THE WIRELESS AGE

Statement of the ownership, management, circulation, etc., of THE WIRELESS AGE, *published monthly at New York, N. Y., required by the Act of August* 24, 1912. *Editor, J. Andrew White,* 450 *Fourth avenue, New York; Managing Editor, J. Andrew White,* 450 *Fourth avenue, New York; Business Manager, John Curtiss,* 450 *Fourth avenue, New York; Publisher, Marconi Publishing Corporation,* 450 *Fourth avenue, New York; Owners: Marconi Publishing Corporation,* 450 *Fourth avenue, New York.*

Stockholders holding 1 *per cent. or more of total amount of stock, Marconi Wireless Telegraph Company of America,* 233 *Broadway, New York City.*

Stockholders of Marconi Wireless Telegraph Company of America holding 1 *per cent. or more of total amount of stock: Grenfell & Co.,* 3 *London Wall Bldgs., London, England; Francis Robert Gregson,* 5 *Lowndes street, London, S. W., England; Heybourn & Croft,* 43 *Threadneedle street, London, E. C., England; Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W. C., England; Simon Siegman, c|o Kuhn, Loeb & Co.,* 52 *William street, New York, N. Y.; Swiss Bankvercin, London, England; Nieuw Amsterdamsch Administratiekantoor, Heerengracht* 136, *Amsterdam, Holland.*

Known bondholders, mortgagees, and other security holders, holding 1 *per cent. or more of total amount of bonds, mortgages, or other securities; none.*

JOHN CURTISS,
Business Manager.

Sworn to and subscribed before me this 19*th day of March,* 1914.

B. M. SWIFT,
Commissioner of Deeds,
New York City, No. 463,
Commission Expires April, 1915.
Residing in New York County.

MAY, 1914

THE RADIO REVIEW

AS we go to press Washington dispatches announce that officials of the government are greatly pleased with the offer of The Marconi Wireless Telegraph Company of America to place itself at the disposal of the Government in the present Mexican crisis. Secretary Daniels said it was a most generous offer and it would be accepted.

Voluntary Aid in Mexican Crisis

The Marconi company has voluntarily offered to furnish free service for the transmission of messages to and from American warships on both coasts of Mexico and Marconi stations ashore or afloat, for the purpose of relaying messages to and from the fleet. The Marconi company also has voluntarily agreed to give these government messages preference over all other dispatches. The Navy Department made an official announcement of the offer, as follows:

"The Marconi Wireless Telegraph Company of America has placed at the disposal of the American Government free service and preference over all other business, which includes the company's stations on the Atlantic and Pacific Coasts and all Marconi equipped vessels in American waters for relay purposes.

"The offer includes on the same terms its South Wellfleet station for long-distance work. In making this offer the President of the Company telegraphed that in addition they so far as possible would co-operate with the Government in all such work as can be done at the almost completed ultra-powerful stations at Belmar, New Brunswick, N. J., and Marshalls and Bolinas, Cal."

FOLLOWING a series of remarkable tests made with the Lundin housed power lifeboat close to the Ambrose Channel Lightship and later in the East River, which were witnessed by steamboat inspectors from all parts of the country, word has been received that the boat has been approved and adopted by the United States Government. In the tests made in March, and reported in our April issue, George Uhler, the supervising inspector general of the Steamboat Inspection Service, and eight members of that service were present; three metal lifeboats of the Lundin type were used.

Wireless Equipped Lifeboat Adopted

The largest boat in the test was a thirty foot metal power boat, equipped with a twenty-four horse power Standard motor, giving the craft a speed of six miles an hour. The propeller works in a tunnel, which protects it from driftwood, the boat carries a Marconi wireless outfit and is the smallest craft fitted with a wireless apparatus. This apparatus is capable of sending messages for a radius of fifty miles and messages can be received from a distance of one hundred miles. This housed lifeboat is entirely closed by watertight iron doors and windows, and in the test for stability off Sandy Hook fifty men were carried in the cabin of the boat, while seventeen men hung on to the outside guard rail on one side without causing the slightest list.

Life lines are carried on reels on both the bow and stern of the boat, and these lines can be shot to shore or on board a rescue ship by guns mounted forward. The double bottom of the boat is fitted with air compartments and scuppers. Rowlocks are also fitted just below the port lights, so the boat by the use of sweeps may get away from a vessel's side.

A capsize test with forty men aboard was made of the twenty-four foot Lundin boat at the foot of the company's wharf in Long Island City. A line was swung under the boat and she was "parbuckled" upside down but "flopped" back in a second.

The Rescue of the Sealers

THOSE who have read Kipling's "Captain Courageous" or of Dr. Grenfell's work in Labrador have an idea of the desperate hazards of the fishermen and sealing crews in those perilous latitudes, but neither the novelist nor the medical missionary have penned anything more harrowing than the tragically brief messages brought by wireless, telling of the fate of the crew of the sealing steamer Newfoundland.

Sixty-four men perished and thirty-seven were rescued after two days and nights of wandering about on the frozen wastes in the midst of a blinding blizzard. It is described as the worst catastrophe in twenty years of sealing. The report of this tragedy appearing elsewhere in our pages gives some idea of the agonies of exposure the men were subjected to. It is difficult to conceive men enduring the hardships undergone by the survivors. Yet with all its harrowing details, the horror of the incident is somewhat mitigated by the comforting thought that through wireless advices the rescue was eventually accomplished and the commanders of the vessels relieved of anxiety terrible to contemplate.

Marconi Phone at Exposition

IT is announced from Rome that Ernesto Nathan, Rome's famous ex-mayor, who has been appointed Italian commissioner to the San Francisco exposition, has just completed negotiations with Guglielmo Marconi for the largest exhibit at the exposition of wireless telegraphy that has ever yet been made. Marconi has also promised that he will have his wireless telephony sufficiently developed by that time to permit all exposition visitors to do a little telephoning.

THE EDITOR.

Annual Meeting of the American Marconi Company

THE annual meeting of the Marconi Wireless Telegraph Company of America was held in the offices of the company, 15 Exchange Place, Jersey City, on April 20. In the speech of the Hon. John W. Griggs, president of the company, it was pointed out that "The business organization of the company has been systematized and strengthened in preparation for the new business that is expected to be done by the long distance stations, and when the stations are ready the company is fully prepared to handle the large amount of traffic." Mention was also made of the successful operation of Marconi Wireless telegraphy on trains of the Delaware, Lackawanna and Western Railroad Company, and the victory won by the Marconi Company in its patent suits against the National Signaling Company. The address was as follows:

"The balance sheet of the company submitted to you by the Board of Directors is made up for the eleven months ending December 31, 1913. The uneven period was taken because of the change made in the termination of the fiscal year, which became operative in the year 1913. The balance sheet shows a surplus of $178,251.29.

To Maintain Surplus for the Present

"In view of the present depressed condition of general business and of the probable expense of operation that will be connected with the inauguration of the trans-Atlantic service, the Board of Directors have considered it wise not to make a declaration of dividend at the present time. They have considered it more to the interest of the stockholders to maintain for the present this surplus than to pay it out in dividends. Its retention strengthens the financial condition of the company and provides against any unforeseen loss in profits that may ensue in the present uncertainty of business conditions. In this respect it is in line with the action of other corporations who are husbanding their profits. Whenever business conditions are such as to warrant the distribution, the directors will feel free to make it at any period of the year.

"Our stockholders will readily understand that it is impossible for the directors or for the management to predict with any accuracy the business which will come to this company on the opening of the high power stations, but there is an enormous volume of business in cabling done between America, the United Kingdom and the continent, and with only a very small proportion falling to this company the result will be most gratifying.

Increase in Ship to Shore Business

"The progress of the work and increase in receipts in the ship to shore business during 1913 has been most satisfactory, for during that year the ship to shore stations of the company sent and received 379,110 messages, which contained 6,728,379 words, and the revenue derived from the transmission of these messages amounted in gross to $125,417.20.

"This result compares very favorably with the result shown and reported last year and as given out in our president's address, which result, although showing a very large increase over 1911, totalled only $109,143.10; therefore the increase for the year 1913 is shown to be $15,474.10.

"To equal this for the coming year and to better it will be the desire of those in connection with the Traffic Department, and we think that this end will certainly be attained.

"There has been unforeseen delay in the completion of the long distance stations which are in process of erection. This has been due to a variety of causes, the principal one being delay by material men in furnishing machinery and other supplies for the work. We are now informed by our engineers that the trans-Atlantic stations between America and Great Britain will be completed within a month or six weeks. The stations in California and the Hawaiian Islands ought to be completed shortly afterwards. A site has been selected at Marion, Massachusetts, for the Norwegian station, and work has begun there.

"The business organization of the company has been systematized and strengthened in preparation for the new business that is expected to be done by the long distance stations, and when the stations are ready, the company is fully prepared to handle the large amount of traffic.

"By arrangement with the Western Union Telegraph Company they are to give us identification in messages delivered, by indicating 'marconigram' on all messages turned over to them for delivery. They also concede us the same land line rates for the wireless letter and also the week-end letter which they give to their own cable company.

"Stations have been planned for two points in Alaska, namely Ketchikan and Juneau. The telegraph business in Alaska is now handled by the United States government, and the rates are very high. We expect to be able to make a lower rate and still leave a margin of profit, provided the business develops as we are led to think it will. Success in the operation of the stations already planned in Alaska will encourage us to erect other stations at Valdez, Nome, and points along the coast and in the central parts of the territory.

Railroad Wireless a Success

"The practicability of the operation of the wireless system for the management of railway trains has been demonstrated by the Delaware, Lackawanna and Western Railroad Company, which now has three of our sets in use on its trains and is negotiating with this company for the installation of several more sets. The work which has been done for the Delaware, Lackawanna and Western Railroad Company by your company has been most satisfactory, and the railroad company is congratulating itself upon having acquired this means of communication, which in times of storms and other casualties putting the land lines out of operation, has proved itself to be most efficient.

"The Board of Directors recommended that the by-laws be changed so as to avoid the great trouble and expense of mailing notices of annual meetings to stockholders, intending to consolidate both the minutes of the annual meeting and the statement of accounts, which should be sent out to all stockholders, but as some of the more important stockholders have objected to any change in the by-laws, the matter has been withdrawn and will not be voted on to-day."

Reference to Judge Veeder's Decision

The following reference to the patent situation was made in a report presented by the secretary:

"It is with great pleasure we are able to announce that under the decision rendered by Judge Van Vechten Veeder on the 19th of March, the patents under contest issued to Mr. Marconi and his associates and contested by the National Electric Signaling Company were held to be valid.

"The decision is regarded by the Marconi Company of the widest importance to Marconi interests, since it puts the control of wireless telegraphy in America practically in the company's hands, and declares the National Electric Signaling Company of Pittsburgh, which has been the principal rival of the Marconi Company in this country, to be an infringer in vital particulars.

"After an admirably comprehensive study of wireless signaling, from its almost prehistoric beginning, in beacon fires on hilltops, down to the utilization of Hertzian waves, Judge Veeder has decided that Marconi was the first man to make of wireless telegraphy a practical means of communication and that the patents for which he applied in 1886 and secured in 1897, 1898 and 1904 are valid.

"As such litigation goes, in matters of such financial importance, this is quick work. Litigation over wireless telegraphy will doubtless continue, in one form or another, for some time to come, but Judge Veeder's decision, confirming, as it does others to like effect rendered in England and France, gives Mr. Marconi a strong position from which to conduct his battle. It is in harmony, too, with public sentiment everywhere, for there has never been any question in the general mind, as to the originator of wireless telegraphy, or to whom fame and gratitude should be accorded for the almost inestimable benefits which the world has derived, and will derive, from this remarkable invention.

"This decision of Judge Veeder's is so satisfying, that we think it will be of further interest to the stockholders, to present to them some literal quotations from it, as the matter in hand cannot be more clearly expressed, than as contained in the decision.

"In commenting on the improvements of Marconi apparatus over the early attempts of Lodge the Judge stated:

"'That this apparatus overcame the difficulties emphasized by Lodge is not disputed. Where Lodge compromised, Marconi reconciled. With this definite control over radiation, effective selectivity was maintained.

"'So far as possible with a coherer, it enabled full use to be made of the principle of sympathetic resonance.

"'In combination with the increased available energy in the transmitter, the distance over which messages could be sent was enormously increased.

"'With this apparatus Marconi communicated across the Atlantic in 1901, and the claims of issue constitute the essential features of apparatus which has since made possible communication over a distance of 5,000 miles.

"'It is used in more than 1,000 installations by Marconi, and is admittedly an essential feature of the wireless art as at present known and practiced.'

"Referring to the attempts of the National Electric Signaling Company in making the defense, the matter is very concisely summed up as follows:

The Fessenden Defense Deficient

"'The Fessenden defense is deficient because not a single piece of apparatus claimed to have been used is produced; not a scintilla of corroborating written evidence that such apparatus as Fessenden illustrates in his 1913 sketch was in fact used; no corroborating written evidence as to when, where, how long, or to what extent any such apparatus was used. It is supported only by the oral testimony of witnesses with respect of occurrences happening a dozen years ago. And this evidence is conflicting and contradictory.

"'It was not until June 19, 1902, therefore, that Fessenden stated anywhere that the condenser circuit must be tuned.'

"The bearing of all this upon Fessenden's extensive claims of prior knowledge and use of tuning is significant. As Judge Hand has neatly put it: 'How much he or anyone knew is not capable of ascertainment except by what he said, and neither in his patent nor anywhere else, did he say anything in the least resembling it.'

Pupin on the Possibilities of Wireless

"In summing up, the judge, in quoting Professor Pupin, of Columbia University of New York, who is on the consulting staff of this company, says:

"'What we want then is, in the first place, to be able to put a great deal of energy into our radiators; secondly, very rapid succession of sparks; thirdly, radiators and receivers of small damping; and as a result of all these things an efficient tuning of the receiving to the transmitting apparatus. The solution of these problems will increase the sphere of future possibilities of wireless telegraphy more than anything else that I know of.'

"Referring to this the judge further states:

"'The enumeration in the final paragraph of the particulars of the problem to be solved, is a clear summary of the disclosures of the patent in issue.

"'My conclusion is that the claims in issue are valid, not anticipated and infringed.

"'Decrees in accordance with the foregoing conclusions may be settled upon notice.'

"I may state further, in behalf of the directors, that matters are actively in hand to bring all infringers to terms which will be satisfactory to the best interests of the stockholders of this company."

The following officers were elected for a term expiring in April, 1915, or until their successors be elected:

President, Hon. John W. Griggs; first vice president, Guglielmo Marconi; second vice president and general manager, Edward J. Nally; third vice president and secretary and treasurer, John Bottomley.

Guglielmo Marconi, James W. Pyke and J. Van Vechten Olcott were elected directors for a term of five years, or until their successors be elected. The following were elected as members of the Executive Committee for the ensuing year: John W. Griggs, Guglielmo Marconi, Edward J. Nally, James W. Pyke, James R. Sheffield and John Bottomley.

The Report of the Directors

THE report of the directors and the statement of accounts for the year ending December 31, 1913, was in part as follows:

The balance sheet and profit and loss account, in accordance with the amendment to the by-laws, is made up for eleven months ending December 31, 1913. It will be noted that the balance sheet shows a surplus of $178,251.29.

In connection with the balance sheet, your directors desire to point out that it was necessary to make very large and unusual expenditures during the year, but it is confidently expected that the extraordinary conditions which called for them will not occur again.

In round figures these expenditures aggregate over $60,000.00, and were caused:

First: By the dismantling of sundry ship and land stations, the latter of which were found to be unnecessary owing to the consolidation of the property of your company and the defunct United Wireless Company.

Second: Increased ship and maintenance expenses were necessary to bring our ship stations up to the standard required by the government.

Third: We were put to large increased expenses on account of stock transfers, caused by the issuance of the new stock and the transfer of temporary securities into those of a permanent nature.

Fourth: Owing to disturbed labor conditions on the Pacific coast, we were put to an increased expense in order to maintain the integrity of our service and to preserve our independence in the conduct of our business.

Another important matter which should be taken into account, and which makes for considerable difference in our balance sheet, is the number of large orders unfilled both on private contracts and contracts with the United States government, which remained open at the close of the year, and which, while showing a profit, could not be properly taken into the account inasmuch as the profit had not then been definitely ascertained. Since the close of the year the majority of the orders have been filled and profits assured for the current year.

The work of erection of the high-power long distance stations is progressing and unless unforeseen circumstances should arise, we hope they will be completed and open for business early in the summer.

As to the Pacific stations; everything seems favorable to our being able to start service with Honolulu prior to June 1st.

Nothing much has been done in regard to our proposed Philippine station because of many obstacles which have been placed in the way of our securing concessions and rights from the United States and Insular governments. A bill, however, has just been passed by the Philippine Assembly, granting us, subject to the approval of the secretary of war, the right to erect a high-power station which will work with Honolulu, Japan and China, and we hope at an early date to receive the approval of the War and Navy Departments enabling us to proceed with the work of location and installation.

The imperial Japanese high-power station, which is being constructed to work in connection with our Honolulu high-power station, is not yet completed and we are unable at this writing to obtain definite information from the Japanese Embassy as to the exact date when this station will be ready for business.

Norwegian Station Under Way

Land has been purchased at Chatham and Marion, Massachusetts, the former for a transmitting station and the latter for a receiving station, for high-power work with Norway. The Norwegian government station also is now under way.

Satisfactory arrangements have been completed with the Western Union Telegraph Company under which connection will be made between its main operating rooms in New York, San Francisco, Boston, etc., and our new high-power stations in New Jersey, California and Massachusetts. These wires will be equipped with the latest devices for direct and expeditious exchange of traffic.

Inasmuch as we shall be in competition with the Western Union Telegraph Company, as well as all other cable companies, for trans-Atlantic business, it will be necessary not only for us to influence patronage in our favor in all large cities, but we shall have to keep it coming. Therefore, a business-getting organization has been perfected and representatives will be located in New York, Chicago, New Orleans and San Francisco who will be in charge of a capable corps of canvassers which will keep in touch at all times with the cabling public and inform them of our superior facilities and reduced rates.

The tendency of governments everywhere to enforce and enlarge wireless regulations, making it obligatory for all ocean and lake going craft to be equipped with wireless, increases the demand for our equipment.

The very severe storms on the Great Lakes last season demonstrated the necessity for wireless. Many vessels were wrecked and many lives lost, but no losses occurred where ships were equipped with wireless.

Another striking instance of the value of wireless in times of storm and stress was given during the recent snow storm in the vicinity of New York which played havoc with all overhead systems of wires. One railroad, however, which this company had equipped with its wireless apparatus, was able to run its trains and handle its traffic without cessation or delay. We were able to extend facilities and aid to other railroads, giving them service with New York, Philadelphia and Baltimore. Thus the value of wireless on trains as an auxiliary service in time of storm is now generally recognized and as a result we have had many inquiries from railroad officials and we expect to build up a substantial business in train wireless.

This company is arranging to construct several high-power stations along the Alaskan coast and in the interior, and steel has already been shipped for stations to be constructed at Ketchikan and Juneau for commercial business with Seattle and Astoria, Washington. There are good prospects for good business.

We are in negotiation with the Cuban government to take over and operate on a joint basis several wireless stations which that government has been maintaining independently.

We are gratified to be able to report a favorable decision by Judge Van Vechten Veeder of the United States District Court, in our suit against the National Electric Signaling Company for infringement of patents, by which the validity of all three patents on which the suit was brought is fully sustained and by this decision Marconi is now for the second time officially recognized in this country as the inventor who made commercial wireless telegraphy a possibility, and this decision as it stands to-day will have a far-reaching effect on competing wireless companies.

The balance sheet will be found on the page following.

THE SHARE MARKET

New York, April 27.

The tone of the general market is weak to-day. Brokers believe that the war in Mexico has something to do with the decline in which standard securities established new low levels for the year for the preceding three successive days. This movement was accompanied by marked declines in all classes of stocks and the weakness of Marconis is looked upon as part of the temporary slump in all securities.

Bid and asked prices to-day:

American, 3⅝—3⅞; Canadian, 1⅞—2⅛; English, common, 15—17½; English, preferred, 12—15.

MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA

General Profit and Loss Account—For the Eleven Months ended December 31, 1913.

ADMINISTRATION EXPENSES, including Salaries of Directors, Executive Officers and Consulting Engineers, Rents, Taxes and General Office Expenses	$159,831.61	PROFIT FROM OPERATION OF LAND AND SHIP STATIONS, SALE OF APPARATUS AND OTHER RECEIPTS	$177,913.63
LEGAL, PATENT AND STOCK TRANSFER EXPENSE	19,971.18	INTEREST ON TEMPORARY INVESTMENT OF SURPLUS FUNDS	213,372.99
DEPRECIATION ON BUILDINGS AND EQUIPMENT	33,232.54		
PROFIT, CARRIED TO BALANCE SHEET	178,251.29		
	$391,286.62		$391,286.62

BALANCE SHEET—DECEMBER 31, 1913.

ASSETS

CASH IN BANKS, ON HAND AND AT CALL:		
Cash in Banks and on Hand	$67,312.23	
Bankers' Certificates of Deposit	720,000.00	
Bankers' Collateral Call Loans	550,000.00	$1,337,312.23
INVESTMENTS AND LOANS (At Cost):		
Railway Bonds and Notes	$1,832,607.62	
Bankers' Time Collateral Loans	99,839.94	
Foreign Government Bonds	195,625.00	
Municipal Bonds and Notes	400,000.00	
State Notes	300,000.00	
Shares of Other Companies	1,470.00	2,829,542.56
SUNDRY DEBTORS AND DEBIT BALANCES		278,476.52
WORK IN PROGRESS, MATERIALS AND SUPPLIES ON HAND		407,371.06
PLANT, MACHINERY AND TOOLS		75,060.62
REAL ESTATE, BUILDINGS AND LAND STATIONS		1,992,148.90
SHIP STATIONS		258,496.77
PATENTS, PATENT RIGHTS AND GOODWILL		2,741,539.16
		$9,919,947.82

LIABILITIES

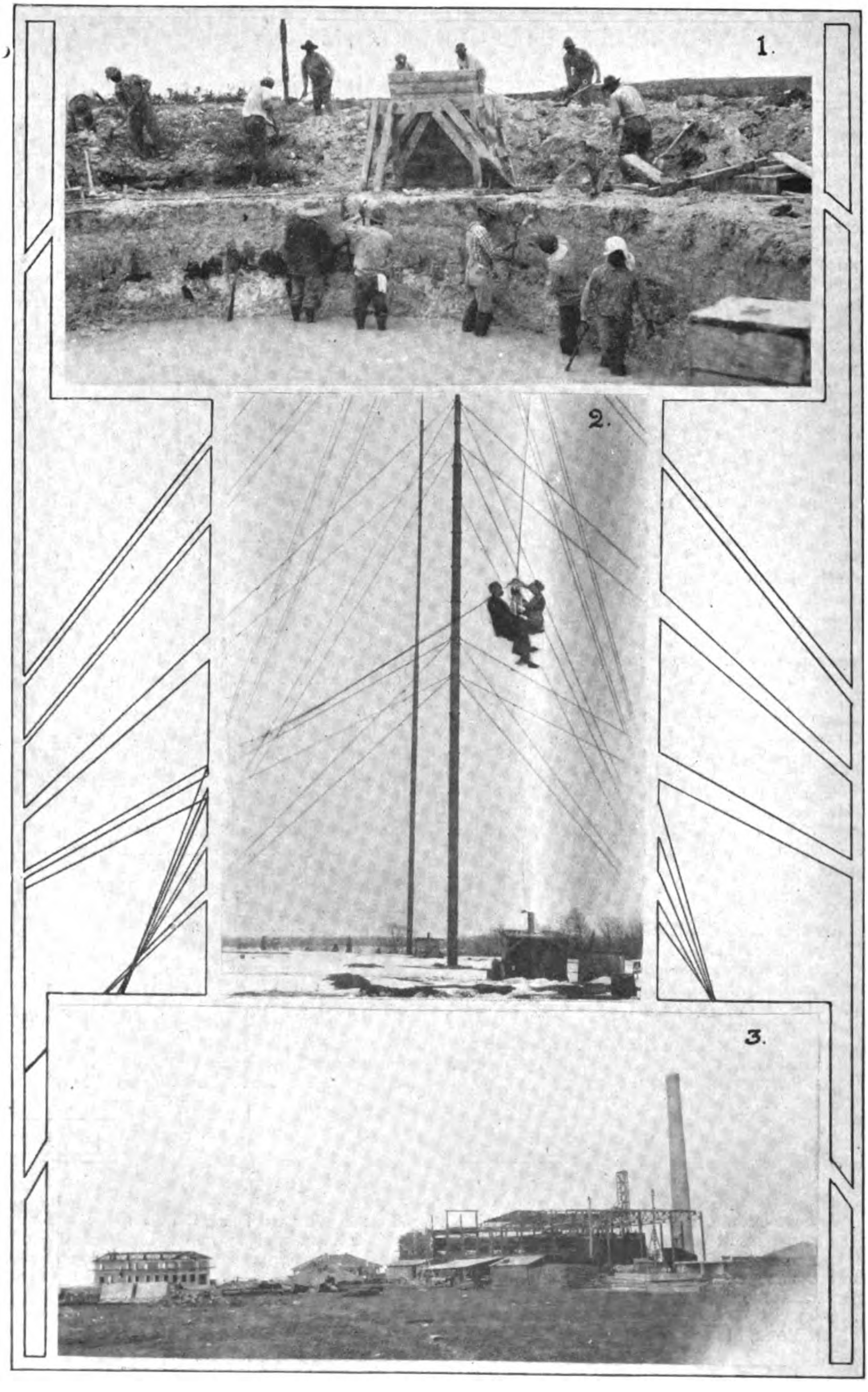
CAPITAL STOCK:			
Authorized: 2,000,000 Shares, par value $5.00 each, fully paid and non-assessable	$10,000,000.00		
Less: Subscribed for but not yet issued: 119,486 Shares par value, $5.00 each	597,430.00		
	$9,402,570.00		
Less: Stock held in Treasury		500.00	$9,402,070.00
SUNDRY CREDITORS AND CREDIT BALANCES			303,184.28
SURPLUS:			
Balance, per Certified Accounts, January 31, 1913	$224,483.65		
Less: Dividend paid as of August 1, 1913	188,041.40		
	$36,442.25		
Net earnings eleven months ended December 31, 1913	178,251.29		214,693.54
			$9,919,947.82

We have examined the accounts and records of the Marconi Wireless Telegraph Company of America, and as a result thereof have prepared the above balance sheet and accompanying general profit and loss account. These, subject to the value placed upon its patents, patent rights and good will, in our opinion correctly represent the financial condition of the company on December 31, 1913, and its transactions for the eleven months ended that date.

NEW YORK, MARCH 24, 1914.

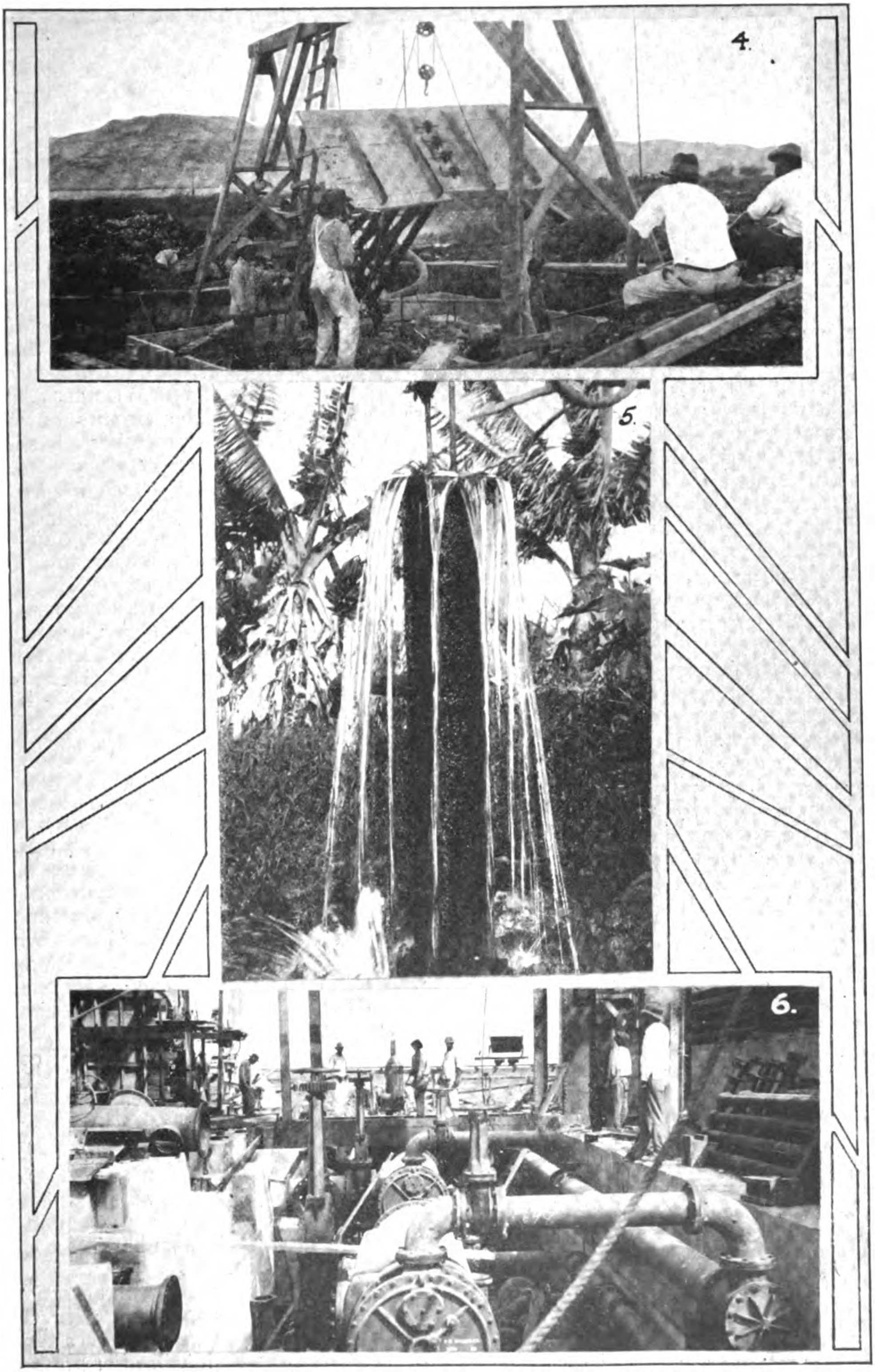
ARTHUR YOUNG & COMPANY,
Accountants and Auditors.

A Few More Views of the



(1) Excavating for fresh-water reservoir. (2) The first woman to ascend the masts at New Brunswick

Marconi Trans-oceanic Stations



(4) Pouring concrete for the mast anchorage foundations in Honolulu. (5) The artesian well at Koko Head station. (6) The steam condenser pit of the power house

How to Conduct a Radio Club

By E. E. BUTCHER

ARTICLE IV

THERE is ample evidence at hand to show that the inductively coupled receiving tuner is the most popular type of this apparatus in use among present-day amateurs. Experimenters will be interested to learn that in a recent United States court decision Mr. Marconi was for the second time given full credit for the invention of the device, the claims of his patents having been fully sustained.

That the inductively coupled receiving tuner affords a certain flexibility of control and adjustment with a degree of simplicity that cannot be approached in other types of receiving tuners may account to a considerable extent for its present popularity.

The writer has discovered through experience that many amateurs do not fully understand the theory of the operation and the mode of manipulation of this tuner. This knowledge is necessary in order to obtain the greatest possible efficiency. In a later article the matter will be discussed in detail.

