of such dimensions that the remaining instruments comprising the set may be mounted on the top. The condenser, which consists of six 8 by 10 photographic plates covered with tinfoil 6 by 8 inches on each side, should be mounted at one end of the case with the leads terminating at one corner near to the rotary gap, as shown in the drawing. The rotary gap should be mounted facing the condenser and as close as possible in order that the connecting leads may be of a minimum length.

The primary winding of the oscillation transformer consists of one turn of 1 by

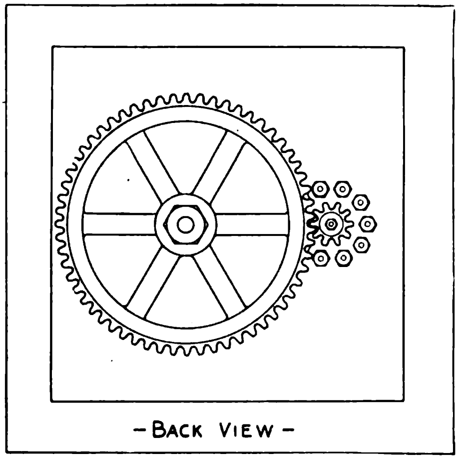


Fig. 2, First Prize Article

1/32 inches copper ribbon, 8 inches in diameter with the terminals at the bottom of sufficient length to be used for further connection without splicing.

The oscillating circuit is then connected up as follows: From one terminal of the condenser a connection is made to one of the stationary leads of the gap. This lead need not be more than 3 inches in length. Then one end of the primary strip is connected to the other terminal of the condenser. From the bottom of the single turn to the condenser there should be a space of more than 3 inches. The other end of the strip is connected to the other terminal of the gap; a space of 4 inches should intervene from the bottom of the turn to the gap. It is desirable to use the same strip for the connection from the primary to the condenser and spark gap, as two joints are thereby eliminated. Furthermore, connection of the leads to the top of the rotary gap removes the necessity for posts of considerable length which is of course undesirable. The total length of the leads in this circuit, including the diameter of the rotary wheel, need not be more than 15 or 16 inches.

It must be remembered that appearances are sometimes deceptive and the leads in a circuit may seem to be considerably shorter than they actually are. Thus the leads to the condenser must be measured to the point where they touch the coating and not merely to the edge of the glass or to the top of the case. Also, the material in the circuit of the rotary gap, such as the uprights, stationary electrodes, etc., must be taken into consideration as effecting the length of the leads in the closed circuit.

The secondary winding of the oscillation transformer consists of five turns of the same kind of ribbon and is arranged to move backward and forward so as to allow the coupling between the two windings to be varied.

I wish to include in this manuscript the description of a practical break-in system. The method to be described has been evolved by the author after making a number of experiments to produce a satisfactory piece of apparatus.

In the design for a break-in system several important matters must be taken

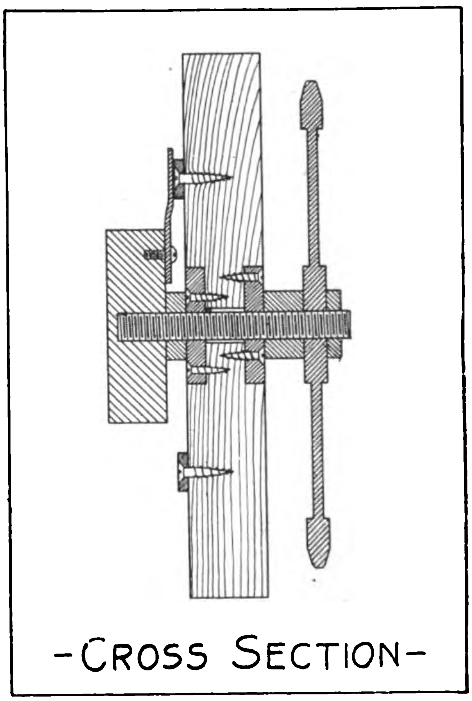


Fig. 3, First Prize Article

into consideration; the most important one is the retention of the sensitive adjustment of the receiving detector. Obviously, no system may be rightfully termed a break-in system or have the slightest value as such if the detector

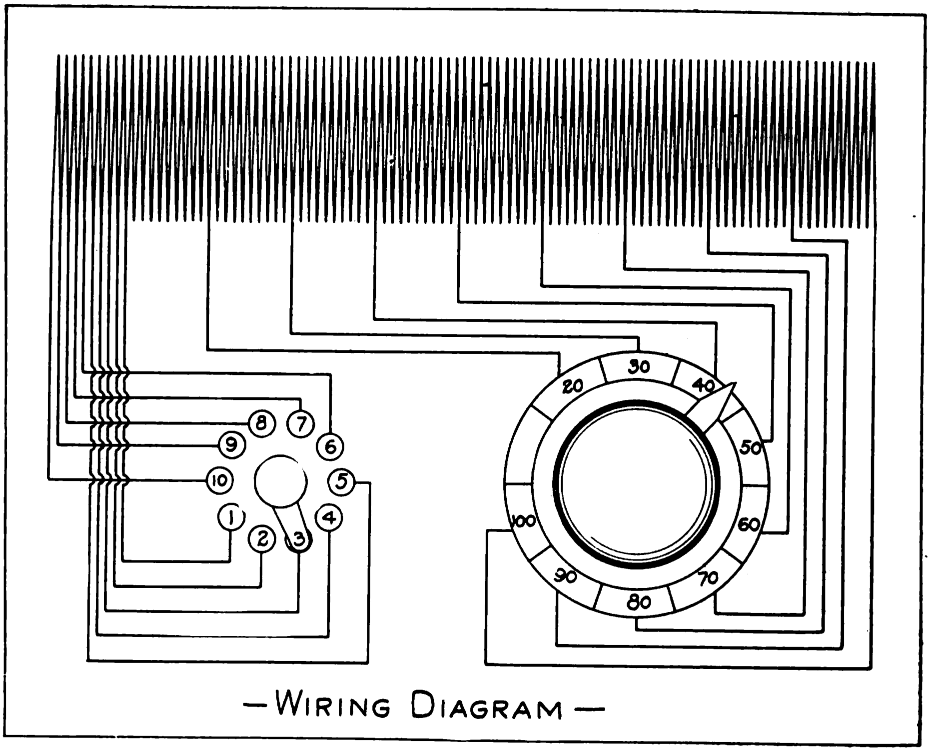


Fig. 4, First Prize Article

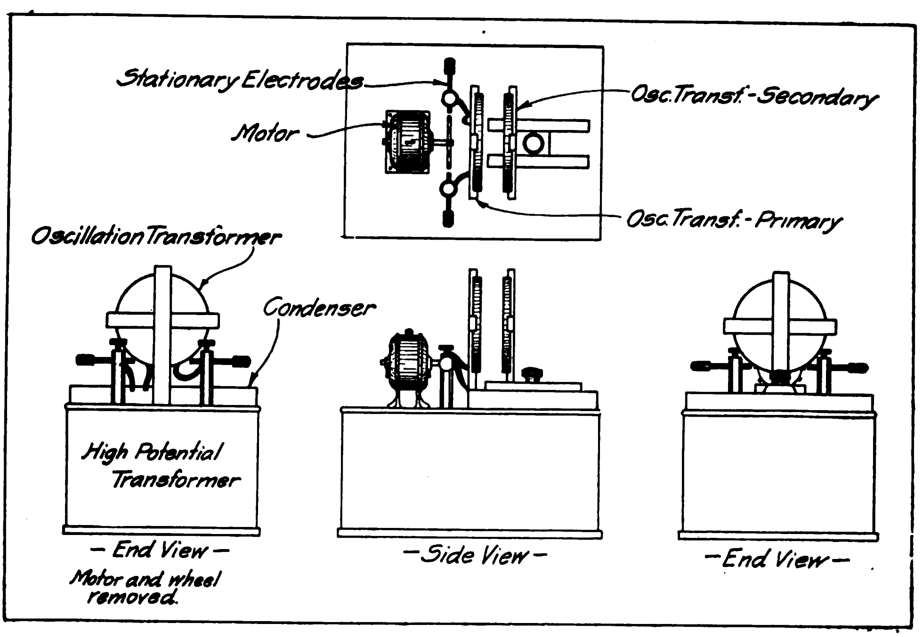


Fig. 1, Second Prize Article

loses its adjustment the first time the sending key is pressed.

With a vacuum valve detector this problem is easily solved by simply breaking the filament circuit through the medium of a telegraphic relay just before the power circuit is closed by the key. The difficulty, however, is not so readily obviated with the crystal detector, excepting, of course, the crystal of carborundum; but as few amateurs use the carborundum detector it becomes necessary to provide means for keeping a delicate adjustment with a silicon or galena crystal. However, it may be stated that a good carborundum crystal properly used will give very satisfactory results. With the silicon or galena detectors, which probably rank together in popularity and general use, I have found that the only satisfactory method to retain a sensitive adjustment is to completely isolate the detector from all circuits and then place it on short circuit, as close to the crystal as possible. As will be seen later, this can easily be done automatically.

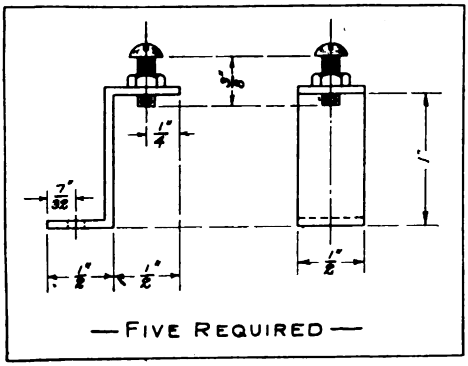


Fig. 2, Second Prize Article

The second consideration is that of the flexibility of the system as regards speed in sending. Systems using groups of contacts mounted upon extended key levers have the great disadvantage of making the key very stiff and sluggish in its action. Also they bring the high-tension transmitting leads in proximity to the receiving leads which is, of course, very undesirable.

Other points may arise in the design of a break-in system, but they are usually due to local conditions which vary, of course, with different stations.

In some systems an anchor gap is inserted in the earth lead and the receiving set is bridged around its terminals. Personally I have found this method very unsatisfactory because no matter how close the points in the gap are set a considerable amount of current flows through the receiving apparatus which is usually of sufficient intensity to destroy the adjustment of the detector. The gap also introduces an objectionable resistance in the radiating circuit which may hinder full compliance with the United States radio laws.

In my experiments with similar systems I could never prevent the sending current from destroying the adjustment of the detector except by short-circuiting the primary winding of the receiving tuner, or in other words, connecting the sending set directly to earth. I find this, by all means, the most satisfactory method if additional means are provided for disconnecting the leads of the receiving apparatus and connecting the transmitting apparatus direct to the earth; no gap of any kind is used.

The system I have evolved consists of nothing more than two D. P. D. T. switches mounted so that they work automatically together, one connecting the receiving set to the aerial and the ground; the other simultaneously connecting the detector to the receiving circuit. In the other position the first switch disconnects the receiving circuits, leaving them isolated from all high tension wires, and connects the sending set directly to the earth. At the same time the other switch has disconnected both leads to the detector and short-circuited it. More than one detector stand can easily be used, all of them being disconnected from the receiving set, but

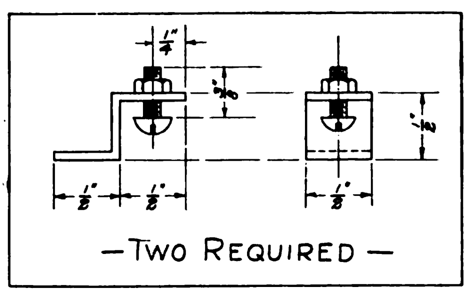
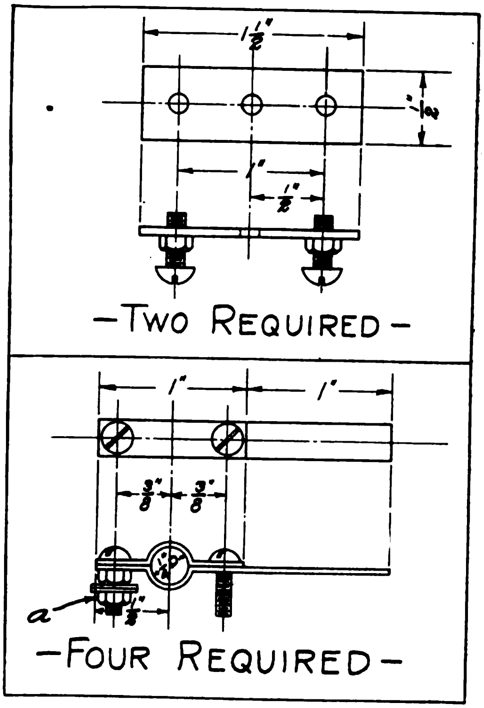


Fig. 3, Second Prize Article

only the one actually in use can conveniently be shorted.

In Fig. 11 A represents the first switch, B the second switch and C the operating magnet and armature. These three ele-



Figs. 4 and 5, Second Prize Article

ments are mounted on a light fibre or wooden rod about ¼ of an inch in diameter and as long as necessary to conform with the following desirable restrictions: The ground lead should be made as short and direct as possible from the transmitting instruments to the ground. The rod should then be so mounted that the switch, A, will be as close to the wire as possible. The leads to the receiving set should preferably be at right angles to the ground lead.

It is desirable in any wireless station that the transmitting instruments should be grouped together as closely as possible; but it is absolutely essential in an amateur station if any degree of efficiency is to be expected. The receiving instruments should also be compactly arranged and should be connected with stranded wire soldered at all joints. The receiving set ought to be at least three feet from the transmitting instruments and even farther if convenient.

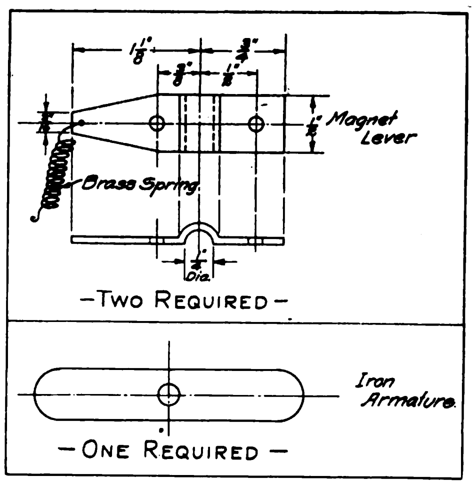
The switch, B, should be mounted near the receiving set and as close to the detector as possible. As there is no jarring in the action of this switch it is possible to mount it quite near the detector without throwing it out of adjustment.

The magnet, C, may be mounted at any point along the rod as convenient. It is shown in the sketch as being placed at one end merely for the sake of clearness.

Figs. 2 to 5 give the details of the switches and Fig. 10 gives an idea of the appearance when assembled. Both switches are identical in construction:

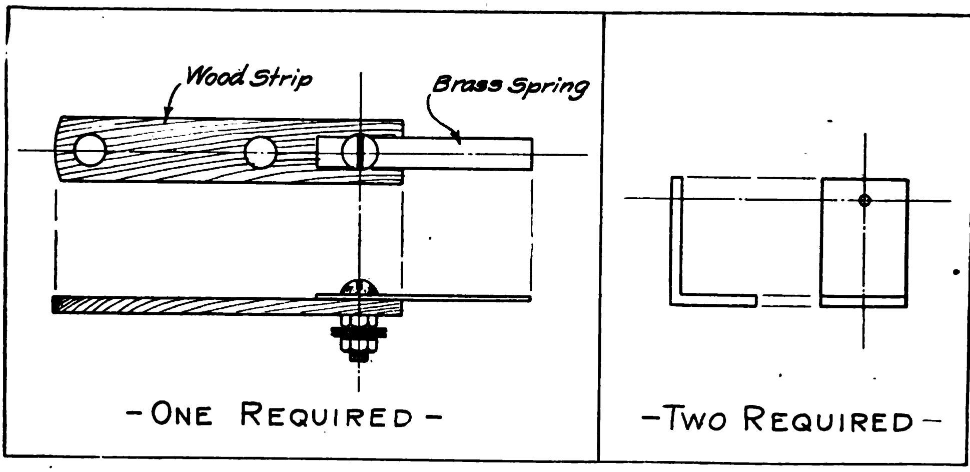
Figs. 6 and 7 give the details of the magnet armature lever. The iron armature is bolted to the short end of the lever and a spring is attached to the other.

Fig. 8 illustrates one method of constructing a suitable attachment to the key. It is nothing more than a piece of wood drilled so that it may be clamped to the key lever by means of the lock



Figs. 6 and 7, Second Prize Article

nut to the stop screw and the tension screw. A bracket (Fig. 2), is mounted beside the key so that when the key is pressed the attached spring will make contact with the contact screw of the bracket just before the power circuit is closed. This action will not make the key act stiffly or sluggishly in any manner and sending may be done at the speed desired. Fig. 9 shows suitable brackets in which to mount the rod. A small



Figs. 8 and 9, Second Prize Article

wire nail driven into the end of the rod through a small hole in the bracket provides a practically frictionless bearing. The advantage of this type of switch is that there is no group of contacts mounted on the key to stiffen its action and necessitate wide "play." The sending and receiving leads are not brought into close proximity and if properly constructed the action of the device is practically noiseless, thereby permitting the operator at a far distant station to break in upon the sending operator at your station.

General Instructions.

If trouble is experienced from noise and vibration of the rotary gap motor, hang it from the ceiling by cord. This is not so foolish as it seems at first, for by so doing practically all noise from the motor as well as vibration of the instrument table is eliminated. If a cabinet transmitter is employed, suspend the entire case.

In one instance the suspension of the rotary gap from the ceiling made it possible to reduce the length of leads in the primary circuit by 11 inches, thereby permitting the use of an extra condenser plate which, of course, resulted in increased absorption of power, while still not increasing the wave-length.

The magnets used in my device may be taken from a 20-ohm telegraph sounder. Two dry cells are quite sufficient to operate the break-in and should last for several months. The armature is fastened on the short end of the lever so as to provide a speedy action to keep pace with any rapid sending. A spring is attached to the long end of this lever so as to draw the switch back to the receiving position. The play between the contacts is represented in Fig. 10 to be about 3/16 of an inch. When the play is so adjusted, the armature has only to move 1/16 of an inch to change from receiving to sending.

The springs used for the switch arms should be made of a good grade of spring brass, heavy enough so that they will not vibrate when they are moved.

A convenient size for all bolts and taps is 8-32. The brackets may be of ½-inch strip brass 1/16 of an inch in thickness, but any other size may be employed, provided it is heavy enough so that it may be easily bent, drilled and tapped.

The cost of construction for such a switch is very small. In general it is found that material is available at any amateur work shop.

With a switch of similar design, mounted under the table in a station where the sending instruments were at the operator's right and the receiving instruments at his left, and with the ground lead going directly through the floor, I was able to hear Key West, 1,300 miles, while transmitting to an amateur near by at every interval between the dots and dashes of my sending. As the ground lead was vertical and the leads to the receiving set were horizontal no trouble was experienced from induction.

The aerial was 80 feet in length by 50 feet in height comprising two wires, and the receiving set consisted of a sim-

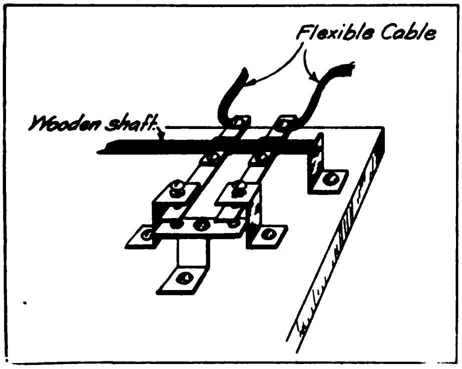


Fig. 10, Second Prize Article

ple inductive tuner used in conjunction with a Silicon detector.

JAMES A. KILTON, JR., *Texas.*

THIRD PRIZE, THREE DOLLARS
A Synchronous Rotary Spark Gap

Many amateur workers are prevented from fitting their stations with a synchronous rotary spark gap on account of the expense of a satisfactory motor. The design which we present for consideration is not entirely original with ourselves, but was suggested by Professor A. S. Jordan, of the physics department of the Polytechnic High School of San Francisco. The design of this motor is rather unique, but we are certain that it will appeal to the amateur experimenter who lacks the necessary funds for one of standard make.

So far as we can see, the only disadvantage of this motor is that it is not self-starting, *i. e.*, the rotor must be first revolved by some mechanical means. For example, we suggest that a small pulley be fastened to the shaft and by means of a piece of string wound around this pulley a few preliminary turns may be given after the manner of winding up a toy gyroscope. The current being turned on at the field magnet the rotor will continue in rotation at a very high speed. It should be remembered that this gap will give synchronous discharges at a frequency of 60 cycles and therefore the note may not be quite as high as that obtained with certain types of non-synchronous gaps.