For the present the writer will confine himself to the description of a type of receiving tuner which is little known in the amateur field, but has been employed to some extent commercially. It will be well to bear in mind that the arrangement of circuits of this new tuner is the subject matter of a patent* issued in 1911.

Before entering into details concerning the subject, a well-known circuit in use to-day by a commercial company will be briefly discussed. At first sight it seems to bear a certain resemblance to the one to be described, but in reality it relies for its operation on a totally different principle. Reference is made to the Marconi multiple tuner.

* U. S. Patents Nos. 997,515, 997,516.

Doubtless many amateurs who have read the educational articles appearing from time to time in THE WIRELESS AGE, are familiar with the circuits of this tuner. They will remember that an intermediate circuit is employed for the sole purpose of giving sharp resonance effects, allowing a no uncertain degree of separation of wave lengths to be obtained. Those who have had experience with this or similar circuits will agree with the writer that the degree of selectivity obtained is sometimes disagreeably sharp, requiring an exceedingly accurate adjustment to pick up certain stations.

For the benefit of the amateurs who have had no experience a sketch of the circuits employed on the "tuning side" of the Marconi multiple tuner is shown in Fig. 1. L is the primary of the receiving transformer which is inductively coupled to the intermediate circuit at L1. The intermediate circuit comprises the inductance L1, the variable condenser C, and the inductance L2. The inductances L1 and L2 are so proportioned that when used in connection with the variable condenser C, the combination gives wave length adjustments suitable for resonance with the antennæ circuits.

The intermediate circuit is then coupled to the local detector circuit at L3. Furthermore, the two fixed inductances L1 and L2 are so arranged that they can be turned at right angles to L and L3. To be more explicit, L1 and L3 are wound on balls or spheres in such a manner that they can be rotated in a 90° arc; considerable flexibility of coupling is thus obtained.

The members of amateur organizations who have had no experience with this circuit would do well to construct a tuner along these lines as it will afford an un-

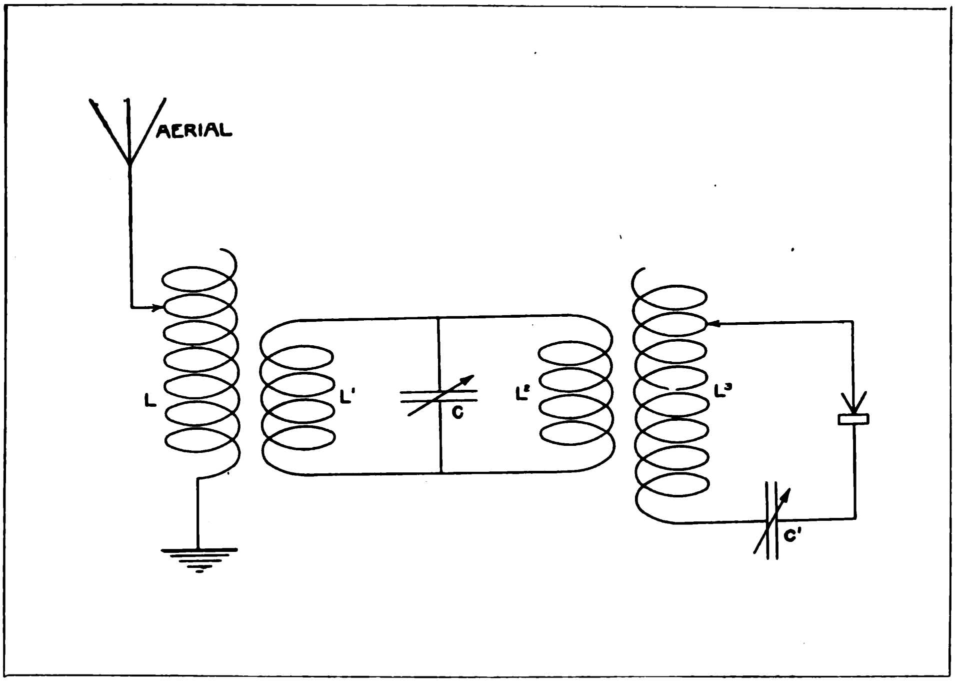


Fig. 1.—Elementary circuit Marconi multiple tuner

believable degree of selectivity which is obtained, of course, somewhat at the expense of the strength of received signals.

Let us suppose, on the other hand, that an amateur is possessed of two single slide tuning coils and through lack of funds is unable to purchase or construct the much desired "loose coupler." He need feel no sense of discontent on this account because we shall furnish him with data and advice on a new type of inductively coupled tuner which will give equal, if not better results, than any other type of amateur receiving tuner.

We herewith introduce such experimenters to the "linking circuit," an invention whereby an amateur may quickly convert two single slide tuning coils into an efficient "loose coupler" in less than an hour. The arrangement of the circuits is shown diagrammatically in Fig. 2, and photographically in Fig. 3. The latter shows the "linking circuit" as used for receiving at the wireless laboratory at the East Side Y. M. C. A., New York.

Referring to Fig. 2, A is an ordinary single slide tuning coil of the type found in the average amateur station. It is connected in series with the antennæ as shown. B is also a single slide tuning coil of the same type. These two coils are electromagnetically linked through the "linking circuit" coils C and D.

Now our entire story lies in the circuit C D, and it is believed that all amateurs will agree that nothing simpler could possibly be imagined. In fact the circuit C, D consists of nothing more than a *very few* turns of wire wound around the lower end of coils A and B. Suppose, for example, that A and B were single slider tuning coils about 12 inches in length and 2½ inches in diameter; then, for the "linking circuit," we would secure a few feet of No. 16 insulated magnet wire and wind about 3 or 4 turns of it tightly around the turns at the base of coil A. We then continue this circuit and wind an equal number of turns about the coil B. Thus coils A and B are inductively coupled through a loop of small inductance, negligible resistance and practically zero capacity. It should be understood that the "linking circuit" C D is in no sense resonant with the antennæ circuit or the detector circuit; the loop simply acts as an energy transfer circuit between the two coils A and B.

It will be evident that the wave length of the detector circuit can be increased or decreased by means of the slider S1, and likewise the wave length of the antennæ circuit at slider S; therefore any tuning to be effected may be done in the simplest manner, for it is only necessary to adjust for resonance at sliders S and S1. Furthermore, no attention need be paid to the degree of coupling as the position of the "linking circuit" remains constant and it will perform its duties quite independently of the values of inductance in either coils A or B. This statement may seem somewhat unreasonable, but it is suggested that doubters make their own experiments and draw their own conclusions.

Numerous tests of the "link" were recently made at the laboratory of the East Side Y. M. C. A. and it was found that this circuit would give louder signals from far distant stations than any other type of apparatus in the possession of the experimenters.

It may seem at first thought that considerable increase of signals could be expected if the linking circuit contained a greater number of turns about each coil, and he is apt to try it in this manner; if he does he will meet with defeat. The patents on this circuit state specifically that the "link" should contain a few turns of inductance, very low resistance and zero capacity. These are the only conditions under which it will work properly and effect the purpose for which it was designed. Experiments with a greater number of turns are useless. In fact fair signals can be secured when the loop consists of a single turn of wire about coils A and B.

Particular care should be taken to keep coils A and B at a considerable distance from one another, say, 3 or 4 feet. If this cannot be done, they should be placed at right angles to each other; thus we avoid the direct transference of energy from A to B which might happen were they too near each other.

The writer made some early experiments with the "link" several years ago. Several peculiar effects were noted, one of which was particularly interesting. It was found that with certain aerials, when receiving signals from ships emitting two waves in the neighborhood of 600 meters, the aerial circuit could be set at one value of inductance; that is to say it was adjusted to a distant transmitting station and then by moving the slider in the closed circuit at B the entire length of the coil from a nearly zero value of inductance to maximum, two points of resonance could be found; one of these, in the majority of cases, gave

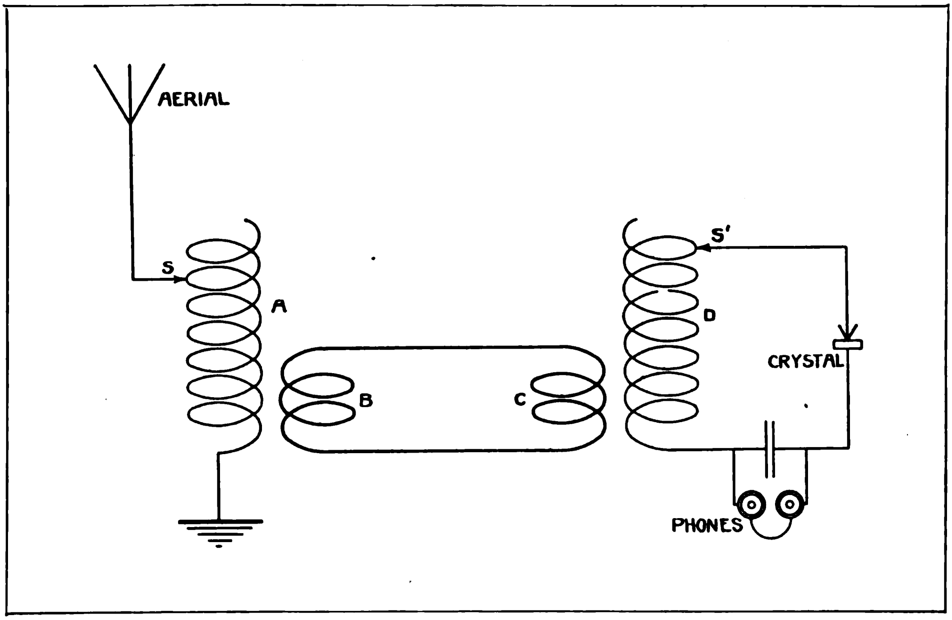
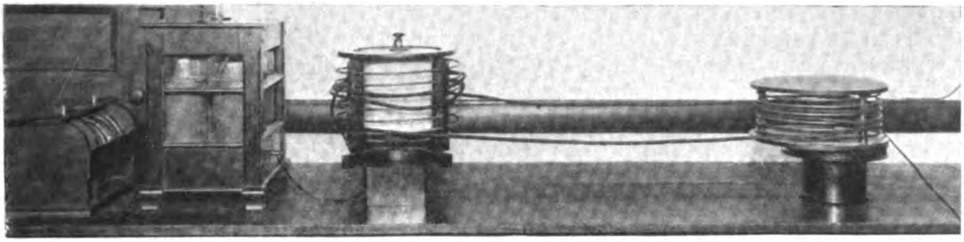


Fig. 2.—The linking circuit applied to the receiving transformer



The linking circuit, consisting of one or two turns of very coarse wire

a greater intensity of signals than the other. Thus by a simple movement of the slider it was possible to plot mentally a resonance curve of the distant transmitting station.

In some cases the shorter wave length would have the greater intensity; in others the longer wave length. Occasionally a ship would be heard where both waves emitted would be received with equal intensity. It is not believed that this was an effect to be attributed to some peculiarity of the circuits employed, for the wave lengths actually received were the same as those of the distant transmitting station.

The writer had an opportunity to check up with a wave meter some of the transmitting sets from which signals were received and invariably these transmitters contained two wave lengths as noted on the "linking circuits." Furthermore, in the cases where it was known that the transmitter emitted but one wave, only one point of resonance could be located on the receiving tuner.

Variable condensers may be adapted to the circuits shown in Fig. 2 in the regular manner, such as in shunt to the coil B, in series with the earth at coil A, or in shunt to coil A. Such condensers should not be connected in any manner to the "linking circuit" C, D or the signals will be destroyed.

The "linking circuit" has been found to be of some value in connection with the audion or similar gaseous detector. A sketch of connections is shown in Fig. 4 where A1 is the aerial tuning inductance, F is the short wave condenser, and the single slider tuning coil is represented at A. The earth connection is indicated at G. The intermediate circuit is represented by the loop C, D. The single slider tuning coil B is shunted by a very small variable condenser C1. The terminals of the inductance coil B are connected directly to the audion as shown, avoiding the use of the fixed stopping condenser ordinarily used in such circuits. The circuits of the audion were fully described in the first article of this series and should not require further explanation.

Careful consideration of the foregoing description of the "linking circuit," as applied to the receiving apparatus, should reveal the fact that it is equally applicable to the transmitting apparatus. It is here that it should make a distinct appeal to amateurs. Experimenters who do not possess a wave meter, much less a decremeter, are at a loss to tell whether or not their transmitting set emits a pure wave. We can assure them that if they employ the "linking circuit" their transmitting set will emit a pure wave without any special precaution on their part.

We have applied the "linking circuit" to the transmitting apparatus in Fig. 5. L is the primary winding or, perhaps, the plain helix of an amateur transmitting oscillation transformer; C the condenser, S the spark gap. The coil L′ may be called the secondary winding of the oscillation transformer. The aerial is represented at A.

The "linking circuit" M N consists of one or two turns of very coarse wire wound closely about L and L′. The inductances L and L′ should be widely separated so that direct transference of energy by electromagnetic inductance cannot take place. That is to say, all the energy arising at L′ from L should be transferred by the link. If the inductances L and L′ cannot be conveniently separated they should at least be placed at right angles to each other. Before describing the operation of the circuit, the dimensions of the circuit of this type, as suited to amateur needs, will be more explicitly set forth.

If the closed oscillatory circuit L C S is of the dimensions of the average amateur ½ K.W. set, the transmitting helix L need not be changed at all. In case it is necessary to construct inductance L it is suggested that if possible it be made of 3/16-inch copper tubing or of wire of similar diameter. Then the "linking circuit," consisting of winding M, which is wound tightly about L, and winding N, which is wound tightly about L′, may be made of No. 4 or No. 6 D. B. R. C. wire. No. 4 is preferable. Two turns about M and two turns at N are sufficient. The inductance L′ may be a helix of the ordinary type, such as that used as a loading coil at an amateur station. In the event that no such helix is at hand one may be constructed of 10 or 12 turns of No. 8 D. B. R. C. wire wound closely on a cardboard tube, or any other insulating support 6 to 8 inches in diameter.

Winding L should have a variable connection T and winding L′ a variable connection T′. In large transmitting sets, if the link is employed, it may be necessary, on account of the high voltages, to separate the turns of the link an inch or so from L and L′. Otherwise disastrous sparking may ensue.

The writer has tested this arrangement on transmitters of 2 K.W. size and has found that heavily insulated D. B. R. C. wire held without dissipation the voltages encountered in such sets.

The operation of the "link" in connection with the transmitting apparatus is of interest. As stated previously in connection with the receiving apparatus, the "linking circuit" is in no sense in resonance with the antennæ or closed circuit and, on account of its extremely low capacity, it possesses no distinct natural frequency. However, the frequency of the oscillations passing through it is of the same order as that of the spark gap circuit. This is a point of particular interest, for on this account, within a reasonable range of accuracy, the wave

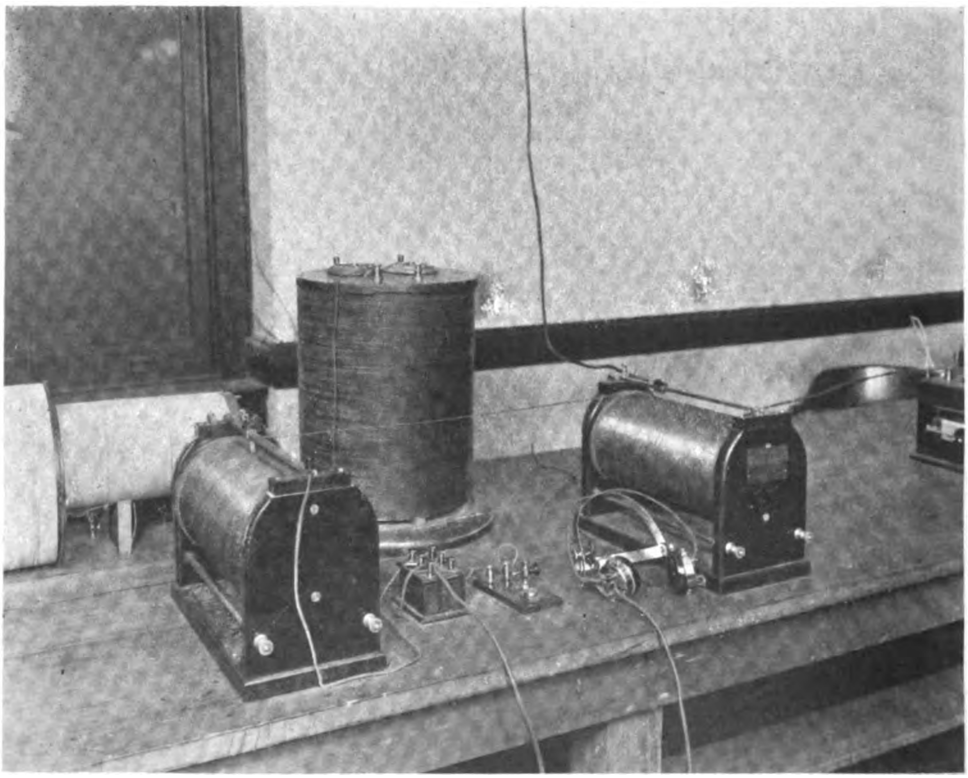


Fig. 3.—The linking circuit in use at the East Side Y. M. C. A. radio laboratory

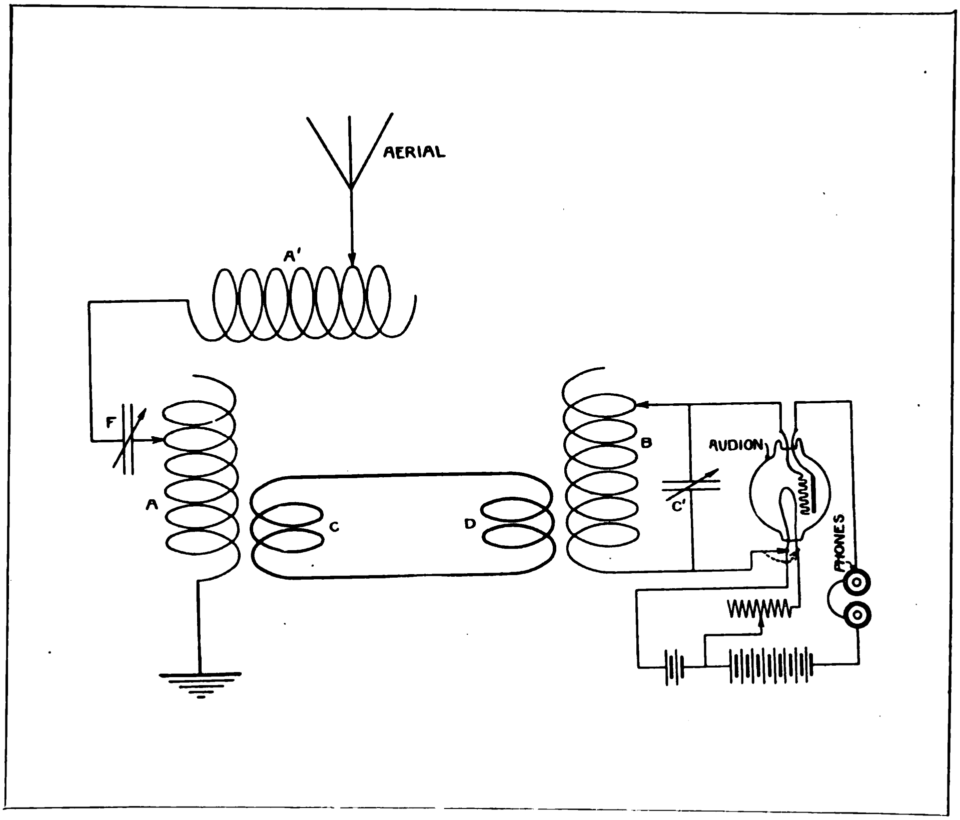


Fig. 4.—The linking circuit in connection with the audion detector

length emitted from the antennæ will be that of the closed circuit; but the greatest number of amperes will flow in the aerial circuit when the aerial circuit is in resonance with the spark gap circuit. This point of resonance is easily determined by a hot wire ammeter connected in series with the aerial circuit as shown in the sketch.

When tuning with a hot wire ammeter the variable connection in the aerial circuit is set at some distinct value of inductance. The closed circuit accurately tuned to it by a variation of the number of turns of inductance in the closed or spark gap circuit.

By no means an unimportant point is the fact that in the case of the "linking circuit" there is little or no reaction from the antennæ circuit to the spark gap circuit. Thus the aerial does not emit a complex wave, but one of single frequency. This should make the link of more than ordinary interest to the amateur who is concerned about the radiation of his aerial.

Even though there should be a slight reaction between the two circuits referred to, resulting in the emission of two wave lengths, it has been found that the energy of one wave predominates—*i.e.*, contains the most energy; the other wave is of insufficient strength to carry any distance.

For rapid changes of wave length at the transmitter the "linking circuit" is ideal because no attention need be paid to the degree of coupling; it is only necessary to adjust the spark gap circuit and the aerial circuit to resonance by the two variable contacts shown in Fig. 5.

Finally, the dimensions of the tuning coils of the receiving apparatus, the actual number of turns employed in the link, and the dimensions of the two helices in the transmitting set may all be varied to suit conditions and the apparatus at hand at a given station. But if the general principles laid down in this article are followed, the amateur

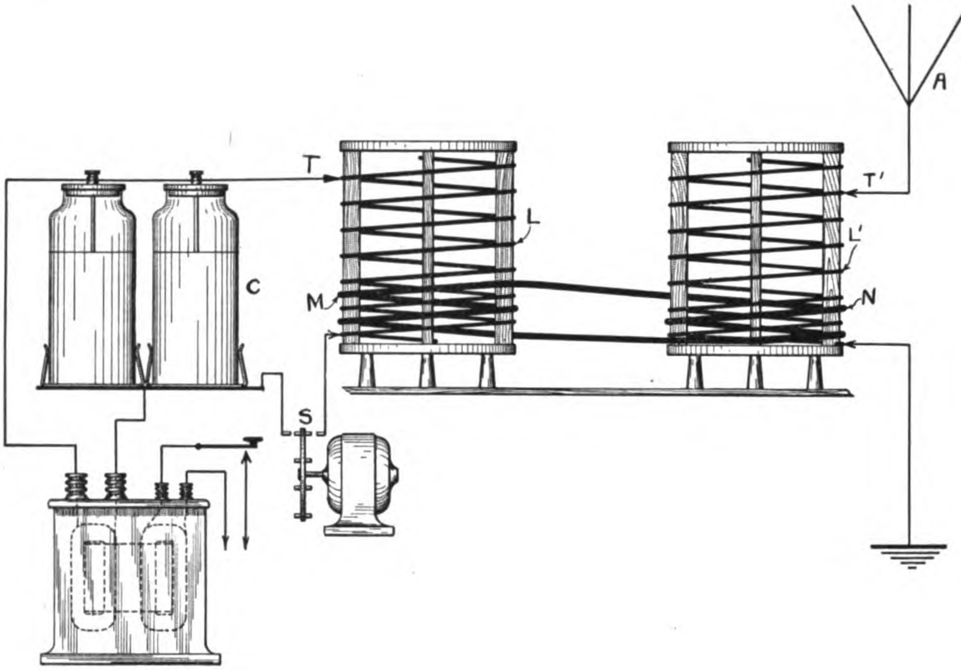


Fig. 5.—Linking circuit applied to amateur transmitting equipment

will find himself in an interesting field of experiment and research.

It is advisable for all radio clubs to construct or purchase a wave meter as soon as possible, because the experiments to be described in succeeding issues of this series necessitate the possession of such an instrument.

(*To be continued.*)

A STEP IN THE RIGHT DIRECTION

In an effort to abolish the use of slang expressions among radio students and operators the following resolutions have been adopted by the students in wireless telegraphy at the East Side Association Institute:

"Fellow-workers: We hereby declare that we do not 'push the key,' 'slam down' or 'flop over' the aerial switch, nor 'juggle' the variable condenser. We depress the transmitting key, raise or lower the aerial switch, and alter or change the capacity of the variable condenser.

"Electricity in our language is not 'juice'; neither is radio interference 'jamming.'

"Electrostatic induction is not 'kick-back.' We do not 'fiddle' the potentiometer; we adjust it. The transmitting condensers do not 'blow up,' 'explode' or 'go up the flue'; they puncture.

"The secondary winding of the power transformer is not 'baked,' or 'fried out'; it is burned, or short-circuited.

"A hot bearing at the motor generator is not 'frozen.' It melted and stuck fast.

"The aerial does not 'squirt juice'; it brushes.

"Wireless messages are not 'smashed' through the ether; they are transmitted through the ether.

"We have long since forgotten the term 'loose-coupler'; we are, however, quite familiar with the inductively coupled receiving transformer.

"The term 'jigger' in our tongue is obsolete; we know all about high-frequency oscillation transformers.

"Finally, we are optimists from the very bottom. We believe that the English language will not suffer by our declaration."

Impressions of Hatteras

THE Board of Trade doesn't say so, because no such organization exists, but that doesn't alter the fact that tradition, the native's and the whole atmosphere of the island give credence to the report that the famous treasure of Captain Kidd is buried on Hatteras. That may be an inducement to some to go there and it is featured because inducements of a more tangible sort are few and far between; unless, of course, you happen to be a botanist, a wireless operator or an exponent of the rapidly disappearing doctrine of Simple Life.

Which is another way of saying that Cape Hatteras is still unspoiled by the assiduous tourists. Yet local color is splashed all over the place and material galore for the romanticist fairly blinks at you from all sides—once you get there.

Merely getting to Hatteras is a unique experience. The nearest railroad connection is at Elizabeth City, N. C., about 90 miles distant, and since the island is some 50 miles off the coast of North Carolina the intervening distance must be covered in small sailing vessels. The good sloop Defender, a thirty-footer, about as broad as she is long, is the favored conveyance, and while making your dicker with the owner you learn that, weather permitting, the passage will take about two days. This owner, by the way is yclept Midgett, and there are a dozen or more six-foot Midgetts, all named after some state or territory of the Union; either Alaska, Oklahoma or Nebraska will probably be selected to pilot you through the waters of North Carolina.

On your way to Cape Hatteras, dreaded by sailors for the dangerous shoals which annually exact such heavy toll, you sail for twenty miles down the Pasquotank river, the stream from which our battleships secure drinking water for long cruises. This water will remain fresh under the most adverse conditions and is agreeably woody to the taste. Your pilot will suggest that you sample this famous water and you will display proper reluctance, for it is inky black in appearance, until dipped up, when it is found to be clear as crystal.

Entering Croatan sound then, you finally pass into Pamlico sound, a body of water about 250 miles in length separating the mainland from Hatteras Island. Roanoke Island is passed on the way and you will learn that it was here Sir Walter Raleigh made his headquarters during his exploration of the American coast. Croatan sound takes its name from the fact that when Sir Walter returned from England he found that his entire colony had disappeared, leaving no traces. The word "Croatan" had been cut in a tree, meaning literally, according to the natives of Hatteras, "the crow ate the hen." Roanoke Island has another claim to distinction; it is the birthplace of Virginia Dare, the first white child born on American soil. The county in which Hatteras is situated is known as Dare County, the oldest in the country.

Thirteen years ago the U. S. Weather Bureau erected a wireless experimental station on Roanoke, but it was discontinued before the end of the year.

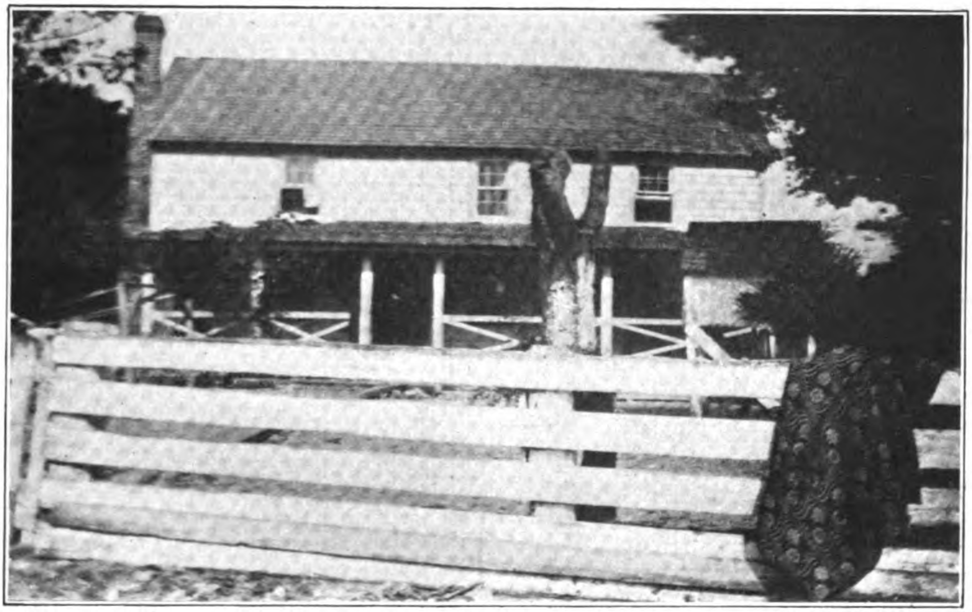
Passing Roanoke Island, to the left may be seen Killdevil Hill, the scene of the Wright brothers' early experiments in aviation and selected by them mainly because of its isolation.

An eight-hour sail brings you to Hatteras, or rather, within three miles of Hatteras. Having threaded her way through unchartered shoals reaching seven miles out at sea, the zigzag progress of the sailing vessel is halted about three miles off shore. The balance of the trip is made in shallow rowboats and on the backs of the natives, for, to quote our pilot: "There be plenty o' water, but it's spread out a mite too thin." Whereupon you must laugh or thereafter be reprimanded by the deep, hurt silence of the unappreciated.

Viewing Hatteras Island itself, it is found to be about forty miles long, from two to four wide and comprise six towns or villages, namely: Chicamaconico, Clarks, Kinekeet, Cape Hatteras, Trent and Hatteras; although the postal authorities recognize them under the names of Rodanthe, Salvo, Avon, Buxton, Frisco and Hatteras, respectively. There are about eighteen hundred people on the island, about a quarter of this number being located at Hatteras and engaged mainly, from all appearance, in the business of life saving.

There are eight life-saving stations from New Inlet to Hatteras Inlet. One Benjamin J. B. Dailey has the distinction of being the first keeper of the Cape Hatteras station and many are the rescues credited to this man; likewise many the stirring tales he loves to tell. Just thirty-one years ago, on the completion of the station, he was appointed keeper; before a year had elapsed keeper and crew were famous for heroic work. By act of Congress they were each awarded a gold medal in recognition of their services in connection with the wreck of the barkentine Ephraim Williams. This memento is cherished by Dailey and if you catch him right he will, in addition to permitting an examination, unfold graphic descriptions of wreck rescues from when he was serving his time as surfman at Little Kinnekeet down to the present

The good sloop Defender is the favored conveyance, and while making your dicker with the owner you learn that, weather permitting, the passage will take about two days



Hatteras has one hotel, named the Chateau de la Miller by the wireless men, where the main article of provender is razor-back hog; in the morning it is served as bacon, at noon as ham, and in the evening, shoulder—three hundred days in the year!

day. Hearing these tales you will begin to appreciate all his medal stands for. The medal, incidentally, contains eighty-four dollars' worth of gold and was made by Tiffany. An eighth-inch thick and one and one-half inches in diameter, it bears on one side the national emblem, name of the hero and the service performed, with the inscription: "In testimony of heroic deeds in saving life from the perils of the sea." On the reverse side is engraved a scene where life savers are rescuing a woman from the hungry maw of the sea.