A top view of the complete rotary gap is given in Fig. 1, a side view in Fig. 2 and details of construction in Fig. 3.

The field magnets must be of fairly large proportions to obtain efficient results, and the core must be laminated or built up of many thin sheets of soft iron insulated from each other. The electro magnets should be wound with about No. 24 D. C. C. wire. A suitable impedance or reactance coil should be constructed and connected in series with the field coil, as it is not possible to operate such a small coil directly on a 110-volt alternating current circuit.

No descriptions of the details of the bearings are given, as materials, such as the bar magnet, etc., may be found in the amateur's work shop. The bearings are very simple in construction and, with a little ingenuity, the entire gap can be

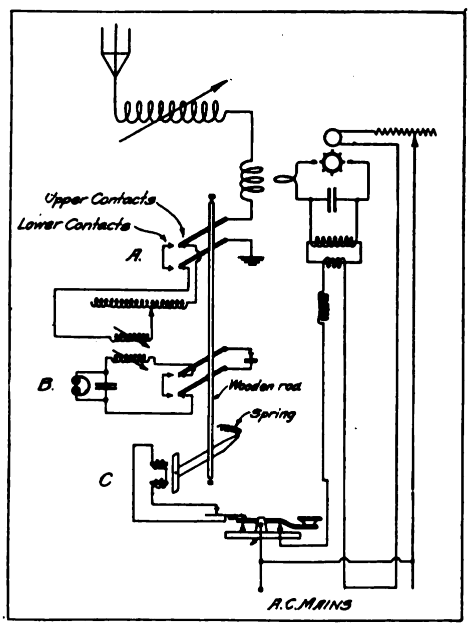


Fig. 11, Second Prize Article

constructed of odds and ends. On the outer ends of the bearings is located the rotary spark gap proper. The electrodes are two in number and are insulated from the shaft by means of a rubber bar. Both electrodes must be connected together by means of a piece of wire.

The rotor of this motor is a fairly large, but strongly magnetized steel bar magnet. There should be a very small clearance between the ends of the coils and the poles of the magnet.

The stationary electrodes may be taken from any ordinary type of straight spark gap, the binding post for supporting them being separated by the necessary distance according to the design.

We believe that the details of construction will be readily understood from the drawings and, if the general directions given are followed, a very useful and satisfactory piece of apparatus for your station will result.

E. G. Mahn, Walter Maynes, *California.*

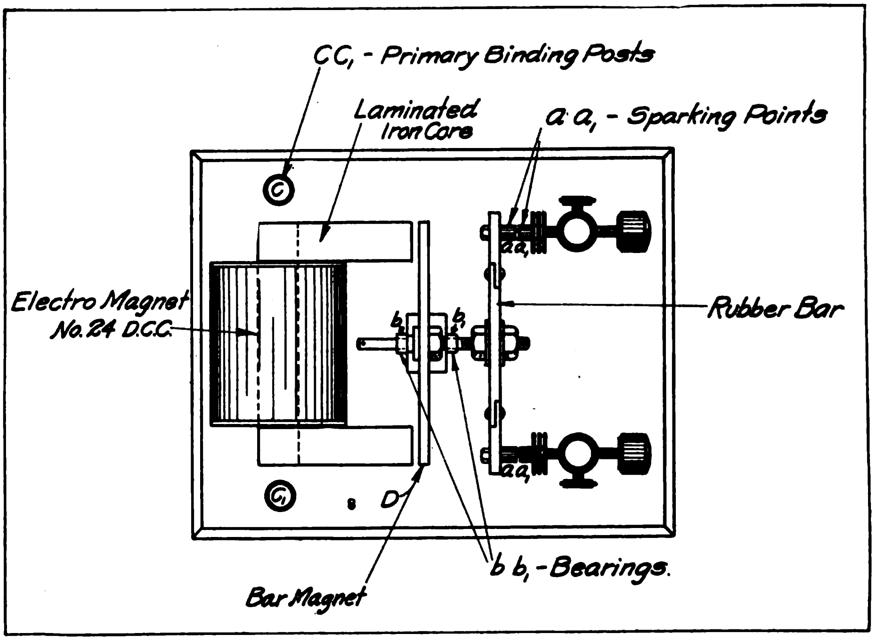


Fig. 1, Third Prize Article

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

A ½-k.w. Amateur Transformer

If the proper directions were available many amateurs would construct their own high potential transformers. If they live in a town where 30-cycle current only can be obtained, they may find it difficult to procure the necessary data. The following described transformer was specifically designed for 30-cycle alternating current, but has been found to work equally well on 60-cycle current.

The details of a suitable winding machine to take care of the secondary "pies" are shown in Fig. 1, while a general idea of the transformer frame is given in Fig. 2. A schematic drawing of the primary winding is shown in Fig. 3.

The core is made from 28 gauge stove pipe iron, which is generally procurable from the scrap at any tinsmith's store. The following pieces are required: 126 pieces 2 inches in width by 12 inches in length; 126 pieces 2 by 9 inches; 126 pieces 2 by 8 inches, and 126 pieces 2 by 5 inches. The 12-inch and 9-inch pieces should be shellacked on both sides.

The long legs of the frame are made by stacking 63 pieces 2 by 12 inches and 63 pieces 2 by 8 inches. First a 2 by 12-inch piece and then a 2 by 8-inch piece is placed in position. The 2 by 8-inch pieces are placed so that the 2 by 12-inch pieces will overlap them 2 inches on each end.

These legs should now be clamped together tight enough to make a pile about 2½ inches in height. This can be done by using two iron clamps after which the legs are bound with two layers of ordinary friction tape. In this manner the laminations will be held tightly together. The height of the pile can be maintained by moving one clamp at a time. Two inches at each end of the core are not to be covered with the tape. The center of each leg is now covered with ten layers of Empire cloth. The primary winding, which consists of four layers of No. 13 D. C. C. magnet wire, is wound on one of the legs. This winding will require 4½ pounds of the wire

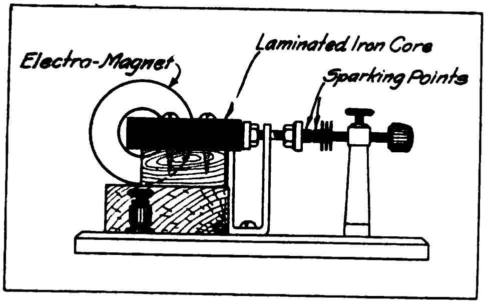


Fig. 2, Third Prize Article

referred to. Starting 2½ inches from the end wind two layers of 80 turns each, and two layers of 75 turns each. Taps are taken off from the second, third and fourth layers, as shown in Fig. 3. In this manner the secondary voltage may be varied as desired. The secondary winding is made up of twelve pies about ½-inch in thickness, each pie having 2,350 turns of wire. The total winding will require 7 pounds of No. 32 black enameled wire.

These pies are made in the following manner: A form is cut from a block of wood about ½-inch thick to the size of the core outside of the Empire cloth. A flange is fastened to one side of the block so as to overlap each edge about 2½ inches. The foundation for each pie is made of a piece of cardboard ½-inch wide, which is wound around the block. For a distance of ¼ of an inch in the center of this strip wind 20 turns of wire, which is covered with a ½-inch strip of thin onion skin paper, glazed on both sides. This is followed by 20 additional turns of wire and another strip of paper until 2,350 turns of wire are wound on each pie. The pies are now taped tight enough to keep the layers in place, and then placed in boiling paraffine wax for about half an hour.

The pies are now placed on the leg with two pieces of Empire cloth between each pie where they are connected from the inside and one piece where they are connected from the outside.

Care should be taken that the pies are so placed that the current will travel in the same direction around the entire core. If the pies are all wound in the same direction and every other pie is reversed as it is being placed on the core, the maker will have little difficulty in effecting the proper connection.

The two long legs are now joined together by the short pieces (2 by 9 inches and 2 by 5 inches). The long pieces should span the full width of the core, while the short pieces will go between the long legs. The short legs are clamped and bound with two layers of friction tape.

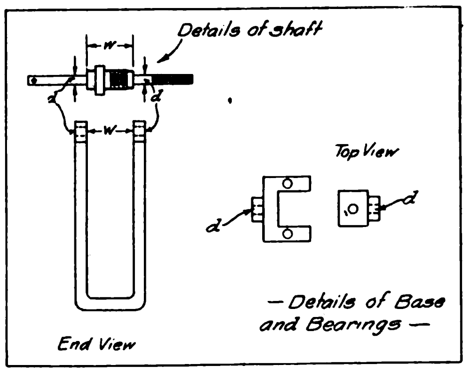


Fig. 3, Third Prize Article

The transformer is then placed into a metal box and covered with transformer oil. Care should be taken to see that the box is large enough so that no portion of the transformer will touch the sides.

When the full four layers of the primary winding are used this transformer will furnish a secondary potential of about 12,000 volts. The spark produced is not the kind of spark given off by a spark coil, but is a flame sufficient to make needle points red hot for a distance of 1 inch from the tip.

If the builder of this transformer will make use of the winding machine shown in Fig. 1 he will have little difficulty in making the secondary coils. The construction is as follows:

Cut enough pieces of cardboard, 2 inches, 2½ inches, 3½ inches and 5 inches in diameter to make four wheels

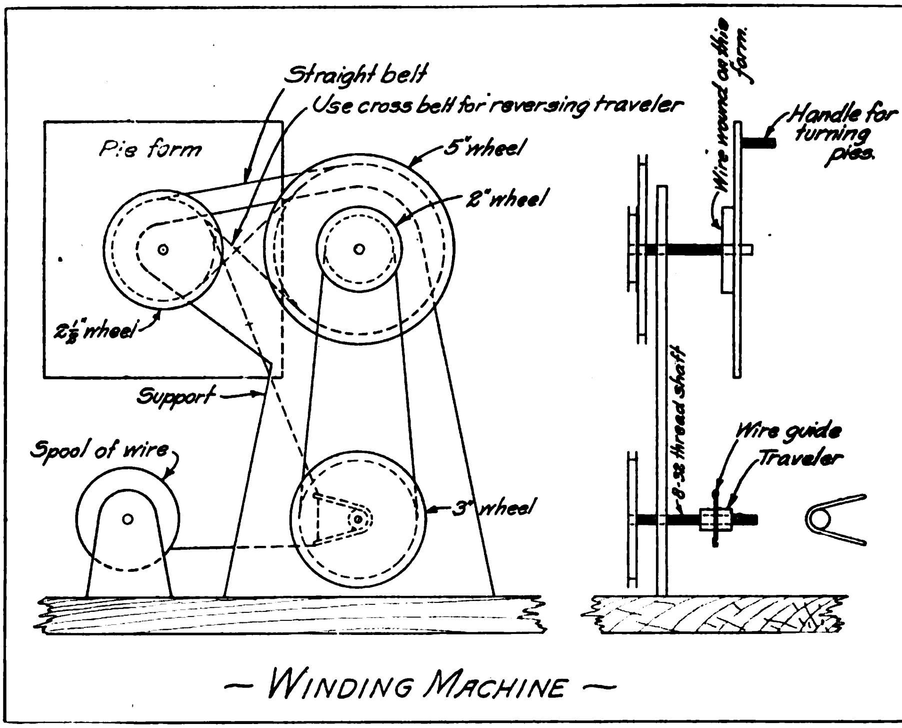


Fig. 1, Fourth Prize Article

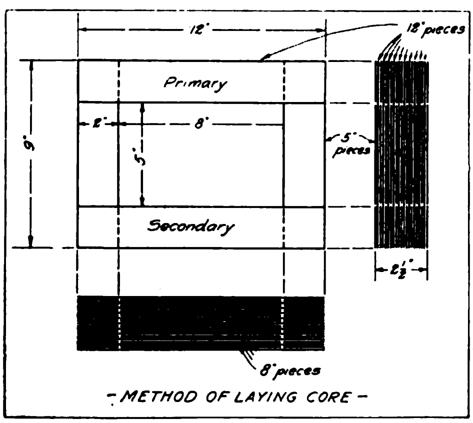


Fig. 2, Fourth Prize Article

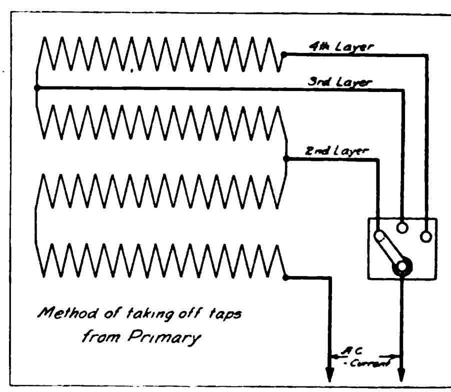


Fig. 3, Fourth Prize Article

about ⅛ of an inch thick. Then cut two pieces each 2½ inches, 3 inches, 4 inches and 5½ inches in diameter and glue them to the wheels for flanges. The 2-inch and 5-inch wheels are glued together and mounted on the same shaft; the 3½-inch wheel is mounted on a shaft which is cut with an 8/32 thread.

A small traveler is tapped out with an 8/32 thread so that it will work on the shaft. Two string belts will be required to go from the 2½-inch wheel to the 5-inch wheel. One is straight and the other is crossed so that the pie will turn in the same direction, but the traveler will work back and forth. I believe this explanation is sufficient to allow construction on the part of many amateurs and I feel assured that they will be satisfied with the operating characteristics of this transformer.

JAMES E. MACGREGOR, *Michigan.*

RADIO RAVINGS

Conducted by D. Phectiff Inslater

Scene: Marconi Superintendent's office, any division, morning of the millennium. (B. McLean, impresario.)

Amateur: "Have you any vacancies at the present time, sir?"

Chief Operator: "Well, what can you do? You, of course, have sent and received messages at least five thousand miles?"

Amateur: "No, sir — have never worked that far."

Chief: "But surely you know all about wireless and can draw a diagram of every system in existence?"

Amateur: "No, sir; I've got a fair knowledge of wireless, but don't claim to know it all."

Chief: "Then without a doubt you can send and receive at least 40 words per minute?"

Amateur: "No, sir; I couldn't work that fast, but think I could handle about 25 words O. K."

Chief: "Then surely you see where the Service could be improved in many ways and can install apparatus more neatly than our construction department?"

Amateur: "No, sir; while I have seen and heard a number of your stations work, I have no fault to find. In fact, I think I've got considerable to learn before I would feel able to make any criticism."

Chief: "Then at least you can furnish forty recommendations from the leading citizens of your community regarding your ability and character, and if given a position, you, of course, would expect the best job we have?"

Amateur: "No, sir; I have only my high school diploma and a letter of introduction from our superintendent of schools. Will take any position you give me and if given a chance, will do the best I can."

Chief Operator, showing signs of immediate departure by fainting route, gasps incredulously and reaches feebly for glass of ice water. Said g. of i. w. externally applied, revives him and he stutters weakly: "Come back at two this afternoon. Consider yourself assigned to the steamship Veritas, leaving Pier 61 at four-thirty."

SONG OF THE SUBMARINE

If X-4-11-44
Should bump the Hully-G
Do you suppose her gallant op
Would, quick, forsake the sea?
"I doubt it," says Repeater, "for
'Tis there I think he'd be."

Can you send me a sample copy free?—*Letter from Henry Byer.*

With the very greatest pleasure
I do what you desire,
No pay I'd think to take for it
Although you are a Byer.

Striking a tune on the lyre seems to be the pleasantest of indoor sports these sultry days when clothing manufacturers are patriotically advising us to stick to clothes made in U. S. A.

Merely to show that nothing is worse than verse, lamp these:

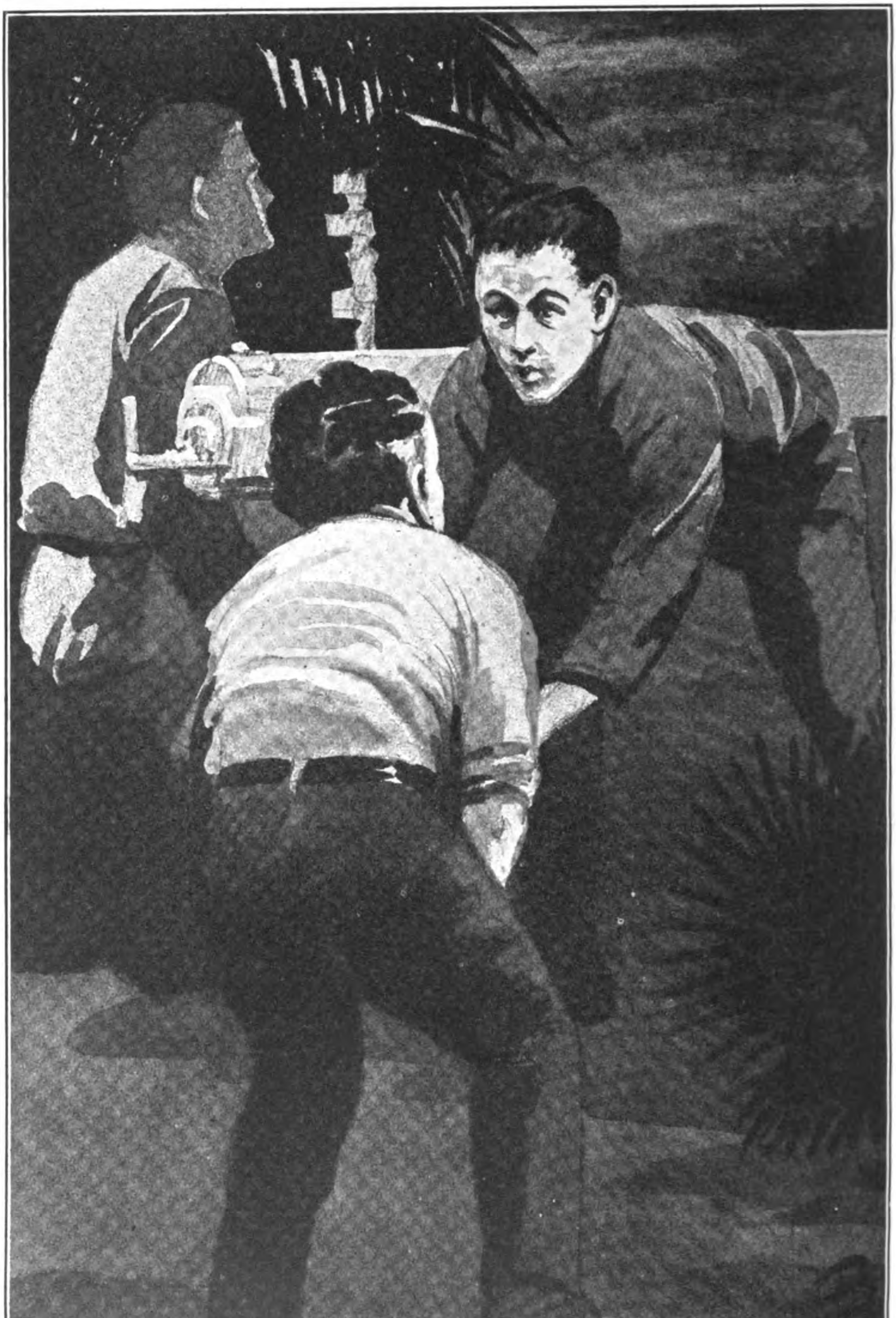
Mary had a little lamb,
And a piece of pie or so;
But Mary did not have them
When the ship tossed to and fro.

Mary had a plate of soup,
Some cabbage and fried pork—
But Mary missed them strangely
Just two hours from New York.

And just to think that Mary
Was there on pleasure bent,
And merely leaned across the rail
To see where pleasure'd went.

It's quite enough, Roderick, I can stand no more.

See you in September.



Curtiss fired the shells as fast as Hans served them

The Defense of Noronha

by Warren H. Miller

CURTISS dug both hands into the locks of hair back of his ears and pored over the yellow message slips spread out before him. The walls of the new wireless station reflected dimly the shaded incandescents on the sending and receiving desk, and no sound save the licking of the tropical surf on the coral reefs outside broke in on the after-midnight silence.

Curtiss was sorely perplexed. The wireless station of Noronha had been established for strategic and military reasons upon a lonely coral island two hundred miles east of the coast of Brazil. It was the nearest point of dry land to the European cable connections in the Cape Verde Islands, reaching in one relay the important naval bases of Gibraltar, Marseilles and the German concessions in Morocco. There had been much international jealousy, from a military point of view, regarding the control of the station. The soil belonged to Brazil; the dominant influence of France and Germany in both Brazil and Argentina had dictated that a French officer of the line should be in charge; the apparatus had been installed and the station constructed by an American company with Curtiss representing them as the construction engineer.

Then suddenly the whole world had become involved in the Great War. The fundamental aversion of the United States to militarism had caused our country to withhold its sympathy from all that the Prussian military caste represented, and this in turn had been deeply resented. We had seen all we wanted to of the pomp and glory of war in '61; to us all this seemed antiquated, out of date, childish; we could not be induced to approve. Our absorption of a flourishing South American trade that once had been a fond dream of the ruling caste in Germany, stirred this resentment into activity. It showed itself not in overt hostility to the United States, but in the fomenting under Prussian auspices of distrust and hatred of us by the very nations in South America which, under the Monroe Doctrine we were bound to protect. Aided by the 2,000,000 German colonists in those countries, Brazil and Argentina had been goaded into open hostility to us. We little realized how powerful those two nations had grown, how little they respected or feared us, how strong were the commercial and social bonds that knitted them to Germany. And now we were upon the brink of a breach of the Monroe Doctrine, not from without but from within, by the very nations it was designed to protect; and Curtiss on Noronha found himself in the vortex of diplomatic activities. In the event of war, what should he do? Hold the station as a strategic advantage for his own country; turn it over to Lieutenant LaPlanche, the Frenchman, as neutral territory, or destroy it and make his escape to one of our cruisers? The Frenchman and he had become great friends, and he felt that, as La Planche was intensely jealous of everything that represented German influence, he could count on him not to interfere in case he decided to hold the station. Then there was Hans, his German-American electrician; which side he would fight on was yet to be seen, for he had always been intensely sympathetic with the Fatherland's increasing influence in Brazil and any prowling torpedo boat on the Brazilian side was pretty sure to be officered by some of his own countrymen, young university graduates, freiwilligers in the army and navy of the Fatherland, who were making their careers in this new land under the German sphere of influence.

LaPlanche and Hans were the only inhabitants of the island with him at present, all the workmen having been taken off by the last steamer that had touched there. Curtiss studied the situation without arriving at a satisfactory solution. Affairs had reached a serious situation, more serious than the authorities at Washington probably realized, and he well knew that the blow when struck would be sudden, and it would be left to him to do all the deciding on the spot.

Suddenly the receiving galvanometer began to swing. It was of the new electrolytic responder type, taking forty words a minute, and Curtiss translated rapidly, his eyes dilating as he grasped the full import of the words. Then the sending ceased and after a short pause he acknowledged receipt, grabbed up the despatch and dashed into the sleeping quarters of the station.

"LaPlanche! LaPlanche! Wake up!" whispered Curtiss, quivering with excitement, as he shook the khaki-clad figure on the cot before him.

LaPlanche only groaned in the inflexionless cry of the dead-asleep, and his long drooping French eyelashes shuddered as Curtiss bored into his ribs with his knuckles.

"Frogs! Wake up! War's declared!" he hissed into his very ear.

"Nom du nom!" growled the sleeper, turning over and opening half-conscious eyes. *"Dites donc——"*

"It's come! Read this!" cried Curtiss hoarsely, waving the yellow slip. "Get up——"

Into LaPlanche's eyes shot the rapier-like glint that Curtiss had come to love so well. *"Tiens!* We're in the World's War at last!" he exclaimed, now wide-awake and all interest. "America?"

"Yes, us! The best military secret that was ever kept! It's hit us like a steam engine. They're after us—over the heads of these two tropical republics, with the whole continent of South America as the prize! The waking half of the world's agog over it now and the other half will read it at their breakfast tables to-morrow——"

"You! America! Incredible. Why, you are the children of us all—*C'est* impossible!"

"What do you suppose that bunch of Prussian fire-eaters cares about that!" retorted Curtiss bitterly. "They'd drench the world in blood—anything to keep their seats on the back of Germany! If they lose at home, here's where they start in next, and if I know my nation it means open war right off!"

"Eh bien!" snapped LaPlanche excitedly. "And that's your message, is it?"

"You bet! We *are* the war just now, this little lonely island of Noronha, two hundred miles from nowhere off the coast of Brazil, and this wireless station that we Americans put in, and you, Froggy, are to command. Brazil and Argentina have allied against us and declared war."

"Tha's all ri'. And now let's get back to bed. I thought you Americans were noted for sang froid," taunted LaPlanche, slightly arching his eyebrows. "It will be many a day of weary watching over our rim of horizon before we see a hostile ship."

"No. To-night. In twenty minutes.

And we only have the one-pounder out in front of the station.'

"Ah! *Mon Dieu!*" bantered LaPlanche sarcastically.

For answer Curtiss spread out some crumpled message blanks. "I caught these at five o'clock yesterday, just before dawn," he said, quietly, "but thought it best to keep quiet about 'em. Hans, the electrician, you know——"

LaPlanche translated the messages: "Daily coal report in tons—Para, 2,350; Rio Janeiro, 2,295; Argentina, 3,956; Amazona, 3,050," he read.

"All dreadnoughts of the latest type as their names show and since we got them, somewhere within six hundred miles of us, as that is our night limit."

"Ah! Ah! Their fleet coal reports."

"Yes. Signalled as usual to their flagship at eight bells. And, as I caught them at 5 A. M., that places those ships somewhere about the Cape Verde Islands, that is, twenty-four hours ago. I tell you it's the suddenest blow that ever was struck, and we are the blow."

"*Tiens!* and they must still be four hundred miles off! Let's go to bed."

"Wait." Curtiss detained him. "Read this despatch," thrusting the yellow slip before his eyes.

LaPlanche read it over good naturedly. "It's from your consul at Rio, and simply says that reports have reached him that the torpedo boat *Scorpio* left Guyaquil at 10 P. M. last night, diplomatic crisis reached at Washington, war likely declared any hour.'"

"'Diplomatic crisis at Washington!'" echoed Curtiss savagely. "The *Scorpio* will be here at 3.30. First blow —that's the way wars begin—and it's three in the morning now."

"*Oh! La la!*" derided LaPlanche. "Shall we uncrate the shells?"

"Sure thing, and right now."

"*Mais non!* If she comes to seize the station, all you have to do is to destroy the wireless and surrender yourself. You're still officially in charge here, so I shall not interfere."

"She's coming, don't you worry about that, and what for? Our New Hampshire is now at Pernambuco, and the Washington at Bahia, one battleship, one armored cruiser, widely separated. Do you recall the Varjag incident at the beginning of the Russian war, when a fleet of Japs caught her alone with one gunboat?"

"Oh——?"

"Yes. You and I and those on that torpedo boat are the only persons in this part of the world that know of the whereabouts of that big fleet off the Cape Verdes. I'll bet it's that same fleet which left Buenos Aires a week ago, ostensibly for a practice cruise. What that torpedo boat is after is to sieze this station, pick up their fleet and give them the whereabouts of our cruisers."

"Still, if she comes, all you have to do is to warn your ships, destroy your apparatus and surrender."

"I have warned them, much good it did! Ever hear of any of our ships running away on a wireless rumor and without specific orders from Washington? I tell you they won't move until they actually hear the torpedo-boat calling her own ships—then they will move all right, but it will be too late. They *must* have twelve hours' head start. If we could only fix the wireless so that the torpedo-boat would warn our fleet without reaching theirs——"

"Impossible!"

Curtiss looked at him fixedly, turning a thought over and over in his mind. His eyelids rose until the blue eyes shone through mere slits. "There is a way—" he mused, "but we must fight for it. Will you?"

"*Ah, bon!* Anything better than to rot here day by day, and *Ciel!*—grow fat," yawned LaPlanche, stretching himself. "*Pst!* What was that?" he cried, suddenly straightening up and pointing through the open door of the station out over the sea.

"Where?" exclaimed Curtiss, following the other's index finger.

"Oh, nothing but a wisp of red flame out there in the blackness; there it is again."

"It's her! That's forced draft!" shouted Curtiss, grabbing up a hatchet. "Go wake Hans, while I run down and unpack the shells. He's either got to fight or we'll lock him up somewhere."

Curtiss lit the cellar lamp, pried gingerly at the cover of the ammunition crate, and had started the first plank when a heavy footstep descended the stairway and Hans stood before him. He had nothing on but his washed out, light-blue overalls. The bare muscles of his huge shoulders stood out in great, knobby bunches in the lights and shadows of the lamp, his general appearance giving a hint regarding his queer character. Possessed of a university education and the thorough, analytic German mind, he had nevertheless, perforce, come to America and obtained employment as a wireless electrician—at double the pay he could earn in the Fatherland as an electrical engineer.

He stood silent, waiting for Curtiss to speak; his face, with its Saxon blue eyes, its blond mustache, its wistful expression, never more in earnest than now.

"Hans," began Curtiss, looking up from the crate, "We are going to be two against the twenty on that torpedo-boat out yonder, and some of her officers and men happen to be your own countrymen fighting for Brazil much as you would do for America."

Hans nodded and shifted his weight to his other foot, concentrating his intelligent gaze on Curtiss' eyes.

"Now what you care to do I leave entirely to your own sympathies, Hans, and to your conscience. We sorely need another man, indeed we do—but I wouldn't ask any man to—to—you know. . . . Suit yourself; with us or neutral, this station's going to be *held*. What do you say?"

Hans made a deprecatory movement and again shifted his weight. "Mr. Curtiss," said he slowly, "I love the Fatherland; what man wouldn't? I know for why she encourage this war. Maybe she right . . . But America! Ah, America!" he exclaimed tenderly, the tears welling up in his eyes. "Mr. Curtiss, she take me cold, an' sick, an' hungry, she gif me vork, she gif me mooney, so I send for mein frau an' mein liddle ones. Mr. Curtiss, I—I—I die for her, gladly. Efry Cherman in America feel that way. It iss our debt."

Curtiss wrung his hand. "That's fine, old man," he muttered huskily. "Maybe the Fatherland is right; but America, right or wrong, for us. Bring up a dozen of these shells, old top, will you, while I go get the canvas off the one-pounder."

He hastened out into the little green in front of the station, where the new one-pounder, with its naval base bedded in a neat concrete pier, pointed seaward. The torpedo-boat was quite near now and coming on fast. Not a light was to be seen on her, only the hum of her draught and an occasional lick of flame out of her funnels told of her approach. Presently she slowed up and stopped while Curtiss shoved in a shell and trained the gun on the dark mass.

"The moon will be up in half an hour. Oh, if I could only see!" he exclaimed anxiously.

"You will not fire now!" exclaimed LaPlanche, on tiptoe at his elbow.

"Sure! Attack's the best defence. Any boat that comes up to this station with no side lights, no signals, ignoring all the laws of navigation, is hostile and ought to be fired on."

"Alloo!" A hail in German came in from the black bulk out over the water.

"Answer him, Hans."

There were a few shouts of parley. "He say you mus' surrender the station," translated Hans, "an' he goes to put overboard a liddle boad."

"Tell him to get under way at once and show his side-lights, or I will fire," commanded Curtiss.

Considerable shouting between ship and shore followed. "He say it is nonsense, and he call me a traitor," said Hans, his eyes flashing angrily.

"Well, there go his davits, and I'm going to open up the minute the boat comes around her stern. If I could only see!"

The three strained their eyes in silence as the noises of lowering and manning a boat reached them. The faint dawn, presaging the rising of the moon, slowly began to relieve the intense blackness of the sea.

"C'est ca!" hissed LaPlance tensely, gripping Curtiss' arm. A blurred black shape separated itself from the larger bulk.

Bang!

"Too high. Missed him. Give me another shell," snapped Curtiss. Hans silently handed up another one.

"My friend, don't bother with the little boat, fire on him, he can't return your fire without wrecking the station," whispered LaPlanche.

"Froggy, old man, I love you for that thought. Here's for his boilers. Quick now! Fast as you can hand 'em to me!"

Curtiss got off the shells as quickly as he could aim, landing one of them. The commander of the torpedo boat was equally swift to comprehend his predicament, however, and, taking the bow-line of his gig, he rang for full speed and circled the point so as to be able to fire across the station at the one-pounder.

"Quick! Bring me some armor-piercers!" shouted Curtiss, firing his shells as fast as Hans could serve them.

LaPlanche dashed below, while the torpedo-boat stopped and took on the gig's crew.

"Now she's got us! Hurry, Frogs! She'll sweep this point in a minute."

A loud report echoed up from the bay, simultaneously with the deafening crash of the shell as it exploded directly in front of them. It was ear-splitting, terrifying, seeming to shake earth and air with its intense dynamic power.

"Now's the time to be economical of our army," said Curtiss jocularly, abandoning the gun and pushing Hans before him. "Here, LaPlanche, come back, come back,—you're too late!"

Again came a belch of fire and smoke from the torpedo-boat and again the driving crash of the shell. It seemed to transport LaPlanche into fury of excitement. He whirled open the breech, jammed in a shell and put his shoulder to the stock, driving home shot after shot as fast as he could crowd in the shells.

Boom! Crash! Another shell exploded over the gun, and there was a tang of steel as one of the guys of the tall aerial mast of the station parted.

"They won't try that again," panted Curtiss; "no more shells for us, La-Planche! Frogs! He's down; come on Hans."

They dashed out and dragged the Frenchman back into the station.

"It is nothing," he expostulated, struggling to his feet. "A touch. A scratch. *Rien*. The force of it knocked me down."

They tied his left arm in a sling, while the torpedo-boat fired slowly and steadily with both her fourteen-pounders, using solid shot which drummed past and out to sea across the point. The huge red rim of the moon rose over the horizon, bringing ship and shore out, black-red and sharp. Presently a solid shot struck the steel naval base of the gun, wrecking it.

"Now she'll get out a boat," declared Curtiss. "All hands down to the grove of trees along the shore back of the point. Where's Hans? Oh, Hans!" he called, stopping for an instant in the station to pick up his rifle. LaPlanche was already off, brandishing a French automatic pistol in his free hand, so Curtiss waited no longer but ran after him into the dark jungle of ironwood and seaside scrub palms which bordered the mangrove swamp along the shore. Already the gig was pulling across the little bay.

"Now! The quicker the better!" he gasped, taking a rifle rest against a small palm.

"Ah! The *sans culottes*. After you, *mon cher*."

Their shots rang out simultaneously, striking the water beyond the gig; whereupon a sharp command caused her to instantly dash forward, the six oars rising and falling like machinery. A seaman in the bow and two in the stern returned their fire as she came on, while Curtiss looked anxiously over his shoulder for signs of Hans.

"We're lost if we don't sink her. Where, oh where is that thick Dutchman?" growled Curtiss, jamming another magazine clip into place.

The gig tossed oars about fifty feet off the mangroves and headed into the only landing place among them as the rowers snatched up their rifles. Suddenly a huge blurry form trod out into the mangroves and stood motionless in the moonlight for an instant while those in the gig levelled their rifles at him. It was Hans. In another second a thin sizzling arc of fire curved out from him to the boat, while the rifles aimed at him spit out their steel bullets. Then came a dazzling glare, a stunning report, a chorus of hoarse shrieks, and the water was dotted with bobbing heads amidst a few floating splinters and frames of the gig.

"Arnold von Winkelried over again!" exclaimed Curtiss pityingly, straining his eyes on the still form of the devoted Hans lying under the mangroves. "Isn't that the Teuton of it, though, to give one's self for all! He must have fixed over one of our shells into a kind of bomb. Poor Hans! Come on Frogs!" he called to LaPlanche in the jungle. "They got him, but they paid dearly for it, ten to one, I'll bet. Leave off potting those poor devils in the water; there's two of them can't swim a stroke as it is. Let's get back to the station."

"*Regardez;* the other boat," answered LaPlanche, pointing towards the torpedo boat.

"All the better. We have a few minutes to think up something new, as they will wait for her to come up."

LaPlanche shrugged his shoulders. "*Eh bien!* There is still a good harvest of herrings below. But I'm all out of shells anyhow," he said philosophically.

"Well, France and Germany have had a crack at it; now let's see what a Yankee can do," said Curtiss as they reached the station grass-plot.. "Why, here, this thing's no bigger than one of those ancient petronels," he cried, kicking the dismounted one-pounder; "give me a shrapnel shell and some help around with it to the other side of the station and I'll show you what a Yankee can do!"

"My friend, she will kick your shoulder-blade down into your lungs without the steel pedestal mount."

"Never mind, Hans knew how to die. I guess I can stand a little mule-play. Help me carry the thing, old man. It's our only chance."

They unbolted the swivel-pin and carried the gun around to the other side of the station, where it would command the grove of trees along the shore. Hurriedly they buried the piece in a low mound of cement bags and sand, while the noises of the landing of the second boat floated up to their ears.

"Now, get down, Frogs," said Curtiss, slipping in the shrapnel, "we're to be heard, not seen, you know. That lieutenant's going to march his men abreast through that jungle, and when they come out into the open—"

"*Eh bien?* You will be Chanticleer."

"Raise the sun, eh?"

"You will raise the devil, *mon cher,*" corrected LaPlanche cheerfully.

"If we can only hold them till the sun does come up."

"Ah—? You have a plan?"

"Why, don't you know—that's all we're after! We've just got to hold 'em till the sun comes up."

"But, *mon ami*—Pst! Here come the herrings!" The squad from the torpedo-boat burst through the trees and formed in the open. Another sharp command and they started to march across the little field.

"It's like taking money from a blind organ grinder," drawled Curtiss, bracing his shoulder against the firing stock and shutting both eyes.

Boom!

The shrapnel opened out with a sound of many rapiers swishing the air, mingling with the cries of wounded men, the scattering volley of the platoon and the guttural shouts of their lieutenant, who angrily waved the survivors back into the jungle, disappearing immediately himself.

"*Encore!*" jeered LaPlanche, stopping the sputtering fusillade of his own weapon. "Those that do die of your goose-gun, my friend, seldom or never recover. Six down if I reckon right."

"I don't believe they're feeling very well just now," gulped Curtiss, trying to smile; despite his efforts, however, the twitching of the muscles of his mouth increased.

"Hurt?"

"Yes—shoulder—help me to—station—old scout, will you——?" He fell over on his side, almost unconscious with the pain.

LaPlanche felt for the wound, locating a smashed collar bone, and then resignedly rolled a cigarette, paying no attention to the pattering fire from the thicket.

"Dawn's come, and this moonlight's half daylight already," he observed. "If I pick up the American and try to hobble with him to the station, with all those rifles in the bushes"—he shrugged his shoulders—"the defense of Noronha will come to an end *toute de suite*."

"Frogs—drag me—straight back—from this mound—keep down out of sight——"

"Inhuman! Drag you! Man, your shoulder-blade's cracked."

"Do it, I say——!" Again he fell over and buried his face in his arm.

LaPlanche shrugged his shoulders and slowly began to work the grim, silent body towards the station, while the zipping chorus of bullets whistled over their heads. Soon a shout from the thicket and a bullet which clipped Curtiss' head told them they were discovered, and LaPlanche, picking up his man, dashed around the corner of the building and in at the rear door, which he slammed and barred.

"*Mais non!* but soon!" he gasped, as Curtiss staggered into a chair. The desultory fire outside kept on, but Curtiss hardly heard it. His wandering gaze had fixed itself on the metallic collar at the extreme top of the aerial mast, which could just be distinguished through the upper panes of the station windows. He watched the shiny metal fascinated, curious, incredulous of his own eyesight, as the minutes slipped by, for it appeared to glow and shine with a peculiar radiance.

"My friend," declared LePlanche solemnly, returning from an observation at the windows, "this defense is almost *a fin*. They've brought up a cannon from the ship and it's on the edge of the woods now. What are you starting up at?"

"Top of mast. Look! Sun! Never mind gun," gasped Curtiss, "they daren't fire it. Look—top—wireless—mast——"

"Ah! Ah! Sunlight! The Sun!"

"Thought so—that' s all—let 'em come."

"First this though, eh?" questioned LaPlanche, aiming his pistol at the big wireless induction coil.

"No! Let it alone!"

—"*Nom du nom!* Let it alone? What? Don't you want to save your ships?"

"Put up your pistol!"

Crash! The main door was torn from its hinges and driven in upon them by a rain of grape shot, its fall simultaneous with the report of the field piece on the edge of the jungle. There was a sharp shout and the squad of sailors charged across the field, dragging the cannon with them. They whirled it about in front of the door and took position.

"Quick! Wave handkerchief," commanded Curtiss, laying a restraining hand on LaPlanche's pistol, "set me down in doorway."

LaPlanche, wondering, mystified, did as he was bid. They made a ghastly group, framed in the black doorway of the station, Curtiss pallid and helpless in a chair, LaPlanche with his left arm in a loose white sling; both grimy and bloodstained.