Another local celebrity, particularly if you happen to be a wireless man, is Charlie Olson. Your heart warms to this big Norwegian right away, for in his capacity as cook he prepares the only food worthy of the name in all of Hatteras. Olson, by lining their stomachs with delectable culinary morsels, has contributed more to the contentment of operators than any possible form of entertainment could. At last report a die was being prepared for a medal for Olson, bearing an apple pie argent and a portrait of an individual wearing the composite Steeplechase smile of wireless men since the first stations were built. His services are ever in demand, but over the seething kettle he will tell you that he was engaged as head painter when the Brooklyn Bridge was built, thinks there is no place on earth the equal of Hatteras, has settled there for the remainder of his life, assisted in the erection of the first wireless station thirteen years ago, and—do you like your meat rare or well done?

How this Norwegian ever reached the island is one of its unrecorded facts; but the date is set about eighteen years ago, when he presumably blew ashore and subsequently married one of the young ladies, in turn becoming a father and a fixture.

If you inquire the occupation of the islanders you will be given the impression that fishing and life saving are the principal industries. A large percentage of the men are employed in the government service and the others exist somehow; just how, nobody seems to know. The natives say by fishing, but as near as you can determine through investigation the piscatorial industry is not a profitable one. Some lumber is shipped from Hatteras, but in small and irregular quantities. The ideal method of earning sustenance is by gunning, a sport not only enjoyable

Wild geese are so plentiful that the inhabitants "edge them on" with corn and they become so tame that they can be caught as easily as their domesticated brothers

but sometimes profitable. Rabbit, deer, wild birds, ducks and geese are plentiful and marketable in season.

Life at Hatteras is exceedingly dull, but to the honest, easy-going and friendly inhabitants nothing in the great universe quite compares to their island. Several men of forty-five years or more have never left the place and the majority of the natives have yet to see a steam train, an electric car or an automobile.

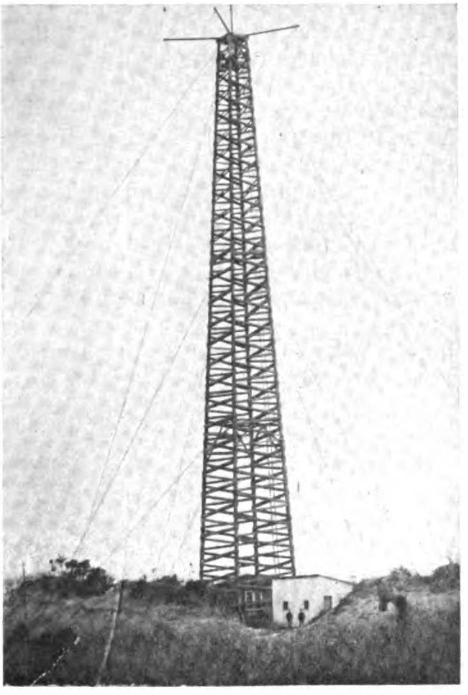
Educational advantages are about on a par with the average country village. School terms are designated as pay and free terms, the country appropriation providing for the maintenance of the school for a period of three or possibly four months; then a pay term of four or five months is held with the individual scholars charged two or three dollars per month for tuition. The stability of the pay term is uncertain, for the length of time it is held depends on the financial standing of the community.

Following the traditions and habits of several generations back the natives know nothing of the complexities of modern civilization. They cannot conceive of the strenuous conditions of the north, nor do they want to. Once in a while though, a venturesome spirit starts on a lone pilgrimage to other localities, but soon returns a wiser, and certainly sadder man. One dear old fellow, Miller by name and a veteran of the Civil War, admits that he had to cut his week's stay in New York down to three days—the excitement was too much for him. That elevated railroad, now; never did hear such an infernal racket, and all those people and teams and autos on the streets; powerful dangerous to human life, he reckons.

Another young blood of some 28 years made a famous trip to Norfolk, Va., riding on steam vessels and steam trains, neither of which he had ever seen before. His absolute amazement on beholding the city of Norfolk left him speechless for hours; but when he was taken to a theater—he nearly had a spasm!

The social gathering, ordinarily such a prominent feature of small community life, is unknown on Hatteras. When asked what is their form of entertainment you learn that "there ain't none in particlar; just sort'er wile away time." The young men call on the younger members of the opposite sex, of course, but it is a rigidly observed rule that only one caller may appear at a time. Six o'clock

The first wireless station was constructed under great difficulties; it was often necessary to wait two weeks for material and tests had to be made piecemeal



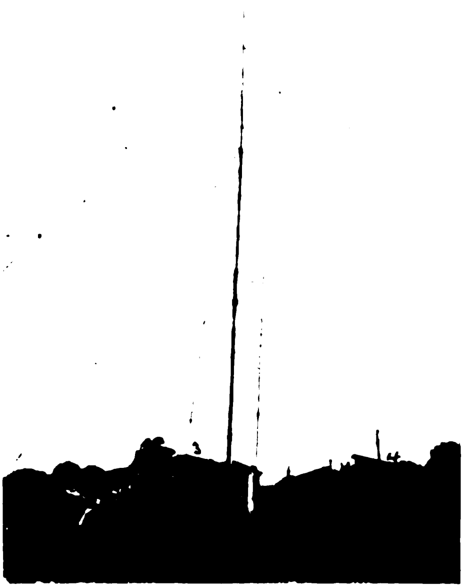
Salvage lumber collected by natives from a wrecked schooner was used for the first tower, a 210-foot structure which went down in a hundred-mile-an-hour hurricane

in the evening is the fashionable calling hour and the departure is taken about the time we would arrive, nine o'clock. He who makes his appearance first is the honored one, for previous engagements are seldom made. But even in such case the caller must present himself in advance, to insure against possible intrusion from others, for scarcely ever does the girl make known a previous engagement, for fear of wounding the first caller's feelings.

The men, while shrewd, reliable, honest and friendly, are very jealous and often suspicious. Once their friendship is gained, however, they can be relied upon in all emergencies. The women are comely, simple and wholesome, yet most of them are addicted to the usage of snuff in large quantities. No manner or amount of argument is sufficient to convince them that this is not a ladylike accomplishment. The fact that the practice is frowned on throughout the country makes no impression; yet the girls take particular pains to destroy all traces of its use before their callers arrive.

The one big event of the year is the Methodist revival meeting, held each summer and lasting ten days. The natives look forward to this anxiously, for they are all very devout and obey the Bible to the letter. Tramps and negroes are never seen and stealing is practically unknown, not one case of ordinary theft having been reported in years. Yet through some indefinable process of reasoning the community at large considers wreckage as their absolute property, and when a vessel comes ashore the entire population turns out to collect the salvage.

It is hard to reconcile this universal pillage with their otherwise exemplary lives; that is, it is difficult for the stranger to reconcile it—the natives show no concern in the matter. It is nothing unusual to see them climb trees in rough weather and anxiously scan the horizon for the first appearance of wrecks, which, alas, are all too frequent in those waters. Some visitors have vouchsafed the explanation that this is a hereditary trait, coming down from the days when the buccaneers

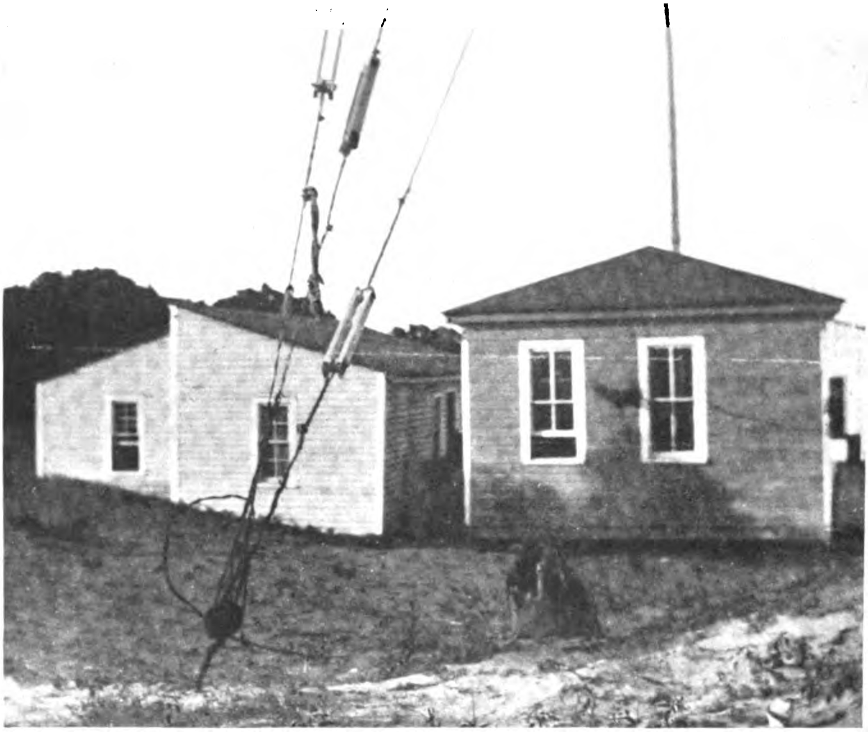


The masts in use to-day are 171 feet and 181 feet high, respectively, spaced five hundred feet apart made Hatteras a central and strategic point for their depredations. The younger and more enlightened generation takes but passing interest in the tales of Captain Kidd and other pirate chiefs, yet superstition is prevalent to a remarkable extent and men have dug innumerable hours in search of treasure.

Marine disasters are not anything like as numerous as in the days before wireless was discovered. Yet during a period of four weeks around Christmas time it is nothing out of the ordinary for a dozen wrecks to be reported in the vicinity. The heavy losses to the merchant marine formerly centered about Diamond Shoals, about fourteen miles southeast of Cape Hatteras lighthouse. In 1897 a lightship was moored in about one hundred and eighty feet of water and some five miles out from Diamond Shoals. This flush deck, schooner rigged steam vessel is now equipped with wireless and frequently reports vessels not so equipped. Powerful lens lanterns are on each mast showing fixed white lights twelve seconds, eclipse three seconds; three lanterns encircling each masthead can be distinguished thirteen miles. Her fog signal has a twelve-inch chime whistle, with a blast lasting five seconds of each minute.

The famous Cape Hatteras lighthouse, which sheds its rays over millions of voyagers, stands a lone sentinel with its light, 196 feet above mean high water, flashing white every ten seconds. The present structure, built in 1870 to replace the first tower erected by the British seventy-two years before, throws a beam twenty nautical miles. The lighthouse is spirally banded black and white, and so symmetrically that old seadogs maintain the tower was first painted and then twisted.

There is considerable art in climbing the two hundred and seventy-four steps that lead to the top without becoming unduly tired. Visitors are instructed to keep close to the wall, pause slightly at each step, throwing the weight firmly



At the Marconi headquarters comfortable accommodations are provided for the operating staff in a separate house containing three bedrooms and a generously proportioned living room upon the foot, and to descend as rapidly as safety will permit. During heavy gales the tower sways several inches in each direction, though at right angles to the wind. It is explained that this is due to the fact that the greatest wind pressure on round objects is, figuratively speaking, on the side rather than directly in front or behind.

Four years were required for the erection of this famous light as the material used in its construction had to be hauled piece by piece in small sailing vessels. For the same reason the first wireless station, started in 1901, was six months in construction. Salvage lumber collected by natives from a wrecked schooner was used for the tower, a 210-foot structure from which was suspended a large aerial. As many as fourteen men were engaged on this installation, the machinery for which was transported in small skiffs, dragged ashore for miles by natives wading in the water. Gasoline for the power equipment had to be sent down from Norfolk, Va., and frequently delivery was delayed two weeks or more.

The first wireless messages received were sent to the Western Union office at Norfolk via the Government cable and land line connected with the lighthouse. This line was seldom in operation, however, for the slightest storm would put it out of commission, so another wireless station was erected on the mainland at Elizabeth City to take the Hatteras messages. Later, communication was established direct with Norfolk and the Elizabeth City station was discontinued.

Some years ago the laboriously constructed Hatteras wireless tower went down in a hundred-mile-an-hour hurricane; it was replaced by the two masts in use to-day, 171 feet and 181 feet high, respectively, spaced five hundred feet apart.

The Marconi station at Hatteras is of immense value to shipping as it occupies a commanding position for communication with coastwise vessels and can immediately report distress calls to all vessels in the vicinity as well as to the various life-saving stations on the island. In touch with practically every vessel making southern ports, Hatteras handles a considerable amount of wireless traffic each month. The station also sends press to passing vessels and keeps commanders posted on weather conditions. Comfortable living quarters are provided for the operating staff in a separate house containing three bedrooms and a generously proportioned living room.

The climate of Hatteras is ideal, snow is scarcely known to the inhabitants and many of the trees keep their foliage throughout the year. One of the strangest sights imaginable is to see this island heavily wooded with trees growing right out of pure white sand. There is no grass on the island except along the edges of the swamps where a few stray clumps may be seen. Hardy northern trees and tropical palms grow side by side, turpentine pines and fig trees are neighbors throughout the island, and semitropical shrubs are mixed in with goldenrod and ferns. Naturalists claim that there are fifteen species of tree peculiar to Hatteras and not known in any other locality.

While some garden truck is grown at the edge of the swamps in the island's center and the natives are forever making fig preserves, all the groceries are brought over from the mainland in the small sailing vessels. The island abounds with wild geese, ducks and deer but the main diet is razor-back hog. In the morning it is served as bacon, at noon as ham, and in the evening, shoulder—three hundred days in the year! Why they don't alternate with venison, duck or fish is one of the inexplicable details of Hatteras life that make it distinctive if not desirable.

And, on the whole, that is the impression the island leaves with the visitor: An interesting place to visit—once.

The Engineering Measurements of Radio Telegraphy

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ARTICLE VIII.

Proceeding to the measurement of inductance at radio frequencies, a method of inductance measurement at radio frequencies and low voltages is described. A method of determining the effective capacity and effective inductance of an antenna is then fully considered, together with certain deductions which show the limiting accuracy to be expected of this method of measurement.

THE methods of measuring inductance so far described have all been at audio frequencies. The values of the inductance thus obtained are applicable only when the inductance is to be used at such low frequencies. A discrepancy arises if this value is applied to coils used at radio frequencies, particularly if multi-layer coils of unstranded wire are employed. We shall, therefore, consider a series of measurements of inductance at radio frequencies, the values of inductance thus obtained being valid at the high frequency used in the measurement.

Section 23.—MEASUREMENT OF INDUCTANCE AT RADIO FREQUENCIES AND LOW VOLTAGE BY THE RESONANCE METHOD. The marked phenomena of resonance which arise between two coupled circuits of equal period and small damping afford a convenient basis for the measurement of inductance.

(a) Theory. If a circuit of inductance L_1 and of capacity C_1 be coupled *loosely* to a second circuit of corresponding constants L_2 and C_2; and if a free or forced alternating current of its natural frequency flows in circuit I, the current produced in circuit II will reach a maximum when the periods of the circuits are equal. That is to say, we shall secure resonance when

$$L_1 C_1 = L_2 C_2.$$

In adapting this principle to actual measurements, a number of different arrangements of apparatus and of procedure may be used. Some of these are shown in Fig. 45, the one most strongly recommended because of its simplicity being (C), though methods (A) and (B) are useful for checking up the results obtained.

Method (A) requires two standard calibrated condensers and one standard known inductance. The exciting circuit $L_1 C_1'$ and the secondary $L_2 C_2$ are first tuned to resonance, with the double-throw switch in such a position that the only inductance in the secondary is L_2. Then the switch N is thrown into such a position that L_x, the unknown inductance, is placed in the secondary circuit, and the primary condenser varied until resonance is again obtained. The resulting value of the primary capacity is called C_1''. Then the following relations hold:

$$L_2 C_2 = L_1 C_1' \quad \text{and}$$

$(L_2+L_x) C_2 = L_1 C_1''$, whence it may be found that

$$L_x = \frac{L_1 (C_1'' - C_1')}{C_2}.$$

Method (B) requires two standard calibrated condensers and one standard calibrated inductance. The exciting circuit $L_1 C_1'$ and the secondary are first tuned to resonance, with the double-throw switch N in such a position that the standard inductance L_n is in the secondary circuit. Then the inductance L_x, which is unknown, is inserted in the secondary instead of L_n, and the circuits again brought to resonance by varying the primary condenser to the value C_1''. In this case, the following relations hold:

$$(L_n + L_2)\, C_2 = L_1 C_1'$$

and $(L_x + L_2)\, C_2 = L_1 C_1''$.

From the preceding equations it may be shown that

$$L_x = \frac{L_1 (C_1'' - C_1') - L_n C_2}{C_2}.$$

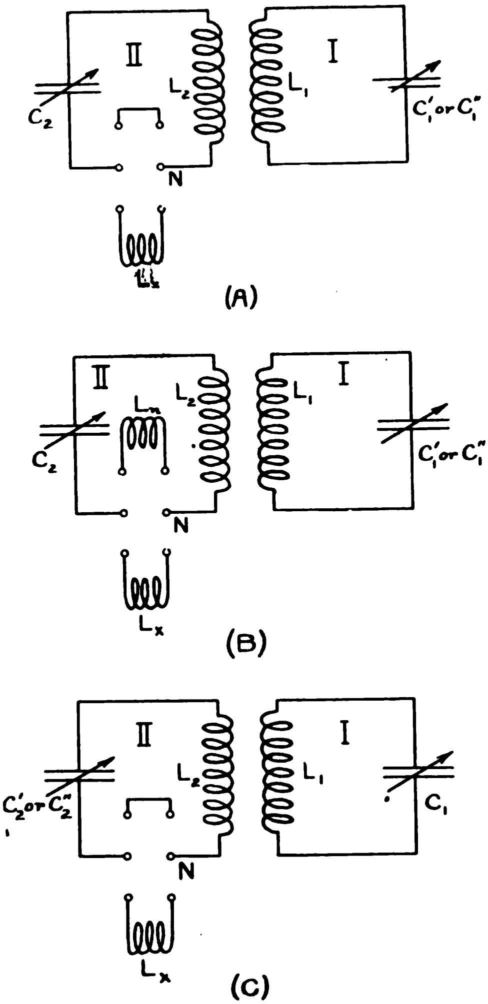


Fig. 45

In Method (C), one standard calibrated condenser is required (in the secondary circuit), and one standard fixed inductance. The two circuits are first tuned to resonance by varying the secondary condenser to the value C_2' with the switch N in such position that the only inductance in the secondary circuit is L_2. Then the switch N is set so that the inductance L_x is inserted in the secondary, and the condenser in the secondary is varied until the maximum indication is obtained as before. Under these conditions:

$$L_2 C_2' = L_1 C_1$$

and $(L_x + L_2) C_2'' = L_1 C_1$, so that

$$L_x = \frac{L_2 (C_2' - C_2'')}{C_2''}.$$

A fourth method, no diagram of which is shown, requires the use of a standard calibrated *variable* inductance for use in the secondary circuit. The primary and secondary are first tuned to resonance with the unknown inductance in the secondary or primary circuit. The unknown inductance is then replaced by the variable standard inductance, and resonance again obtained. Clearly, the unknown inductance is equal to the final value of the variable standard inductance. In applying this method, which is very convenient in practice, the use of sliding contact variable inductances for the standard is not strongly recommended, because they are subject to a variety of defects, such as: short circuiting of adjacent turns by the slider, "dead-end" effects at certain frequencies due to their distributed capacity (see Article IV of this series, January, 1914, page 268), and uncertainty as to the exact point of contact. Generally some type of variometer inductance is preferable, for example, concentric coils wound on spherical surfaces and rotating one within the other. The only disadvantage of importance in this type is that the entire resistance of the inductance is in circuit even for small values of the inductance, which may give rise to high damping, particularly at short wave lengths.

All the methods described permit measuring the inductance at any desired wave length or frequency.

(b) ARRANGEMENT AND DESCRIPTION OF APPARATUS. In Fig. 46, a wiring diagram of the completely assembled apparatus is shown. The method of buzzer excitation of the primary circuit is one of a number which may be employed. Across the contact point of the buzzer E, which is fed by the battery B regulated by the resistance R, is placed the condenser C. The condenser C is of fairly large capacity, say

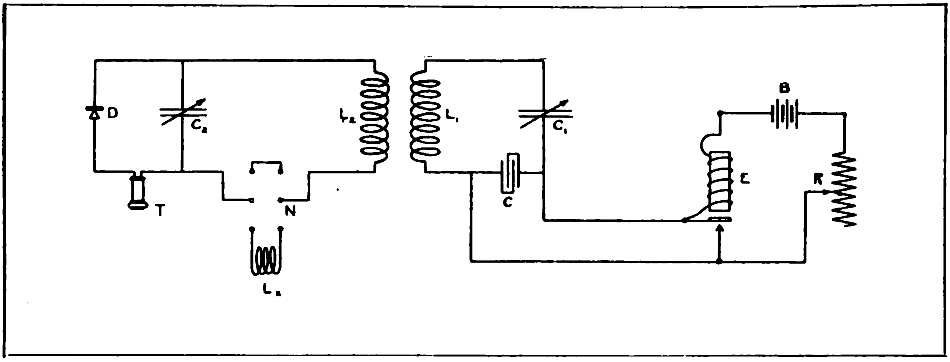


Fig. 46

2 microfarads. Its reactance for currents of frequency of 500,000 cycles per second is, therefore, about 0.15 ohm. In other words, it will not materially decrease the radio frequency current flowing in the primary circuit, L_1 C_1. (The reactance here given is calculated from Formula 11 of Article I of this series, October, 1913, page 57.) Let us further see to what extent it changes the capacity of the primary circuit; that is to say, what deviation from the value C_1 occurs in the primary circuit when C is inserted in series with it as indicated in the diagram. For this purpose we shall use Formula 10 of the article just cited. Suppose that C_1 is 0.00100 μf; and that C is 2 μf. Their combined capacity is found to be 0.0099995 μf. In other words, the percentage error thus produced is 0.05%, which is completely negligible. The method of buzzer excitation shown is one which gives steady results, because there is a minimum of injurious sparking at the contact points. The damping of the primary circuit is also kept at a small value. The primary and secondary are coupled *loosely* through the coils L_1 and L_2. The double throw switch N permits inserting the unknown inductance in the secondary circuit or of short circuiting the point of its insertion. Across the secondary condenser C_2, the detector D and the telephone receiver T are placed in series.

An alternative arrangement of circuits is shown in Fig. 47. As will be seen, the main battery current which feeds the buzzer passes through the inductance L_1 of the primary, and the variations in this buzzer current caused by the normal operation of the buzzer start the slight damped trains of free alternating current in the primary. The condenser C is shunted across the buzzer contact point to reduce sparking. The secondary circuit has also been altered in a minor detail. The condenser S (of about 0.05 μf.) has been placed in parallel with the telephone receiver. The sensitiveness of the arrangement is somewhat improved by the introduction of this condenser for reasons which are somewhat in dispute.

The photograph of Fig. 48 shows the actual apparatus which was used in the experiment. To the right is seen the box containing the high pitch "Lungen" buzzer and the controlling resistance R. The latter was a 12 ohm, 1 ampere battery rheostat of the Manhattan Electric Supply Co. The primary condenser (of approximate capacity 0.002 μf.) and the condenser C of 2. μf. are also visible. The coils L_1 and L_2 were the primary and secondary of a large receiving coupler. The coupling was readily varied by altering the angle between the planes of the coils, and the coupling was readily adjusted to an appropriately loose value. The inductance of the primary and secondary were respectively 0.164 millihenry and 0.238 millihenry (mhy). The unknown inductance was a single layer helix shown in the foreground at the left. The secondary capacity was also a 0.002 μf. air condenser. The detector (silicon), and the 2,000 ohm telephone receivers are to the left.

(c) PROCEDURE. Method (C), described above, was employed. First of all, the circuits were tuned to approximate resonance at fairly close coupling. The coupling was then made looser, until the only sound heard was just at the resonance point. The capacity C_2' was then noted. L_x was then inserted in the secondary circuit; and keeping the primary circuit unchanged, C_2 was varied until resonance was again obtained, the value of C_2'' being then noted. It is desirable that the value of C_2' shall fall on the upper part of its scale, say about 160°, so that the scale readings may be accurately made. It is also desirable that the detector adjustment shall not be altered during a measurement, and that the detector shall be adjusted for maximum sensitiveness (so as to permit very loose coupling).

(d) ERRORS OF THE METHOD, THEIR ELIMINATION, AND PROBABLE ACCURACY. The presence of the detector and telephone across the secondary condenser make the equation used for calculating L_x slightly inaccurate. It can, however, be shown that if the detector and telephone are both of high resistance, the error thus introduced is not serious. It is further to be noted that if the inductances of any of the circuits have a high resistance, and therefore introduce considerable damping into these circuits, the accuracy of the measurement will be much decreased.

A simple measurement follows:

$L_1 = 0.164$ mhy. $L_2 = 0.238$ mhy.
$C_1 = 0.00184$ μf.
$C_2' = 0.001260 \pm 0.000005$ μf.
$C_2'' = 0.000868 \pm 0.000005$ μf.
$L_x = 0.139 \pm 0.001$ mhy.
Probable Error = 1.%

It will be seen that this measurement was carried out at a frequency corresponding to a wave length of 1035 meters.

As a practical, and highly useful example of an inductance measurement, we shall consider the measurement of the inductance and capacity of an antenna near the fundamental frequency. This will differ from the so-called static capacity of the antenna to ground, because the distribution of current and potential along the antenna is non-uniform when free alternating currents are present in it. In consequence, the effective capacity of the antenna will be less than the calculated capacity of the antenna regarded merely as one side of a condenser, the other side of which is the earth; the higher portions of the antenna contributing more in proportion to the total effective capacity than might be expected. We shall, therefore, consider a method for finding the effective inductance of the antenna.

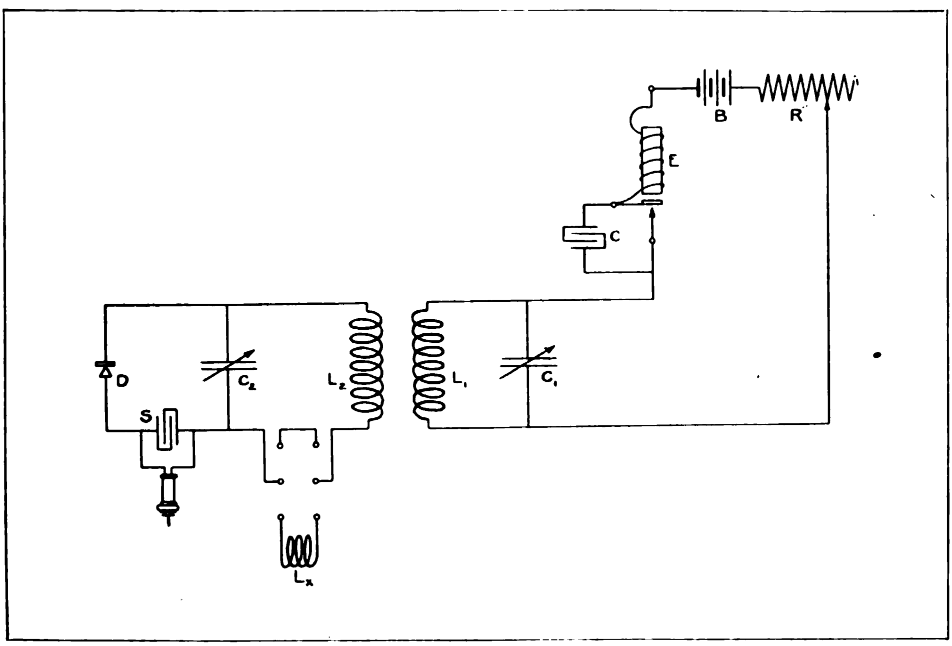


Fig. 47

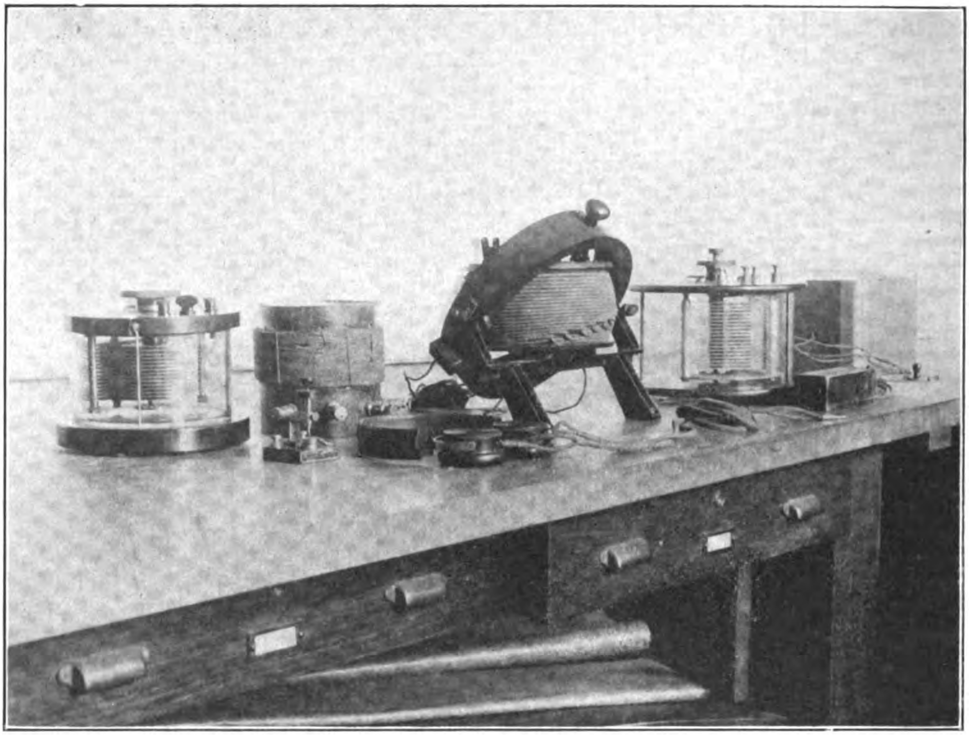


Fig. 48

Section 24. MEASUREMENT OF INDUCTANCE OF ANTENNA AT RADIO FREQUENCY AND LOW VOLTAGE, USING THE SERIES INDUCTANCE METHOD (near the fundamental wave length). Inasmuch as the capacity for energy storage of an antenna is dependent on its electrostatic capacity, it becomes of importance to be able to determine this quantity with some precision. A difficulty at once arises, because the capacity in which we are interested is not its capacity for a static (that is, stationary) electric charge, but rather its *effective capacity* relative to the ground when there is present in it a rapidly alternating potential and current. The capacity for a stationary charge and the effective capacity at radio frequencies are not the same quantity, as the following considerations will show. The distribution of potential along an antenna is by no means uniform when there is flowing a radio frequency current. In fact, at the bottom of the antenna the potential is zero, and at the top it reaches a maximum value. In consequence, the portion of the total (distributed) capacity which is contributed by the upper parts of the antenna is relatively greater than when a stationary charge is being considered. Since we define the effective capacity of the antenna at a wave length λ by the equation

$$C = \frac{\lambda^2}{36\pi^2(10)^{16}L}$$

it is evident that we must obtain the quantities λ and L before we can determine C. In the above equation, λ is expressed in meters, and L, the effective inductance, in henrys. The capacity will be given in farads. Relative to the non-uniform distribution of potential along the radiating antenna, the experimenter is again referred to the discussion on the effects of distributed capacity as given in Article IV of this series, January, 1914, page 268 and Fig. 19.