"Congratulations, a most desperate defense," saluted the German-Spanish lieutenant, standing beside his cannon with drawn sword. "Where are the rest of your men?"

"Here's all we ever had, except poor Hans," answered LaPlanche for the semi-conscious Curtiss.

"What, two!"

"We did our best. Are those seven all you have left?"

The lieutenant bowed stiffly and motioned to two of his men, who saluted and stepped inside to the sending table.

Presently the crackling signal sparks played at the wireless discharge. LaPlanche began to sob.

"Look, traitor!" he stormed, turning fiercely on Curtiss, "*Voila*—the doom of your ships! Do you know what they have just said? I will tell you: 'War declared. Have captured Noronha station. U. S. S. New Hampshire at Pernambuco, Washington at Bahia. Come quickly. Scorpio. Noronha.' You'll hear the answer soon."

"Let 'em—talk, Froggy—let 'em talk," smiled Curtiss amiably, and again his head fell forward on his arms.

"Ah, bah! You should have destroyed your wireless when you had the chance. Do you know what they are sending now? 'Advise detach Argentina, Para, immediate capture Washington; main fleet attack New Hampshire.' For me, I'd rather be dead than sit here and listen to the answer to that message."

"I—want—to—*laugh*," choked Curtiss, grinning painfully. "There won't be any answer."

"What?" yelled LaPlanche excitedly, while the lieutenant frowned impatiently at the chatter in the hated English tongue.

"No—you and I—know something—about wireless—that this—young lieutenant—don't. They're warning—our ships, Froggy—can't reach their's now—too far off and too late. Sun."

"*Diable!* I see. I'd clean forgot. Wireless carries only a third as far by daylight as at night. And our day range is but two hundred miles! Talk, *mes innocents*," he whispered triumphantly. "Talk! Only the American ships can hear you now! And that's why you held out till sunrise, *mon cher!* Ah, *mon Dieu!*"

THE ICE PATROL SERVICE

The U. S. Coast Guard cutters Seneca and Miami have been detailed to carry on the International Ice Observation and Ice Patrol Service provided for by the International Convention for the Safety of Life at Sea, London, 1913-14.

The object of the Ice Patrol Service is to locate the icebergs and field ice nearest to the trans-Atlantic steamship lane. It will be the duty of patrol vessels to determine the southerly, easterly, and westerly limits of the ice, and to keep in touch with these fields as they move to the southward, in order that radio messages may be sent out daily, giving the whereabouts of the ice, particularly the ice that may be in the immediate vicinity of the regular trans-Atlantic steamer lane.

The Miami on April 16 relieved the Seneca, which had been performing Ice Observation and Ice Patrol Service since February 15, 1915, and during the months of April, May and June, and as much longer as necessary, these two vessels will alternate on patrol, making alternate cruises of about fifteen days in the ice region; the fifteen days to be exclusive of time occupied in going to and from Halifax. The movements of the vessels will be so regulated that on the fifteenth day after reaching the ice region the vessel on patrol will be relieved by the second vessel if possible, at which time the first vessel will proceed to Halifax, replenish her coal supply, and return in time to relieve the other vessel at the end of the latter's fifteen-day cruise.

Having located the ice, the patrol vessel will send daily the following wireless messages in 75th meridian time:

(a) At 6 P. M. (75th meridian time) ice information will be sent broadcast for the benefit of vessels, using 600-meter wave length. This message will be sent three times with an interval of two minutes between each.

(b) At 6.15 P. M. (75th meridian time) the same information will be sent broadcast three times in similar manner, using 300-meter wave length.

(c) At 4 A. M. (75th meridian time) a radiogram will be sent to the Branch Hydrographic Office, New York City, through the nearest land radio stations, defining the ice danger zone, its southern limits, or other definite ice news.

(d) Ice information will be given at any time to any ship with which the patrol vessel can communicate.

Ice information will be given in as plain concise English as practicable, and will state in the following order:

(a) Ice (berg or field).
(b) Date.
(c) Time (75th meridian time).
(d) Latitude.
(e) Longitude.
(f) Other data as may be necessary.

While on this duty, the patrol vessel will endeavor by means of daily radio messages to keep ships at sea advised of the limits of the ice fields.

The Rapid and Simple Calculation of the Inductance of a Cylindrical Single Layered Coil

Especially prepared for amateur experimenters

By William A. Priess, B.Sc., R.E.

A STIFF wire when struck vibrates with a certain constant frequency. The period of its vibration is determined by the elasticity of the wire and the distribution of its mass. If an electrical system is correspondingly disturbed it likewise vibrates with a certain definite frequency. In this case the period is determined by the inductance and the capacity of the circuit. Since radio-telegraphic work is joined to an overwhelming extent with the problems concerning the electrical period of a circuit, it is essential that we find some means of calculating the governing factors.

The frequency of oscillation for an electrical circuit was given by Thomson in 1853 as approximately

$$\frac{1}{2\pi\sqrt{LC}} = n, \ldots\ldots\ldots (1)$$

where n is the frequency per second, L is the inductance of the circuit and C its capacity. Naturally L and C must be measured in the same electrical units. The practical unit for capacity is the farad. The practical unit for inductance is the henry or 10^9 centimeters.

Both quantities may be distributed as in the case of an antenna, or concentrated as in the case of coils and condensers. We shall limit ourselves in this discussion to the latter form in which these constants appear.

The Capacity of a Condenser

The calculation for the capacity of the usual forms of condensers is a simple matter. A condenser generally consists of two plane or cylindrical conducting surfaces separated by a dielectric of constant thickness. The problem requires knowledge of the dielectric constant of the insulator between the plates (this quantity being unity for a gas and greater for other mediums; its value is found in the tables of any electrical handbook) and the area and thickness of the dielectric under strain.

The capacity of a condenser formed by two plates each of area, A, separated a distance, D, by an insulator whose dielectric constant is K, is

$$C = \frac{K A}{36\pi D} 10^{-11} \text{ farads} \ldots\ldots (2)$$

For example: The capacity of a condenser formed by two plates 30 cms. square, and separated by a sheet of flint glass 0.2 cms. thick is found as follows:

K = 10 (from electrical handbook)
A = 900 cms.
D = 0.2 cms.

$$C = \frac{10 \times 900}{36\pi \times 0.2} \times 10^{-11} \text{ farads}$$

$$= \text{antilog. } [\log. 10 + \log. 900 - \log. 36 - \log. \pi - \log. 0.2] \times 10^{-11} \text{ farads.}$$

log. 10 = 1.0000
log. 900 = 2.9542

3.9542 = (a)

$$\begin{aligned} \log.\ 36 &= 1.5563 \\ \log.\ \pi &= 0.4970 \\ \log.\ 0.2 &= -1.3010 \\ \hline & 1.3543 = (b) \end{aligned}$$

$$\begin{aligned} & 3.9542 \\ & 1.3543 \\ \hline (a - b) &= 2.5999 \end{aligned}$$

antilog. [ ] = 398

$C = 3.98 \times 10^{-9}$ farads = 0.00398 microfarad.

In the case of cylindrical condensers the only added difficulty is the calculation of the area of the active cylindrical surface presented.

The Inductance of a Coil

The most easily constructed and by far the most useful type of inductance in radiotelegraphic work is a cylindrical single layered coil of wire. We shall, therefore, confine our remarks to this form entirely. This calculation is somewhat more complicated than that of the capacity of a condenser and formulæ expressing its value usually contain a long series of diminishing terms of the increasing powers of the geometrical dimensions of the coil. For example: Webster gives for the inductance of a cylindrical coil of length *b*, radius *a*, containing *n* total turns, the following expression:

$$L = 4\pi^2 \frac{a^2 n^2}{b} \left\{ 1 - \frac{8a}{3\pi b} + \frac{a^2}{2b^2} - \frac{a^4}{4b^4} + \frac{5a^6}{16b^6} - \frac{35a^8}{64b^8} + \frac{147a^{10}}{128b^{10}} - \dots \right\}$$

$\times 10^{-9}$ henries .... (3)

Obviously this is a most tedious calculation. Nagaoka simplified this equation by calling the quantity under the parenthesis a certain constant K, which he evaluates with regard to the parameter $\frac{\text{diameter}}{\text{length}} = \frac{2a}{b}$:

The equation then reads:

$$L = 4\pi^2 \frac{a^2 n^2}{b} K_1 \times 10^{-9} \text{ henries *} \dots (4)$$

* Since there are 10^9 cms. of inductance in a henry

The tables of K. — $\frac{2a}{b}$ may be found in B. of S., Vol. 8, No. 1, pp. 224-225. We have plotted K for all coils lying between a coil of infinite length and a coil whose diameter is 9½ times its length. The curves therefore cover practically all the combinations of length and radius used in practice. The value of K is seen to lie between unity for the slimmest of coils and 0.21 for the broadest of coils under consideration.

To calculate the inductance of a coil

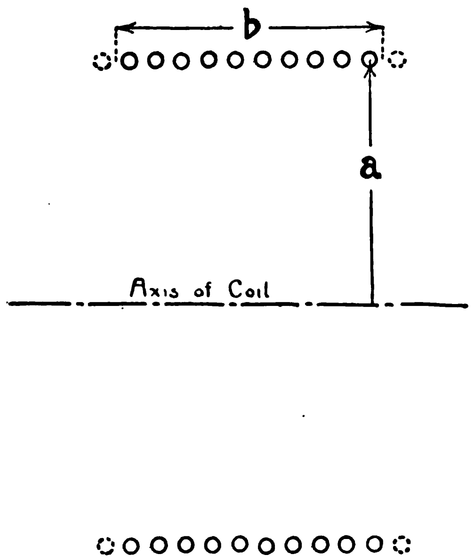


FIG. I

of length b, radius a, containing n total turns of wire, we pick the value of the

$$L = 4\pi^2 \frac{a^2 n^2}{b} K. \text{ cms. of inductance.}$$

abscissa, K, corresponding to the ordinate $\frac{2a}{b}$ from the curves and substitute it in equation (4).

In radio design we encounter two types of inductance coils. First the coils used in the oscillatory circuits of the transmitter, which are constructed of heavy wire to carry efficiently the large currents employed. The turns on this type of coil are widely separated to pre-

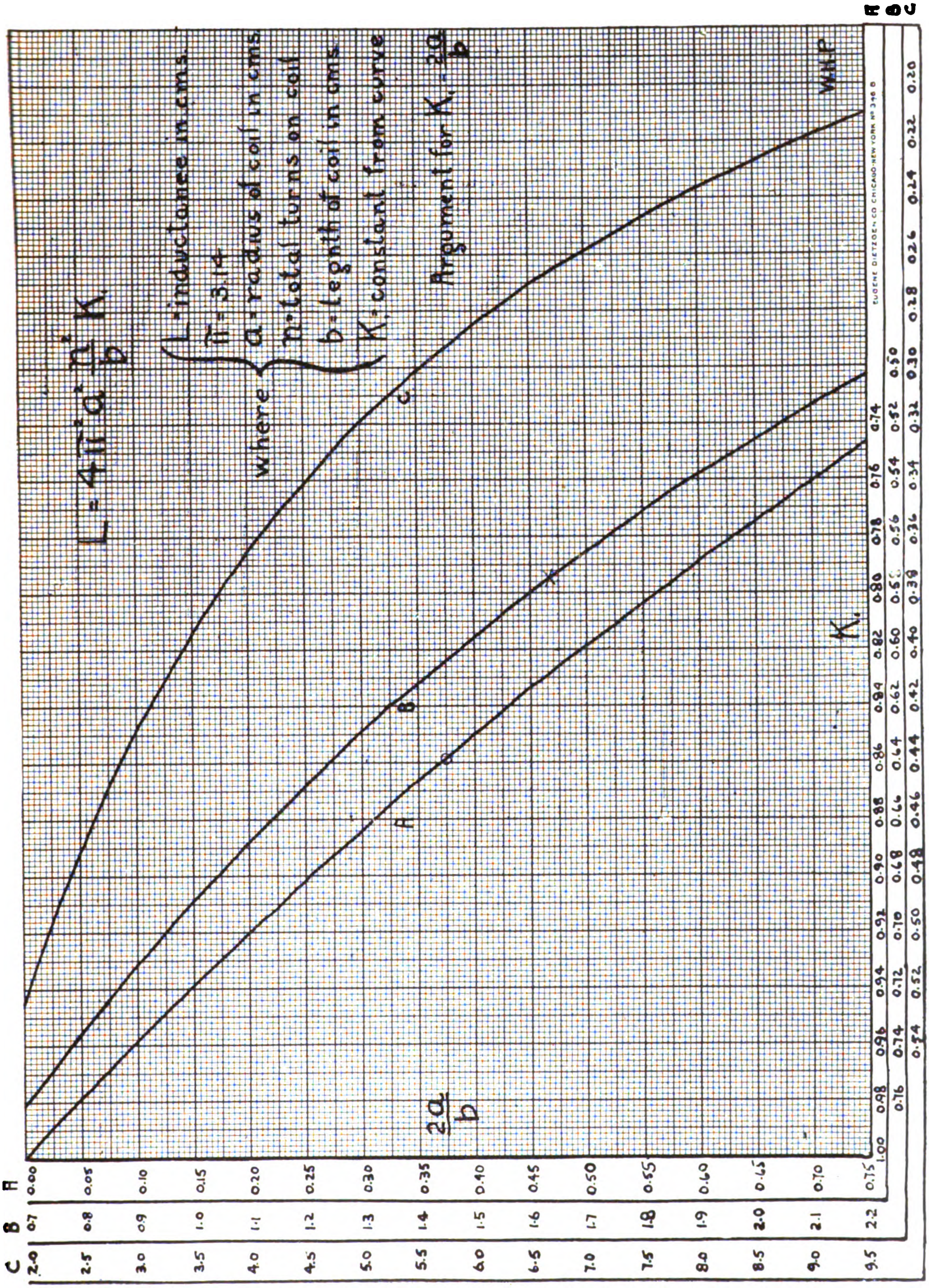

L = 4π²a² n²/b K
where
L = inductance in cms.
π = 3.14
a = radius of coil in cms.
n = total turns on coil
b = length of coil in cms.
K = constant from curve
Argument for K = 2a/b
W.H.P.
K.
2a/b
A
B
C
EUGENE DIETZGEN CO. CHICAGO-NEW YORK No. 346 B

Fig. 3

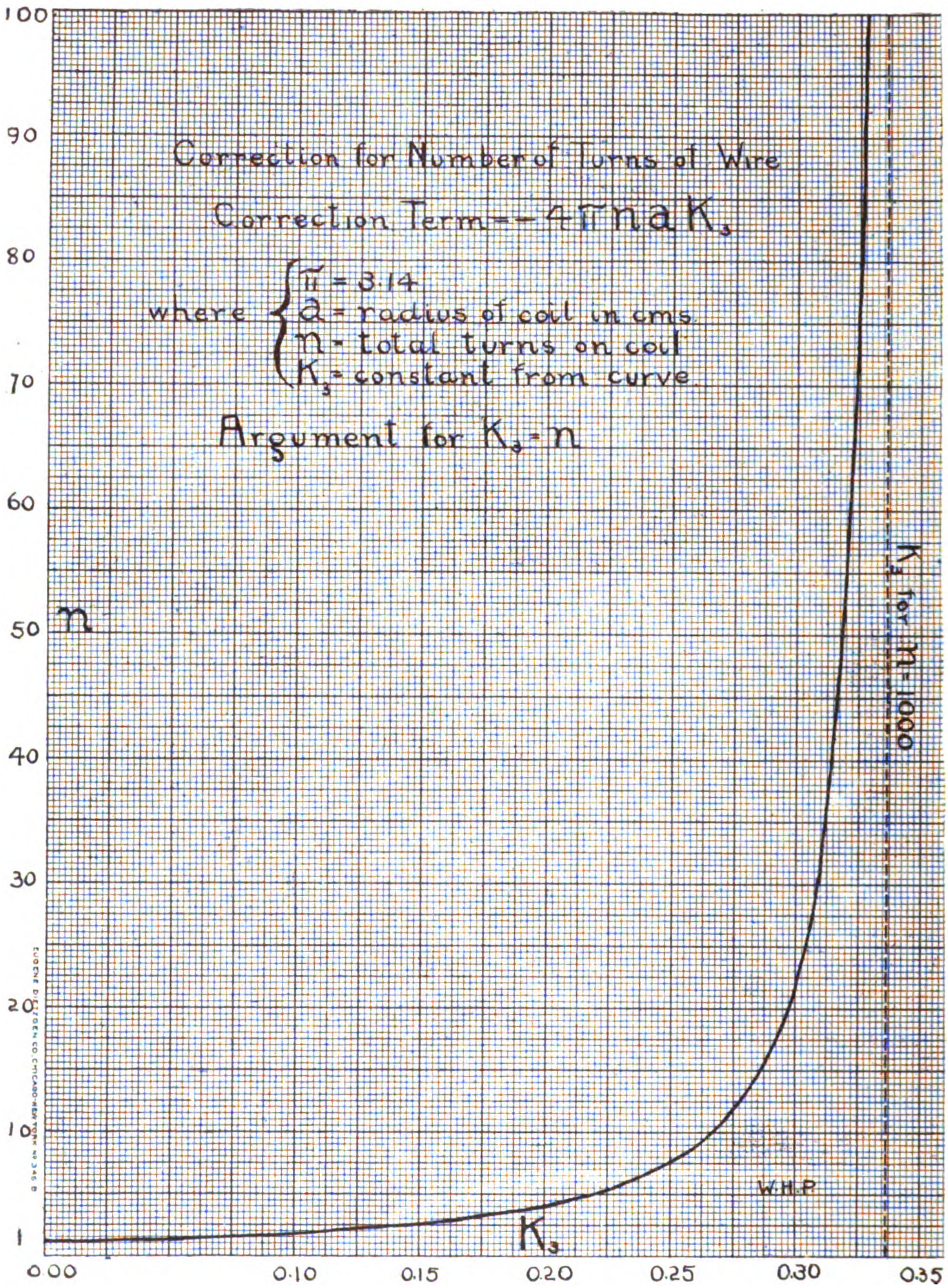


Fig. 3

vent sparking between them, due to the high voltages generated by the rapid oscillation of the enormous instantaneous current flowing. Therefore in order to obtain the proper value of inductance for resonance, these coils must necessarily be of a bulky design. Second, the form of coil used in the receiver. Here we deal with minute currents and voltages and can therefore use light compact coils to obtain the required inductance for resonance. We shall calculate the inductance of a coil of each type.

Example I

Calculate the inductance of a cylindrical coil having a mean diameter of 18 inches and wound with 10 turns of wire spaced an inch apart.

Referring to Fig. 1, we see that the length, *b*, is the overall length of the winding, including the insulation, which *a* is the mean radius.

$n = 10$

$b = 11$ inches $= 27.9$ cms.

$a = 9$ inches $= 22.9$ cms.

$$\frac{2a}{b} = \frac{18}{11} = 1.635$$

The ordinate corresponding to 1.635 on the Nagaoka $\frac{2a}{b}$ K. curve is found in the second or B column. This ordinate intersects the B curve at the cross corresponding to the value K. = 0.575 on the B abscissa. Therefore, substituting these values in equation (4):

$K. = 0.575$

$$L = 4\,\pi^2 \times \frac{(22.9)^2 \times (10)^2}{27.9} \times 0.575$$

$\times 10^{-9}$ henries = antilog. (log. 4 + 2 log. π + 2 log. 22.9 + 2 log. 10 + log. 0.575 — log. 27.9) cms.

log. 4	=	0.60206
2 log. π	=	0.99414
2 log. 22.9	=	2.71978
2 log. 10	=	2.00000
log. 0.575	=	$\bar{1}.75967$
		6.07565 = (e)
log. 27.9	=	1.44560 = (f)
		6.07565
		1.44560
(e — f)	=	4.63005

antilog. 4.63005 $= 4.27 \times 10^4$

$L = 4.27 \times 10^4$ cms. $= 4.27 \times 10^{-5}$ henries.

Example II

Calculate the inductance of a cylindrical coil 3 inches in diameter and 8 inches long, wound closely with No. 26 double silk covered wire.