(a) THEORY. Let us regard the antenna as a closed circuit of inductance L_1 and capacity C_1 at the fundamental wave length, λ_1, excited by a source of radio frequency energy at A (Fig. 49). In series with the antenna may be placed the inductances L_1' or L_1'', as indicated. Coupled loosely to the antenna is a secondary receiving circuit (or wave meter). This latter is the circuit $L_2 C_2$, the indicator being I. Let us assume that the resistance of the indicator is sufficiently high to permit regarding the secondary circuit as a simple circuit of inductance L_2 and capacity C_2. Suppose that this secondary circuit is in resonance with the antenna circuit with no inductance inserted. Then we have

$$L_f C_f = L_2 C_2 \qquad \text{(A) and}$$
$$\lambda = 6\pi (10)^8 \sqrt{L_2 C_2}, \qquad \text{(B)}$$

the wave length being expressed in meters, the inductance in henrys, and the capacity in farads. Now insert the additional inductance L_1' in the antenna circuit. If the new setting of C_2 is C_2', and the corresponding wave length λ', we will have

$$(L_f + L_1') C_f = L_2 C_2' \qquad \text{(C) and}$$
$$\lambda' = 6\pi (10)^8 \sqrt{L_2 C_2'}. \qquad \text{(D)}$$

A third inductance, L_2'', is now inserted in the antenna circuit instead of L_2', and the corresponding secondary capacity and wave length are C_2'' and λ''. The relations that hold are

$$(L_f + L_1'') C_f = L_2 C_2'' \qquad \text{(E) and}$$
$$\lambda'' = 6\pi (10)^8 \sqrt{L_2 C_2''} \qquad \text{(F).}$$

By a simple algebraic process of elimination between equations (A), (C), and (E), we obtain

$$C_f = \frac{L_2(C_2'' - C_2')}{L_1'' - L_1'} \qquad \text{(G)}$$

and

$$L_f = \frac{C_2\ (L_1'' - L_1')}{(C_2'' - C_2')} \qquad \text{(H)}$$

Similarly, if we eliminate L_f from equations (A) through (E), we get

$$C_f = \frac{\lambda''^2 - \lambda'^2}{36\pi^2 (10)^{16} (L_1'' - L_1')} \qquad \text{(I)}$$

and

$$L_f = \frac{\lambda^2\ (L_1'' - L_1')}{\lambda''^2 - \lambda'^2} \qquad \text{(J)}$$

Equations (I) and (J) enable us to substitute a calibrated wave meter of the usual type for the secondary circuit employed here, and do not require any knowledge of the secondary capacity and inductance themselves.

It is to be noted that the values of C_f and L_f which are found by the above method are not strictly accurate, because in equations (C) and (E) we have assumed that C_f remained constant as the wave length was changed. This, however, is not the case. By working at wave lengths near the fundamental, this error is reduced to a minimum.

If we take a series of such observations, varying the inserted inductance gradually from small values to fairly large values, we will obtain a series of values of C_f. If these values are nearly equal throughout a wide range of wave lengths, the antenna is behaving like a closed circuit, and not radiating particularly well (under usual conditions), but if these values are widely different, the antenna is behaving more like an ideal open oscillator.

(b) ARRANGEMENT AND DESCRIPTION OF APPARATUS. In Fig. 50, the wiring diagram of the apparatus as actually used is shown. Here GEF is the buzzer exciting circuit. Across the contact point of the buzzer is placed the capacity A, which serves as the method of charging and discharging the antenna. If A is a large capacity (say 2 μf.), its effect on the tuning of the antenna will be negligible as shown in the preceding measurement of this article. B is the antenna, and L_1' or L_1'' the additional inductance which is to be inserted

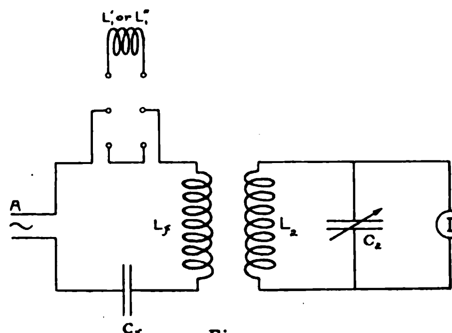


Fig. 49

in the antenna. L_c is a small coupling inductance, which may consist of a turn or two of wire placed near L_2, the secondary inductance. As usual, D is a crystal rectifier and T a high resistance telephone receiver.

In the experiment, G was a small, high-pitch "Lungen" buzzer, F a 12 ohm

1 ampere "battery rheostat," A a 2 μf. No. 21-D Western Electric condenser, and L_1' an inductance of heavy wire variable in steps between 2.5 and 67.0 μhy. (1 μhy. = 0.000001 hy.). One of the antennæ of the laboratory was used. It had an inverted "L" form, highest point about 180 feet (55 meters), running slightly downward about 200 feet to a height of about 120 feet, and thence dropping at a steep angle for about 200 feet to the laboratory. Because of the comparative closeness to it of certain portions of the building, its capacity and fundamental wave length were somewhat larger than might otherwise be anticipated. The coil L_2 was a single layer helix of inductance 192. μhy. C_2 was a calibrated variable capacity, of maximum capacity 0.0020 μf. The detector, D, was an ordinary silicon detector, and the telephones were 2,000 ohm double head band receivers. The ground connection, H, consisted of about 20 stranded wires (each 7 strands of No. 22 phosphor bronze), which were attached to water and steam pipes and buried conductors.

(c) PROCEDURE. With no additional inductance in the antenna, the antenna was excited by the buzzer, and the fundamental wave length (or the capacity C_2 corresponding to it) was determined in the secondary circuit. In making this measurement care was taken to have the coupling between L_e and L_2 as loose as was consistent with securing a clear, sharp, maximum sound point in the telephones. The coupling was sufficiently loose, as was shown by the simple test of making it somewhat closer. When this was done, it was found that the position of the point of maximum sound was not altered by the increase in coupling.

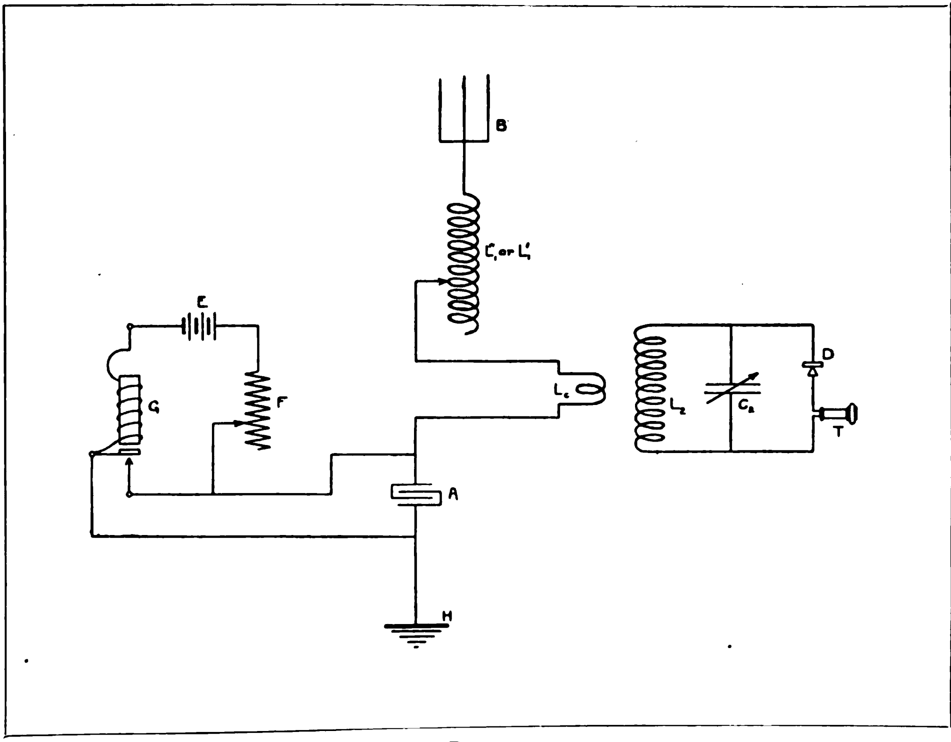


Fig. 50

The additional known inductances L_1' and L_1'' were then inserted, and the corresponding values of the secondary capacity (or of the wave length) were recorded for the resonance position, exactly as before. It was found that the coupling between L_e and L_2 had to be altered slightly for accurate work as the inserted inductance in the antenna circuit was varied.

(d) ERRORS OF THE METHOD, THEIR ELIMINATION, AND PROBABLE ACCURACY. Attention has already been called to the most serious theoretical error in this measurement, namely, that resulting from the varying distribution of current and potential along the antenna as the wave length is altered, that is, the error resulting from the presence in the antenna of distributed inductance. It is not possible to eliminate this error directly, though it may be minimized as indicated.

Slight errors are also introduced by the presence in the antenna of L_0 and A, but these errors may easily be kept very small.

As examples of a sample measurement, the results given below will be of interest. $L_2 = 1.92(10)^{-4}$ hy. At fundamental of antenna, $C_2 = 5.2\ (10)^{-10}$ f. λ F = 595 meters.

The effective capacity was determined at wave lengths between 620 and 903 meters. The average was $C_1 = 0.00166 \pm 0.00018\ \mu$f. and for L_1, $L_1 = 6.0(10)^{-5}$ hy. The average error was therefore apparently 10%. Actually it was less than that, the discrepancy between individual readings being due to the influence of certain metallic conductors in the neighborhood of the antenna rather than to inaccurate measurement.

This is the eighth article by Dr. Goldsmith, in a series on the engineering measurements of radio-telegraphy. The ninth will appear in an early issue.

WIRELESS APPEAL FOR THE BLIND

Forty-five vessels on the Atlantic received King George's wireless appeal on behalf of the National Institute for the Blind sent out by the Marconi Company from Poldhu at midnight on Saturday, March 28.

From the forty-five ships the message sped onward to all ships with wireless that sail the sea. It was repeated to North Sea trawlers, to great merchantmen, and to humbler craft that ply from port to port.

The Lord Mayor's fund in support of the National Institute for the Blind now amounts to $50,000.

THE ECLIPSE AND WIRELESS TELEGRAPHY

The total eclipse of the sun on August 21 will give excellent opportunities for observing the effect of light and darkness upon wireless telegraphy. From Greenland across Norway, Sweden, Russia and Persia to the mouths of the Indus the eclipse will be total. The total eclipse will last a little more than two minutes in Russia. A bulletin issued by the British Association for the Advancement of Science points out the advantages of scientific study during the eclipse. It is likely that the propagation of signal-bearing waves through the air in the umbra and penumbra will obey laws different respecting absorption and refraction from those obeyed in illuminated air. There may be a difference in the strength, frequency and character of natural electric waves and of atmospheric discharges. An investigation of the propagation of signals across the umbra will necessitate the arrangement of wireless telegraph stations on either side of the central line of the eclipse to transmit signals at intervals while the umbra passes between them. Before, during and after totality, therefore, it is desirable that the Scandinavian and Russian stations should transmit frequently throughout several minutes. The stations, with the exception of those in proximity to the central line, should try to keep a detailed record of the variations of signals during the eclipse. Between ten o'clock in the morning and three o'clock in the afternoon, Greenwich time, European stations west of the central line, and stations in the Mediterranean and Asia Minor may discover noticeable changes in the strength of signals, particularly long-distance signals; in the afternoon it is likely that the stations in India and East Africa and ships in the Indian Ocean may feel the effects of the penumbra. Eastern Canadian and United States fixed stations and vessels in the Atlantic, will, it is likely, be affected by the penumbra in the morning. The eclipse (partial) is at its greatest at eight minutes to four o'clock in the morning, standard time. Those possessing the required facilities who are willing to make observations during the eclipse are requested to communicate with Dr. W. Eccles, University College, London, W. C.

Chasing a Title

Enid

A Fiction Story

By JAMES W. VALANDI

IN a whirl of dust and a clatter of pebbles that rained against the sheet iron sides of the pier buildings the big red runabout came to a halt at the entrance. The driver fairly catapulted from his seat before the roaring of the motor had ceased and dashed down the long dark reaches toward the openings that let in a view of the river and the light of a misty morning. At the first opening he stopped abruptly in his tracks. The big liner Ostentacia was swinging slowly out into the stream amid shrilling of tugs and waving of handkerchiefs.

He sat down suddenly on a near-by cotton bale and gazed helplessly at the huge vessel slowly moving toward the harbor. Too late. John Farrish groaned aloud. By the rail he could dimly discern the cause of his perturbation, Enid Flower, and two auxiliary causes, the austere yet motherly Mrs. Flower—and the Duke. Farrish gritted his teeth. For most dukes he had a distinct aversion; for this one, a supreme contempt. Not that he had ever met him; his condemnation was assured by the mere fact that the title had an undisputed charm for femininity in general and Mrs. Flower in particular. Then, too, this Harold de Brentan duke person was the cause of all the trouble.

Mrs. Flower had objected from the beginning to John's attachment to Enid, but it looked as if time would overcome this. Then came the duke. Papa Flower told John shortly afterward that Enid was too young to marry, and Mama Flower told John that he was, too. The young couple voted this parental reasoning absurd, of course, and impetuous John Farrish proposed an elopement. At the time they were speeding in the red runabout and it was but a few miles to the Connecticut state line. In a moment of what might be termed auto-intoxication Enid had tacitly consented and the roadster was headed toward Greenwich. But John was a man of honor and at the last minute his saner judgment prevailed.

"No, Enid, dear," he put it, "I'll fight for you in the open. I will win your mother's consent this very night." The machine was turned back to New York.

Enid had not replied, but, nestled down in the cushions as they spun back through the wooded roads, wafted an enigmatical smile to her suitor. As sweet as love could make a miss of nineteen was Enid Flower, a picture of girlish charm, winsome and demure, with blue eyes and hair of burnished copper.

She bade him good-by at the door, a little less lovingly than he had reason to expect, but John blithesomely prepared for the breaking down of barriers that evening. He had not counted on all the twists and kinks of strategy in the hands of a managing mama, however. Tall, broad-shouldered and direct thinking, he overestimated his powers in the game of love. He did not reach Mrs. Flower that evening; she had a dinner engagement.

The morning papers revealed what he was certain was the reason, and he repented bitterly his chivalry of the previous afternoon. At the breakfast table his eye chanced on a paragraph that threw a flood of light on the situation. It ran: "The Duke de Brentan, who was the guest of honor at a dinner given last evening by Mrs. Henry Flower at Port's, sails to-day for London."

Farrish growled something about being sidetracked for a duke, and found little consolation in the titled impediment's departure. The fiasco of the night before stuck in his mind and at the bank he was ready for anything but figures. After an hour, in sheer desperation of spirit, he called up the Flower home. The butler answered the telephone.

"Miss Enid, please," requested John.

"Miss Enid?" The butler's tone betrayed surprise. "Why, both Mrs. Flower and Miss Enid are sailing at eleven!"

"At eleven?" he gasped; "where, on what?"

"On the Ostentacia, for London," came the reply, and the conversation terminated abruptly with the click of John's receiver hook.

His watch showed him that it was then seven minutes to eleven. John dashed down the steps, cranked up the roadster and taking the corner on two wheels broke all speed regulations on a dash northward through the crowded streets.

But he was too late. There, out in the middle of the Hudson, the Ostentacia was already kicking up a froth at the stern and moving slowly downstream. Seated on the pier the whole thing flashed through his mind in an instant. The parental objections were revealed to him in their true light—and Enid was complaisant to the nefarious scheme! Perhaps that was why . . . but maybe she wasn't? She might be an unwilling participant in the plot!

"I'll beat them yet," murmured Farrish as he sprang to his feet, wheeled about and dashed down the pier. He leaped into the throbbing machine, opened the throttle and shot into high amid a grinding of gears. The motor snorted and the car fairly jumped from the ground. Dodging lumbering trucks and street cars he skilfully swung around a few street corners, made a wild dash straightaway and pulled up in front of the White Line offices.

His memory had not played him false! The express steamer Atlanticus was due to sail late that night.

"Give me a stateroom," he demanded of the clerk, "one on the first promenade deck, if possible."

The clerk shook his head. "Sorry; promenade or any other deck, I can give you nothing. Every stateroom is taken. Not a thing left. Now, next week on the——"

"Never mind about next week," he interrupted breathlessly; "find me something—anything—for *this trip* on the Atlanticus. I am Abner Farrish's son——"

"Oh, in that case, I dare say the purser can make some arrangement, Mr. Farrish," stuttered the wide-eyed clerk. "Come aboard before midnight and he'll manage to fix you up somehow, I am sure."

"Right-o!" called John over his shoulder as he dashed down the steps.

That night found Farrish on the deck of the fast trans-Atlantic liner, pointing her nose through the Narrows and heading for the open sea. He watched the receding lights of the city for a time, then sought consolation in the smoking saloon. But his thoughts were anywhere but with the animated groups about him. The bridge players, all of them, and particularly the one with the watery blue eyes at the next table, irritated him. The book readers annoyed him, too; they were so complacent in the midst of a veritable catastrophe. Thoroughly disgruntled, he went below early. The next morning when he awoke the great leviathan was plowing her way through the even swells of the broad Atlantic.

He scanned the horizon but found no trace of the Ostentacia. A faint smudge of smoke held out hope for a while, but inquiry of the deck steward dissolved that; the Ostentacia was twelve hours ahead and making good time. The day was clear and the air invigorating; before noon Farrish was feeling more cheerful. "We'll beat them yet," he thought. "Gee, I wish I could believe in that blooming mental telepathy they talk about. There must be something in it, at that. Why—hello!" The exclamation was occasioned by a sput, snap, crack! overhead. He glanced aloft; the wireless was working. "The very thing!" he murmured.

He almost fell down the steps to that

purser's office. He found that functionary studying room schedules and checking tickets.

"Oh, purser," he burst out, "can I send a marconigram—in a hurry?"

"Nothing to prevent it, sir," was the answer; "the blanks are right at your elbow. Hope there's nothing wrong."

"Everything's wrong," breathlessly announced Farrish, as he commenced scribbling. "Find out, please, if the operator can get the Ostentacia."

"He'll pick her up easily," responded the purser. "Your message?"

"Here you are."

On the pad was written:

> Enid Flower, S.S. Ostentacia: I am aboard the Atlanticus. I know that duke person is with you. Answer.—Jack.

"I guess that will be a bomb in camp," he mumbled as he strolled into the smoking saloon, much relieved. Everything looked better, he thought, as he found himself again seated at the table adjoining one at which the watery-eyed obsession of the night before was playing cards. My! how he had hated the sight of that person the night before. And for no reason. How silly to let one's nerves jump off at a tangent. Ruminating on the possible effect of the marconigram, he began to enjoy his surroundings; and casual inspection of the adjacent poker game gradually developed into close interest as he noted that he of the fishy eyes was winning steadily. The others took their ill-fortune good-naturedly, particularly a rather distinguished-looking foreigner who sat opposite and evinced more interest in the regularity of the arrival of his brandy and soda than in the game. He was carrying more than his share of the losses, too, and Farrish mentally observed that here at last was true sport.

A steward came through, calling John's name. At a nod the man brought him a marconigram. He tore open the enve'ope and read:

> What if the duke is with us? Pleasant voyage.—Enid.

"Confound him!" John exploded. "I'll spoil his face—that's what!" Rushing to the purser's office he wrote:

> Enid Flower, Ostentacia: I will challenge him to a duel the minute he steps off the gangplank at Fishguard.—Jack.

"Pretty spectacle I'll make of that lovely ladies' man," thought Farrish, returning to the smoking saloon. Dropping in his old seat his attention was riveted for an instant on the poker game. The watery-eyed individual was dealing and his deft handling of the cards fascinated him. The play went on and the good-humored foreigner played with characteristic abandon. When the call came he proved to be a heavy loser. He smiled carelessly and settled for the pot.

Just then, another marconigram was handed to Farrish. It read:

> Did you bring your foils along? —Enid.

John scribbled on the envelope:

> I will fight him with my fists.—Jack.

"Send that," he said to the steward.

Out on deck, he paced up and down with a nervous step. The memories of days when they had driven together through the country made the present attitude of Enid doubly distressing. He thought of the many hours when hand in hand they had spoken their love and made plans for the future.

"Message, sir," the steward's voice interrupted.

> The Duke says he will tweak your nose, sir, when he meets you.—Enid.

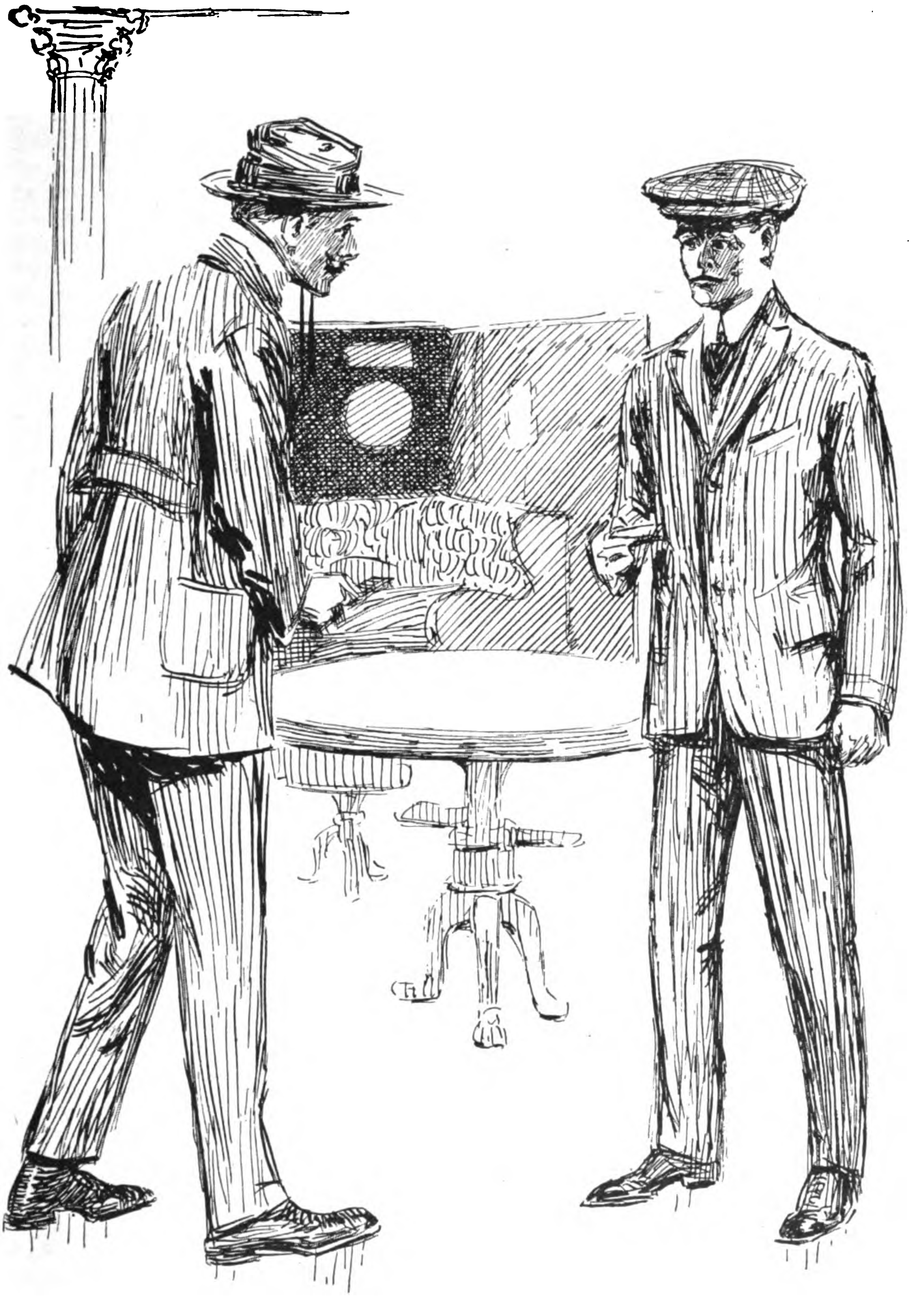
"He will, will he?" snapped John. "Well, he shall have the opportunity . . . the puppy! Here, steward!"

His reply read:

> The Duke de Brentan, Ostentacia: I will smash yours on sight.—John Farrish.

The steward scurried off. "Bah!" thought Farrish, "what's the use of wasting electricity on the fool?" He returned again to the smoking saloon.

It was an unhappy man that dropped into the seat. Fine pilgrimage, this. Out on the ocean, shooting wireless threats of violence through the air to a



"Well, Mr. Duke de Brentan—that is your name?"
"It is my title."

man he had never met. Not that that made any great difference. The nobleman was a scoundrel, it was certain; but this long-distance defiance was undignified, even childish. The trouble was he had made no definite plans. Acting on his first impulse he had boarded the only ocean liner with a record of swiftness that topped the ship which was carrying his sweetheart to a foreign shore. But, now, through his impetuousness, it was certain that Mrs. Flower was aware he was following. She would probably change her plans. The whole thing was a fine mess for him; he would have to rely on the newspapers reporting the progress of the party because of the real live duke in tow, and trail along as best he could.

At a muttered imprecation a man sitting alongside Farrish looked up. John was too busy with his own affairs, however, to notice his presence. The stranger, one of the players in the poker game who had dropped out for the moment, showed some concern as his neighbor continued muttering to himself.

"Pardon me, sir," he remarked, "you seem to be in trouble. May I venture to offer my assistance?"

Farrish looked up and flushed, conscious that he must have expressed his feelings in somewhat forcible language. He gave the stranger a blank stare.

"Bound for London?" the traveler inquired.

"Er, no; that is—yes. I may stop off there for a day or so," stuttered John.

"My card. I am well acquainted in the English metropolis, and perhaps—" the voice held a suggestion of solicitude.

John Farrish was enough of a cosmopolite not to be offended. He glanced at the pasteboard.

"Happy to make your acquaintance, Mr. Thomas," he announced. "And I thank you for your kindly intentions. My name is Farrish—John Farrish."

"Of Farrish & Co., by any chance?" queried the new acquaintance.

"My father is Abner Farrish."

"I know the firm well. We bank with you." Thomas stuck his hand out cordially. "You'd better join the game for an hour or so, old man," he added cheerily, "something is on your mind and it may do you good to forget all about it."

Introductions were mumbled in the usual vague way and John bowed abstractedly to the others. They played with varying fortunes until dinner time and continued the session later. The game grew monotonous after a time, for the phenomenal luck of the watery-eyed individual returned and the foreigner resumed his reckless betting and utter indifference to losses. As the hour grew late a consolation pot was suggested as a windup. It happened that the watery-eyed man held the deal. Thomas opened after the pot had been sweetened four times and the dealer raised. Everyone saw the raise and the game whip-sawed back and forth until all but two had dropped out. The draw was called and the foreigner took one. The watery-eyed plunger laid down his hand and dealt himself three cards, picking up two as he dealt, and glancing at them slyly. He then quietly picked up two from his discarded hand and announced a raise almost before the foreigner's bet had been pushed forward. The foreigner laughed and threw down his hand, jokingly remarking that he had failed to fill his flush. The watery-eyed one reached for the pot.

"Not so fast, there!" exclaimed John, "just hold on, Mr.—I've forgotten your name," looking straight at the winner.

"My name is Browning, sir," he said.

"Well, Mr. Browning," continued John, "I don't know much about cards, not half as much as you do, probably, but I know a double deal when I see it!"

Browning glared and put his hand over the chips.

"You mean that I have been cheating, young man—you are a liar!"

Farrish's right arm shot out and Browning toppled over. He struggled to his feet and made a rush toward his antagonist. The timely interference of the other players prevented a serious row. With an oath the fellow threw the money and chips on the table and left the room.

"Thank you, Mr. Farrish," said the foreigner. "You know I thought his luck most extraordinary, but I really suspected nothing. Outside of the crookedness, though, one hates to think of being fleeced by so old a trick. I admire your action, sir, I am quite sure I would not have had the courage of my convictions, had I discovered what was going on."

Drawing a card from a thin gold case, he presented it to John.

"Should be pleased to have you look me up in London, the St. Francis Club, you know," said the foreigner.

John glanced at the card. As he read the blood tingled and raced through his veins. It read:

Harold de Brentan

"Well, Mr. Duke de Brentan—that is your name?"

"It is my title."

"Yes, to be sure; I beg your pardon. But there is a Duke de Brentan traveling across the ocean this minute on the Ostentacia, with Mrs. Flower and her daughter, my fiancée—or at least she was my fiancée, and I hope she still is."

"You are joking."

"No, indeed. Never was more serious in my life."

"By jove, this sounds like a penny thriller. You're not a newspaper man?"

"No, I wish I were. I might ferret the thing out."

"Some mistake then, most likely. Have you ever seen this other—er, person?"

"From a distance only. But I know something of him; I've sent him a wireless message and challenged him to a duel."

The duke thought a moment and his expression changed.

"By jove, could it be my man Hoffman?"

"Your man?"

"Yes, he left me in Portland."

"The Flowers were in Portland last month!" exclaimed Farrish. "I'll wireless the captain of the Ostentacia and expose him. . . . And later I'll smash his face."

"With me as referee."

"The impostor! I'll get him!" continued John excitedly. "He has stolen your clothes, hasn't he? I'll get a message over to the London police and they'll nab him when he lands."

This was the marconigram sent from the Atlanticus before they turned in for the night:

> Wireless Captain Ostentacia: Arrest Hoffman, booked fraudulently as Duke de Brentan. Charge theft. Will appear against him when we make port. Observe secrecy. — Duke de Brentan.

Three days ater the duke handed John a message to read.

> Ostentacia reports man wanted not aboard.—Scotland Yard.

"Something wrong somewhere!" announced Farrish. "We'll resort to strategy." He took a message blank and wrote:

> Mrs. F. D. Flower, Ostentacia: John Farrish seriously ill, high fever. Requests you inform daughter.

"We'll sign my father's friend, Thomas', name to it; he won't mind," observed John.

All that afternoon and the following night John looked for an answer. None came. By the middle of the afternoon he could wait no longer. He filed this message with the purser:

> Enid Flower, Ostentacia: Enid, I love you. I am not ill. Other message was untrue. May I see you in London?—Jack.

He felt better when this message had been clicked off. He was happy; he could not tell exactly why, but his mind was relieved.

Ten minutes later the deck steward brought him his answer.

> John Farrish, Atlanticus: Dine with mother and me to-morrow night at the Savoy.—Enid.

* * *

"And so there wasn't any duke—real or bogus—aboard?" John laughed as he pressed Enid's hand under the table the following evening.

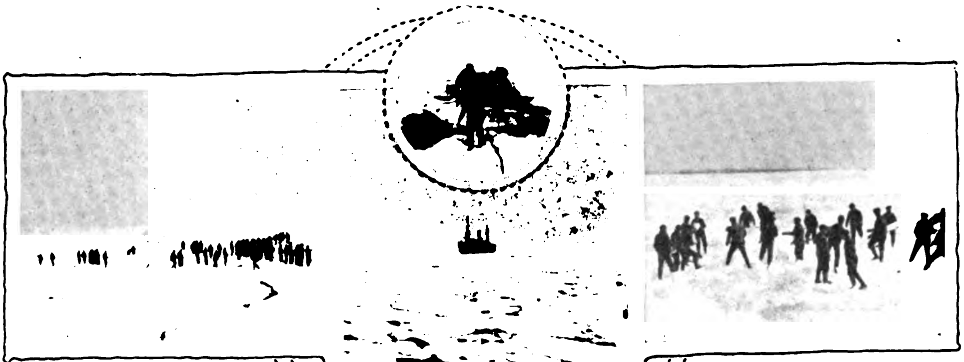
Enid smiled an affirmative.

"But why did you let your foolish suitor believe there was?" asked John.

"You, yourself, gave me the idea in that first message. And I thought there might as well be some one—I wanted to find out how much you really cared—and you seemed to think the Duke de Brentan was with us, and——"

But the laughter of the real Duke de Brentan, sitting at Mrs. Flower's right was so hearty the sentence remained unfinished.