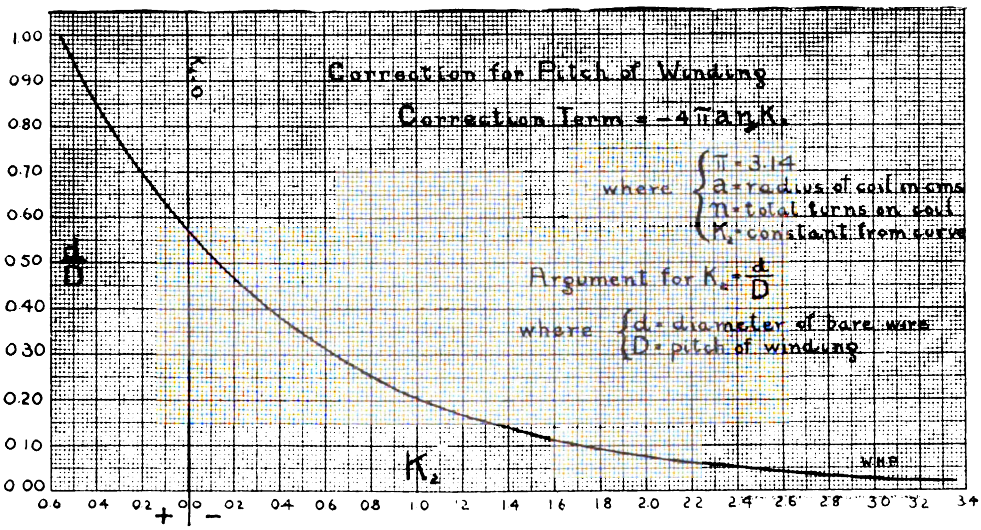


Fig. 4

The diameter of a No. 26 double silk covered wire as found in an electrical handbook is 20.14 mils.

$$n = \frac{8}{0.02014} = 397 \text{ turns}$$

$b = 8$ inches $= 20.3$ cms.

$a = 1.5$ inches $= 3.81$ cms.

$$\frac{2a}{b} = \frac{3}{8} = 0.375$$

The ordinate corresponding to 0.375 on the Nagaoka $\frac{2a}{b}$ K. curves is found in the first or A column. This ordinate intersects the A curve at dot circle corresponding to the value $K_1 = 0.859$ on the A abscissa. Therefore:

$K. = 0.859$

Substituting these values in equation (4)

$$L = 4\pi^2 \times \frac{(3.81)^2 \times (397)^2}{20.3} \times 0.859$$

$\times 10^{-9}$ henries = antilog. (log. 4 + 2 log. π + 2 log. 3.81 + 2 log. 397 + log. 0.859 — log. 20.3) cms.

log.	4	=	0.60206
2 log.	π	=	0.99414
2 log.	3.81	=	1.16184
2 log.	397	=	5.19748
log.	0.859	=	— 1.93399
			7.88951 = (c)
log.	20.3	=	1.30750 = (d)
			7.88951
			1.30750
(c — d)		=	6.58201

antilog. 6.58201 = 3.82×10^6

$L = 3.82 \times 10^6$ cms. $= 3.82 \times 10^{-3}$ henries.

In certain cases we wish to wind a coil of a predetermined value of inductance. For example, we have a bobbbin of length b and diameter 2a, and wish to wind it so that it will have an inductance of value L. The only factor we do not know is the total number of turns that the winding should contain. This can be determined as follows:

$$\text{Since } L = 4\pi^2 \frac{a^2 n^2}{b} K.,$$

transposing we have

$$n = \frac{L\,b}{4\pi^2 a^2 K.} \quad . \; . \; . \; . \; . \; . \; (5)$$

Since there are *n* turns in the length *b*, the turns must be wound with a pitch of $\frac{b}{n}$.

Corrections to be Applied When the Coil is Wound With Circular Sectioned Wire

The foregoing applies with extreme accuracy only to the theoretically perfect case of a current sheet. That is to say, a coil wound with infinitely thin tape, the turns of which touch but are assumed not to be in electrical contact. Rosa has considered the practical case of coil wound with circular sectioned non-magnetic wire and has given an expression by means of which the current sheet formula may be applied. If we call the current sheet inductance L_s, and the true inductance L, then

$L = L_s - L_c$. . . . . (6)

where L_c is the correction term. This term he finds equal to

$4\pi a n (K_2 + K_3) = L_c$ . . . . . . (7)

where K_2 and K_3 are constants of the coil expressed by him in the B. of S., Vol. 8, No. 1, pages 197-199.

We have plotted K_2 and K_3. K_2 is a correction factor plotted to the parameter $\frac{d}{D}$, or the ratio of the diameter of the bare wire to its pitch. K_3 is a correction factor plotted against the total number of turns *n* as an argument. Examining the $\frac{d}{D}$ — K_2 curve we see that K_2 may be positive zero, or negative. On the left of the K_2 — o line, K_2 is positive, on the right of this line K_2 is negative. The other constant, K_3, is equal to zero for one turn and increases rapidly to a limiting value of $K_3 = 0.3365$ for 1,000 turns.

We shall calculate this correction, L_c, for the two previous cases in which we estimated the current sheet inductance. (Example I.)

Assume the wire to have a diameter of a quarter of an inch. Then

$$\frac{d}{D} = \frac{0.250}{1.000} = 0.250.$$

From the $\frac{d}{D}$ —— K_2 curve we find $K_2 = -0.80$.

Since

$$n = 10,$$

from the n —— K_3 curve we find $K_3 = 0.266$.

From equation (6)

$$\begin{aligned} L &= L_s - L_c \\ &= L_s - 4\pi a n (K_2 + K_3) \\ &= 4.27 \times 10^4 - 4\pi a n (-0.80 + 0.266) \\ &= 4.27 \times 10^4 \times 4\pi (22.9)(10)(0.534) \text{ cms.} \end{aligned}$$

$L_c = -$ antilog. (log. 4 + log. π + log. 22.9 + log. 10 + log. 0.534) cms.

$$\begin{aligned} \log.\ 4 &= 0.60206 \\ \log.\ \pi &= 0.49707 \\ \log.\ 22.9 &= 1.35984 \\ \log.\ 10 &= 1.00000 \\ \log.\ 0.534 &= 1.72752 \\ \hline &\quad 3.18651 \end{aligned}$$

antilog. 3.18651 = 1540

$$L_c = -0.154 \times 10^4 \text{ cms.}$$

$$L = 4.27 \times 10^4 + 0.154 \times 10^4 \text{ cms.} = 4.42 \times 10^4 \text{ cms.}$$

$$\frac{L_c}{L} = \frac{0.154}{4.42} = 3.5\%$$

(Example II.)

The diameter of a bare No. 26 wire is 17.90 mils. Therefore

$$\frac{d}{D} = \frac{17.90}{20.14} = 0.889$$

From the $\frac{d}{D}$ — K_2 curve we find $K_2 = +0.441$.

Since $n = 397$, K_3 = approximately 0.335.

From equation (6) and (7)

$$L = L_s - L_c = 3.82 \times 10^6 - 4\pi (3.81)(397)(0.441\ 0.335) \text{ cms.}$$

L_c = antilog. (log. 4 + log. π + log. 3.81 + log. 397 + log. 0.776) cms.

$$\begin{aligned} \log.\ 4 &= 0.60206 \\ \log.\ \pi &= 0.49707 \\ \log.\ 3.81 &= 0.58092 \\ \log.\ 397 &= 2.59879 \\ \log.\ 0.776 &= 1.89042 \\ \hline &\quad 4.16926 \end{aligned}$$

antilog. 4.16926 = 14,800

$$L_c = 0.0148 \times 10^6 \text{ cms.}$$

$$L = 3.82 \times 10^6 - 0.0148 \times 10^6 \text{ cms.} = 381 \times 10^6 \text{ cms.}$$

$$\frac{L_c}{L} = \frac{0.0148}{3.81} = 0.39\%.$$

The percentage error if this correction is neglected is seen to be rather large for some coils and negligible for others.

Further correction may be made to compensate for the high frequency phenomenon of an altered current distribution in the cross section of the conductor, and consequently an altered inductance. This phenomenon always results in a decrease of inductance over the normal current distribution figure. For an infinite frequency the field within the conductor is neglected. The change of inductance due to frequency is prominent in coils built of wire of large cross section, and negligible in coils wound with very fine wire. However, there is no noticeable change of inductance with frequency for coils wound with "litzendraht," or stranded cable built of separately insulated fine wires, even though the cross section of the cable be very large.

TODD PACIFIC COAST RADIO SUPERINTENDENT

Lieutenant Commander E. H. Todd has been appointed Pacific Coast superintendent of radio service, with headquarters at the naval training station on Yerba Buena Island, according to advices received in San Francisco from the navy department headquarters in Washington.

Todd has been in the navy since 1906, enlisting from Illinois. For two years he has commanded the torpedo flotilla of the Pacific fleet. While official headquarters will be on Yerba Buena Island, he will also have offices in the new custom house in San Francisco.

NEW ORLEANS STATION NEARING COMPLETION

The work of enlarging the naval wireless station at New Orleans and installing more powerful instruments is nearing completion, and the Navy Department has been informed that the plant soon will be ready for operation, according to a dispatch from Washington.

As rebuilt the New Orleans station will be the second largest of those owned by the government. It will have a power of 30 kilowatts against the five of the original plant, and will be used principally as a relay for messages between the Atlantic and Pacific Coast stations.

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John R. Irwin......*Supt. Northern District*
George J. Jessop....*Supt. Southern District*

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Operating Department, 25 Elm St., New York.

Ernest T. Edwards..........*Superintendent*
G. W. Nicholls......*District Superintendent*

Southern Division

American Building, Baltimore, Md.

T. M. Stevens..............*Superintendent*

Gulf Division

919 Decatur St., New Orleans, La.

E. C. Newton...............*Superintendent*

Great Lakes Division

Schofield Bldg., Cleveland, Ohio

F. H. Mason................*Superintendent*

Fourteen Years in Wireless

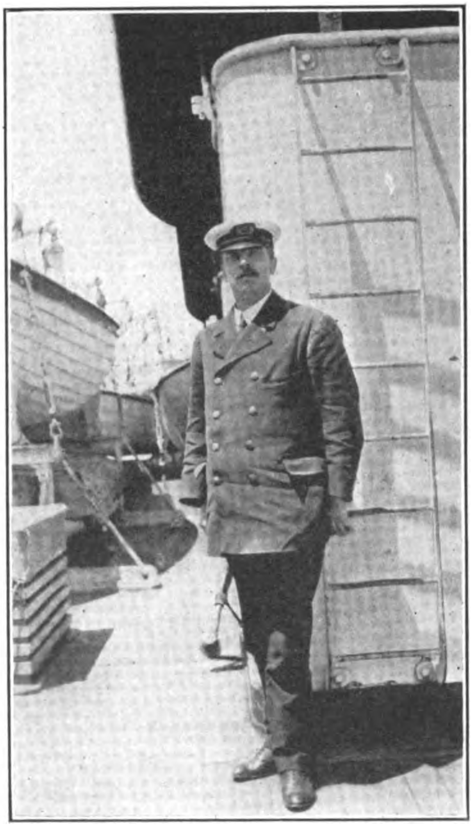
As Related by William J. Brooker, a Veteran of the Marconi Service

William J. Brooker, one of the oldest operators in the American Marconi Company in point of service, resigned recently at the age of forty-five. He has written the following story of his experiences, which range from the early days of wireless to the present—a period of fourteen years.

MANY changes have taken place in wireless telegraphy since I entered the service of the Marconi International Marine Communication Company, Limited, in Great Britain, on March 8, 1901. Those were the days of what is now known as the "coherer age." The magnetic detector afterwards replaced the clumsy coherer receiver, and the modern equipment is still further improved.

Ten days after I had entered the Marconi service I reported for duty at the Chelmsford works, where I received a course of instruction preparatory to being sent to Caister-on-Sea to assist in building a station. I remained at the station until the following October, when I was detailed as operator on the steamship Lake Champlain, which was bound for Canada. Then I was transferred to the Campania, which was about to leave Great Britain for America. My instructions were to exchange posts with the more experienced operator on the Umbria when she called at Queenstown and return to Liverpool to rejoin the Lake Champlain. The weather interfered with this plan, however, the wind kicking up such a sea that the Umbria was unable to stop at Queenstown with safety. Thus fortune gave me an opportunity to voyage as wireless man on a first-class trans-Atlantic liner.

The wireless equipment consisted of a ten-inch coil, two receivers, a Morse printer and a call bell, the latter occasionally disturbing the operator's dreams. There was not great prospect of active



William J. Brooker, photographed in uniform on board ship

communication, for there were only three other steamships on the North Atlantic that we were likely to wireless—the Lucania, Umbria and Etruria. On the European side the land stations were Holyhead, Rosslare and Crookhaven

The station on the American side was the Nantucket Lightship.

I picked up Crookhaven without trouble and worked with that station while we traversed about fifty miles. Then came an exchange of marconigrams with the Lucania. When I picked up the Nantucket Lightship I was called upon to transmit a number of messages, all of which were satisfactorily handled. So when we reached New York I was not dissatisfied with my record as an operator.

My next voyage was even more successful from the viewpoint of the wireless man than the first and as a result I received an increase in salary. After a while I was transferred to other ships, among them being the Lucania and Inomia.

Entering the service of the American Marconi Company in August, 1912, I was assigned to the steamship New York. One of the most vivid recollections I have of my wireless experience is connected with the wreck of this vessel. The New York was steaming across the Channel toward Southampton in a dense fog, when she came in collision with the British transport Assay. We were damaged considerably, the ship arriving at Southampton with a large hole in her bottom and a quantity of water aboard.

I was then transferred to the St. Louis, on which I completed six voyages. One day, however, her cylinders burst and she was forced to lay up for five months. After the repairs had been made I rejoined the vessel, acting as operator aboard her for more than five years. Another transfer found me aboard the Philadelphia, but in January, 1911, I again joined the New York, on which I made two cruises, one to the West Indies and the other to Central and South America.

My detail on the New York was marked by two occurrences which well illustrate the perils of the sea. During a storm in November, 1913, a heavy sea caused the vessel to keel over beyond the safety limit, displacing the motor generator in the wireless room and smashing the tank of condensers. The gale accomplished general destruction in various parts of the ship and few of us were without anxiety while it blew.

The New York met with a second mishap while she was crawling through a thick fog early in the morning of June 13, 1914. We were about 800 miles from Nantucket when we heard the whistle of a steamship. Our vessel was instantly stopped and the engines were reversed to full speed astern, but the ominous whistling become more distinct. Then the approaching vessel was seen through the mist, headed directly for us. She struck us about fifty feet from the bow, making a large wound, although the damage did not extend below the water line. The weather was so thick at the time that even the name of the vessel with which we came into collision could not be seen. It was ascertained by wireless, however, after the two ships had separated.

This brings to a close my brief review of the time I spent in the Marconi service. The foregoing contains only a few of the incidents which went to make up my life during the time I spent as a wireless man on ship and shore. I have not mentioned the many happenings of an unimportant but pleasant nature which help to cheer the dull hours an operator sometimes finds himself facing, nor the agreeable people with whom I came in contact. They all go to make up pleasant recollections of an eventful and not unprofitable fourteen years.

Hudson Strait Station Planned

During a debate on navigation in Hudson Bay, held recently in the Canadian House of Commons J. D. Hazen, minister of marine, announced that the first wireless station would be placed on Hudson Strait. This station will be able to work with the stations at Port Nelson and Le Bas. Mr. Hazen said in answer to a question, that more than one station would be necessary on the Strait in order that ice conditions might be known. Twelve beacons have already been erected in the Strait.

Russia has decided to build a wireless station at Nicolaieff in the Odessa district in order to receive time signals from the Eiffel Tower.

Marconi Men

The Gossip of the Divisions

Eastern Division

P. G. Eberle has succeeded Earl Thornton on the Crofton Hall.

W. E. Bisgrove has been assigned to the E. L. Doheny, relieving G. H. Thomas, formerly of the English Marconi Company's service, who has been detailed as senior on the Korona.

R. E. Pettit has been assigned to the Charlton Hall, a one-man ship.

W. S. Scott has been reassigned to the St. Paul.

J. P. Callan is now junior on the Antilles.

L. J. Michael and C. S. Gould have been assigned to the Coamo as senior and junior, respectively, relieving J. R. Churchill and A. E. Ericson, who are on sick leave.

I. Ellingham, third trick operator at Sea Gate, has resigned from the service. His place has been filled by J. L. Lynch, formerly of the trans-Atlantic staff.

V. H. Rand has been transferred to the Honolulan of the Pacific Coast Division.

R. D. Magann is now junior on the Momus. C. C. Langevin has been detailed to succeed him on the Lampasas.

W. H. Boyle has been detailed to the steam yacht Wakiva, which recently went into commission.

J. R. Churchill and S. R. Kay have been assigned to the Zulia as first and second, respectively.

H. McDonald is now in the New Orleans Division. He has been assigned to the C. A. Canfield.

J. R. Joiner has been transferred to the Alabama. J. S. Farquharson, a new man, has been assigned to take his place as junior on the Florizel.

A. I. Yuter is on the Pleiades.

Sam Schneider is now on the Havana as senior.

F. Lumea has been promoted and is now senior on the Northland.

F. W. Rosenquit is attached to the Comet.

E. H. Bootes has been detailed to the Philadelphia of the Red D Line replacing P. W. Harrison, who has been transferred to the Concho.

J. Maresca is now junior on the Arapahoe.

C. Sandbach and L. C. Callan have replaced G. P. Hamilton and H. M. Ash on the Guiana. Hamilton and Ash are now on the Monterey as senior and junior. Callan is a Baltimore man.

W. H. Wood is now attached to the Florizel as senior. T. A. Tierney, formerly first on that vessel, is now on the Comal.

P. J. Barkley has succeeded H. Williams on the Stephano. Williams is no longer in the service.

J. M. Bassett is now on the North Star as senior. A. E. Voightlander has resigned.

J. W. Swanson has resigned. L. C. Driver has been assigned to succeed him as senior on the Saratoga.

R. A. Merry is now senior on the Apache.

C. Preiss of the Jefferson accidentally shot himself in the hand while celebrating on the Fourth of July. He was relieved on the Jefferson by F. Mayer. The wound, however, proved to be of small consequence and Preiss has returned to duty. He is now serving as junior on the Lampasas.

A. Schweider has succeeded H. Orben as junior on the Kroonland.

C. A. Werker is now senior on the Maracaibo. A. E. Hapeman, formerly attached to the Maracaibo, has been assigned to the Ponce of the Gulf Division.

A. J. Costigan has been assigned to the steam yacht Sultana, which has been newly equipped.

J. Rodenbach has taken the place of Joseph Wright on the Larimer.

N. J. Kearney of the Havana has been appointed senior on the American liner New York to succeed William J. Brookes, who has resigned.

D. Cawman and H. A. Pendleton have been assigned as first and second, respectively, to the El Dia.

W. Miller is now on the El Sud.

H. Hodder is now junior on the Madison.

P. Grasser is now on the Llama. W. Tylar has been transferred to the Devonian, an English Marconi Company vessel, for temporary duty.

C. S. Gould is now on the Gulfoil.

G. F. Hawkins has been detailed to the Santa Rosalia. He succeeded J. A. Jackson, who has been transferred to the City of Hankow.

J. Lohman is now attached to the Santa Cruz.

W. Blackstone is at present attached to the El Norte.

H. E. Orben and J. Feingersh have been assigned as first and second, respectively, to the El Rio.

Alfred De Silva is now second on the Coamo.

H. E. Cohen, late of the C. S. Relay, is now attached to the North Star.

H. Sanders has been assigned as assistant to the Guantanamo. William Dillon is senior.

Friends of Don Surrency will regret to learn that he has met with an accident and is a patient in a hspital at Savannah. Surrency was senior on the City of St. Louis.

Great Lakes Division

Marconi Inspector L. C. Dent, accompanied by United States Government Inspector J. F. Dillon, recently completed a trip of inspection to the various stations on Lake Michigan.

E. I. Deighan has been assigned to the Ashtabula station, relieving H. C. Rodd, who takes the S. S. Octorara as senior. J. H. Coolidge has been assigned to the Octorara as junior.

The S. S. Eastern States has been transferred from the Detroit and Buffalo to the Detroit and Cleveland Division of the D. & C. Navigation Co. G. S. Mackwiz, who was senior on the Eastern States, was transferred to the City of Detroit III. F. Marshall, who was junior on the Eastern States, has resigned from the service. William Read has been assigned to go on the City of Detroit III.

D. A. Nichols is with us again, having been assigned to the second trick at the Mackinac Island station.

V. Burgbacher, on the s. s. City of Cleveland III, has resigned from the service. William Brede takes his place.

C. Bendtsen is now on the Harvester, a one-man ship.

The Lakeland was recently placed on the passenger schedule, running from Port Huron, Mich., to Duluth, Minn. F. Stehmeyer and C. G. Fuss were assigned to her as senior and junior, respectively.

F. C. Goulding, who recently returned from the Gulf Division, has been placed in charge of the Juniata.

C. K. Little is now first on the North American.

R. Wright recently returned from the Eastern Division, who has been doing temporary relief work on ships and at stations in the Cleveland District, has been detailed to the s. s. State of Ohio.