Threescore Lost in the Arctic— Story Told by Wireless



Scenes of the sealer's life *in the Arctic icefields*

THE city of St. John's, N. F., was plunged into grief recently when more than a third of the crew of a sealing vessel which steamed from that port for the north lost their lives on the ice floes in the Arctic regions. For many hours the members of the ship's company wandered about on the frozen wastes, the majority succumbing to the cold and privations. In far away St. John's, where the unfortunate men had relatives and friends, the news of the disaster arrived by means of Marconi wireless telegraphy, having been transmitted to a coast radio station and then relayed via land lines. As the work of rescue proceeded, details concerning the casualty were flashed to the city, and when the ship carrying the dead and saved reached port, those on shore were practically in possession of the full story of the tragedy.

The sealing vessel Newfoundland left St. John's, N. F., on March 10 with a crew of 154 men and proceeded to Wesleyville where thirty-five more sealers were signed, making a total of 189. With Captain Wesley Kean in command, the Newfoundland left for the north on March 12 in company with other sealing vessels. On March 17, when the Newfoundland was off Cape Fogo, 250 old. seals were killed and stowed away.

All of the sealers left the ship at seven o'clock in the morning on Tuesday, March 31, when she was near the Strait of Belle Isle. They walked until they were out of sight of the craft, a distance of about fifteen miles. At half past eleven o'clock the men boarded the Stephano to obtain food. A heavy swell in the sea, accompanied by snow flurries, was noticed an hour afterward, but even then the weather glass did not indicate that a storm was approaching. However, some of the Newfoundland's crew hesitated about leaving the Stephano because of the snow flurries and heavy seas. At length they set out to reach a patch of seals two miles away and the Stephano steamed away to pick up a contingent of her own men who were on the ice.

Captain Abram Kean, the commander of the Stephano, was unable to find all his crew, but he received a wireless message from the Florizel, transmitted by the Marconi operator on the latter, that the missing men from the Stephano had boarded that ship. The Stephano, after taking these men on board, steamed back to within a mile of where the Newfoundland's crew were supposed to be. Captain Kean estimated that the Newfoundland's men would have walked that distance during the interval. There was no sign of the sealers, however, and Captain Kean assumed they had walked toward their own ship. The Stephano kept her whistle blowing all Tuesday night to attract any men who might be on the ice, and when none had reached the vessel up to noon Wednesday, those on board the Stephano fully believed the Newfoundland's crew had reached their own or some other ship before the storm became too severe.

It took the Newfoundland's men about ten minutes to walk from the Stephano to the seal patch. The seals were scarce, however, and only fifteen were killed. A decided change took place in the weather conditions about three o'clock in the afternoon, and the snow began falling heavily, although it was not cold. The men decided to make their way back to the Newfoundland, and started on a course which they expected would bring them to the vessel, expecting every minute to hear her whistle.

Nightfall, however, found them still struggling on. The wind then veered to the north and blew at a hurricane rate. The weather became intensely cold, too, and the less courageous ones among the crew began to express fears concerning their safety. It was impossible to see a yard ahead, but up to this time the men had kept together; now, some of them, exhausted by the buffeting of the storm, dropped out and were left behind, although their companions did their utmost to save them. When daylight came at least a dozen were missing or dead.

All the next day the storm continued and the death roll increased. Men of the crew who looked physically able to withstand the severest hardships succumbed to the cold and exhaustion; some, their minds weakened by their sufferings, danced on the ice until they fell exhausted. Others removed their boots, saying that it was "time to turn in," and fell dead the next minute; in one instance three men met death simultaneously in these circumstances.

The sealers spent the following night huddled behind a pinnacle of ice. Several of the men, declaring insanely that they were "going into the galley," stretched themselves out and died; others went to sleep and never awakened. Almost a score of men died during the n'ght.

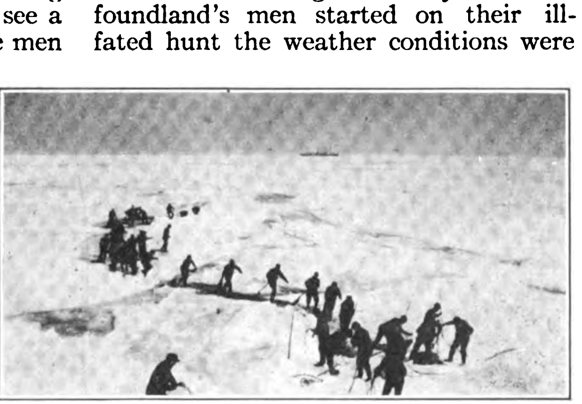
All suffered from lack of food and water. Eating snow relieved their thirst, but left their lips parched and dry. Toward daylight there was a change in the weather; the wind had abated somewhat, but the snow was still drifting and there was no relief from the bitter cold.

About daybreak the half-frozen band saw the steamship Bellaventure in the distance and made their way toward her; their progress was slow, the strongest of the men being unable to walk faster than a child. Before they had gone far, however, the crew of the Bellaventure saw them and came to their aid with food and medicines.

After a count of the living had been made, news of the misfortune was sent out by the wireless operator on the Bellaventure. A statement authorized by Colonial Secretary Bennett said that sixty-four men had perished, and thirty-seven had been rescued.

Captain Randell, of the Bellaventure, talked as follows about the disaster:

"On the morning of the day the Newfoundland's men started on their ill-fated hunt the weather conditions were



When a patch of seals is located a party of men go out over the ice, often miles away from their vessel; in the catastrophe described more than one hundred men were lost in a blinding blizzard not bad. The glass gave no indication of an approaching storm, and, seals being reported in the vicinity of the Newfoundland, it was not unreasonable for Captain Kean to have his full crew on the floe. That morning I had my men on the ice after a patch of old seals, but the seals were driven off, and the men returned to the ship. About noon the barometer indicated a likely storm, and it was snowing lightly, with the wind about S.E.

"By three o'clock in the afternoon the mild weather had given place to a regular blizzard, the wind blowing at hurricane force; but it was not intensely cold. As the day grew, so did the storm, though late in the afternoon there was a change for about one hour when the wind veered to westerly, making it very mild, and wet snow fell. Up to night the temperature was such as not to invite frost bite, but about that hour the wind suddenly chopped to the north, with intense violence, and the temperature fell to in the vicinity of zero.

"Wednesday morning showed no change, and the weather continued frosty. About noon Wednesday there was an abatement in the storm, and at two o'clock it ceased to snow. Even though these conditions were brought about by the change, there was a 'ground' drift on the ice, making it impossible for those on the ship to see men at any great distance, though the men on the ice would be able to see the ship, and yet be unable to reach or signal them.

"Wednesday afternoon the Bellaventure's men were on the ice and killed about 300 seals, and during this time we worked toward the Newfoundland.

"Thursday morning, soon after daylight, one of the men remarked that he saw a couple of men on the ice. When told I remarked that there must be a good patch of seals inside the Newfoundland, or Kean would not have his men out so early. A second report from the barrelman was the men were 'wobbling' about, and looked as if the men had been on the ice all night. The Bellaventure was then forced toward them, and some of them sent out to meet them. One of those sighted walked to the ship, and reported that he was from the Newfoundland's crew, and that more than 100 of them had been on the ice since Tuesday, and that many were dead.

"Full speed was put on the Bellaventure when the tragedy was made known, and our crew were sent out in relays with medicines, foods, stretchers, wood to light fires, and such things as would be of service in rescuing the survivors.

"The ice was so tight that progress was necessarily slow, but our men continued on, and rescued those who had outlived the storm in twos and threes, and brought them aboard.

"In the interim a second man from the Newfoundland walked to the Bellaventure and reported the death toll, even greater than the first. We continued at the work of rescue all day, our men assisting those who could walk to the Bellaventure, and those who could not were brought along on stretchers."

NEW LIGHTHOUSES ON THE FRENCH COAST

Wireless lighthouses are being established along the French coast, the first two being located on islands near the approach to the port of Brest. It is planned to erect two more for the port of Havre. The lighthouses will be operated by a system almost like that of ordinary lighthouses, except that, instead of light waves, wireless waves will give the information to approaching ships.

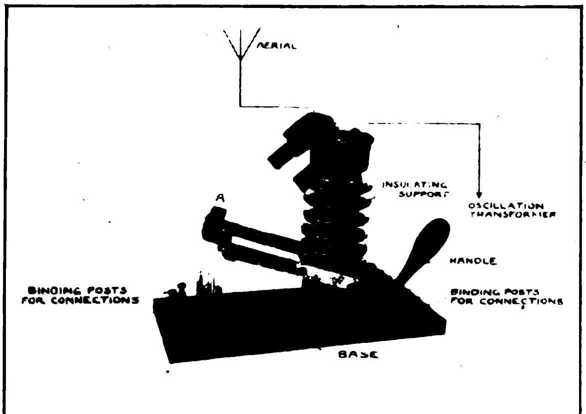
One of the advantages of the wireless lighhouses is that fog will not take away from their efficiency. When a ship approaches Brest and is within thirty miles of the islands, wireless signals will be picked up. If the vessel has an instrument to detect the direction from which the signals come it will be easy to apply the information; but even if it does not have such an instrument, the receipt of any signals at all will be of material aid, for the exact positions of the two lighthouses are known and a comparison of the strength of the signals from each will assist in estimating the ship's position.

Each station, like an ordinary lighthouse, will send out flashes every few seconds, together with special signals, to indicate which station is sending. The sending apparatus is automatic and is constructed so that it will run for thirty hours without any attention.

CHAPTER VIII

TO facilitate the operation of standard Marconi sets, an aerial transfer switch known as type "S" has been designed, with several new features added to the usual ones embodied in a switch of this type.

This device, shown photographically, consists essentially of a double-throw two-blade switch which, when thrown upward, places all apparatus in a receiving position and when pressed downward effects the proper connections for sending.



TYPE S AERIAL SWITCH

The use of the switch in connection with the new type 103 receiving tuner is shown in Fig. 26.

When the switch is thrown upward, the blade connected to lug 5 makes contact with the clip at binding post 1, thus connecting the antenna to the aerial post of the tuner.

The earth connection to the tuner is made through lug 6 and the blade to binding post 2, and thence through the transmitting oscillation transformer secondary to the earth.

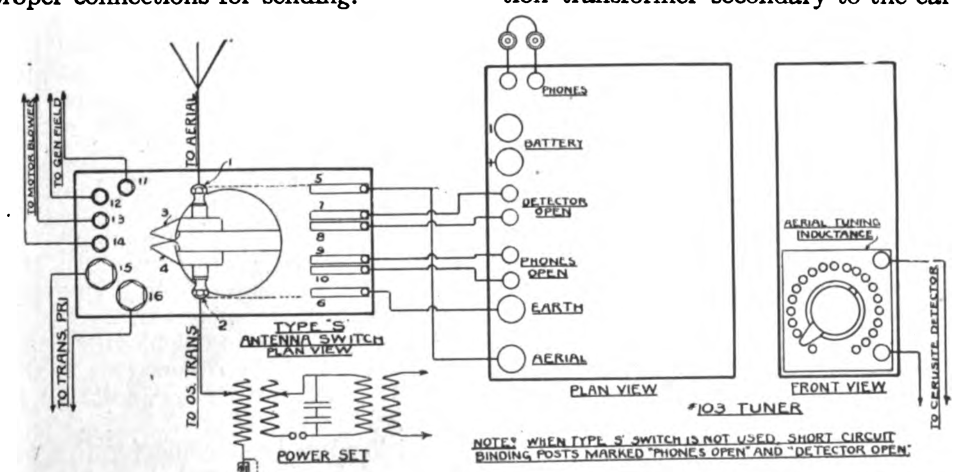


Fig. 26

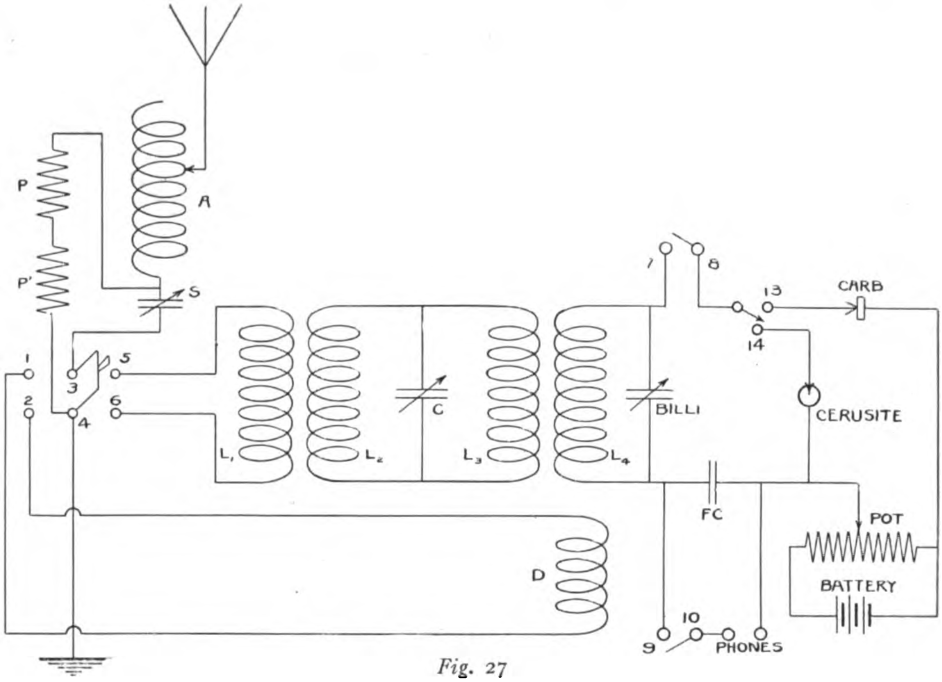


Fig. 27

Simultaneously, lugs 7 and 8 are connected together closing the circuit to the detector, and lugs 9 and 10 closing the circuit to the head telephones.

When receiving the oscillations are prevented from flowing to the earth through the transmitting oscillation transformer at spring contacts 3 and 4, for when the blades of the aerial switch are in an upright position a small fiber wedge mounted on the insulating bar (between the two blades) electrically separates contacts 3 and 4, causing the oscillations to pass to the earth through the receiving tuner.

It will be observed that when transmitting this construction eliminates the spark plate or anchor gap, the losses of which are productive of increased decrement of the emitted wave.

When the handle of the switch is pressed downward all apparatus is connected for transmitting, the contacts referred to are broken; contacts 3 and 4 are then joined, connecting the antenna wires directly to the transmitting oscillation transformer. Contacts 11 and 12 then close the circuits to the generator fields; simultaneouly 15 and 16 close the primary circuit to the transformer, while contacts 13 and 14 may be used to operate a blower or may be employed to close the circuit of any distant control switch which may be necessary in connection with the power equipment.

It has been found desirable to disconnect the generator fields while receiving, for in many cases should the motor generator be left in rotation without disconnecting the field windings of the generator, alternating current flowing through the instruments on the switchboard may set up by induction resulting in objectionable humming noises in the receiving telephones, seriously hindering the reception of weak signals. Additional protection is afforded by the elimination of all "live" circuits while signals are being received, thereby protecting the operator from shock due to accidental contact with any of the power wires.

Type 103 Tuner.

The receiving tuner (type 103), to which reference has been made, is a modification of the standard valve tuner using carborundum or cerusite as the detector, no provision having been made for the use of the Fleming valve. A plan view showing the external binding posts of this tuner and the connections to the type "S" aerial switch are indicated in Fig. 26.

Provision has been made for the use of the cerusite detector through connections made to the two binding posts issuing from the tuner just below the aerial tuning inductance.

The circuits of tuner 103 have been simplified as shown in Fig. 27. The aerial tuning inductance is indicated at A, the short wave condenser at S, and the protective chokes at P and P_1. A two-blade double-throw switch allows connection to either the stand-by or tuning circuits.

When thrown to the left the antenna and earth are connected through contacts 1 and 2 to special winding D, which in turn is closely coupled to the fixed inductance of the local circuit L_4.

When the switch is thrown to the right, winding L_1 is connected to the earth and antenna, causing the oscillations in the aerial circuit to act upon the detector circuit through the intermediate circuit comprising inductance L_2, variable condenser C and inductance L_3.

The circuit to either of the detectors, carborundum or cerusite, is opened up at binding posts 7 and 8. This circuit is closed by the type "S" aerial switch.

The telephone circuit is opened at binding posts 9 and 10. When receiving these contacts also are closed by the type "S" switch.

A single blade double-throw switch makes connection to contacts 13 and 14, allowing the use of either the cerusite or carborundum detectors. It is of interest to note that no local battery current is used when the cerusite is brought into action as it performs its functions without the use of auxiliary current.

When carborundum is employed as a receiving detector it is possible that certain crystals may be so mounted that when they are placed in the crystal holder the battery current flows in the wrong direction. In such cases the external connections to the battery binding

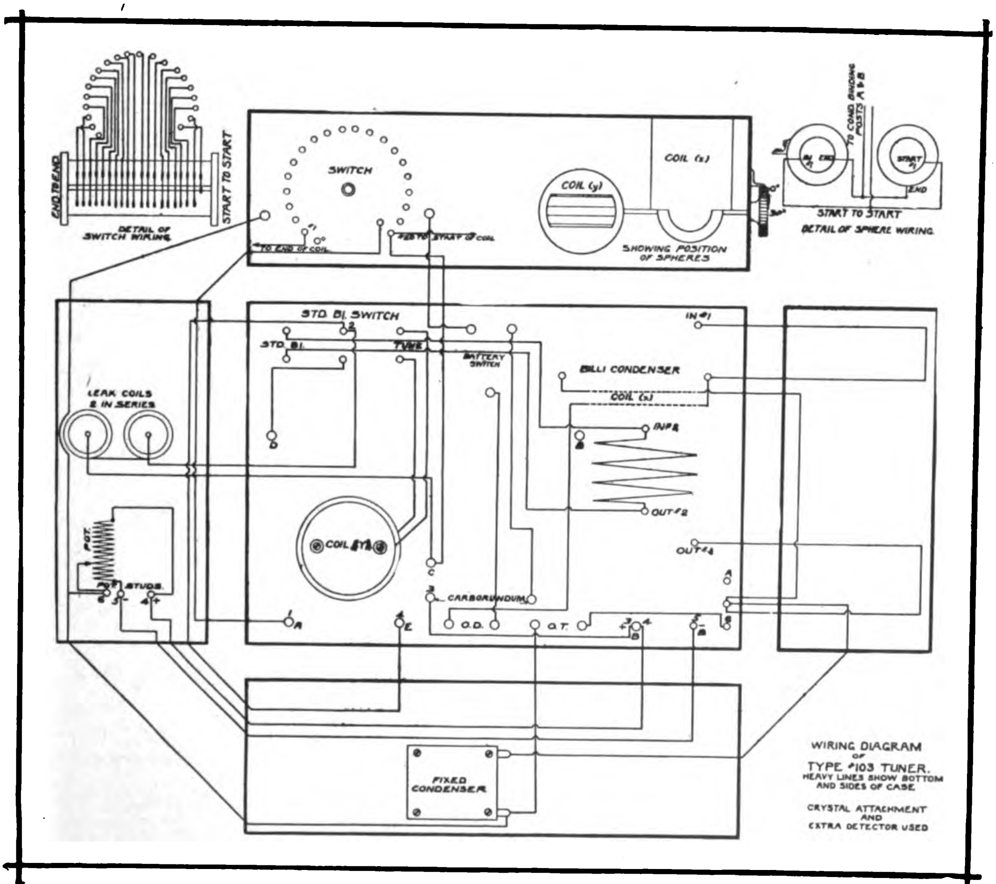


Fig. 28

posts should be reversed and a trial made while receiving weak signals from a distant transmitting station.

Fig. 28 is of interest because it shows the exact inside wiring of tuner 103 as it appears when viewed from the bottom of the tuner. This drawing is invaluable to the commercial operator, for in case of accident to the apparatus it may be referred to and the location of each wire be readily determined.

The operation and the use of the fundamental circuits of this receiving tuner are so well understood by the average Marconi commercial operator that detailed explanation should not be necessary. It is well, however, to keep in mind that when this tuner is used in connection with the type "S" aerial switch it is not necessary to raise the two blade double-throw switch (to the left of the tuner) to a vertical position for the protection of the circuits when transmitting, as the proper disconnections are effected by the auxiliary contacts on the type "S" aerial switch.

(*To be continued*)

THE INTERNATIONAL ICE PATROL

For the purpose of carrying on the International Ice Observation and Ice Patrol Service provided for by the recent London conference, the United States revenue cutters Seneca and Miami have been detailed for this service.

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 wireless 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 was scheduled to leave New York April 1 for this duty. Later she will be relieved by the Seneca, which has been performing ice observation service since February 19, 1914. During 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 will be exclusive of the 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. It is important that the patrol be continuous, and the vessel on patrol will not leave her station until relieved by the other vessel unless it is absolutely necessary to do so.

All time in wireless messages will be sent in seventy-fifth meridian time. Having located the ice, the patrol vessel will send the following daily wireless messages:

(*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.

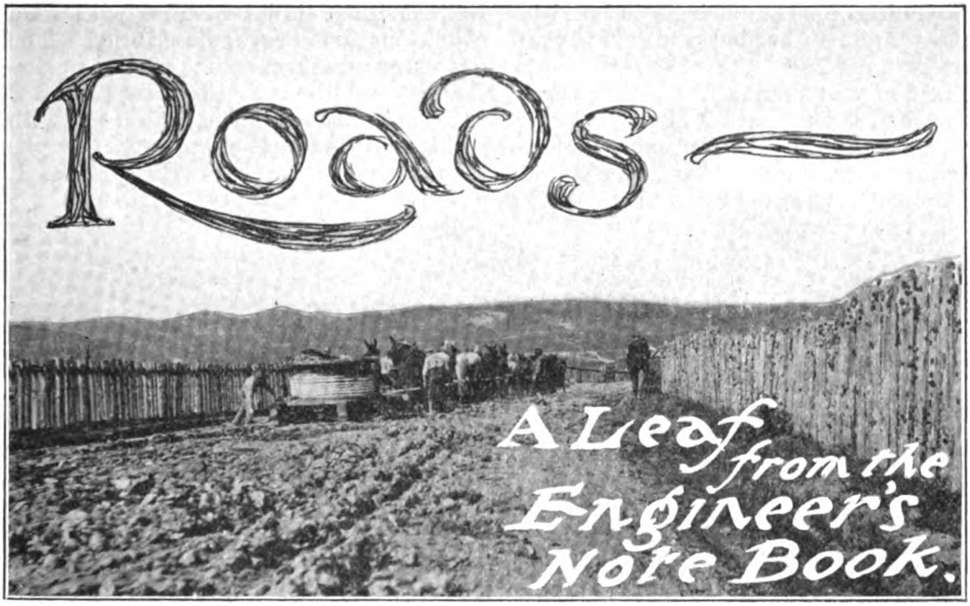
(*c*) At 4 a. m. (75th meridian time) a radiogram wi'l be sent to the Branch Hydrographic Office, New York City, through the nearest land radio stations, defining the ice danger zone, its southern limits, or other definite ice news. The telegraphic address of the Branch Hydrographic Office is "Hydrographic, New York."

(*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, etc.



IF anyone imagines that the construction of transoceanic wireless stations is a sinecure, that individual is mistaken. Not that many take this view; for, to the innocent bystander, the thousand and one blue-prints and the maze of figures attached to each little detail of apparatus and structural equipment appear very formidable. And they are, or rather, were, a source of no little psycho-agitation, expressed in mental gymnastics and burning of midnight oil, before resolving themselves into what we passively term the solution of an engineering problem.

Considerations of equal importance arise, however, which the outsider seldom appreciates. For instance, the transportation of the completed equipment to the particular location selected. And the ever-interesting detail of how to get there yourself, when you decide to see how things are being put together.

A little over a year ago I had the pleasure of personally selecting the property for the station at Bolinas, the transmitting unit of the high-power equipment to connect with Honolulu. I term it a pleasure because the broad view of the ocean from the high bluff, rough and rugged and descending sharply to the water's edge, alone compensated for the three thousand mile trip which preceded the purchase. Then, too, physical conditions were ideal from a wireless standpoint, which was unusual; and a glorious vista was thrown in, which was nothing short of unique. The roads forming the approach to the site were not so good, but neither were they as bad as some we had encountered in the past. Taking it all in all, the location was well favored and promised well.

A few weeks ago I made my inspection trip—and awakened. Jupiter Pluvius had entered into an alliance with California Mud and the result was unspeakable.

The first warning came shortly after I had forsaken the broad highways (and a commuter's home) in New Jersey and landed via the Overland Limited at Ogden, Utah. The cheery telegraph message bore the signature of our Pacific Coast General Superintendent and stated that there was serious doubt whether I would be able to get to Bolinas, owing to the condition of the roads. Making some rapid calculations I found that I could just connect with the Shasta Limited and by proceeding first to Seattle the roads would have a chance to get on their good behavior and dry out. Two or three days sufficed for the business in hand in Seattle and I headed south for San Francisco.

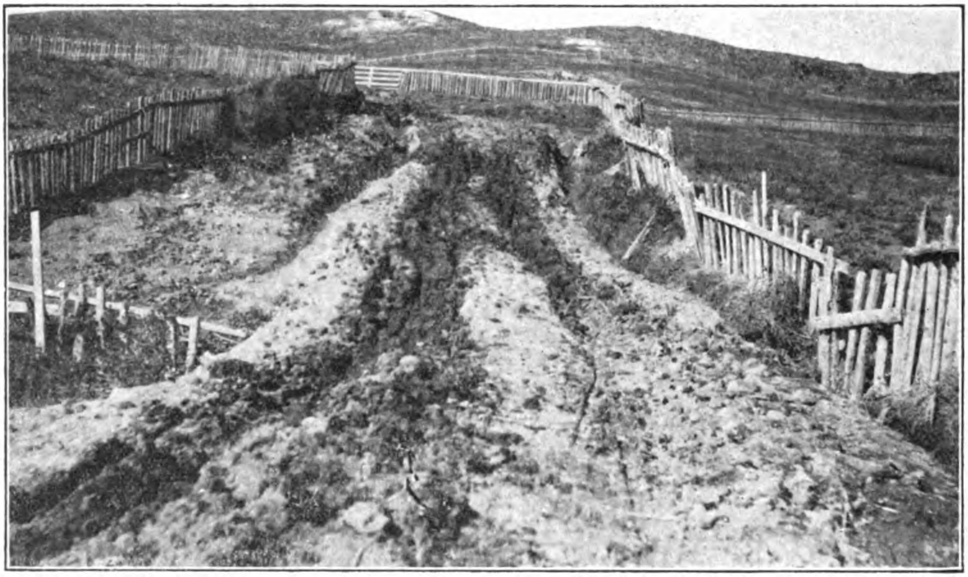
The sun was shining beautifully then, in fact had been for a couple of days, so the trip to Bolinas was arranged for the following day, in spite of the general superintendent's assurances that a successful journey was problematical.

Ferry and train transported us safely to the station at San Anselmo, where we were met by a six-cylinder Packard car, driven by our good friend Mr. Crane, of Crane & Langford, operators of the stage line to Bolinas. This was reassuring, for having driven many miles with both Mr. Crane and Mr. Langford I had a profound respect for their skill in wheel manipulation and knowledge of the roads.

Numerous hairbreadth escapes marked our journey across the mountains, but we eventually arrived intact at the point overlooking Bolinas Bay. To good fortune and careful driving is due the credit, however, for on several occasions the auto darted out of a deep rut or one of the numerous washouts and headed straight for the almost perpendicular hillside and the valley below.

Rounding the head of Bolinas Bay and arriving almost if not quite within the Bolinas town limits we met with road conditions that beggar description. The nearest comparison to one section in particular would be a southern swamp after a freshet—the mud was hub deep, with incidental logs and eucalyptus boughs thrown across in an effort to make it passable.

Up to this time our pilot had neither faltered nor hesitated in his careful negotiation of the road; but here he stopped. The question as to which side of the mud hole was the safer to attempt was determined with attendant scratching of head a few minutes later and we resigned ourselves to inactive participation in an extended battle between mud and motor. The Crane judgment was fortunately upheld and after a time our hubs emerged amid a churning of mud and grinding of gears.



The rate of speed at which we traveled never exceeded a mile an hour. In many places the road had been cut away by the action of the water and the wheels of the rig had but a scant inch or two of anything approaching solidity under them

This was Main street, we were told, and slowly proceeding down it we drew up just below the village smithy's shop. Here we were informed that we had gone as far as possible by automobile; a transfer to the waiting four-horse stage was necessary. As we climbed in this equipage we noticed in front of the smithy's shop a huge sled made of timbers and

In attempting to negotiate this road on wheels a wagon had sunk almost out of sight and the machinery skids rested on the normal road level. The machinery was eventually rescued by one of the sledges built by the village smithy and pulled along the road by sixteen mules

bound with iron runners. Inquiry disclosed the fact that it had been built to make possible the transportation of one of our heavy pieces of machinery over the road.

Our driver (it may be of interest to know that he was the Road Overseer) informed our tenderfoot party at the start that the journey of one mile to the Marconi trans-Pacific station would take about an hour. This surmise proved correct.

When we turned off the road that leads to our property, formerly known as the Ingerman Ranch, we progressed scarcely 100 yards before the horses were floundering in mud of the consistency of plum pudding before baking. The wagon lurched first to starboard and then to port, with the mud well over the forward hubs.

Adopting as a standard that so long as we could see the leaders' ears above the mud it was safe to stick to the ship, and coupling this with the driver's assurance that the wagon had a long gear we lurched along with surprising fortitude. Upon reflection, I feel certain that had we capsized the driver would have but placidly observed that the gear was not as long as he thought it was. As to just what a long gear is, I must confess ignorance; it was to be desired evidently, but I cannot say whether from the standpoint of increased power to buck the mud, or a shorter distance to fall if the rig tipped into the ditch.

Scarcely a quarter of a mile had been traversed when one of the horses tangled up his feet in the eucalyptus boughs (placed there by some kindly disposed individual in an effort to corduroy the road), stumbled and fell and floundered about in the mud. The harness alone kept the animal on the surface. It was distressing and our humane qualities were aroused. Yet there was nothing resembling an argument as to who should have the honor of extricating the noble animal and assisting him to his feet. After a period, the driver, assuming the rôle of a martyr, handed the reins to the writer and gingerly commenced operations. The traces were refractory and he finally had to cut the neck strap so the horse would have freedom to rise. But the animal displayed the much vaunted horse-sense and lay still for several minutes in the soft bed, no doubt debating on the futility of hastening to struggle to his feet to continue such a task. Then, being a horse, he struggled to his feet and with the harness repaired with a manila halter the journey was resumed.

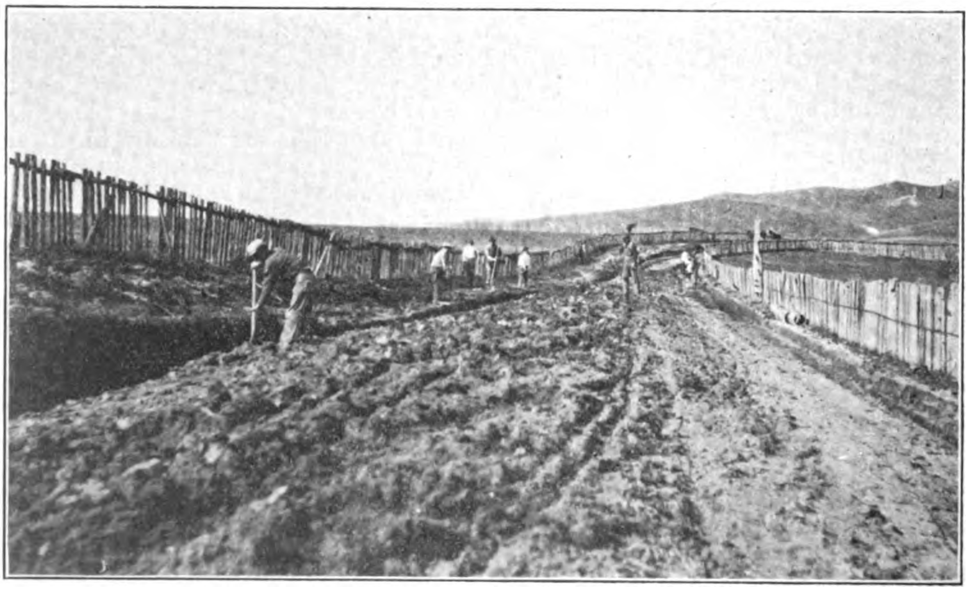
The rate of speed at which we traveled never exceeded a mile an hour. In many places the road had been cut away by the action of the water, now on one side, now on the other, occasionally on both, so that the wheels of the rig had but a scant inch or two of anything approaching solidity under them to support the conveyance in a horizontal position.