B. B. Minium has been assigned to the South American as senior.

R. Sidnell and Grostick have been assigned to the Seeandbee as senior and junior, respectively.

G. Aldridge is now first on the Northland, vice E. H. Striegel, who resigned from the service. E. Leonard has been assigned to the Northland as junior.

Grand Marais station was closed July 1st. Manager Hagen, of the Cleveland station, was assigned to the s. s. Lakeland as senior, vice F. Stehmeyer, who is leaving the service.

E. M. Tellefson is now on the large passenger carrying whaleback Christopher Columbus.

S. K. Culbertson is once more in the fold, having recently joined the S. S. Missouri as senior.

The following transfers and assignments have been made recently in the Lake Michigan District:

W. C. Cram to the Georgia; D. P. Derry to the Arizona; H. Shotwell to the Puritan, vice S. R. Henry, who went to the Illinois; C. P. Eich to the Virginia, vice H. M. Junker, detailed to the Manitou; J. F. Weiss to the City of Grand Rapids; F. Weide to the Holland; G. Keefe to the S. Y. Lydonia; C. M. Dibbell to the Eastland; N. R. Hitchcock to the City of South Haven and M. F. Kliepera to the Minnesota.

H. P. Roberts is doing split trip work on the excursion boats running out of Cleveland.

Pacific Coast Division

E. L. Fairley has joined the Atlas.

C. H. Canfield recently joined Barge 91.

L. S. Grabow, in charge of the Bear for the last sixteen months, was on vacation from June 18th to July 3rd.

D. R. Clemons has been detailed on the Colusa as operator in charge.

H. Grundell, acting as relief operator for the East San Pedro District, has been permanently assigned to the Cabrillo for the summer season.

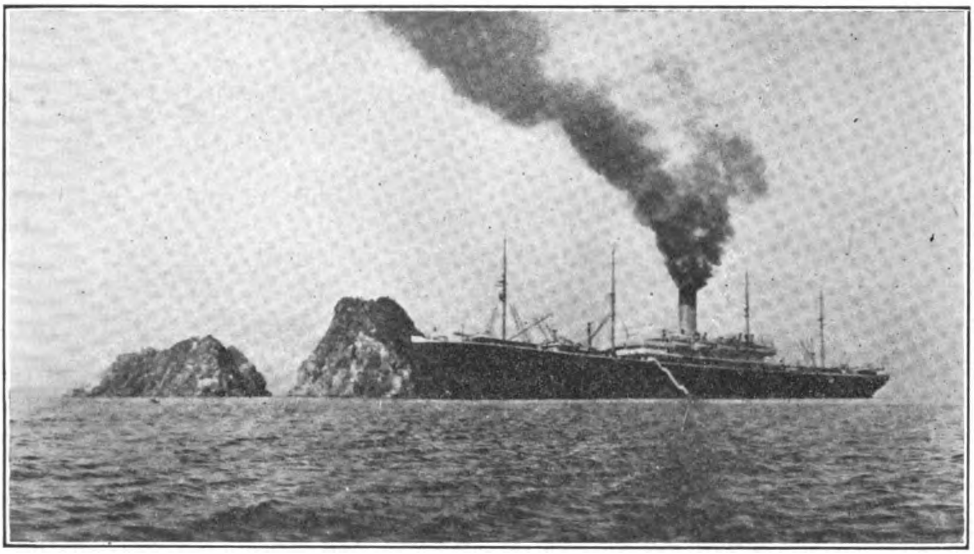
Puebla, left on a vacation trip June 24th.

R. Savage joined the Enterprise as assistant on July 3rd.

J. E. Echlin, formerly of the Construction Department, is now in charge of the Grace Dollar.

H. G. Austin and F. W. Brown are aboard the Governor as first and assistant, respectively.

P. S. Finnell and C. T. Nichols are serving on the Great Northern as first and assistant, respectively.



The steamship Minnesota on a reef at the entrance to the Inland Sea of Japan. Charles F. Trevatt, operator in charge, forwarded an interesting account of his experiences in getting a response to his S O S. This was published in the July issue. Eight divers blasted the reef for nineteen days before the boat was freed

P. Flaig has been assigned as assistant on the Columbia.

S. Rudonett has joined the Celilo as first operator.

W. R. Lindsay has rejoined the Colon.

H. C. Hax has been temporarily assigned as operator in charge of the City of Topeka, with F. L. Comins as assistant.

B. R. Jones and E. V. Baldwin have been assigned to the City of Para as first and assistant, respectively.

A. F. Lange and A. E. Evans are acting as first and assistant of the City of Puebla.

R. F. Harvey, second on the City of

V. H. Rand recently relieved W. S. Scott as assistant operator on the Honolulan at New York.

P. E. White has been assigned as assistant on the F. A. Kilburn.

J. E. Johnson has been assigned to the Mongolia as assistant.

A. Konigstein and F. A. Lafftery have been detailed on Matsonia as first and assistant, respectively.

E. J. DesRosier was recently detailed as assistant on the Manoa.

L. E. Grogan was recently granted a short furlough.

T. Lambert recently joined the F. A. Moffett.

A. Seidl recently joined the Nann

Smith as asistant.

A. Pattison is now in charge of the Norwood.

F. W. Harper has been temporarily assigned in charge of the Northern Pacific.

J. F. McQuaid has joined the Oregon for service in Mexican waters.

N. McGovern is now in charge of the Governor.

J. H. Southard is acting first of the Queen.

S. A. Hodges has been assigned as assistant on the Roanoke.

E. T. Jorgensen recently joined the Hillcrest station staff.

H. Hatton, formerly in charge of the Governor, has been transferred to the Siberia as assistant.

R. W. Baer is now acting assistant on the San Jose.

O. C. Belding has joined the Speedwell as assistant.

J. C. Mitchell has been assigned as operator in charge of the San Ramon.

C. E. Goodwin recently relieved D. W. Kennedy as assistant on the Santa Clara. Kennedy is leaving for a short vacation.

George Jensen recently relieved operator J. M. Foy on the Henry T. Scott.

O. Treadway has relieved J. H. Gaud as operator in charge of the William Chatham.

S. Cissenfeld recently joined the Wilhelmina as assistant operator.

J. W. Morrow has rejoined the Wapama as operator in charge.

L. Fassett has been detailed in charge of the Yosemite.

Seattle Staff Changes

M. A. Obradovic was recently transferred from the Pavlof to the City of Seattle and later assigned as second operator of the Senator.

A. C. Burntswiller of the Senator is now first on the City of Seattle.

A. P. Neilson, second on the City of Seattle, is now in charge of the Alliance.

R. F. Harvey, first on the City of Seattle, was recently transferred as second on the City of Puebla. He proceeded to San Francisco, where he will spend a short vacation.

C. E. Capwell, a new man, is second on the City of Seattle.

J. M. Chapel, second operator on the Humboldt, has been promoted to first operator on the Admiral Evans.

A. Lang of the Admiral Evans is now first on the City of Puebla.

G. B. Ferguson of the tanker Mills is second on the Umatilla, where he is filling in temporarily pending an opportunity to return East.

F. M. Ryan has re-entered the service and is now first on the Umatilla.

E. Lee has been appointed to the tanker Mills.

B. C. Springer, second on the Spokane, who has been ashore on sick leave, is now on the Humboldt.

A. E. Wolfe recently spent a vacation on a ranch which he has acquired. W. B. Wilson, late of Friday Harbor, relieved Wolfe during the latter's absence.

MARCONI PANEL SET TEST

The United States Department of Commerce recently arranged for a test of the latest Marconi ½ k. w. panel set, together with a set of 100 Edison batteries of 80-ampere hour capacity on the Steamship Howard of the Merchants & Miners Transportation Company. Previous tests indicated that the 40-ampere hour battery was not of sufficient capacity to meet the requirements of the radio act. The battery and wireless outfit were installed on the Howard at Baltimore on July 5th. The following persons planned to witness the test: Frederick A. Kolster and R. Y. Cadmus, representing the Depart of Commerce; Mr. Smith of the Edison Battery Company; T. M. Stevens of the Marconi Company, and Charles J. Pannill, representing the Merchants & Miners Line and the Naval Radio service.

A dispatch from Gloucester, Mass., says that John Hays Hammond, Jr., who for several years has been conducting experiments in wireless telegraphy is to set up a manufacturing plant and experimental station on Fisher's Island, Long Island Sound.

ANOTHER SIDE OF AN OLD STORY

A new version of the circumstances under which Stephen S. Sczpanck, wireless operator on Car Ferry No. 18, lost his life on Lake Michigan, September 9, 1910, has been given by one of this magazine's readers. Inspired by the account of the mishap published in the June issue, and what were considered some discrepancies contained therein, the letter introduces the subject thus:

"The writer at the time of this disaster, was employed as an operator in one of the Great Lakes stations, and although I was not on duty at the time of the sinking, I received first hand information within a short time thereafter from the operators who were responsible for all that was done in the matter of rescue.

"To begin with the Marquette Car ferries do not carry loaded passenger trains. They are equipped with four tracks running through the ship, with a capacity of thirty-two cars, eight on each track. The only cars carried normally, are cars of freight between the Pere Marquette terminal at Ludington and the Chicago and Northwestern, or Chicago, Milwaukee and St. Paul railroads at Manitowoc and Milwaukee. The shipping of cars, loaded across the lake, on steamers at this point, saves the time and expense of the long haul around Lake Michigan. There are several other car ferry systems similar to the Pere Marquette system, but in no case except at Mackinaw and the Detroit River are passenger cars loaded aboard the ferries. Like the Pere Marquette ferries, most of the other ships of this class which make cross-lake runs are fitted with stateroom accommodations for a comparatively large number of passengers. At the time of the sinking of the 18, only a few passengers were carried.

"In reference to the accident itself, the cause of it has never been definitely determined. The night watch on one of his rounds found two feet of water in the after hold, below the car dock, which was the first evidence that anything out of the ordinary was wrong. After it was found that the vessel was taking water faster than the pumps would remove it, several of the loaded cars were shot out over the stern of the ship. This is generally supposed to have been the immediate cause of the rapid settling of the after end of the ship, as it undoubtedly caused the remaining cars to be torn loose from brakes and caused the final plunge, carrying the ship down within a very few minutes.

"The distress signal was sent out at soon as the operator could be aroused (the operator on these ships is also the purser and his only chance for rest is during the trip across the lake). Night Operator Durffe, at Ludington, I think was the first operator to hear these distress signals. Later other stations picked them up. The only intelligible message that was received was 'Number 18 sinking in mid-lake.' All efforts to get more definite information were without avail. Tugs were immediately dispatched from various points around the lake, but a rescue of the greater portion of the crew and passengers was affected by the steamer Pere Marquette 17, which was bound from Milwaukee to Ludington. It is said that she loomed up through the haze that hung over the lake just in time to see the 18, with her bows high in the air, take the final plunge. So rapid was the sinking that the deck forward was blown out, due to the compression of the air under it.

"A strange part of this disaster, if the rumor be true, is that the only piece of wreckage that was found was the Type D tuner which floated ashore on the Wisconsin coast. This was picked up by someone and was displayed in a window in Manitowoc.

"Trusting that this information may be of some interest to your readers, I am

"Yours very truly,

"M. E Packman,

"Dept. of Radio Telegraphy."

It is announced that inland distribution of weather forecasts by wireless is the latest weather bureau experiment. Messages will be transmitted at a speed slow enough to accommodate amateur wireless operators.

Herbert L. Winn, who had served as a wireless operator in the U. S. Navy for a number of years, died recently in Cedar Rapids, Ia. He was twenty-six years old.

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.

Positively no Questions Answered by Mail

Ans.—Secretary of the Talo Club:

The phase displacement of the current and voltage in an alternating current circuit becomes zero when the frequency

$$N = \frac{1}{2 \pi \sqrt{L C}}$$

where L and C are respectively the inductance and capacity of the circuit. Likewise, the energy in the secondary circuit of two coupled circuits is at maximum when the circuits have the same frequency, n, that is to say, when the two circuits are in resonance, or from the previous equation where $L_1, C_1 = L_2, C_2$, where the subscripts 1 and 2 refer respectively to the primary and secondary circuit constants. This should settle your argument relative to phase displacement in an aerial and the actions taking place when wireless telegraph receiving circuits are brought into resonance. You are quite correct in believing that enameled wire for a given size has greater distributed capacity than double covered wire, the effect in such a circuit being that of a small condenser connected in shunt to the coil.

Do not forget to take into consideration that when the condenser capacity in series with the receiving aerial is decreased and the inductance correspondingly increased that the decrement of damping is decreased and the circuit may therefore become more selective.

* * *

A. B. Lorain, Ohio, inquires:

Ques.—(1) What causes an aerial to be directional?

Ans.—(1) The following explanation is adapted from Fleming: If a rectangular closed oscillator has its current at a certain instant flowing in the direction of the arrows, as in Fig. 1, its field will consist of concentric closed lines of magnetic force perpendicular to the paper, towards the reader in the area of the loop and away from the reader in the outside space. Now place an open oscillator, DF, whose length is the same as CE, near to it, and whose current is the same as CE but in the opposite direction. The magnetic fields due to DF consist of concentric rings about DF. This causes a weakening of the external field on the right hand side of the loop and a strengthening of the external field on the left hand side of the loop. Now bring the open oscillator in connection with CE. This is equivalent to Fig 2, since the current in the right hand side of the loop will neutralize. Therefore the effect of an inverted L antenna is to strengthen the field on the side away from the horizontal member and consequently to cause a strengthened signal to be received from that side.

Ques.—(2) Is a slanting aerial as good for sending as for receiving?

Ans.—(2) Yes.

Ques.—(3) Does a rotary spark gap put as much current in the aerial circuit at high speeds as when running at slow speeds?

Ans.—(3) It depends upon the design of the rotary gap and the constants of the set. Speaking generally of amateur apparatus, however, when the rotary disc is operated at high speed the current flowing in the antenna circuit will decrease.

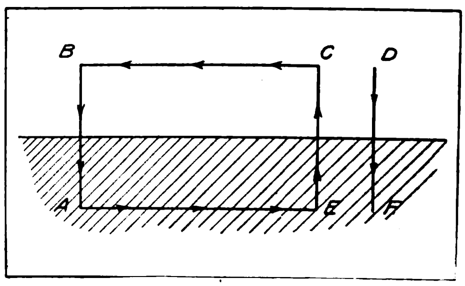


Fig. 1

J. A. R., Milwaukee, Wis.:

Ans.—The new government station at Darien, Isthmus of Panama, is in daily communication with Arlington, Va., and Point Loma, Cal. It is fitted with a 100 k.w. arc set and operates at present on a wave-length of 10,000 meters. The call letters are NBA. The signals from this station are only audible on a "tikker" type of receiver or special vacuum valve detector circuits. The station may be heard working with Arlington between 9 and 9:30 P. M. and at 1 A. M. eastern standard time.

The station at Sayville, L. I., sends nightly on a wave-length of 8,000 meters. Tests are made with Nauen on the undamped oscillation apparatus (Joly system), but the preliminary experiments have not been wholly successful. The new towers at the Sayville station have just been completed.

The Marconi stations at San Francisco, Cal., and Honolulu, Hawaiian Islands, are in daily communication and give highly satisfactory commercial service.

The wave-length of the Marconi station at Glace Bay, Nova Scotia, is 8,000 meters; the spark frequency is about 600 per second.

The New Brunswick station of the Marconi Company is not open and will probably not be in operation until the corresponding stations in England are released from the control of the British Admiralty.

The Marconi high power station in Carnarvon, Wales, is in daily communication with the corresponding high power station in Petrograd, Russia.

* * *

J. B. N., St. Louis, Mo., inquires:

Ques.—(1) I often hear that certain ship installations are fitted with arc transmitters and are thus able to transmit and receive with vessels employing the spark system. How is this accomplished? I have always been under the impression that arc sets are inaudible on the ordinary type of receiving apparatus.

Ans.—(1) To our knowledge only a very few vessels are fitted with arc installations. To establish communication with other stations employing the crystalline receivers, a device known as a "chopper" is employed to interrupt some portion of the oscillatory circuit at a certain rate per second of time. Audible pulses are thus produced, but the resultant note is not clear and rather unsuitable for rapid transmission. Arc sets used in this manner are not efficient and may be considered as a temporary makeshift.

Ques.—(2) Do arc sets operate more successfully at wave-lengths of 3,000 or 4,000 meters than on the shorter wave-lengths?

Ans.—(2) Yes.

Ques.—(3) If so, would this be considered as a hindrance to their general adoption?

Ans.—(3) Yes, as long as other ship installations or land stations are fitted with the spark type of apparatus.

* * *

R. A. L., Chicago, Ill., asks:

Ques.—(1) Can the induction coils advertised in THE WIRELESS AGE and offered to the amateur field be used in connection with an oscillation transformer and a condenser? If so, what range of wave-lengths can be covered?

Ans.—(1) Yes. The potential of these coils is such that they operate most efficiently with a condenser capacity of .002 microfarad. If a sufficient number of turns are added at the primary winding of the oscillation transformer, wave lengths up to 800 meters may be obtained.

Ques.—(2) Is the spark note produced by these coils clear and well pitched?

Ans.—(2) The note produced is superior to that given by the average mechanical or magnetic interruptor.

Ques.—(3) What wave-lengths may be adjusted to with the type D tuner?

Ans.—(3) If a "looped" aerial is employed wave-lengths up to 2,000 meters may be reached. If the left hand tuning coil of this tuner is used as a loading coil for the right hand tuning coil, wave-lengths between 5,000 and 6,000 meters may be obtained.

Ques.—(4) Are assignments ever made from the operating service of the Marconi Company to the other departments, such as the Traffic or Engineering divisions?

Ans.—(4) Practically the entire force of assistants in these departments has been recruited from the marine service.

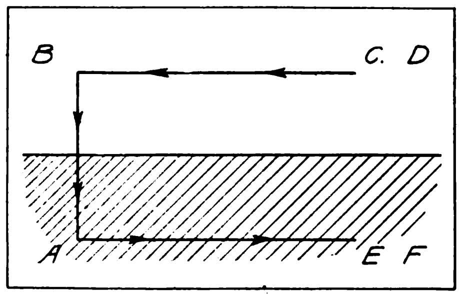


Fig. 2

S. F. M., Mercer, Pa., inquires:

Ques.—Will you please give me the name and address of the author of the First Prize Article on page 691 of the June issue of THE WIRELESS AGE? I have tried to make a detector similar to the one he described, but failed to get results and therefore wish to consult him.

Ans.—William O. Tait, Rossmore avenue, Bronxville, New York.

* * *

A. T. H., Northeastham, Mass., inquires:

Ques.—(1) Please tell me the wave-length of an aerial, consisting of three wires, 150 feet in length. The aerial is 40 feet in height at one end and 24 feet in height at the other. The lead-in, taken from the lower end, is 15 feet in length. The ground wire is 20 feet in length.

Ans.—(1) The natural wave-length of this aerial is about 330 meters.

Ques.—(2) What diameter and length of both the primary and secondary tubes are necessary for an inductively-coupled receiving tuner having a wave-length adjustment up to 4,000 meters? How many contact points should be used on this coupler to obtain the best results?

Ans.—(2) The secondary winding of the receiving tuner should be 9¾ inches in length by 3 inches in diameter, wound closely with No. 26 S. S. C. wire; or, if desired, the length of the coil may be slightly decreased and wound with No. 30 S. S. C. wire. The secondary winding should be shunted by a small variable condenser, such as the Clapp-Eastham type, having a capacity of .001 microfarad. The turns of this winding should be equally divided between the taps of a twelve point switch.

The dimensions of the primary winding will vary with the size of the aerial with which it is to be employed. But in the particular case cited it may be 3½ inches in diameter, 9 inches in length, wound closely with No. 24 wire. A suitable switch for the primary winding of this receiving tuner is described in the First Prize Article published in this issue.

Ques.—(3) Will the aerial described in my first question be of sufficient length when used with a loading coil 3¼ inches in diameter by 8½ inches in length, wound full of No. 24 B. & S. enamel wire, to adjust the aerial system to wave-lengths between 4,000 and 5,000 meters, with efficient results? It should be understood that a 4,000-meter loose coupler is to be used in connection with a fixed condenser and galena detector.

Ans.—(3) If it is intended to use a loading coil of this description, the primary winding for the tuner previously suggested may be considerably reduced in length, say, to one-half its value. In that case wave-lengths up to 4,500 meters may be received.

* * *

B. A. B., Louisville, Ky., inquires:

Ques.—Please give me the wave-lengths and call letters of some of the high power wireless telegraph stations within, say, 4,000 miles of the United States.

Ans.—A list follows:

Locations of Stations.	*Call Letters.*	*Approximate Wave-Lengths.*
Glace Bay, Nova Scotia	WSS	8,000 meters
Newcastle, Province of N. B., Canada	VAN	8,200 meters
New Brunswick, New Jersey, U. S. A.	WII	8,000 to 15,000 meters
(Arlington) Radio, Virginia	NAA	Spark set... 2,500, 3,500 meters Arc set... 7,000 meters
Darien, Isthmus of Panama	NBA	15,000, 10,000 meters
So. San Francisco, Cal.	KSS	6,000 to 8,500 meters
Bolinas, Cal.	KET	7,000 meters
Kahuku, Hawaiian Islands	KIE	5,000, 12,000 meters
Hecia Point, Hawaii Islands	KHX	9,000 11,000 meters
Point Loma, San Diego, Cal.	NPL	5,500, 6,000 meters
Eilvese, Hanover, Germany	OUI	8,100 meters
Nauen, Germany	POZ	9,400, 8,000 meters
Carnarvon, Wales, England	MUU	6,500 meters
Clifden, Ireland	MFT	6,000 meters

C. R. P., Saginaw, Mich., inquires:

Ques.—(1) Can you calculate the wave-length of my aerial from the following data: It is 95 feet in height at one end and 85 feet at the opposite end, the total length being 105 feet. It is made up of four No. 22 B. & S. gauged phosphor bronze wires, spaced 7 feet 4 inches apart; the lead-in being brought down from the lower end and composed of four No. 22 copper wires twisted together. The total length of the lead-in is about 135 feet. My calculations indicate that the natural wave-length of this aerial is about 279 meters. Am I correct?

Ans.—(1) The natural wave-length of the aerial described is about 380 meters.

Ques.—(2) Where can I obtain complete data for the construction of a 2 k.w. 500-cycle generator?

Ans.—(2) This question is beyond the scope of the Queries Answered department. We suggest that you communicate with some prominent manufacturing concern. You may obtain from the latter, at considerable expense, the necessary data.

* * *

C. U., Marion, Ohio, asks:

Ques.—(1) Please tell me whether I should be able to receive signals from Glace Bay, Nova Scotia, with the following receiving outfit: My receiving tuner has a primary winding, 4¼ inches in diameter by 4¾ inches in length, wound full with No. 24 enamelled wire. The secondary winding is 3½ inches in diameter by 4¼ inches in length, wound full with No. 30 S. S. C. wire. I have two loading coils in the primary circuit, one 3¾ by 16 inches in length, wound with No. 24 enamelled wire, the other 6 inches in diameter, 23 inches in length, wound with No. 22 D. C. C. wire. I also use a loading coil in the secondary circuit; it is 4 inches in diameter by 10 inches in length, wound full with No. 36 S. S. C. wire, the entire secondary winding being shunted by a condenser of .001 microfarad capacity. I employ ferron and galena for the receiving detector; also a 2,000-ohm head telephone set which is shunted by a fixed condenser of .0165 microfarad. The receiving aerial consists of two wires, 325 feet in length by 35 feet in height, the wires being spaced 2 feet apart. The lead-in consists of one No. 4 copper wire, 80 feet in length.

Ans.—(1) It is extremely difficult to receive the signals of the Glace Bay station inland, except with the most sensitive types of receiving apparatus. It is very doubtful, indeed, whether you will receive the signals from this station. The inductively coupled receiving transformer described will not allow a sufficient degree of coupling for the maximum strength of signals. Furthermore, the loading coil wound with No. 36 wire has entirely too much resistance for efficient results.

This core should be wound with No. 30 or 32 S. S. C. wire.

We do not recommend the use of a condenser in shunt to the head telephones having a capacity of .0165 microfarad. A condenser having capacity of .003 microfarad is quite sufficient. In the February, 1915, issue of THE WIRELESS AGE, the secondary winding for a receiving tuner, capable of receiving wave-lengths up to 11,000 meters, is fully described. The primary winding will, of course, vary with the size of the aerial.

Ques.—(2) Are there any regular working hours for the Glace Bay station?

Ans.—(2) This station is in continuous communication with a corresponding station in Clifden, Ireland, giving a 24-hour service.

Ques.—(3) Have you any information concerning the opening of the New Brunswick station and its working hours?

Ans.—(3) See the answer to the inquiry of J. A. R. in this issue.

We suggest that you redesign your receiving tuner, as per article in the February issue of THE WIRELESS AGE.

Your query in reference to Sayville is fully answered in the response to the question of J. A. R. in this issue.

* * *

A. B. R., Alton, Ill., inquires:

Ques.—(1) Will a stranded wire aerial give better results for receiving than a solid wire?

Ans.—(1) This can only be determined by a comparison of the conductivity afforded by the two types of wire. Stranded wire has a slightly lower value of high frequency resistance, but, on the other hand, equal surface conductivity will be afforded by a solid conductor of increased dimensions. From an amateur standpoint, it makes little difference whether stranded or solid wire is used, provided the solid wire is at least as large as No. 18.

Ques.—(2) Does an aerial give better results when the wire is new than when it is old and dirty?

Ans.—(2) It is possible that with certain types of wire, other than copper, a coating of rust or other formation may possess a partial degree of conductivity and, in the effort to travel on the surface of the wire, the high frequency oscillations may encounter some resistance. With the copper wire ordinarily employed in aerial systems, the matter need not be taken into account.

Ques.—(3) Does the Glace Bay station use a sustained wave?

Ans.—(3) Strictly speaking, no, but the oscillations have very feeble damping.

Ques.—(4) I have had considerable trouble with my vacuum valve detector, which seems to act in a peculiar manner. I can copy vessels all along the Atlantic Coast with ease. I get WHB, WSE and many other coast stations very clearly. I often hear signals from Cape Hatteras (WHA) so loud that I can copy them with the receivers several inches from my head. But Arlington, Key West, Sayville and even a 10 k.w. station at Springfield, Ill., sixty-seven miles away, can hardly be heard. If I switch from the vacuum valve detector to a silicon detector, the order of things is completely reversed and the larger stations come in clear and strong. Please advise me regarding my difficulties?

Ans.—(4) Lacking complete data concerning your receiving tuner, we advise as follows: It is very likely that, in order to adjust to the longer wave-lengths, you employ a variable condenser in shunt to the secondary winding of the receiving transformer and, therefore, require a considerable value of capacity for resonance. In the case of the vacuum valve detector, which depends upon potential for its operation, considerable energy is diverted to the condenser itself and, therefore, the signals are weak. On the other hand, when you employ a silicon detector, the condenser in shunt to the secondary winding does not have such disastrous effects, probably because the silicon detector requires less potential and, in consequence, the signals are received with considerable strength. The difficulty can be eliminated in the following manner: The secondary winding of the receiving tuner should be rewound with finer wire or the present wire winding extended so that wave-lengths of the higher power stations can be adjusted with an exceedingly small value of capacity in shunt to the secondary winding; say not more than .0001 microfarad. If this change is made you will find that the signals from the higher power stations will be heard with increased strength when the vacuum valve is employed.

* * *

L. J. E., Gloversville, N. Y., inquires:

Ques.—(1) Please describe a receiving set that will receive undamped waves?

Ans.—(1) Secure a copy of United States patent No. 1,113,149. The complete circuits of a supersensitive receiving set of this type are fully described. Also observe the drawing (Fig. 2) appearing in the Queries Answered department of the September, 1914, issue of THE WIRELESS AGE. The circuits for a sliding wire type of receiving tikker are fully shown in that issue.

Ques.—(2) Is a set of this type necessary to receive signals across the ocean?

Ans.—(2) Yes, if you desire to receive signals from stations employing undamped oscillations.

Ques.—(3) Where can vacuum valve detectors be purchased?

Ans.—(3) Communicate with the Cost and Sales Department of the Marconi Company, 233 Broadway, New York City.

Ques.—(4) Please tell me where I can purchase a book on vacuum valve detectors and the necessary diagrams of connections?

Ans.—(4) No publications have been issued on this subject but the forthcoming issue of the proceedings of the Institute of Radio Engineers will show a number of schematic diagrams applicable to the valve.

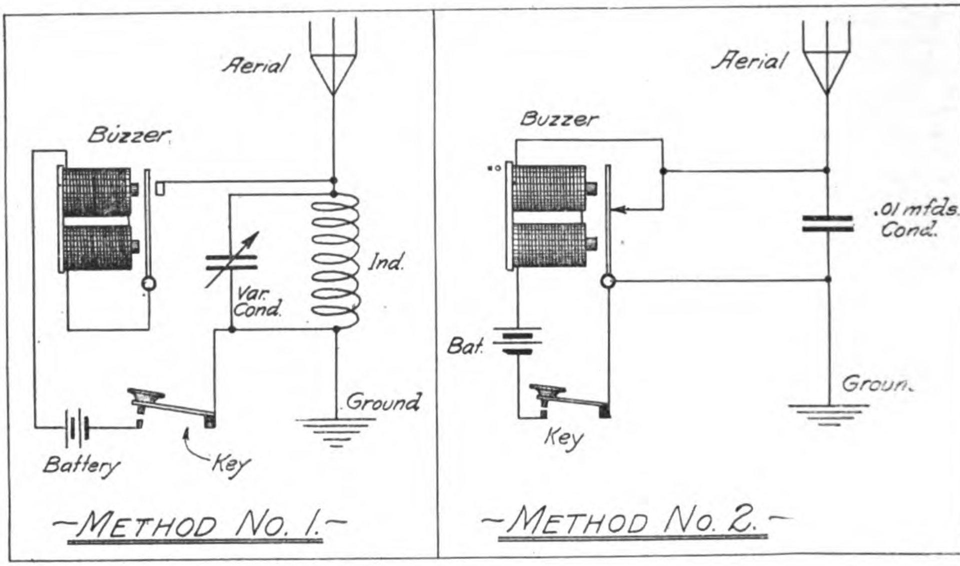


Fig. 3

A. S., Brooklyn, N. Y.:

Ques.—(1) Give a diagram of connections for a transmitting buzzer set capable of transmitting about two miles.

Ans.—(1) A complete diagram of connections is given in the accompanying drawing (Fig. 3).

Ques.—(2) Does a spark coil have to be used in this set?

Ans.—(2) No.

Ques.—(3) Please tell whether I will be able to hear the signals from Sayville on 4,800 meters with the following apparatus: The aerial has a natural wave-length of 190 meters and the receiving-tuner has a single winding, 9 9/16 inches in length by 3¼ inches diameter, with two sliders. I have four condensers of 3, 4, 8 and 11 plates covered with tinfoil 2½ inches by 1½ inches, separated by wax paper. The condensers are variable from the detector side as shown in the enclosed diagram of connections. The system of connections employed is that shown by S. C. Beekley in the March, 1915, issue of The Wireless Age. The coil is covered with No. 28 wire.

Ans.—(3) A loading coil in the antenna circuit is required. It should be about 8 inches in length by 3 inches in diameter, wound closely with No. 24 wire.

* * *

C. B. C., Superior, Wis., inquires:

Ques.—(1) Please state the natural wave-length and capacity of my aerial which is 140 feet in length and 25 feet in height. It has four No. 14 copper wires 18 inches apart. The lead-in, which is at one end, comprises two wires of the same size, 75 feet in length.

Ans.—(1) The natural wave-length of this antenna is about 310 meters; the capacity is about .0005 microfarad.

It is difficult to calculate the capacity of the antenna described in your second query, but roughly speaking, we should say it is about .00055 microfarad, and the natural wave-length about 400 meters.

Ques.—(3) Do you think I would be troubled by induction from alternating current power lines 80 feet away if the aerial was 25 feet above them?

Ans.—(3) If the antenna wires lay parallel to the power wires, severe induction noises will be experienced. If the antenna is placed at right angles to the power line the effects may be minimized, depending, of course, upon other local features.

Ques.—(4) Will my sending range be considerably reduced by these wires?

Ans.—(4) Somewhat; particularly if the antenna wires lay parallel to the power wires.

* * *

E. M. T., East Orange, N. J., writes:

Ques.—(1) Can I obtain satisfactory time signals from Arlington using an indoor aerial 36 feet in height by 23 feet in length, with crystalline detectors?

Ans.—(1) It is very doubtful, indeed, whether you will be able to receive these signals. The aerial should be at least 60 or 70 feet in length. In a wooden building it makes little difference whether the aerial is indoors or out of doors, provided the necessary dimensions are obtained.

Ques.—(2) What would be the first and second choice of crystals?

Ans.—(2) Cerusite and galena are preferable.

Ques.—(3) Please give the dimensions for a tuning coil and other apparatus applicable to the reception of time signals?

Ans.—(3) The primary winding of the receiving tuner should be 3½ inches in length by 3½ inches in diameter, wound fully with No. 26 S. S. C. wire. The secondary winding may be 3¼ inches in diameter by 3½ inches in length, wound fully with No. 28 S. S. C. wire. The secondary winding as described is intended to be used with a .001 microfarad variable condenser in shunt. The secondary winding may have a 10-point multiple point switch while the primary winding should have a sliding contact or multiple-point switch, such as described in the First Prize Article in this issue.

* * *

B. S., Davenport, Ia., writes:

Ques.—(1) Please publish the call letters and power of amateurs holding special licenses in District No. 9:

Ans.—(1)

Locations.	*Call Letters.*	*Owners.*
Ames, Ia	9YI	Iowa State College of Agriculture and Mechanics' Art.
Beloit, Wis	9XB	Beloit College.
Grand Forks, N. D	9YN	University of North Dakota.
St. Louis, Mo	9YC	Christian Brothers' College.

Ques.—(2) I have had trouble with the contacts on a 2-inch spark coil and cannot get anything but a ragged tone. Is a mechanical converter practical? If not, what would you advise? I am using a 30-volt storage battery unit as the source of current.

Ans.—(2) The average magnetic interrupter is not apt to give a high spark note except with certain types furnished with small spark coils which often give a fairly constant note, but will not remain in that adjustment for an indefinite period. Mechanical converters are practical for the smaller coils up to the size you suggest, but beyond that power considerable arcing is apt to be experienced. The electrolytic interrupter will give a very high spark note of considerable smoothness and if you have a 110-volt source of supply, we advise the use of this type.

Ques.—(3) Would a hot wire ammeter help in tuning the aerial circuit when using a 2-inch coil?

Ans.—(3) If the spark gap of this coil is connected directly in series with the antenna, it would be of no value except to indicate the actual amount of current flowing. An ammeter for this purpose should have a maximum range of not more than one ampere; in other words it should be a milliampere meter having a range of from about 100 milliamperes to 1,000 milliamperes. If you employ an inductively-coupled oscillation transformer, a hot wire ammeter is of considerable value for indicating when the two circuits are in exact resonance.

Ques.—(4) Should the secondary terminals of a transformer be connected across the spark gap or across the glass plate condenser?

Ans.—(4) Either connection may be employed. If the secondary winding is connected to the terminals of the spark gap, the coils of the secondary are protected to some extent from the high frequency surges of the condenser, but as far as general efficiency is concerned, equal results will be obtained with either connection.

Ques.—(5) What companies have wireless telegraph exhibits at the San Francisco Exposition?

Ans.—(5) The United States Navy and the DeForest Radio Telegraph & Telephone Co.

* * *

A. L., Winsted, Conn., writes:

Ques.—(1) I have a vacuum valve detector with which I am not able to get as good results as with the perikon detector. In the high voltage battery circuit I employ ten eveready flashlight cells connected in series, the potential being adjusted by means of a three-point switch. For lighting the filament I use four red seal dry cells regulated by a rheostat. The complete equipment is wired up as per the drawing. The only stations that I can hear are Arlington and Sayville, the signals of which do not come in any louder than when I use a perikon detector. I can hear South Wellfleet on my perikon, but cannot hear them at all on the valve. Is my apparatus connected up correctly or what would you suggest to eliminate the trouble? If it is connected up wrong, will you please give a diagram of the proper connection?

Ans.—(1) A diagram of connections is unnecessary. The variable condenser which you have connected in series with the filament of the valve should be connected in series with the circuit to the grid. You have no variable connection in the antenna circuit and consequently it is adjustable to one wave-length only. One slider of your 2-slide tuning coil should be connected to the antenna system and the other slider connected to the variable condenser which is in series with the grid. A connection should be taken from the filament of the valve to the earth lead of the tuning coil. The high and low voltage battery circuits are connected up properly. When the changes suggested have been made you should have no difficulty in reading the signals from Cape Cod, provided your aerial is not of abnormal wave-length. We advise an eight or ten-point switch in the high voltage battery of the valve so that closer regulation of potential may be obtained.

Ans.—(2) Your second query is fully answered in the answer to J. A. R. in this issue.

Ques.—(3) I have a Packard high potential transformer which gives 13,500 volts in the secondary. It is of the closed core type. How many glass plates, 7 by 10 inches, are required to make a condenser for said transformer? The remainder of the transmitting apparatus comprises an oscillation transformer which has 7 turns of heavy brass strip in the primary winding and 13 turns of brass strip in the secondary winding. Also a rotary spark gap having eight points on a 5-inch disc; speed, 3,000 revolutions per minute. The aerial is 85 feet in length, consisting of 4 antenna wires, spaced 6 feet apart. One end of the aerial is 35 feet in length and the other end 30 feet. The lead-in is 20 feet and the ground wire about 25 feet.

Ans.—(2) The natural wave-length of the antenna system is about 200 meters and when the secondary winding of the oscillation transformer is connected in series it will be raised to a value above that number. Therefore, to comply with the amateur law, you require a short wave condenser of about 0.0004 microfarad connected in series.

A condenser suited for this transformer should have a maximum capacity of .009 microfarad. Fifteen plates of glass of the size given, covered with foil, 5 by 8 inches (all plates connected in parallel) will give a capacity of .009 microfarad. With this capacity no more than two turns at the primary winding of the oscillation transformer are required.

Ans.—(4) The query concerning the Darien station is fully answered in the answer to the question of J. A. R. in this issue.

Ques.—(5) I use a Murdock two-slide tuning coil with my vacuum valve. Would an inductively-coupled receiving tuner give better results? Why is it that I cannot hear stations other than Arlington and Sayville?

Ans.—(5) The two-slide tuners will give satisfactory results and if you make the changes suggested in our answer to your first question you should have no difficulty in receiving the signals from stations of shorter wave-lengths.

* * *

E. J. M., Lewiston, Me., writes:

Ques.—(1) One evening last February I heard CN (Carnarvon) and GB (Glace Bay) exchanging signals and, strange to say, they were received on 600 meters. The signals received were practically all figures, containing but few letters. Do you think it is possible to hear CN on 600 meters? I am positive that is what they signed. I verified the message I received with a certain amateur the next day.

Ans.—(1) The signals which you received are not from the Marconi high power stations but have their source on board certain Admiralty cruisers and battleships near New York harbor, in fact CN is the former White Star liner Caronia, which has been near New York for some time.

Ques.—(2) What is the wave-length of my aerial, which is 60 feet in length and has four wires spaced 2½ feet apart? The height is 70 feet, while the lead-in is 35 feet in length. It is of the inverted L type.

Ans.—(2) The natural wave-length of this antenna is about 225 meters.

Ques.—(3) I have two 20-foot pipes to support the antenna and two guy wires on each pipe with insulators. Will the pipes interfere with my receiving work? I painted them with tar.

Ans.—(3) The pipes will practically have no effect on your receiving work.

Ques.—(4) Is it more difficult to get a position with the Marconi Company if the course in wireless telegraphy given by the Radio Institute of Boston is taken, instead of the course at the Marconi School in New York?

Ans.—(4) If you wish to be employed in the Eastern Division of the Marconi Company it will be necessary for you to take a finishing course at the Marconi School in New York City.

Ques.—(5) Please tell me the sending range of my transmitting set with the antenna as described, the high potential transformer having capacity of ¼ k.w. and the spark gap being of the stationary type. The oscillation transformer is 9 inches in diameter and has 3 turns in the primary, and 12 turns in the secondary of No. 4 copper wire spaced ½ inch apart. I use a glass plate condenser, 8 by 10 inches, 1/16 of an inch thick. Has the condenser the right capacity?

Ans.—(5) If this condenser comprises a single plate only its capacity is not sufficient for the work. If the transformer is fitted with a condenser of the proper capacity—about .009 microfarad—you should be able to cover a distance of about twenty-five or thirty miles, depending, of course, upon the type of receiving apparatus used at the receiving station.

* * *

R. W., Portsmouth, Ohio, writes:

Ques.—(1) I have under construction a receiving transformer for special purposes. It is of the enclosed primary type. The primary winding is 9½ inches in length by 5 inches in diameter, covered with No. 31 enameled wire. The secondary winding is 9½ inches in length by 4⅝ inches in diameter, wound with No. 40 enameled wire. If this transformer will give efficient results, I should like to know what range of wave-lengths it can be adjusted to on a moderate sized aerial.