A half mile had been covered at the expiration of thirty or forty minutes when we encountered a section of road even worse than that which had gone before. All hands disembarked, clambered over a near-by fence and walked in the field, allowing the rig to lurch forward in its drunken way for another hundred yards or so.

Walking in the fields not being good, several members of the party returned to the wagon, willing to take the long chance of arriving some time at the Ingerman Ranch and the Marconi station. Our local engineer and myself were less adventurous than the others and preferred to strike out across country on foot; we arrived simultaneously with the wagon party, which was fairly recognizable; the horses, however, had taken on the appearance of hand-dipped chocolates.

Having enjoyed a good meal and made the inspection for which we had traveled 2,999 miles at an average speed of 50 miles an hour, and the 3,000th mile at one mile an hour, we again boarded, rather reluctantly, the conveyance which we had christened the good ship "Mudlark." Our journey back to town was a repetition of the experience outward bound, except that we discovered even a worse place directly in front of the Ingerman Ranch house. Here, it is no exaggeration to state, the horses, like Dr. Foster of the nursery rhyme, "stepped in a puddle up to their middle and (let us hope) never went there again." The front wheels disappeared entirely from sight, but fortunately the viscosity of the mixture was not so great that it refused to release us, as we feared. A few vigorous strokes of the whip and good coöperative work between horses and driver served to pull us safely through, to our great relief.

About halfway back to town we passed one of our teams struggling with an iron girder weighing perhaps a couple of tons, an essential part to the continuation of the work immediately in hand. It had been placed on two sledges and with four horses tugging and straining was hitching along the road a few feet at a time. To pass this party in distress necessitated some careful maneuvering; at the imminent risk of capsizing we lurched forward into the ditch and back again on to the apology of a road and rocked our way onward. Strewn along the—let us call it a road, anyhow—could be seen, first



Rebuilding the road between Bolinas and the Marconi trans-oceanic station in California to right and then to left, not only steelwork and building material, but groceries; sacks of potatoes, flour and what not had been temporarily abandoned to lighten the load of some unfortunate teamster, who trusted to luck that some less heavily burdened Samaritan would pick them up and carry them to their destination.

A sigh of relief arose as we reached the junction and made the transfer to the waiting automobile.

As we were preparing to start three rigs hove in sight, two with six horses each and the other with four, pulling about a ton of steel apiece. The drivers informed us that they had been on the road 38 hours, en route from St. Reyes to Bolinas, a distance of approximately 25 miles. Further inquiry disclosed the fact that in attempting to negotiate this same road on wheels a somewhat heavier piece had sunk to a point where the wagon was almost out of sight and the machinery skids rested on the normal road level. With one of the sledges built by the village smithy this piece of machinery had eventually been rescued and pulled along the road by sixteen mules. Even then it had been found impossible to negotiate the remaining mile we had just traversed and the machinery was being stored in a barn for several weeks—so near and yet so far from its destination.

Aside from the question of the delay and the addition of another problem to the engineers' many, there is no excuse for these conditions. You hear a lot of, and from, California's sons praising the glories of their home state. Surely a spot such as Bolinas—of all the scenes in California not one exceeds in beauty that view of Bolinas Bay, the town nestled on its westward shore and the beautiful expanse of the Pacific with the Faralons on the horizon—no place, I repeat, is more entitled to good roads. The residents should institute a systematic campaign for them. People from all over the country will certainly want to see the huge Marconi trans-Pacific station we have built. If on their first trip they find the roads in the condition we found them in January they will never come again. On the other hand, with reasonably good highways Bolinas may soon become an objective point for thousands of residents and tourists.

SERVICE ITEMS

Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, and William W. Bradfield, general manager of the English Marconi Company, left for England on the steamship Mauretania on April 7. Mr. Bradfield, who spent two weeks in this country, inspected the new Marconi trans-Atlantic stations at Belmar and New Brunswick, N. J., during his visit.

* * *

Lee Lemon has been appointed commercial representative of the Marconi Wireless Telegraph Company of America with headquarters in the Webster building, Chicago, Ill. He will direct the activities of a corps of assistants who will be located in all the larger cities of the middle West. Mr. Lemon has had a wide experience in the operating and executive branches of telegraphy, having been employed at various times by the Western Union and Postal Telegraph companies and the Baltimore and Ohio Telegraph Company. At one time he was superintendent of the fire and police telegraph in Baltimore, Md.

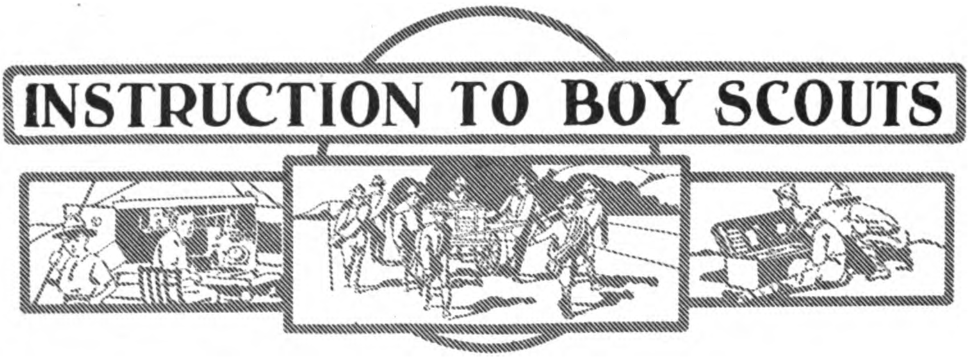
IN COMMUNICATION WITH PORT NELSON

A dispatch from Ottawa says that communication by wireless telegraphy has been established by the Canadian government with the Port Nelson terminus of the Hudson Bay Railway. The minister of railways received the following message from Chief Engineer McLachlan: "All well; comfortable, busy here."

TOWER FOR THE STUDY OF ATMOSPHERIC PHENOMENA

A dispatch from Brussels says:

In the presence of members of the International Commission on Wireless Telegraphy, the first metal section was erected close to the royal residence at Laeken recently of a huge tower intended to facilitate international scientific study of atmospheric and electrical phenomena. When completed it will be in the shape of a pylon, 333 metres (about 1,082 feet) high, 33 metres (about 108 feet) higher than the Eiffel tower.



By A. B. COLE

CHAPTER X

A Portable Transmitting Set

IN this set no helix or oscillation transformer is used, as better results for our purpose will be obtained without them and the size and weight of the set will be decreased by their omission. In at least one particular this set is unique; no aerial switch is required to change the aerial from the sending to the receiving set, or vice versa, for this arrangement permits more rapid operation and a smaller set than the old methods.

The one-inch spark coil previously described is employed to charge the aerial to high potential. The operator may build his own coil if he has the facilities, or may purchase it; in the latter event the apparatus in the portable case will have to be arranged in a slightly different manner. The present directions apply to the home-made coil which for this purpose should be made up without the containing case.

Carrying Case

In Fig. 57 are shown the dimensions of the portable carrying case of the set. It is made of wood ¼ inch thick and consists of a body and a cover. The cover is secured to the body by means of two hooks (H) and screws (B). The instrument case (A) is ½ inch thick and fits inside the body of the case so that ¼ inch projects above it, to hold the cover in place. Two straps (S) of brass or copper strip are bent so that a leather strap, with which the case may be carried, may pass through them and around the case.

Fig. 58 is a top view of the body of the case with instrument base (A) removed. It is divided into three main

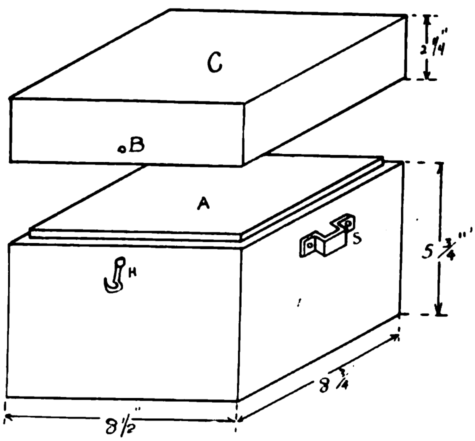


Fig. 57.—Carrying case

parts (D) (F) and (K) by wooden walls. Section (D) is to contain the sending condenser, and is 1½ inches wide. Section (F) is 2½ inches square and will contain the spark coil. Section (K) is ½ inch wide and will hold the primary condenser of the spark coil, and as this space is only 5½ inches long, this condenser will have to be shortened, which may be

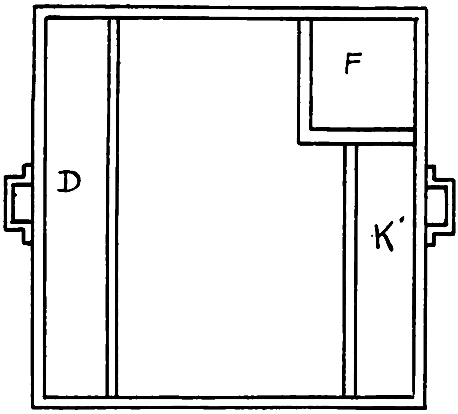


Fig. 58.—*Top view of case*

done without difficulty during its construction. These three parts are spaced so far apart in order to prevent any leakage of the high tension currents developed in the coil and sending condenser to the primary condenser.

Fig. 59 illustrates a top view of the instrument base (A) shown in Fig. 57, with the exposed parts of the set in place. The telegraph or small wireless key (E) should be purchased, as a good one cannot be made easily. The interrupter of the coil (I) is mounted back of the key and the end of the core of the spark coil passes through the instrument base, projecting ⅛ inch above its surface directly beneath the disk on the vibrator spring. Binding posts (B) (B) are the battery connections for operating the coil. Binding posts (A) and (G) connect to the aerial and ground respectively, and wires for the receiving set are taken from binding posts (R) and (T).

Spark and Anchor Gaps

The construction of spark gap (SM) and anchor gap (RT) is shown in Fig. 60. They are very simple and consist of two binding posts, known as the "double" type, having two holes through each. Through the upper holes pass zinc rods ⅛ inch in diameter and 1½ inches long. The ends of the rods are threaded to take the hard-rubber handles. In the anchor gap the inner ends of the rods are ground down to points, whereas those of the ends of the spark gap are left flat. The binding posts are set on the instrument base of the case and connections are made to them beneath the base.

Fig. 61 illustrates the method of placing the spark coil in section (F), Fig. 58, of the case. The upper end of the core fits exactly a hole in instrument base (A), and the lower end passes into a hole in a square block of wood (B). This end of the core is held also in place by means of a flat head wood screw passing through the bottom (D) of the carrying case and secured directly between the core wires, thereby preventing any side motion of the coil. The entire space around the coil is filled with hot paraffine after the necessary connections have been made, and this provides good insulation and holds the coil in place.

Sending Condenser

The sending, or high tension, condenser is made from glass photographic plates measuring 4 by 5 inches. Eleven plates are required for the purpose. The emulsion is first washed off in hot water, and after the plates are completely dry, the condenser may be assembled rapidly.

Ten sheets of tinfoil, each three inches wide by five and one half inches long, are

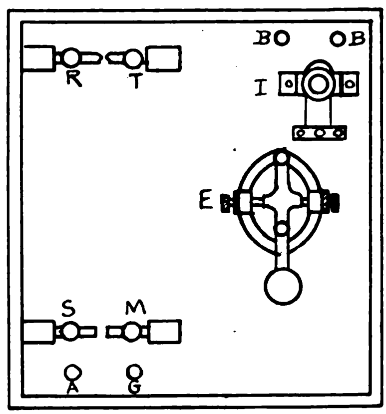


Fig. 59.—*Case with instruments in place*

used between the glass plates. One glass plate is coated with shellac and placed on a table, and one of the foil sheets is placed upon it, leaving a margin on each of the two longer sides of ½ inch, and on one shorter side of one inch, as shown in Fig. 62 (A).

Then another sheet of glass is coated with shellac and placed above the first, and a second sheet of foil is placed on this as shown in (B), Fig. 62, projecting from the glass at the opposite end. The third

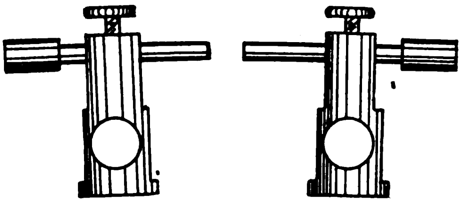


Fig. 60.—Spark and anchor gaps

glass sheet and foil are arranged the same as the first, the fourth the same as the second, and so on until eleven glass sheets and ten foil sheets are used, forming a pile.

When completed, the condenser will appear as in Fig. 63. All five projecting foil sheets at each end are rolled together and each of these two sets of five acts as a terminal of the condenser. The glass and foil sheets will be held together to some extent by the shellac between them, but the completed condenser should be bound together by several layers of insulating tape, placed as shown in Fig. 63. The tape will serve also to keep the glass plates out of contact with the containing case and will act as a cushion to prevent breakage of the glass when the case is carried about in actual service. Sufficient tape should be used to insure a close fit of the condenser into the section (D) of the containing case, Fig. 58.

Wiring the Set

All wiring inside the case of this set must be done with automobile cable of a quality between that known as "magneto cable" and that termed "high tension cable." "Primary" cable should not be used, as all the wires in the case are liable to be subjected to the high voltage of the secondary of the coil in case of accidental contact between them. Care should be taken to secure all the wires so that they will not be moved out of place by the shaking to which the set may be subjected. Especial caution should be observed in regard to preventing contact between the primary wires, which include the connections of the primary condenser, and the high tension wires of the spark coil or of the sending condenser.

The diagram, Fig. 64, shows the best method of wiring the instruments. In this diagram the letters refer to the same instruments and parts as in Fig. 59. The aerial and ground are to be connected to this set at the binding posts (A) and (G) respectively, and the aerial and ground connections for the receiving set lead from binding posts (R) and (T) respectively. The battery of five dry cells or three cells of storage battery is connected to posts (B) (B).

Battery Case

The batteries to operate the set are not placed inside its case because they are heavier than the balance of the outfit and should be carried by another member of the party, and because they require

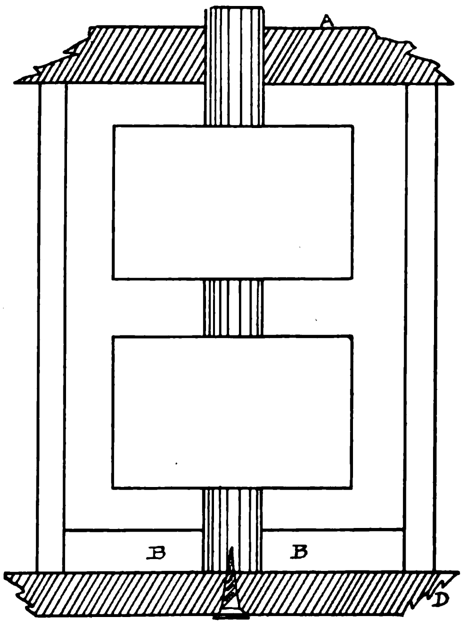


Fig. 61.—Spark coil in place

renewal from time to time. They should be contained in a separate case of any desired or convenient shape having two binding posts as battery terminals.

Operation of the Set

The aerial to be used in connection with portable sets will depend upon local conditions for its height, length and number of wires. It should be remembered that an aerial for transmitting purposes must be better insulated from the earth than one for receiving purposes only. It

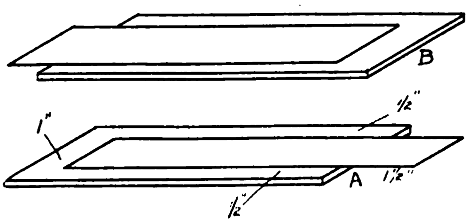


Fig. 62.—Condenser construction

is suggested that two or three porcelain cleats in series or composition insulators be employed. Only two or three insulators are necessary for an aerial.

The best kind of wire to use for this work is No. 20 Old Code lamp cord. This wire consists of two large strands, each composed of many strands of fine copper wire, with rubber insulation. This insulation must not be depended upon, however, for transmitting purposes. The lamp cord should be untwisted before use. It will be found to be very flexible, and will stand much wear.

Wherever a portable transmitting set is used, the operator should arrange to stand or sit upon some material which will insulate him from the earth, such as a dry board, for otherwise there is a possibility of receiving a shock, which although quite harmless, is not exactly pleasant.

In the transmitting set described in this chapter it is essential that the rods of the anchor gap be brought very close together, since this gap is in series with

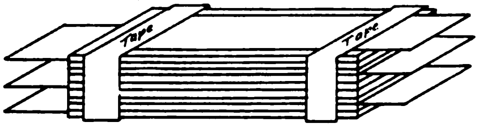


Fig. 63.—Completed condenser

the ground wire of the outfit, and consequently carries all the high tension currents, and because if the gap is too long a less amount of energy will be radiated by the aerial, due to the high resistance of this gap. Moreover, in this event, the voltage across the gap will be quite high and will injure the crystals in the detector, since the receiving set is connected to the gap terminals. The anchor gap should be adjusted to a separation equal to the thickness of an ordinary sheet of writing paper. If no space were left between the terminals, the receiving set would be short-circuited, and no signals could be received. The proper adjustment of the anchor gap is therefore of vital importance to the efficient operation of both the transmitting and the receiving sets.

The adjustment of the spark gap is also an important matter, and the most

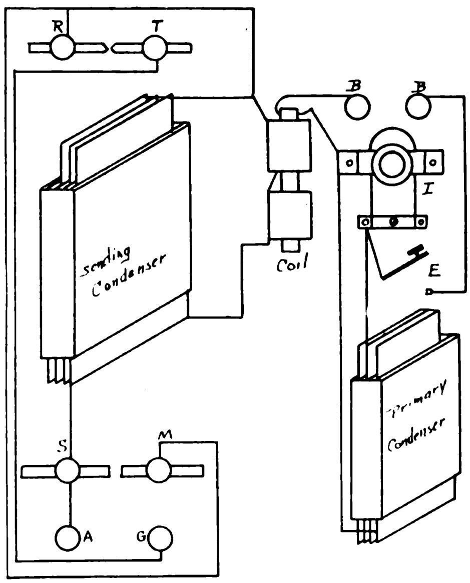


Fig. 64.—Wiring diagram

desirable spacing of the terminals will be found best by experiment. If the gap is adjusted to a point where the spark is of maximum length, the signals received at the distant station will not be clear, and if the gap is too short, the signals will have a "mushy" sound. A point will be found between these two where the spark will be of almost maximum diameter, and where best transmission will be obtained.

For the benefit of those of our readers who have as yet not mastered the code, we print herewith the characters of the continental code, which is almost universally used in wireless communication. This can be learned readily by the use of a small buzzer giving a high pitch, in connection with a telegraph key and a dry cell.

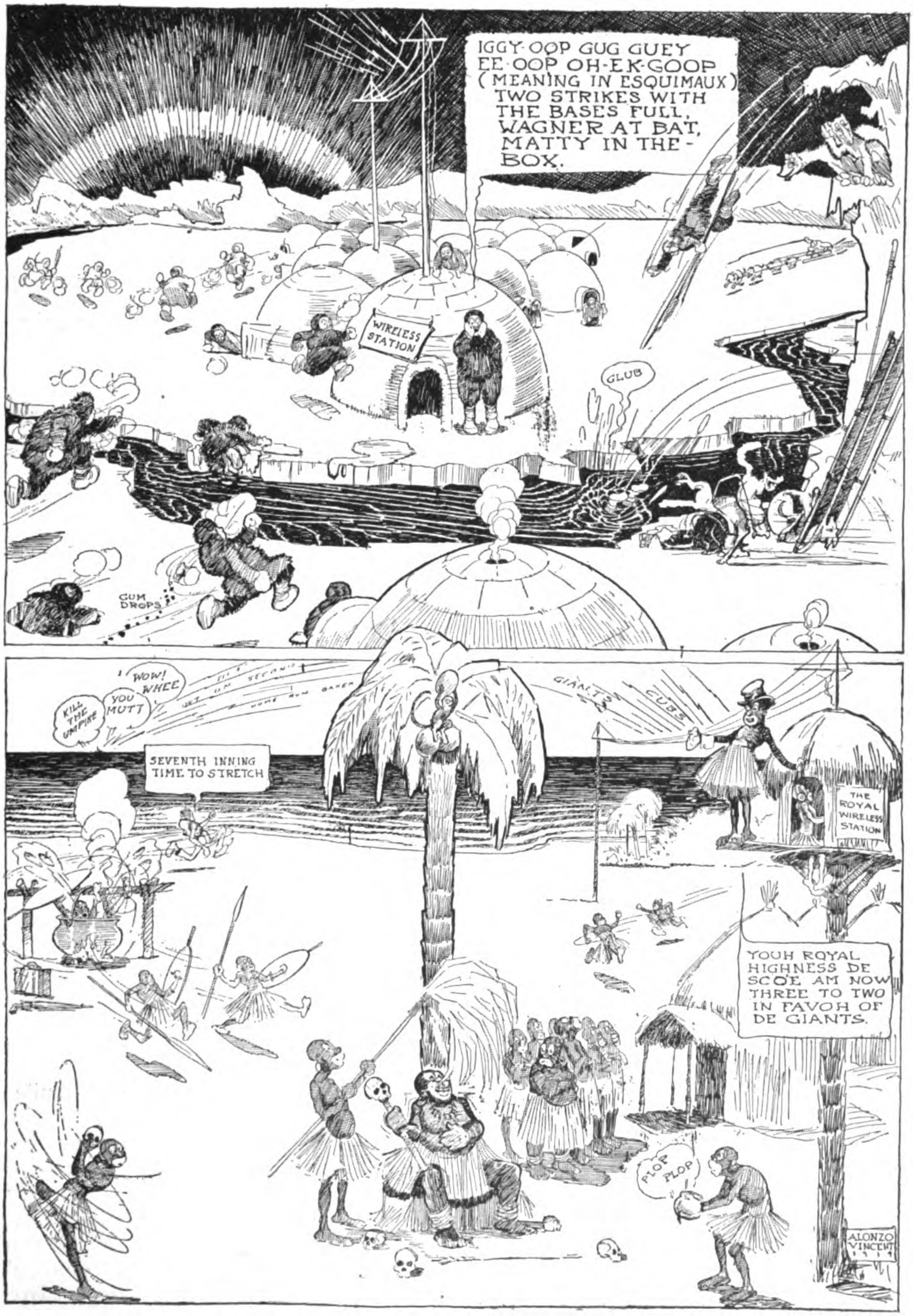
This is the seventh installment of Instruction to Boy Scouts. The eighth lesson by Mr. Cole will appear in an early issue.

WIRELESS CONTINENTAL TELEGRAPH ALPHABET

A	● ▬
B	▬ ● ● ●
C	▬ ● ▬ ●
D	▬ ● ●
E	●
F	● ● ▬ ●
G	▬ ▬ ●
H	● ● ● ●
I	● ●
J	● ▬ ▬ ▬
K	▬ ● ▬
L	● ▬ ● ●
M	▬ ▬
N	▬ ●
O	▬ ▬ ▬
P	● ▬ ▬ ●
Q	▬ ▬ ● ▬
R	● ▬ ●
S	● ● ●
T	▬
U	● ● ▬
V	● ● ● ▬
W	● ▬ ▬
X	▬ ● ● ▬
Y	▬ ● ▬ ▬
Z	▬ ▬ ● ●
Wait	● ▬ ● ● ●
Understand	● ● ● ▬ ●
Don't Understand	▬ ● ● ● ● ▬ ●
Period	● ● ● ● ● ●
Interrogation	● ● ▬ ▬ ● ●
Exclamation	▬ ▬ ● ● ▬ ▬
1	● ▬ ▬ ▬ ▬
2	● ● ▬ ▬ ▬
3	● ● ● ▬ ▬
4	● ● ● ● ▬
5	● ● ● ● ●
6	▬ ● ● ● ●
7	▬ ▬ ● ● ●
8	▬ ▬ ▬ ● ●
9	▬ ▬ ▬ ▬ ●
0	▬ ▬ ▬ ▬ ▬
Call	▬ ● ▬ ● ▬
Finish	● ▬ ● ▬ ● or ▬

The Opening of the Season

Results observed following the Giants' world tour



The Protection of Land Line Telegraph Circuits in the Vicinity of Wireless Transmitting Stations

By DONALD McNICOL

RECENTLY the writer was called upon to provide and install protective devices for the land line telegraph circuits connected with the Telefunken wireless station at Sayville, L. I., and the Marconi station at Sea Gate, L. I. The purpose of this article is to describe the method of protection employed and to illustrate the devices and circuits as installed.

As is well known, all long-distance radio stations located along the sea coasts have direct land line connection with the large relay offices of the Western Union and Postal Telegraph Companies nearest at hand for the purpose of facilitating the delivery of wireless messages to and from the radio station.

In most cases the telegraph and telephone circuits leading to the wireless stations consist of metallic loops, to avoid the evident objection of an "earth" connection at the radio station. The land line instruments are generally located on the same table with the wireless apparatus, and within reach of the operator. This being the case, it is evident that in some cases troublesome electrostatic induction will take place between the wireless system and the land line circuits.

In some cases these disturbances are excessive, making it imperative that a path to ground be provided for the high-frequency surges superimposed upon the Morse circuits.

Fig. 1 illustrates the arrangement in use at Sayville on a Morse loop about 50 miles long. The line wires are shown attached to binding posts at the top of the regular fuse and air-gap lightning arrester block, while the leads to the Morse relay and key are shown connected to binding posts at the bottom of the block. The 10-ampere line fuses are shown; LA, are air-gap lightning arresters on each side of the line, and

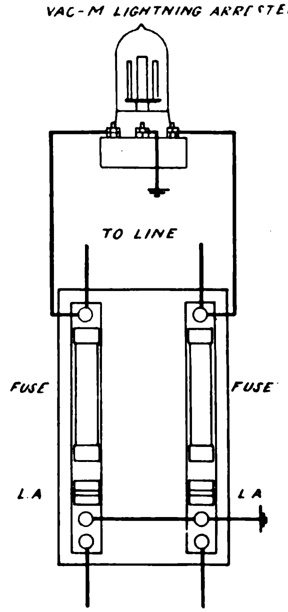


Fig. 1

VA is a vacuum lightning arrester consisting of three carbon blocks sealed in a glass globe—resembling an incandescent lamp bulb—the globes being exhausted to a fairly high degree of vacuum. It will be noted that each side of the line is connected to one of the outside carbons, while the center carbon block is earthed. This device provides a fairly constant and dependable drain for high-frequency surges from the Morse wires to ground. If, while the radio transmitter is in operation, the operating room is not brightly illuminated, the outgoing signals may be read in the vacuum-gap arrester, the signals

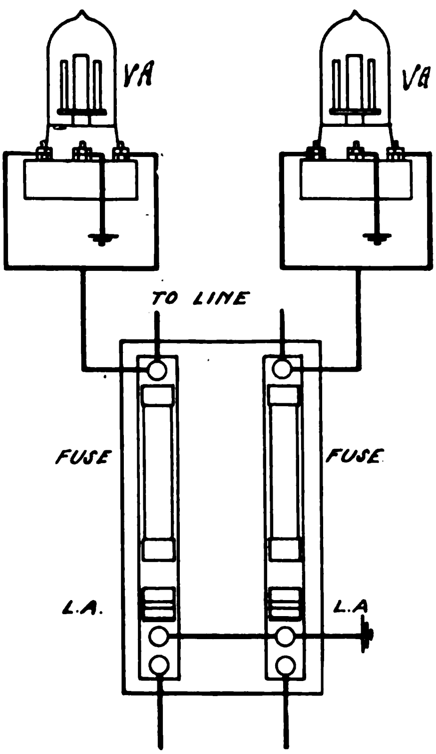


Fig. 2

appearing in the form of bright, bluish brush discharges between the line and ground carbon blocks.

Fig. 2 illustrates the arrangement employed at the Sea Gate station on Morse loop 20 miles in length. This is the same as the method previously described except that two vacuum-gap arresters are employed instead of one. The two outside carbons are strapped together and connected to one side of the line, while the center carbon in each case is grounded. This modification simply doubles the surface of the carbon block connected with the line wire, increasing the capacity of the arrester to that extent.

A telephone loop may be protected as shown in Fig. 3, using a standard telephone fuse and lightning arrester unit. From each side of the line a tap to ground is made through a low-capacity condenser, say, .004, or .005 microfarad each. When this method of protection is employed the discharges are dissipated and telephonic transmission is not impaired, either locally or over long distances.

Note.—This article should be of interest to those who desire to protect wire circuits which are exposed to electrostatic induction from high-voltage radio transmitters. It is generally found that such inductive troubles are not due to the nearness of the wire instruments to the wireless transmitting apparatus, but are caused by direct electrostatic induction from the sending stations' aerial to the exposed wire line. This points to the desirability of having

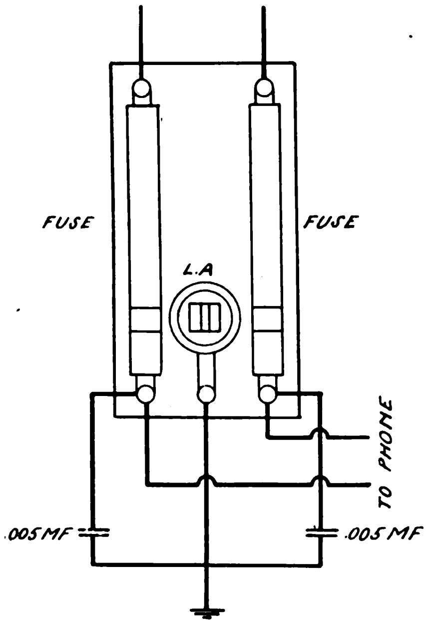


Fig. 3.

the telegraph or telephone lines placed in conduits under ground at a distance of five or six hundred feet from the sending antenna. Such practice will completely eliminate inductive troubles without the use of arresters, as is readily understood. On account of the fact that antenna voltages with present-day transmitters are of considerably less value than those to be obtained with the earlier types, the adverse effects of electrostatic induction are not so noticeable. If, however, conditions are such that the necessary precautions cannot be taken, the use of devices as described by the author are imperative. The reference to the protection of telephone lines without disturbance to regular telephonic communication is of particular interest. —*Technical Editor.*

In the Morning's Mail

I have read many books and papers on wireless, but I find that THE WIRELESS AGE covers this subject most completely, both from the professional and amateur standpoint.

H. C. McD., *New York.*

* * *

Your numbers of THE WIRELESS AGE have been greatly enjoyed. They contain much valuable information which I have never been able to find in even the latest works on radio telegraphy. It, therefore, gives me great pleasure to renew my subscription to so worthy a publication.

E. J. B., *U. S. Navy.*

* * *

THE WIRELESS AGE is the *only real* wireless magazine worth reading, among a number of so-called wireless magazines.

W. B. D., *Rhode Island.*

* * *

I think it is the best publication on wireless at the present time.

A. R. R., *Connecticut.*

* * *

I cannot say too much in praise of THE WIRELESS AGE and its efficient work.

O. E. C., *Massachusetts.*

* * *

I beg to remain a constant reader and a booster for THE WIRELESS AGE.

C. E. S., *U. S. Army.*

* * *

As one of your subscribers, and a student of radio engineering, I wish to express my appreciation of the new magazine, and say that I consider it all that can be desired in its field.

D. T. S., *Minnesota.*

* * *

Your magazine is interesting from the first page to the last.

A. S., *New Jersey.*

I wish to express my heartiest appreciation for the new magazine you have brought before the wireless public. The need for a publication such as THE WIRELESS AGE has long been felt and I am sure every progressive wireless man welcomes its entrance into the wireless field. I had been under the impression that the various wireless magazines covered every phase of the wireless art which would be of interest to amateurs; and was agreeably surprised when I found such articles in your publication as "The Engineering Measurements of Radio Telegraphy" and "Elementary Engineering Mathematics."

THE WIRELESS AGE, in my opinion, is as near a perfect magazine as can be obtained.

H. L., *New York.*

* * *

For a long time it has been my intention to write, complimenting you on the various articles published in THE WIRELESS AGE. In my estimation it is one of the best magazines for amateurs and I have recommended it to my friends.

G. K., *New York.*

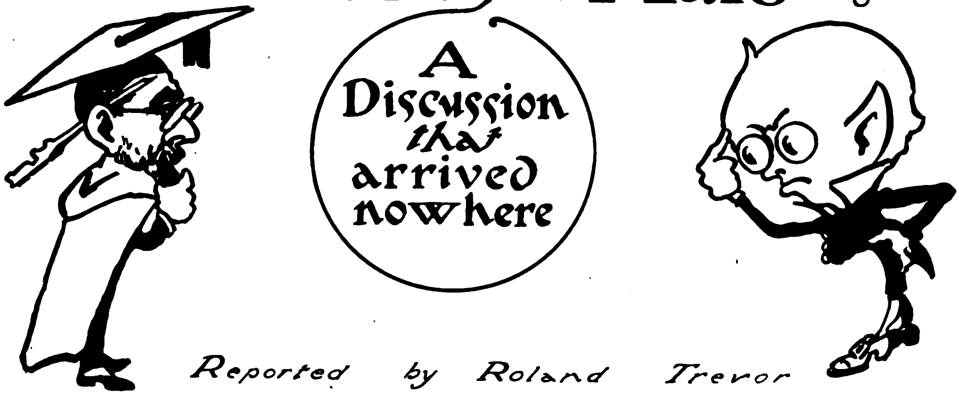
* * *

It sure is a sixty-one-seconds-to-a-minute magazine. For four years I have been looking for magazines which would thoroughly cover the wireless field. I think you have more than succeeded; I would not take a dollar apiece for my back numbers. I have been in the wireless game for five years and in all that time never saw anything as interesting as THE WIRELESS AGE. I wanted to quit high school in order to go to the Marconi school at San Francisco, but my folks said wait until June, when I graduate. I am anxious to get in the Marconi service. But "enuf is enuf"; hope to see your magazine unchanged for many years—I don't say better, because I hardly think it's possible to make it any better.

C. R., *California.*

? Wireless to Mars ?

A Discussion that arrived nowhere



Reported by Roland Trevor

WHEN the Layman blew three successive smoke rings, flicked the ashes from his thirty-five center and from the depths of the club's most comfortable morris chair languidly addressed him, the Engineer temporarily ceased his mental juggling of equations covering the week-day behavior of certain circuits, and affected an air of interest.

"Great thing, this wireless game you're mixed up in," the Layman was saying. "Railroads using it to transmit orders to moving trains, highbrows reconstructing laboratories so the world's time may be accurately determined, and all that sort of thing—no end of possibilities, eh, what?"

"Oh, yes," answered the Engineer, with a pitying glance. "Lots of stunts done every day, though, that beat these more practical applications a mile, so far as the spectacular element is concerned."

"Which is practically an admission that wireless has its limitations?" queried the irrepressible Layman.

"Uh-huh, something like that."

"What are these limitations?"

"Financial, mainly," came the grunted response.

"You mean lack of funds to carry on the work?" persisted the assiduous seeker.

"No; financial conscience. Most of us are built so that we cannot reconcile ourselves to burning up some one else's coin chasing a radio rainbow—you know, all those cute little capers the papers like to report; about as useful, even if true, as an automatic hat-tipper for a Broadway masher."

"You mean, then . . ."

"That all these unknown but alleged scientists, with their discoveries that are to immediately 'revolutionize' wireless communication, seldom have anything that the Board of Directors would recommend purchasing."

"Then wireless is not so very wonderful an industry after all; it's really just a phlegmatic telegraph business."

"In the last analysis, yes. And that is the great trouble. Those who don't look at it from a cold dollar-and-cents basis often get excited over something that is all right in its way, but doesn't bring any ducats over the message counter. But you are wrong in thinking that wireless is not wonderful. Regardless of the fact that dividends are the objective point, you can't get around the basic wonder of telegraphic transmission without wires. Take the new Marconi transoceanic stations, for instance: New York to London direct, San Francisco to Honolulu, and so on, for that's what it amounts

"They inquire our attitude on the recognition of the Huerta government in Mexico, and we reply '23'"

to; nothing very ordinary about that! You'd understand better if you had listened to a message winging its way through space, thousands of miles——"

"Whew! Thousands of miles, eh? Why, next they'll be communicating with Mars, and——"

"There you go again," interrupted the Engineer wearily. "Now, what in Creation's name would be the sense of working up a conversational medium with the Martians? To get the new midsummer styles for the ladies? Or perhaps a few points on——"

"But the scientific fellows——"

"Never *have* any money. Of course it is possible they might raise some, but the best that could be expected would be a more or less useless lot of astronomical data and unintelligible lingo, even if success followed the expenditure of 'steen millions of good dollars. No; it will do us all more good if the real money of this sphere we are living on is applied to tying up the commercial activities of its own inhabitants."

"There can be no question but that you are right," agreed the Layman. "But don't you think this communication thing with Mars will soon be attempted?"

"Somebody has been telling you that, I suppose," yawned the Engineer.

"Saw it in the paper," responded the other. "Some fellow out in Ohio, one of those scientific chaps, mixed up with aviation, I believe, gave out an interview in which he outlined plans to establish communication with this earth's neighbor. Sounded really quite feasible——"

"Yes, they all do," announced the patient listener. "This is about the four-hundred-and-ninety-second announcement of the kind. Did he say just when he was going to pull off the great experiment? No? How surprising! He must indeed be a nonentity—nearly all the others gave out a date, somewhere in the near future usually. Made their announcement sound so much more sincere—self-confidence, and all that sort of thing, you know."

"Then this aviation person, in your belief, does not even intend to carry out his experiments?"

"He may. There are two kinds of people you never can depend upon: fools and notoriety seekers. This fellow may try to break his neck. But I doubt it."

The Engineer here indicated his slight concern with the outcome by an ill-concealed yawn.

"It's funny how the public falls for that stuff regularly," he resumed a minute later. "Outside of a deplorable lack of scientific knowledge of any description you, for example, are a well-balanced being. Yet you have swallowed this fabrication, hook, line and sinker. And, though you probably don't realize it, you have accepted somewhat similar statements seriously in the past. And you are not the exception. Most laymen will believe nearly anything about science if the yarn is spun with an air of sincerity. It's an old axiom, but a true one, that the public has no memory. This latest version of the communication with Mars thing I dare say—and I haven't seen the article—follows along the lines of great Naughty Nine project that stirred up the whole country for a time. It was the classic; the others all more or less weak imitations."

"Tell me about it," encouraged the Layman.

"It is a long yarn, and not worth the telling; but, briefly, the ball was started rolling by a well-known aeronaut—they hadn't commenced calling them aviators then—and appeared first in the form of an interview in a New York daily. The aeronaut, a prominent and popular figure, announced that in conjunction with a well-known University scientist he had completed plans for a voyage to the edge of the world's atmosphere in a mammoth balloon, equipped with special wireless apparatus that would set up communication with Mars.

"The newspapers played the thing up big and the aeronaut was clever enough to withhold all details of the equipment until public interest had reached white heat. Then one morning, about this time of the year, he announced: 'We will be talking to the people of Mars before the 15th of next September!' The universe gasped. Two or three days later a description of the equipment leaked (?) out. The daring scheme necessitated most remarkable paraphernalia, including two hermetically-sealed glass-fronted aluminum cases, with tanks of oxygen attached for breathing, speaking tubes connecting one tank with the other, a powerful wireless set with ten miles of wire trailing down to the earth and all manner of navigating instruments. According to the prominent aeronaut the professor would occupy one case and himself the other, resorting to the oxygen tanks at a height of five or six miles. At the edge of this world's atmosphere the wireless was to pick up messages from Mars and the ten miles of ground wire would carry them straight to the earth, there to be recorded. Great scheme that, when dressed up with all the details." The Engineer smiled.

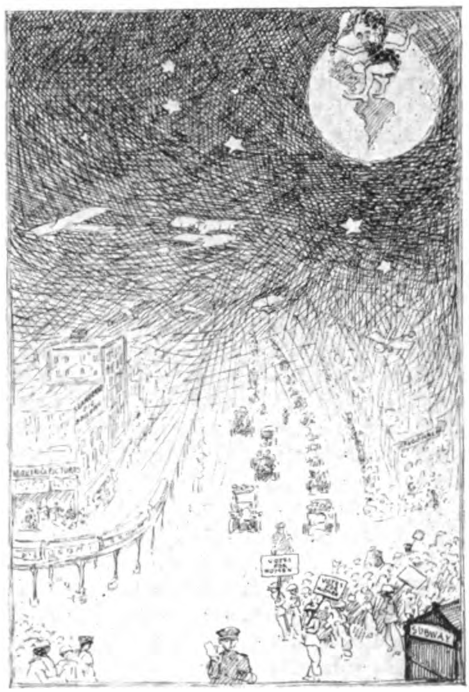
"But the result?" asked the Layman.

"The usual one—the public had no memory. The scheme was kept alive up to the middle of August, then tailed off until it was completely forgotten when the 15th of September, the date set for the experiment, rolled around." The Engineer lit a fresh cigar, announcing between puffs: "Thus endeth the Naughty Nine lesson—called that, because it happened in 1909. Nothing has been heard of it since."

"Even so," persisted the Layman, "you haven't said that the feat is an impossibility."

"My dear sir," answered the Engineer, "we do not recognize the impossible in wireless. The impractical, yes; the worthless, yes—but the fancies of to-day are the facts of to-morrow."

"Which observation is perfectly justified," agreed the other. "Anyone who would have suggested fifty years ago that we would be communicating without



"These Mars fellows are supposed to have had an up-to-date civilization centuries before we shed our skin clothes"

wires between points even fifty miles apart would have been hung as a believer in witchcraft. Now, why shouldn't an apparatus be devised by which Mars could be connected by wireless?"

"Or might we not invent something in the way of a talkless mother-in-law, a boreless popular magazine, or something really useful?" innocently inquired the Engineer.

"Merely another indication that your mind thinks in kilowatts," returned the persistent Layman. "The scientific formula is the epitaph on the grave of progress. You fellows bury your imagination under a mass of skepticism and—"

"Your type of man sticks his head out of the window looking for the Millennium every time a huckster toots his horn."

"No, no; here is the point," said the Layman impatiently. "Only a few years ago Marconi sent a single wireless impulse but a few hundred feet; now he is sending countless messages every hour through thousands of miles of space; increase that range to millions of miles and there you are—in touch with Mars! To quote you: 'the fancies of to-day are the facts of to-morrow;' then all that is necessary is for some worthy plutocrat to put up the cash."

How sublimely convincing was Newton's discovery of the law of gravitation. Had it been the hired man he would have only contaminated the atmosphere with cuss words

"And if the Martians don't get the message or don't know how to reply, what becomes of the ten million and what good does it do?" asked the Engineer.

The Layman glared his impatience. "One has to take a chance on everything in this world," he snapped, "or out of it, for that matter. Statistics show us that $12,000,000 were gambled away in one metropolitan city in a single year. If it costs the shaving public that much in twelve months to indulge in a little recreation, what need we care about a smaller sum to put us into communication with our sister sphere of the solar system? Just think of the ideas we'd get on almost every subject from those Martian chaps!"

"On how to build canals, I suppose," superciliously volunteered the Engineer. "Why not save time and ask Colonel Goethals?"

"Canals are not everything," replied the Layman irritably, "we might learn from them—"

"How to run ours," interjected the Engineer, who had heard of the Hay-Pauncefote treaty.

"No sense of argument," muttered the Layman. "Stick to the subject in hand; these Mars fellows are supposed to have had an up-to-date civilization centuries before we shed our skin clothes, and just so soon as we establish communication with the Martian national bureau of information we can learn the latest wrinkles in all the vexatious problems now confronting us."

"Said information being supplied in Esperanto, I take it," returned the Engineer, "always considering the danger that Mars may have developed simplified conversation to such an extent as to place it beyond our grasp. Let's see . . . we, for example, wireless the Esperantan equivalent for 'What is the nature of your protective tariff on messaline and swiss cheese?' and the operator in Mars' capital answers 'X-Y-Z,' which in the highly simplified code, would represent seven volumes of the congressional record in Martianese, which might take us 7,000 years to translate. Or they inquire our attitude on the recognition of the Huerta government in Mexico, and we reply '23;' they might construe this simple answer as a detailed history of American independence from July 4, 1776, to the end of the Standard Oil dynasty."

"Irreverent flippancy, which proves nothing," growled the Layman. "Of course it is going to be a hard problem to get together, no matter how careful we might be, but doubtless the proper kind of scientist," with a baleful glance at the Engineer, "the proper kind of scientist would figure out each move in the game with the formulated logic of science. Despite the mercenary croakers, science is a wonderful thing. What we need is another Newton. How simple, yet how sublimely convincing, was his discovery of the law of gravitation! One day while walking in an orchard—bing! an apple landed on his head. Did Sir Isaac stop to contaminate the atmosphere with cuss words and scout the idea of objects still continuing to fall? Not a bit of it! He looked at the apple, saying to himself, 'apples do not grow on the ground. This must have fallen from a tree. What caused it to fall? Some mysterious force of nature. The problem is a grave one—' "

"Therefore, I will call it the law of gravitation," interposed the Engineer blandly.

"So the difficulties are not insurmountable," continued the unperturbed Layman, "people had always known that heavy bodies took a downward course when released, but a jolt on the pate of a thoughtful man pointed the way to solving the problem, where otherwise it would only have led to a string of profan—"

"As in the case, had it been the hired man who was bumped on the bean with the apple while walking in the orchard, he would have said 'Damn!' and we would have had the law of damnation!"

"Bah!" exclaimed the Layman, wrathfully, "I referred to the Newton episode merely to illustrate the working of the genuinely scientific mind. A serious man working on the problem of wireless to Mars would reason like this: The planet is very far away. What is lacking to establish intercourse between the world and Mars? Communication, of course. There must be a method of extending present wireless communication. The rest is trite—just as was the minutiæ of what made the apple fall. It is merely a matter of working out detail and—"

"Wasting a lot of money that would better be applied to linking up things on this earth!"

An 8,000 Miles' Communication

Another wireless record has been made. The Marconi station on the Filene building in Boston, Mass., has recently been in communication with a vessel nearly 8,000 miles away, or almost one-third the way around the world from Boston.

The operator who was sending when this record was made is Harry R. Cheetham. Amid a number of other signals, he said, he received a signal from the Pacific mail steamer Mongolia. Answering this signal he got into immediate communication and for several minutes he "talked" to the operator on board the Mongolia. In the course of the "conversation" he learned that the Mongolia was then 200 miles east of Nagasaki, Japan.

That this feat was performed at the Boston station is all the more amazing when it is realized that the range of the Filene installation is guaranteed for only 300 miles. According to people who understand wireless, though, the performance was a "freak." That is, conditions were just right, and there was an element of luck. "If the station tried to get that distance again," said a wireless authority, "they could not do it. But, still they might."

This same station recently was in communication with the steamship Carrillo every night of her round trip to Colon, including the nights she stayed at Colon, which is 2,300 miles away.

Records of this sort are becoming more common every year. The condition which allows them is not wholly one of the atmosphere, but may be accounted for by constant improvements in transmitting and receiving apparatus, which establish new standards of efficiency.

It is a known fact that conditions on the Pacific Ocean are especially conducive to long-distance wireless transmission. Given distances may be covered with much less power than it is necessary to use on the Atlantic coast.

The New England coast, however, is notoriously detrimental to the transmission of wireless telegraph signals, this condition being attributed to the underlying rocky soil. In view of this fact the news of the 8,000 miles' record will cause no little interest.

Records of this nature are made at night time only. For daylight work over long distances, very high-power stations, similar to those now being erected by the Marconi Company in the United States, are required.

Comment and Criticism

THE auto-transformer, described in the January issue of THE WIRELESS AGE as used in connection with the audion amplifier, has induced much criticism and inquiry from amateurs. While the data given in the article was brief, still, in connection with the accompanying diagrams, it should have been quite sufficient to allow immediate construction.

Apparently the function of this transformer is to act as a temporary storage for the energy from the high voltage battery in the telephone circuit of the first audion. The variations of current through this transformer winding produce magnetic lines of force which cut the turns of the coil, setting up an electromotive force which is applied to the filament and grid of the second audion. Here the intensity of the current is again increased by the "trigger" action of audion No. 2.

Amateurs should know that all audions do not possess the same characteristics of adjustment and therefore specific directions for working can not be given. A little experience will enable the experimenter to overcome such variations without difficulty.

The data given for the constants of the auto-transformer (in the January issue) should not be considered as final. It is simply a record of the actual values used in the certain experiments in which very good results were obtained.

Later tests have indicated that the design of the windings in core of the transformer may vary over a wide range, and efficient results will be obtained as long as corresponding changes of voltage are made at the filament or at the high voltage battery. When the resistance of the winding of the auto-transformer is inserted in series with the local battery circuit, it is generally necessary to increase the number of cells in that circuit. The voltage of the filament battery is then decreased in value. This statement, however, may not apply in all cases.

It is not absolutely necessary to go to the expense of especially constructing a transformer for this purpose. The secondary windings of induction coils, of open or core power transformers, like those found in the average amateur's station, may be used. It is not even necessary to use an inductance having an iron core, provided the windings are made sufficiently large to give an equal number of magnetic lines of force.

Again this transformer need not be of the auto type. An inductively-coupled transformer may be employed but better results are generally obtained with the single coil transformer.

One of our readers writes:

> I noticed the statement is made that some times 60 volts are required at the high voltage battery. I have made many tests of audions, and I have never found a single bulb requiring such a voltage, although I am aware that the actual voltage necessary will depend on the degree of vacuum.

Experiments do not bear out the first part of this assertion. While the average bulb requires from 30 to 35 volts, many which have been highly exhausted require considerably higher values of voltage and it has been our experience that such bulbs produce the best signals. It is interesting to know that the degree of vacuum may be altered by holding a small alcohol flame close to the bulb. Try it.

* * *

Another reader objects to the winding of the receiving tuners, also described in the January issue. He states that he has tried windings of all types and sizes, but he invariably finds that while the coarse wire tuners are theoretically correct they do not give the best results. He therefore favors the finer winding.

We agree with him in the case of strictly potentially - operated detectors such as the audion or those of crystalline structure. For maximum signals it is best to so design the receiving circuits that the maximum voltage will be produced at the terminals of the detector. We further advise that upon investigation the writer of the series on How to Conduct a Radio Club, found that the secondary winding of his tuners, which he supposed was No. 28 wire, was actually No. 30.

Our experience has been that if a tuner is to be used in connection with the audion only, the secondary winding of the receiving tuner may be made of wire as small as No. 36. If wire of this size is used, it will be found that the tuning coils described in the January issue may be considerably decreased in length for the given range of wave-lengths.

If the receiving tuner is to be used in connection with crystal detectors we prefer secondary windings in the neighborhood of No. 28 or No. 30 S.S.C. In the case of the crystal detector the resistance of No. 36 wire affords too much resistance, causing undesirable energy losses and very broad tuning.

The data for the windings given in the January issue are suitable for both the crystal and audion detectors. It should not be forgotten that as the size of the wire decreases the value of resistance increases, and therefore the desired gain of potential through the use of small wire may be absent.

The finer wound secondary *do* possess an advantage in the case of potentially-operated detectors, because the value of distributed capacity for a given wave-length is at a minimum. Therefore, a higher voltage is available for the detector.

Our critic says:

I once had the idea that the larger the wire I wound on a tuner the better for everything concerned. Theoretically, this is quite true, so I commenced making tuners. I even went so far as to construct a special stranding machine which would make an evenly wound cable of a large number of strands of insulated wire. The wires of the strand, you understand, were insulated from each other. I made a couple of tuners with this kind of cable, which you will recognize as being similar to that employed by the Telefunken Company. I secured results, but they were no better after careful tests than those from any other "coupler" wound with finer wire. Then I wound a primary coil with No. 17 S.S.C. wire, the secondary with No. 23 S.S.C. wire.

I secured certain results on the shorter waves, but I did not think much of the working of the tuner, so I took it apart and wound it again. For the primary winding, this time, I used No. 24 S.S.C., for the secondary winding I used No. 32 D.C.C. I used no sliders at all, tap-offs being taken to switches and contacts of the latest design. I also used the interpolating system of connection.

I was certainly surprised at the results. The signals seemed to be much louder. I found I could use the coil over a range extending from the shorter wave-lengths up to the very longest, with no trouble. The peculiar part of it is that this coil seemed to give much louder signals than the tuner first described even on the shorter waves.

* * *

Another of our readers had made note of the argument in our columns concerning the relative merits of the long and short aerials. He describes a series of experiments with freakish aerials in the form of triangles and rectangles. Since aerials of this type are not to be compared with that described by Mr. Dreher, publication of the details has been omitted. The communication, however, indicates that the writer has conducted a series of serious experiments. Apparently he finds that freakish aerials, when abnormally large, possess characteristics similar to those of any long aerial.

He declares that long aerials are productive of unnecessary interference and if they possess a considerable value of resistance, long distance working can not be expected. He finds that aerials of this type are quite responsive to plain aerial spark transmitters, but tuning is out of the question. He says:

From these and observations of numerous other aerials I draw the following conclusion:

For wireless waves of all kinds and particularly for the now common slightly damped waves, it is preferable for the prevention of interference, both local and distant, to use an aerial having a low value of resistance. Such aerials are conducive to the reception of the maximum strength of signals.

If the length be increased, keeping the resistance unaltered, the range is increased, especially for long wave-lengths. But at the same time three other effects are increased; the directiona effect, static, and the interference from loca sources. The latter is probably due to forced oscillations. To construct an aerial having a low value of resistance is an expensive and often impossible job, thus making the interference a still worse proposition.

To bear out the foregoing I might mention that a tin roof of low resistance, some 25 feet square, even with its leakage has always been my stand-by as an aerial. It is good for 500 miles in dry weather. Furthermore, an aerial about 60 feet in length, consisting of 8 wires, having a spread of 8 feet, and height of 25 feet, brings in NAR (Key West) loud enough to be read through static any night.

If any one advocates the use, for year-around work, near to other stations, of a long (not large) aerial, he will have to show me an extraordinarily well behaved specimen, and not any I have ever seen in an amateur's station.

Much interest has been created by the article appearing in the Jahrbuch der Drahtlosen Telegraphie, Vol. 7, page 75, describing some experiments made by the author with various elevated conductors or capacities as a substitute for the ordinary used aerial wires.

The author reminds us of the fact that when near to very high power stations, it is only necessary to stretch out a pair of cords connected to a 2,000-ohm telephone receiver, in a horizontal position to read the signals. We advise that the signals so received are produced by electrostatic induction and not Hertzian radiation.

He says that for ranges of, say, 50 miles a metal rod of any kind may be used such as a leader pipe or fire-escape ladder. The gas-pipes of a house may also be used as an aerial and the earth connection made to the water system.

He declares that up to distances of 150 miles an aerial may be erected indoors. He has even tried rectangular clothes driers so common to the roofs of many apartment houses in New York. Again, a lightning rod fastened to a brick chimney responded very well. When smoke belched forth from the chimney the signals became considerably louder. He believes the smoke was conducive to electrical oscillations and therefore had the effect of lengthening the aerial. He also describes other arrangements which were employed. Practically every test which the author writes of was performed in the United States some years ago. Tests were made in this country eight years ago on telephone lines, very satisfactory results being obtained. It was observed that these experiments could be carried on without interfering with telephone conversation, provided the radio-receiving apparatus was connected to earth through a condenser of small capacity, say, .001 mfd.

Messages were received in this manner several hundred miles overland. Tin roofs on apartment houses were next tried and it was found that they acted in some cases with great efficiency and on the shorter wave-lengths it made no difference whether the roof was grounded or not. In one case where the house had a copper rain gutter of exceptional capacity, signals could be received up to a distance of 1,600 miles. The capacity of this roof was found to be .025 mfd. and the natural wave-length 550 meters. When the roof was grounded the aerial simply acted after the manner of the well known loop, formerly employed by the American DeForrest Company. In this system one leg of the aerial, when receiving the shorter wave-lengths, was invariably directly connected to the earth.

The action of fire-escapes in this respect was observed 6 years ago. In one particular case it was possible to copy signals at a distance of 500 miles. The apparatus was connected to the high end of the fire escape and earthed to the steam pipes.

Indoor aerials have been in quite common use among amateur experimenters for a number of years, particularly in New York and its vicinity. In fact for amateur communication in the average city it is not at all necessary to erect outdoor aerials only in cases when exceptional distances are to be covered.

Water tanks have been used and it makes no difference if the tank is earthed or not. If a wire is connected to the tank about half way up or, better still, to the top, signals may be received at considerable distances.

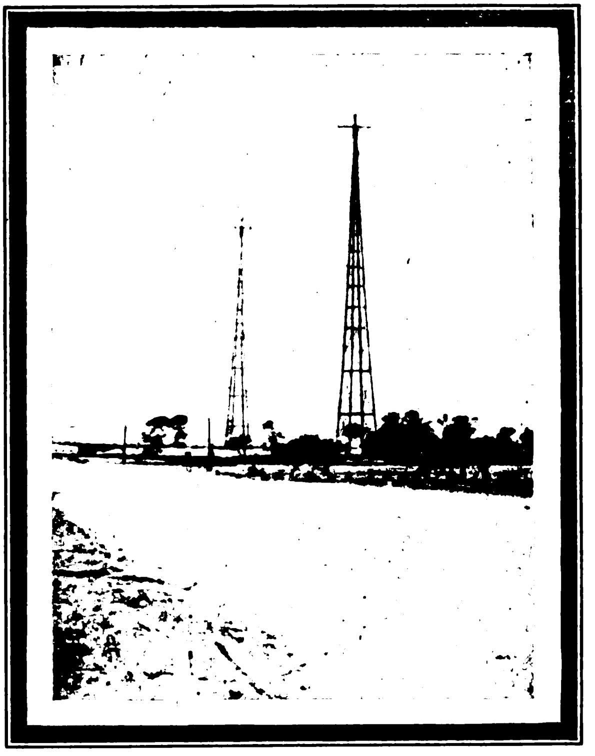
Any tree may be used for receiving from ten to fifteen miles. A nail is driven in the tree about 15 feet from the base and a wire is led to the receiving apparatus. The sap is sufficiently conductive for electrical oscillations to allow energy to be tapped off to the detector circuits. It is best that the nail be driven in a branch at some distance from the earth.

With a sensitive audion amplifier the time signals may be copied from Arlington at a distance of 200 miles with 200 feet of bell wire coiled up in the room. It has been found in some cases that the energy so received was really reradiated energy from the water pipes in the house and unless the bell wire bore a certain position to the water pipes the signals would disappear. It sometimes has been found to be of considerable advantage to string a receiving aerial parallel to telephone wires. An increase of signals was effected on account of the reradiated energy from the phone wires.

When employing telephone wires as an aerial up to 15 miles in length, it is

(Continued on page 685.)

The New Station at Miami



The towers from the land side

MIAMI, called "the magic city," because of its rapid growth, has gained added fame through the establishment there of a Marconi wireless station. This new link in radio communication has taken a place among the important commercial wireless stations in the United States. The growing demands of commerce necessitated the erection of the Miami station, which will fill the gap in the long stretch between those at Jacksonville and Key West.

The new station is located in a community which is filled with bustle and life. In July, 1896, Miami was incorporated as a city with 300 registered voters, as required by the laws of Florida. Afterward several adjacent settlements were taken in and the total population now numbers about twelve thousand. In the city, which is at the mouth of the Miami River, may be found many handsome buildings built of Miami rock, and well paved streets.

In the country districts not far from Miami is a wealth of tropical foliage. Cocoanut, magnolia, palmetto and flowering trees dot the landscape, and thousands of acres are devoted to the cultivation of pineapples, oranges and grapefruit. The Marconi employees at the station will find no lack of recreation, for fishing ranks high among the sports and those fond of hunting will have an opportunity to follow this pastime.

There are also many points of interest near Miami, among them being Cape Florida, Fowey Rocks Light, Florida Keys, Norris Cut and the Miami Rapids. William Jennings Bryan and other well known men make their winter homes in the city.

Work on the new station was commenced several months ago and progressed rapidly. Previous to that time Frederick W. Sammis, chief engineer of the Marconi Wireless Telegraph Company of America, visited Miami, secured the site and made arrangements for the construction of the buildings. There are two towers of the self-supporting type which are located close to the ocean. A 5-kilowatt set has been installed. A comfortable cottage containing a living room, dining room, kitchen and three bed rooms has been built close to a small lake. This structure is the home of the operating staff.

The pavilion adjoining the station buildings

In addition to breaking up the stretch between Jacksonville and Key West, which will considerably facilitate the handling of messages, the new station will control much of the business which now passes through the government station at the latter point. A connection will be made between Nassau and the Miami station, it is expected, to supplement the ship to shore business.

AUSTRALIAN STATIONS PLANNED

Residents of Casterton and Strathdownie, in Victoria, Australia, expect to be able to communicate by wireless telegraphy in a short time. The commonwealth postmaster-general has issued instructions for the stations to be erected as rapidly as possible as he is anxious to have a practical test of the efficiency of the system before establishing it between other centers.

DOMINICAN GOVERNMENT OPERATES A STATION

Apparatus has been ordered from the United States for the installation of a wireless station at San Pedro de Macoris, to be operated in connection with the wireless stations at Santo Domingo and La Romana. The wireless service is operated by the Dominican government, and wireless messages are now being accepted for Europe and the United States, the latter being sent via La Romana to Guanica, Porto Rico and thence to San Juan, Porto Rico.

FIXING THE LONGITUDES IN THE WILDS

Word has been received in London that Commander Herbert A. Edwards, who was loaned by the British government to command the Bolivian Survey Commission, has once more reached a point of civilization after a journey of many miles in the wilds. The members of this expedition fixed all of their longitudes through time signals sent by wireless telegraphy from the Marconi station at Porto Velho, located 120 miles from the base of operations. Commander Edwards carried with him a receiving set and a long wire which was rigged up on trees.

INSTALLATION IN DUKE'S CASTLE

A dispatch from Berlin says that Duke Ernst II, of Saxe-Altenburg, the greatest lover of science among German princes, is about to have a wireless installation fitted at his castle in Altenburg. It will be used specially for communicating with airships. The Duke has long taken an interest in wireless telegraphy and telephony.

From and For those who help themselves

Experimenters' Experiences.

FIRST PRIZE, TEN DOLLARS

An Amateur's Receiving Tuner

After considerable experimenting with various types of receiving tuners, I have recently constructed one in which fixed values of inductance are used in the antenna circuit for obtaining certain wave length adjustments. I have found this tuner more desirable than any of the ordinary amateur type, where only a portion of the turns are in actual use. It is a well-known fact that if the natural wave length of a tuning coil is about the same as the wave-length of the antenna circuit, plus the number of turns of the coil included in that circuit, considerable energy will be lost on account of the dead-end effect. It is apparent that it would be better if possible to avoid this waste of energy by a special design of the receiving tuner.