Ans.—(1) This transformer will be found wholly inefficient at any wave length. The secondary winding should be covered with No. 30 or 32 S. S. C. wire and the primary winding with No. 26 or No. 28 S. S. C. wire. It is advisable not to use enameled wire on account of its distributed capacity. The present windings will give a wave-length adjustment of between 8,000 and 12,000 meters.

Ques.—(2) Are the connections for the primary circuit, given in the enclosed drawing, correct?

Ans.—(3) The method shown may be used, but care must be taken that the secondary winding is placed in inductive relation to the used turns of the primary winding; otherwise no signals will be received. If wired up exactly as shown in your drawing, the unused turns of the primary winding will overlap the secondary winding by several inches. Observe the First Prize Article in this issue, which contains a description of a unique switch for varying the inductance of the primary circuit. The article in the series on "How to Conduct a Radio Club" in the February, 1915, issue of THE WIRELESS AGE will aid you in designing an efficient receiving transformer.

* * *

M. R. S., Pennsburg, Pa., inquires:

Ques.—(1) How can the power factor of a transformer be determined and of what importance is it? Please give the power factor for the ½ k.w. Packard transformer.

Ans.—(1) The power factor of an alternating current is the percentage measurement of the angle of lag between the current and voltage in that circuit. The power factor equals the ration of R over Z, where R equals the ohmic resistance of the circuit and Z equals the impedance. If the power factor of an alternating current circuit is definitely known, also the apparent voltage and current readings, then the actual watts of that circuit may be calculated from the following formula:

$$W = E \times I \times \cos\Phi$$

where W equals the power in watts.
E equals voltage of the circuit.
I equals current flowing.
$\cos\Phi$ equals power factor or ratio of R over Z.

If you are in possession of voltmeter, ammeter and wattmeter, the power factor of an alternating current circuit can be quickly determined. When these three instruments are properly connected in the circuit to be measured, simultaneous readings of the watts, as given by the watt meter, and the apparent volts and amperes, as given by the volt and ammeter, are taken. The apparent watts can be obtained by multiplying the apparent current by the apparent voltage; the actual watts by the wattmeter. The ratio of the actual watts to the apparent watts is the power factor of that circuit.

We cannot give you the power factor of the Packard transformer, because we have no data as to its construction, resistance, impedance value, etc.

Ques.—(2) I have a small $3 Murdock vertical plate condenser. Please give me dimensions for an inductance suitable to this condenser to make a wave-meter which will adjust to 500 meters; also a table to translate the readings on the condenser into wave-lengths. I saw a description of a similar wave-meter, given in one of the series of articles on "How to Conduct a Radio Club," but it did not cover a condenser of this capacity.

Ans.—(2) We are not familiar with the capacity of this condenser nor have we any data regarding it.

Ques.—(3) In which direction is an inverted L type of aerial most effective?

Ans.—(3) In the direction opposite to the free end.

Ques.—(4) How can the wave-lengths of the inverted L and T aerials be determined? Give formula.

Ans.—(4) See article in the Electrician by Cohen, February, '13.

Ques.—(5) Please give a formula for determining the proper capacity for a sending condenser. How can the inductance value of an oscillation transformer be determined?

Ans.—(5) The following formula is applicable to a sending condenser:

$$C = \frac{K\ A\ 2248}{T \times 10^{10}}$$

where C = the capacity in microfarads.
A = the area of the dielectric in use.
T = the thickness of the dielectric in inches.
K = the dielectric constants which ordinarily vary from 6 to 9.

The inductance of an oscillation transformer may be measured by the process given in an article of the series on "How to Conduct a Radio Club" in the September, 1914, issue of THE WIRELESS AGE. This measurement requires a calibrated wave-meter. Please note the article appearing in this issue on the calculation of inductance.

* * *

S. L., Scranton, Pa., inquires:

Ques.—(1) What is the wave-length of my aerial? It consists of four strands of No. 14 aluminum wire, 104 feet in length, arranged on 6-foot spreaders. It has four lead-in wires, 20 feet in length, and the entire aerial is spaced 30 feet above the earth.

Ans.—(1) The natural wave-length of your antenna is about 250 meters.

Ques.—(2) I have an R. J. four-vacuum valve detector in my station. It works very well at all wave-lengths up to 1,000 meters, but I am unable to hear stations sending above this wave, although I can hear them distinctly on a crystal detector. I am enclosing a drawing of the connections I use as I have found that my set will not work with any of the standard connections. Can you tell me how the signals from the other stations may be received?

Ans.—(2) We have made a careful examination of your drawing and cannot understand why it is necessary to employ this method of connection. If your receiving tuner had the proper values of inductance in both the primary and secondary windings you should be able to use any of the standard diagrams of connections. Note the article in the series on "How to Conduct a Radio Club" in the January, 1914, issue of THE WIRELESS AGE. The circuits and the constants for receiving tuners of various dimensions are fully covered. We suggest that you connect a variable condenser of very small capacity in series with the grid of your vacuum valve detector. Signals are received with greater strength on your crystal detector because the secondary winding is more suitable for this particular type of detector, but if you will give the secondary winding increased dimensions so that for a given wave-length the capacity of the variable condenser in shunt is at a minimum value you will secure increased results. There are a number of first-class amateurs in your vicinity who are perfectly familiar with vacuum valve detectors and no doubt will be able to help you.

* * *

J. A. K., S. S. Winifred:

We are not familiar with the details of the Jackson System and do not know whether it includes anything out of the ordinary.

The Armstrong circuits are given in U. S. Patent 1,113,149.

The description of the phenomenon in your third query is too long for publication, but it should be understood that, when placing the finger on one side of the crystal detector results in increased strength of signals, it is due to the added capacity of your body which gives a fineness of adjustment that the variable elements of the apparatus do not afford.

The intermediate circuit of the Marconi valve tuner should give very sharp tuning. If it does not do so, there is some error in the circuits that needs correction.

Increasing the spark electrodes on the Marconi non-synchronous discharger from 6 to 10 does not result in any loss in current, but will probably give increased results on account of the higher spark pitch produced. Since the telephones are more sensitive to spark frequencies of between 600 and 800, increased strength of signals may be obtained.

* * *

E. W. M., Berkeley, Cal., asks:

Ques.—(1) Is any advantage derived in using a rotary spark gap on a small spark coil fitted with a magnetic interrupter?

Ans.—(1) No.

Ques.—(2) How far should I be able to send with a ½ k.w. Clapp-Eastham hytone set at a wave-length of 200 meters?

Ans.—(2) About 25 miles.

Ques.—(3) How can I figure out the primary voltage of a spark coil?

Ans.—(3) Try to obtain this information from the makers of the coil.

Ques.—(4) What are the dimensions for a two-inch spark coil and how should it be made?

Ans.—(4) The primary winding should consist of two layers of No. 14 S.C.C. wire wound on an iron core 1¼ inches in diameter by 10½ inches in length. The primary winding should then be covered with several layers of Empire cloth or a hard rubber insulating tube about ⅛ of an inch thick. The secondary winding should comprise four sections of No. 34 B. & S. S.C.C. wire and the total length of the winding should be about 7 inches. Two and one-half pounds of wire are required. The primary winding may be fitted with a magnetic interrupter like that supplied with the ordinary spark coils. The design of a satisfactory interrupter is described in "Wireless Telegraph Construction for Amateurs," by Alfred P. Morgan.

B. G., Newark, N. J., inquires:

Ques.—(1) I am about to erect a new aerial and I want it to be of the most efficient type. The aerial will have a span of 80 feet length and a height of 55 feet. The aerial leads will be 25 feet in length and the ground connection about 18 feet in length. I use seven-strand No. 20 phosphor bronze wire with the necessary insulation and 15 feet 6-inch spreaders. Please give me the number of strands and the length of the horizontal and vertical portion for transmission and receiving purposes on 200 meters? Should it be of the inverted L or T type?

Ans.—(2) The aerial as described has a natural wave-length of about 235 meters, which is too long to comply with the United States regulations. An amateur's aerial for transmitting purposes should have a natural wave-length of not more than 165 meters. When the secondary winding of the oscillation transformer is connected in series the wave-length will be raised to 200 meters. An aerial having a natural period of 165 meters may consist of four wires 50 feet in length by 40 feet in height, spaced 2 feet apart. Such an aerial will have a capacity of about .002 microfarad.

Ques.—(2) Could I employ a Clapp-Eastham ½ k.w. hytone set at its full input with this aerial, or am I limited to a ¼ k.w. rotary gap?

Ans.—(2) The Clapp-Eastham hytone set may be used at full ½ k.w. input on 200 meters.

Ques.—(3) Is a series condenser and a large aerial more desirable when the receiving range is taken into consideration?

Ans.—(3) As far as receiving is concerned we answer in the affirmative, but if the aerial is also to be used for transmitting, the use of a series condenser is not advisable. Amateur aerials have not been found efficient when the wave-length is reduced by means of a series condenser, and we, therefore, advise that its natural wave-length be not more than 200 meters under any conditions. If it is desired to receive the wave-lengths of higher power stations we recommend the use of two aerials, one having the dimensions described for transmission on a wave-length of 200 meters, and the second one which may have a natural wave-length of from 600 to 800 meters, for receiving from stations employing the longer wave-lengths.

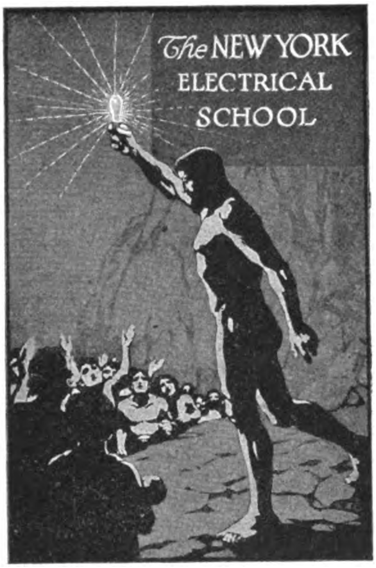
Amateurs have informed us that they have secured better results in transmitting by means of the series condenser and an antenna of increased proportions, but our experiments have not borne out the assertion.

* * *

G. A. W., Lynn, Mass.:

The aerial described in your first query has a natural wave-length of 255 meters and a capacity of about .00392 microfarad.

The receiving apparatus described in your second query should give a day range of about 200 miles and a night range of 800 miles.



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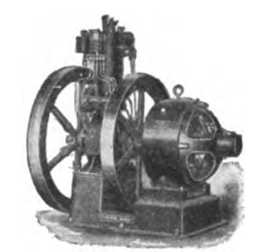

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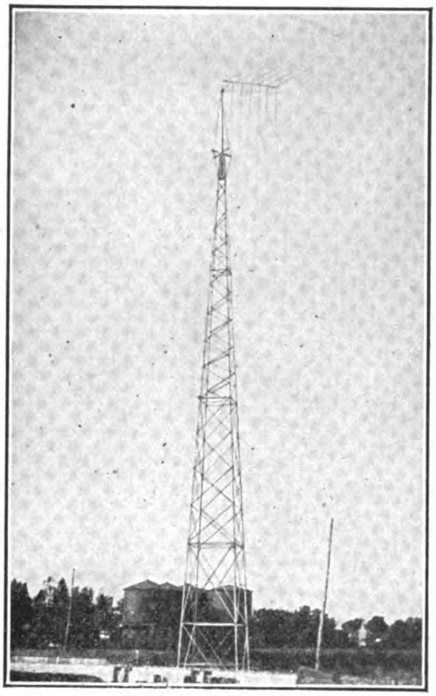

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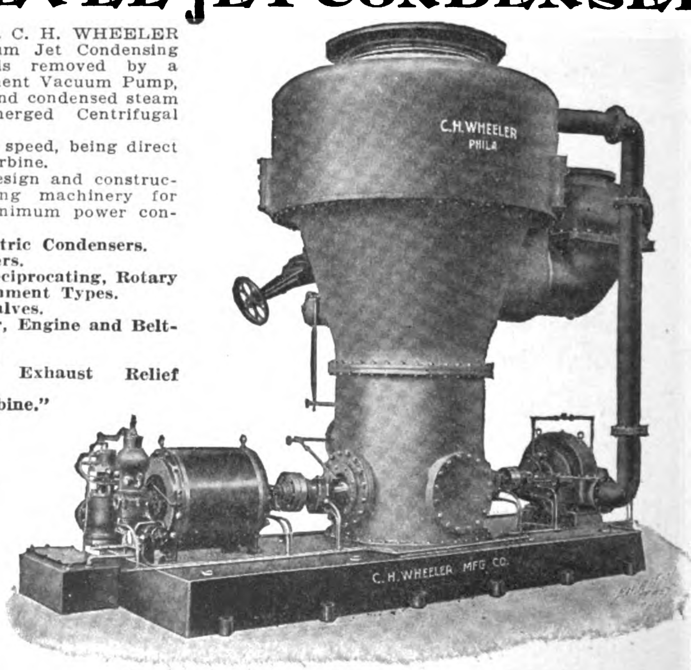

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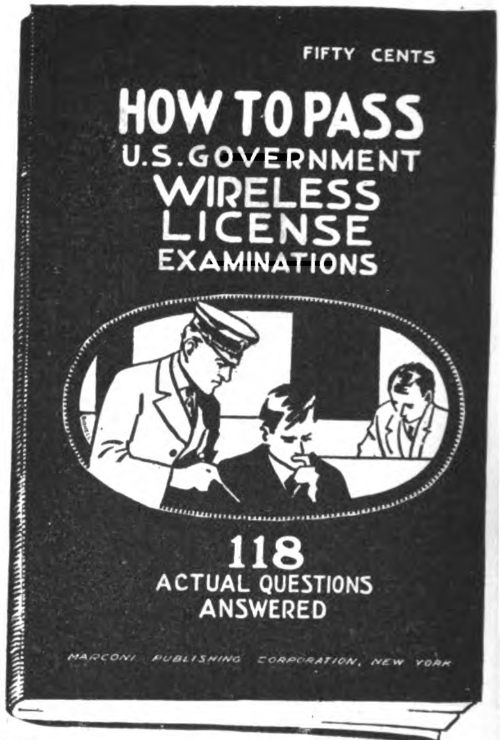

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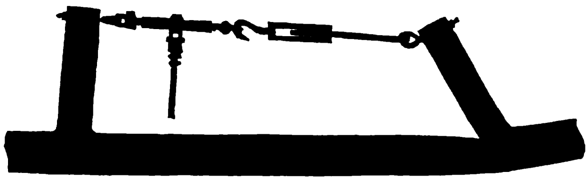

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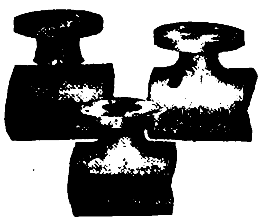

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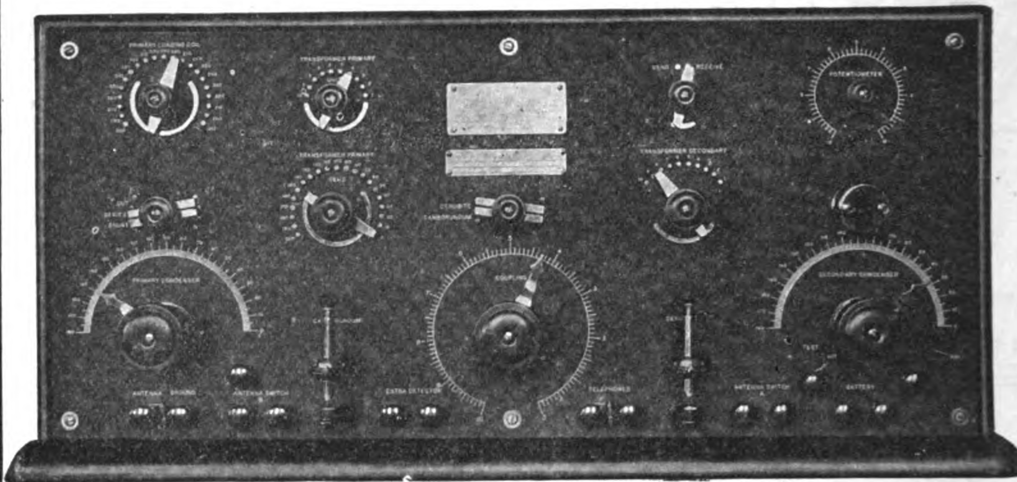

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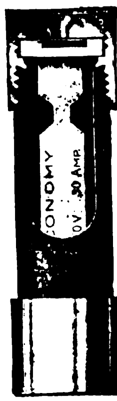

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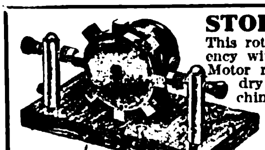

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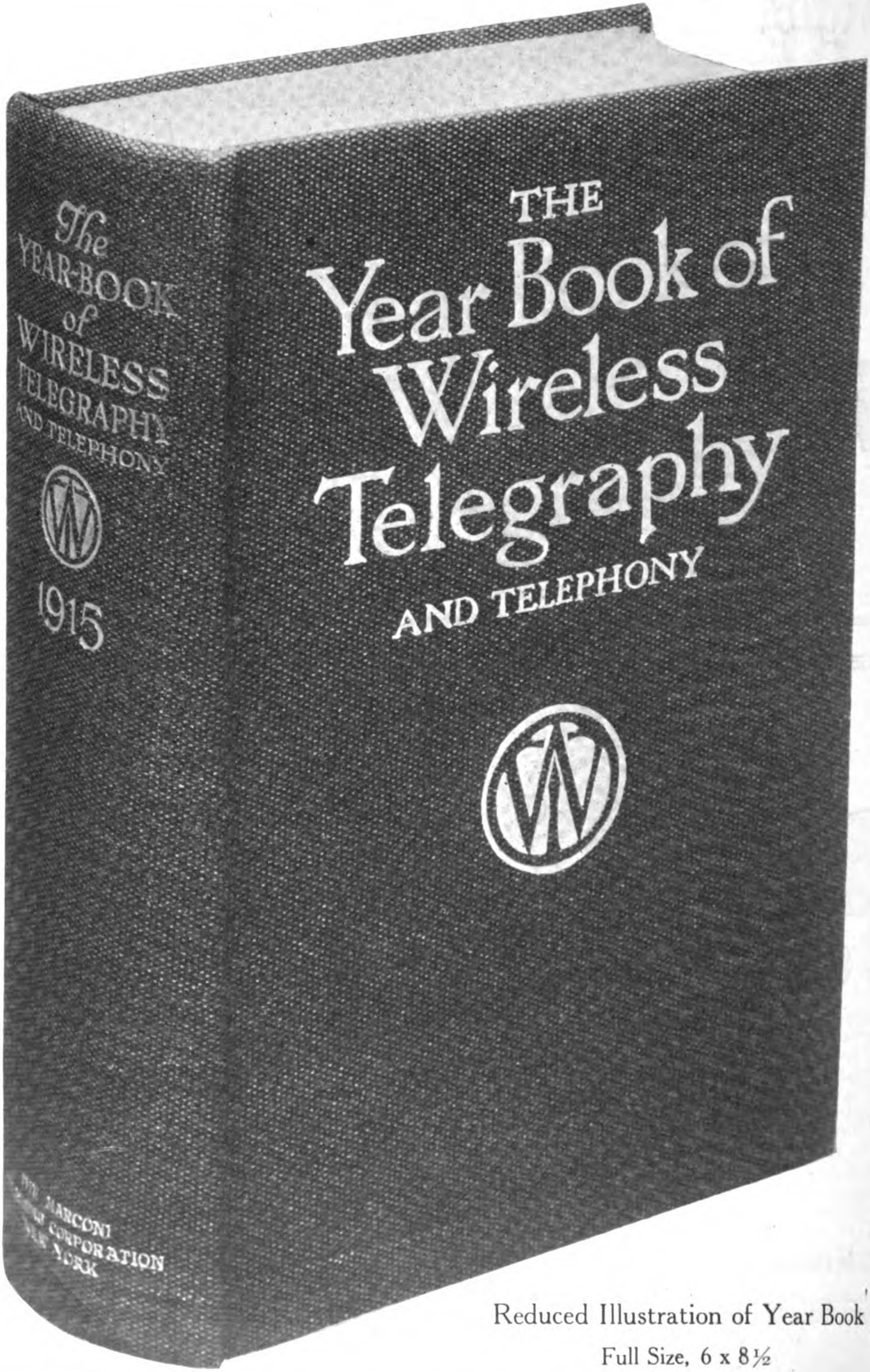

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