The effect of dead-ends on a tuning coil is not equally disastrous in all cases. It is only when the coil having dead ends and the aerial circuit are in approximate

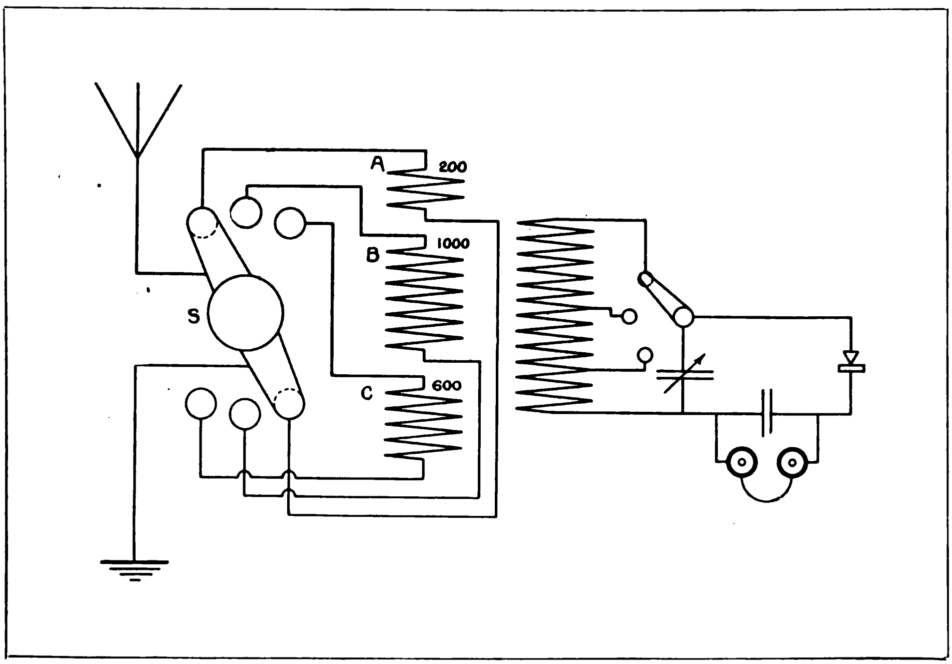


Fig. 1, First Prize Article

resonance that energy losses may be expected. Still, there are some losses under all conditions, and it is therefore better to avoid such construction.

A schematic diagram of the receiving tuner I have designed to overcome dead-end losses, is shown in Fig. 1. It will be observed that the primary winding consists of three coils A, B and C. These coils are thrown in series with the antenna circuit independently of each other by means of the switch S. The coils contain values of inductance so that when A is thrown into the circuit the antenna is adjusted to 200 meters; when B is thrown into the circuit the antenna is adjusted to 1,000 meters; when C is in the circuit the antenna is adjusted to 600 meters. The coils A, B and C are actually separated on the winding tube by about 3/8 of an inch. It is evident, then, that my design practically overcomes the losses due to dead-ends, for I insert just sufficient inductance in the antenna circuit to give me the wave-length adjustment desired.

The actual values of inductance of coils A, B and C may be determined by experiment or by calculation. The average amateur may find it easier to first wind up coils on a tube of the same size to be used in the actual tuner; thus a little experimenting will enable him to adjust his antenna circuit to some amateur station which he knows is sending on a 200-meter wave-length. In the same manner coils suitable for 600 and 1,000-meter wave-lengths may be constructed.

I find that in the case of the 600-meter wave, which is used by all commercial stations, it is best to adjust the antenna circuit for a wave-length of, say, 580 meters, because it must be remembered that some of these stations radiate wave-lengths below and above 600 meters.

It is therefore more desirable to adjust the antenna circuit to less than 600 meters, for I find that by a slight increase of coupling between the primary and secondary windings, or by judicious use of the variable condenser across the secondary windings, I am enabled to reach the 600-meter adjustment without difficulty. I find this arrangement far more preferable than making the primary winding of such value that it is necessary to insert a series condenser to bring the wave-length down to that desired.

Amateurs will readily understand that I can not give any definite data in advance as to the size of these fixed coils for the reason that their antenna are rarely alike, that is to say, the condition of inductance and capacity of these antenna vary.

In connection with my specially constructed primary winding I have found

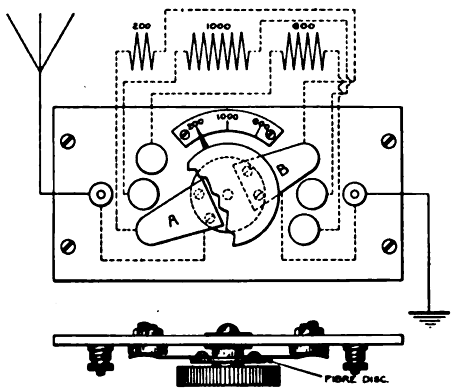


Fig. 2, First Prize Article

a single winding quite sufficient for the secondary coil to cover the wave-lengths given. The secondary winding I actually use consists of 266 turns of No. 30 S. S. C. wire wound on a 3-inch tube. A switch is provided so that 60, 180 or the full 266 turns may be used.

The primary winding is made of bare No. 24 copper wire, the turns being separated by thread. The diameter of the primary tube was 3½ inches. I do not favor the use of enameled wire, for unless it is spaced and treated as bare wire, considerable loss, due to capacity, will occur.

A more detailed sketch of the switch and its connections to the primary windings is shown in Fig. 2. The two spring contacts A and B are screwed to a fiber disc as shown. The earth and the antenna leads are connected by means of flexible wire to the spring contact A and B. A hard rubber knob H allows the switch to be placed in any position desired. A small pointer may be fixed to the hard rubber knob and made to work over a scale as shown in the drawing.

Fig. 3 is a more detailed sketch of the tuner I have constructed. It gives the actual dimensions of the supports and other details. To the binding posts A and B I connect a variable condenser of about .0004 M. F. I prefer the condenser made by the Clapp-Eastham Company, which seems the most desirable of the cheaper condensers on the market.

It should be understood that with each change of wave-length in the primary winding the degree of coupling between the primary and secondary coils will need to be changed for the maximum degree of efficiency, because the relative positions of these two windings are changed, depending upon which of the three primary windings are actually in use. As a "standby" circuit it may be necessary to "tighten" the coupling, but after a certain station is heard the coupling should be varied until the loudest signals are obtained.

A pointer fastened to the secondary winding should slide over divisions on a scale so that it will show either the distance from center to center of the primary and secondary winding respectively or the coupling co-efficient at various positions. In fact any empirical scale which at a glance will give the observer a relative idea of the value of coupling in use will be of advantage.

If it is desired to tune to a wave-length of more than 1,000 meters the 3 coils may be connected in series by a special switching arrangement or extra loading coils may be inserted in series with the antenna and detector circuits. Other modifications of the design and application of this tuner can be made at the discretion of the builder; it is assumed that he is able to work out the details to suit his own ideas.

In conclusion, I might state that it is best at all times to connect the receiving tuner to the antenna as near to the actual earth connection as possible for the pri-

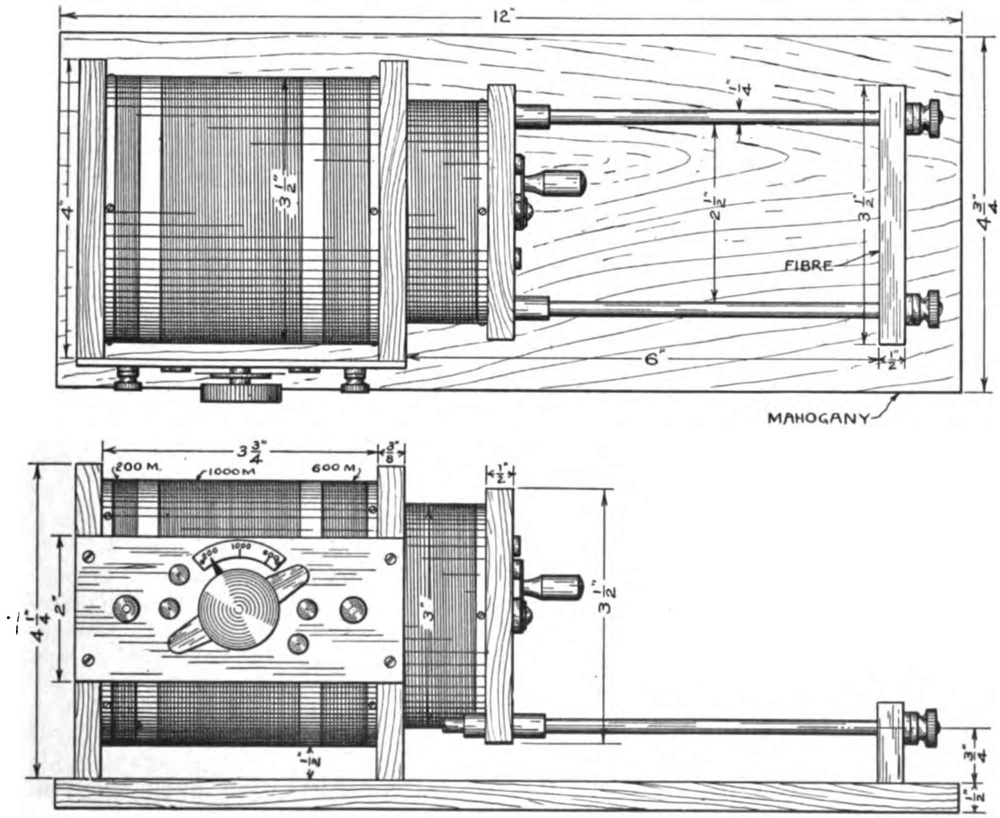


Fig. 3, First Prize Article

mary winding is then connected at a node of potential and a loop of current. The primary winding, therefore, sets up the maximum amount of magnetic lines of force which are effective in producing a potential at the terminals of the detector.

Charles S. Ballantine,
Pennsylvania.

Note.—While the writer of the First Prize article has practically eliminated the dead-end losses in the primary windings of his receiving tuner, he evidently does not consider it so important to employ similar construction in the secondary winding. We do not doubt the desirability of the construction which he has described. We recommend it to the entire amateur field. A precalibrated tuner is always an advantage, for it removes in no uncertain manner the degree of uncertainty which exists in the manipulation of the average amateur tuner. Should amateurs desire to calibrate the antenna circuit with a wave meter we refer them to the article appearing on page 416 of the February issue of this magazine, and also to Fig. 24 on page 418.—*Contest Editor.*

SECOND PRIZE, FIVE DOLLARS

The Audion Magnetically Intensified

The usual audion amplifier, consisting of two of the bulbs connected in cascade, is very satisfactory in operation, but the expense is rather high for the average amateur. In a series of experiments to secure similar results with cheaper apparatus the writer employed the magnetic method, which is simple and inexpensive.

The apparatus consists of a permanent horseshoe magnet, the poles of which are far enough apart to allow the audion bulb to be introduced between them, so arranged that it may be rotated around the bulb until the point of maximum sensitiveness is found and clamped there. In Fig. 1 A is the audion bulb, M the magnet, S a standard to support the magnet, and R, a pair of concentric brass rings, machined to the shape shown in Fig. 2 between which the standard S moves, and clamped at any point by the nut N. This allows the magnetic field of M to be rotated with respect to the audion A, and held at the most sensitive position.

The effect of the magnet when properly placed is surprising. Stations which were formerly inaudible come in clearly, and others which were very faint may now be read with the phones lying on the table. I believe that the action of the apparatus is as follows:

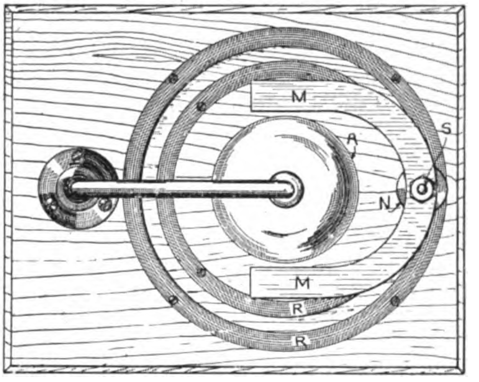


Fig. 1, Second Prize Article

As is well known, if the current flowing through an audion at varying voltages be plotted, a non-linear, or in this case a saturation curve results, as shown in Fig. 3 (1). As this curve shows, until the voltage reaches 16 there is little change in the current strength, but on raising the voltage only 3 volts the current is increased to 170. At 22 volts the current has reached 210, and any further increase in voltage has but a slight effect on the current strength. Thus it will be seen that there is a critical point in the curve where a very slight increase in voltage causes a large increase in current. The audion is kept at this point of the curve and when the weak wireless waves are impressed upon it the critical point is passed, and an increase in current in the phone circuit takes place.

The steeper the curve the greater the current increase for a given voltage increase will be, and therefore the more sensitive the audion. Note the effect of the magnet upon the shape of the curve (2), which shows the effect of the magnet when improperly placed, the curve being flatter. But in (3) the correct position has been found, and the curve is much steeper than in (1) and (2). The magnet has deflected the cathode rays, which carry the current between the wing and the grid, out of their normal path sufficiently to bring about the following condition. Just enough electrons pass to bring the curve to the critical point. The strength of the magnet or its position must be such that a very slight increase in voltage will cause as large a number of ions to return to their former path as possible, increasing the conductivity of the audion and making the curve steeper.

Any amateur will be well repaid for his trouble in making up this simple piece of apparatus, as it will increase the sensitiveness of a good bulb to a great degree, while a poor bulb will be less affected.

A. A. SKENE, Pennsylvania.

NOTE.—The method described by the writer for increasing the sensitiveness of the audion bulb is not new, but was well known in 1906-1907. It should however be of interest to those amateurs who have been unaware of the effect of the magnetic lines of force upon the action of the audion. We take exception to the inference that a single audion with a properly adjusted magnetic field will equal the double amplifier. A series of experiments covering a number of months have indicated that the sensitiveness of some audions is not increased by the magnetic field, but is actually decreased. Certain bulbs, however, were enormously increased in sensitiveness in the manner described by the author. Two audion bulbs properly connected in cascade however will invariably give decided amplifications. The experiment described by the author is well worth trying.—*Contest Editor.*

THIRD PRIZE, THREE DOLLARS

An Amateur Sending Outfit

The following description and drawing of the sending set I am now using may be of interest to amateur experimenters. Many amateurs having a 1-inch coil and wishing to improve their set both in efficiency and in appearance would do well to construct apparatus along similar lines. I am using my set for talking around town to friends within about a 1-mile radius. It is easily read at this distance, and although I have never been able to test it, I believe it will work over 5 miles: at least the makers claim this distance for the coil.

The necessary materials are:

One 1-inch spark coil, 1 spark gap, ½ pound No. 6 aluminum helix wire, six plates of glass, 8 x 10 inches, of an even thickness; battery switch, about 25c worth of tinfoil, a 1-foot phosphor bronze or brass spring strip, No. 28 gauge and ½ inch in width, and 4 binding posts.

It is best to buy the coil, gap, wire, binding posts and spring from any reliable supply house. You may get the glass from any local store and the tinfoil from a florist.

The woodwork may be of oak or mahogany, the former being more within the reach of the average amateur. For the cabinet you will need for the top and bottom 2 pieces ¾ x 12 x 16 inches (it may be necessary to glue these), 2 ends, ¾ x 3 x 10 inches, and 2 pieces ¾ x 3 x 14 inches for the front and back. You may mitre the corners or use any other standard joint. The top is hinged at the back and has some sort of a catch in front. The bottom is screwed on.

You may use any finish. I used dark oak stain and filler followed by two coats varnish. This makes a shiny finish and brings out the grain.

The helix is sawed from two pieces of material ¾ x 10 x 10 inches in the form of a circle 9 inches in diameter. Next cut five mortises, as shown in the accompanying drawing, for slats. Make the slats ⅝ x 1 x 10 inches. On the first slat cut 11 notches for the wire, beginning 1½ inches from the top and every ¾ of an inch apart. On the next, start down 1½ inches from the top and only cut 10 notches. Start 1⅜ inches down on the third, 1½ inches on the fourth and 1⅝ inches on the fifth. Cut 10 notches in

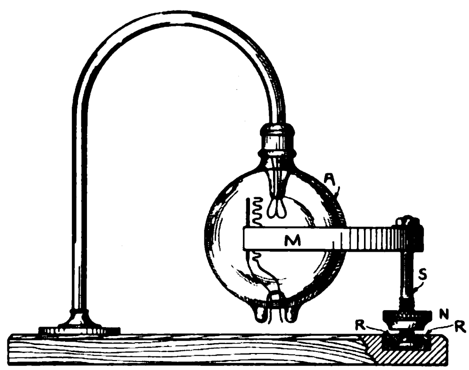


Fig. 2, Second Prize Article

all but the first. Put the helix together, using 1½-inch blued round, head-wood screws. Fasten wire at A, using a battery binding post and wind wire from one to two and so on, placing wire in slots cut for this purpose. It is best to stain and finish helix before winding. Fasten the end of winding at B in same manner as at A.

After the cabinet and helix are stained and finished you are ready to assemble. First screw the coil down and then the helix. The latter is fastened by two wood screws run through the lid of the cabinet into the bottom of the helix. Place the spark gap on top of the helix as shown. It may be fastened with 3/8-inch wood screws. Use about 8 or 10 blued 1¼-inch screws to fasten the coil as its weight might wrench it loose in handling if too few were used. Then place the switch and the binding posts. A snap switch may be used if preferred.

The connections are made as per diagram. The wire to the spark gap is run through center of helix. It may be found necessary to sink the primary wiring into the bottom of the lid as it looks better. Green lamp cord may be used for connections.

To make the condenser take 6 plates of glass 8 x 10 inches of even thickness. Cut the tinfoil in sheets 6 x 8 inches. These are fastened to glass with varnish. Care should be taken not to get any air bubbles under the tinfoil, as the condenser will not work well and may puncture. Now take a piece of tinfoil and fold it several times until it is 1½ inches wide and about 6 inches long. Lay it at C on the bottom of the cabinet. Next lay the first sheet of glass on it. Then lay the piece of foil at D and place plate of glass on it and so on until the entire condenser is completed. Connect these flaps with a battery binding post as at E. For contact on the top sheet of foil use a spring from the lid, at O. Make two helix clips as shown at F. Fasten these to wires running from G and H, these wires being of sufficient length to reach all parts of helix.

The key is not shown as many prefer to place it on the table in a handier position.

On my set the coil and gap are of the Electric Importing Company's make and if a coil of another make is used, it may be necessary to change the dimensions slightly.

I think amateurs will agree with me in saying that after construction they will have the best looking and the best working one inch coil set in town.

H. E. Welch, Oregon.

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

Where to Connect the Receiving Set

Many amateurs in connecting up their sending and receiving sets use a small spark gap, commonly known as an "anchor gap," in either the aerial lead-in or the earth wire. This, of course, puts additional resistance in the open circuit.

With the direct couplings which were formerly in general use the potentials in

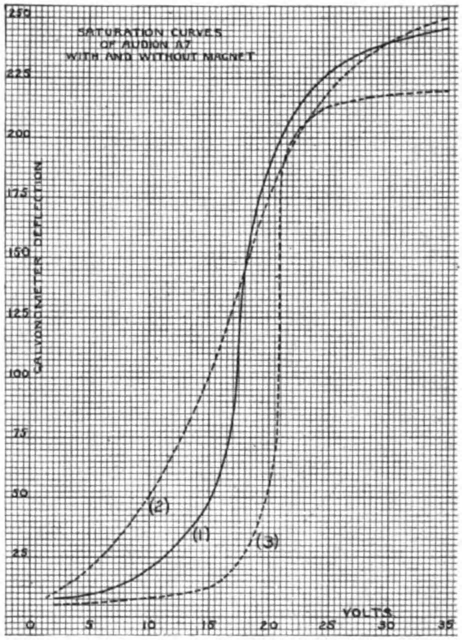
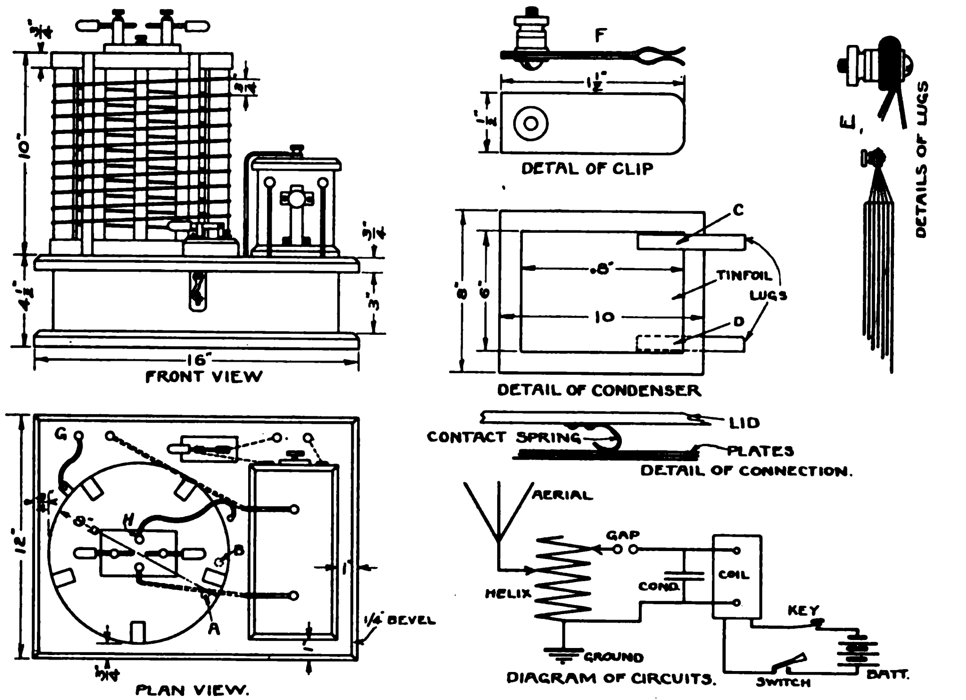


Fig. 3, Second Prize Article

the open circuit were of such value that the current would readily jump the anchor gap. Therefore the effect of the gap was not so disastrous as it would be under present United States regulations. With the loose couplings which are required under the new wireless regulations the potentials in the open circuit are much lower and the use of an anchor gap should be avoided wherever possible.

In the accompanying diagram is shown a method of connecting in the receiving set which not only eliminates the anchor gap, but also has several other advantages.

The earth wire, the receiving tuner, and the primary circuit of the transformer are all connected to a D P, D T



Diagram, Third Prize Article

switch as shown in the accompanying diagram. As this switch is connected to the earth wire instead of the lead-in wire, no special insulation is necessary. Any switch having blades large enough to carry the earth current may be used.

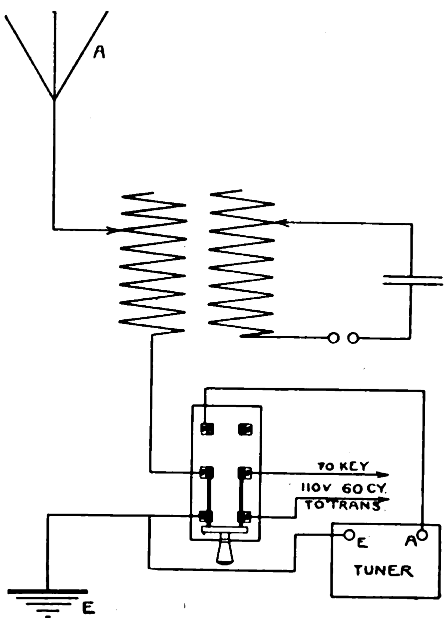
With the switch in the receiving position the primary circuit of the transformer is open and there is a break in the earth wire around which the receiving set is connected. With the switch in the sending position the primary circuit of the transformer is closed, as is also the break in the earth wire, and the aerial post of the receiving set is disconnected.

This method of connecting in the receiving set lowers the resistance of the open circuit to its lowest value with a consequent sharpening of the radiated wave, gives better insulation of the aerial lead-in than when connected to a switch; and when transmitting, sparking, in the receiving set and disagreeable noises in the head phones formerly experienced, are now absent.

CLINTON D. HEINLEN, Ohio.

NOTE.—An expensive, high potential change-over switch is unnecessary, when the arrangement described is in use; in fact, a double pole double throw 15-ampere switch is all that is required to change the apparatus from a sending to a receiving position.

It should have been mentioned that this



Diagram, Fourth Prize Article

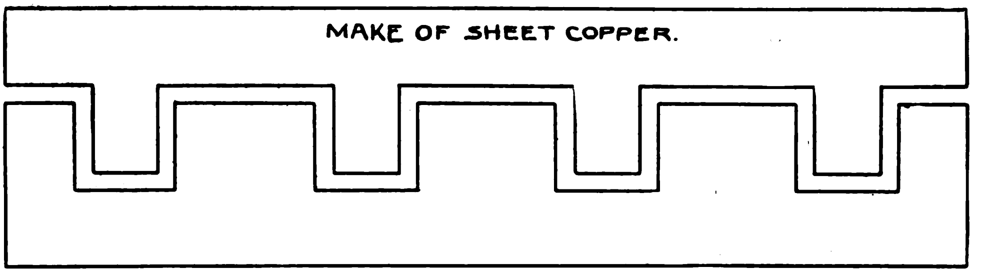


Fig. 1, Honorable Mention Article, Peter Coleman

switch must be placed as near to the actual earth connection as possible; otherwise a difference of potential between the connections to the switch and the earth wire may arise, causing sparking.—*Contest Editor.*

HONORABLE MENTION

A Method of Using a Rotary or Quenched Gap on any Spark Coil

Many amateurs who have taken the trouble to introduce the rotary or quenched spark gap into their stations have found that instead of a musical or high-pitched tone the spark, unless, or even when finely adjusted, gave a ragged note. Commercial stations secure such notes by use of an alternator giving 500 cycles current with the aid of the synchronous type of revolving gap. This means that for each reversal of current the condensers charge and discharge in synchrony. As a makeshift, the amateur is apt to install the non-synchronous type of gap, which in many cases has proven unsatisfactory, particularly when used in connection with a set securing its energy from batteries. I have successfully used a type which I will now describe. If my diagrams are carefully followed the amateur will find himself amply repaid for the labor expended.

Having a high-speed motor, I extended the shaft for the mounting of a commutator. I then cut a commutator 2 inches in diameter from some sheet copper. I cut two pieces, each piece consisting of four teeth, as per Fig. 1. I then laid them together as per Fig. 1. I then cut out a circular piece of wood, on which I screwed the pieces of sheet copper (as cut), making sure that one does not touch the other. The complete commutator is then fastened to the motor shaft.

The commutator, having four teeth on each side, makes 8 reversals of current per revolution. The action of the complete outfit can readily be seen and easily understood. When a pair of plugs on the rotary come opposite the

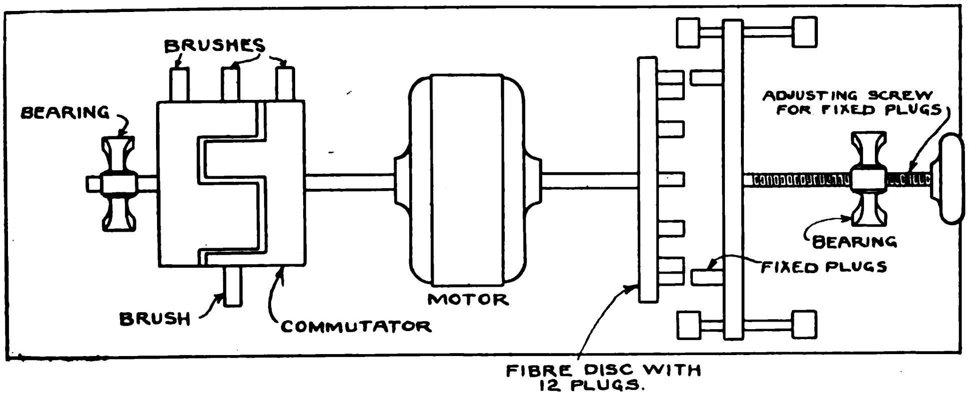


Fig. 2, Honorable Mention Article, Peter Coleman fixed or stationary electrode a reversal of current takes place at the commutator. This gives the same result as if an alternator was being used. By means of a very high-speed motor and a rheostat you get any pitch you wish.

By cutting off at the dotted line, as indicated in Fig. 2, you can use this arrangement with great success on a quenched gap.

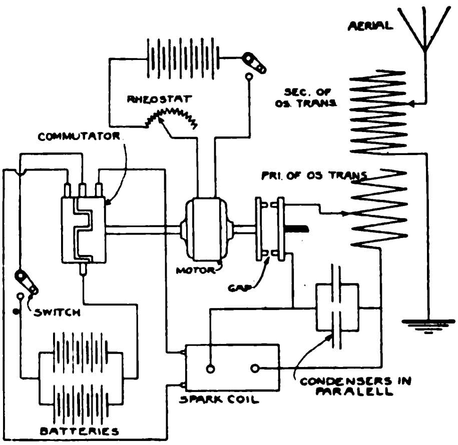


Fig. 3, Honorable Mention Article, Peter Coleman

Connections for use with a rotary are shown in Fig. 3; connections for use with a quenched gap are shown in Fig. 4.

One more word in regard to the adjustment of the rotary spark gap: Great care must be taken that the stationary or fixed electrodes are in line with the rotary plugs, and also when the brushes pass from one segment to the other, so that the spark jumps at each reversal of current of the commutator.

PETER COLEMAN,
Care Charles Metzler, New York.

Note.—Before commenting we should prefer to see this device in operation. We are of the opinion that it would be desirable to have the stationary spark points so arranged that they may be shifted in the arc formed by the disc, thus allowing the spark to discharge at the proper time and to the best advantage.—*Contest Editor.*

HONORABLE MENTION

An Efficient "Break-in" System

After experimenting for several months with various hook-ups and apparatus in an endeavor to find a "break-in system" that had no disadvantages and which could be used successfully in long-distance work, I finally adopted the system which I am about to describe.

In the system now employed by the Marconi Company a "sparkplate" or anchor gap is inserted in the earth lead of the transmitting set as near to the actual earth connection as possible. This spark plate consists of two brass plates separated by a thin disc of mica slightly smaller in diameter than the brass plates, around which are connected the aerial and earth binding posts of the receiving set, as per Fig. 1. In this system the received wave passes through the aerial inductance and secondary of the oscillation transformer, then through the tuner to the earth. When the transmitting key is pressed the current jumps the minute air gap in the spark plate in preference to flowing through the tuner. The nearer this spark plate is placed to the actual earth connection the lower will be the potential of the aerial side of the spark plate.

This system has slight disadvantages, viz.: the sparking at the spark plate making an unnecessary noise, liability of the spark plate becoming shorted by carbon deposit from the sparking (thereby earthing signals), cutting down the radiation of antennæ and also the difficulty of keeping a crystal detector in adjustment. The spark-plate system works well in conjunction with a valve or magnetic detector, but will not give satisfactory results if the transmitting set is a powerful one and a crystal detector is used.

In my system I use a closed-circuit relay in place of the spark plate (see Fig. 2), which eliminates the undesired sparking, and which also earths the tuner at the instant the transmitting key is touched. I first tried operating the relay by having two extra contacts on the front of the key, making contact as the key was depressed, thus closing the relay and grounding the tuner. This proved to be unsatisfactory, as sometimes the key would arc, causing a spark to jump while the relay was open, thus knocking the crystal out of adjustment.

I then changed the relay into a closed-circuit relay by putting the contacts on

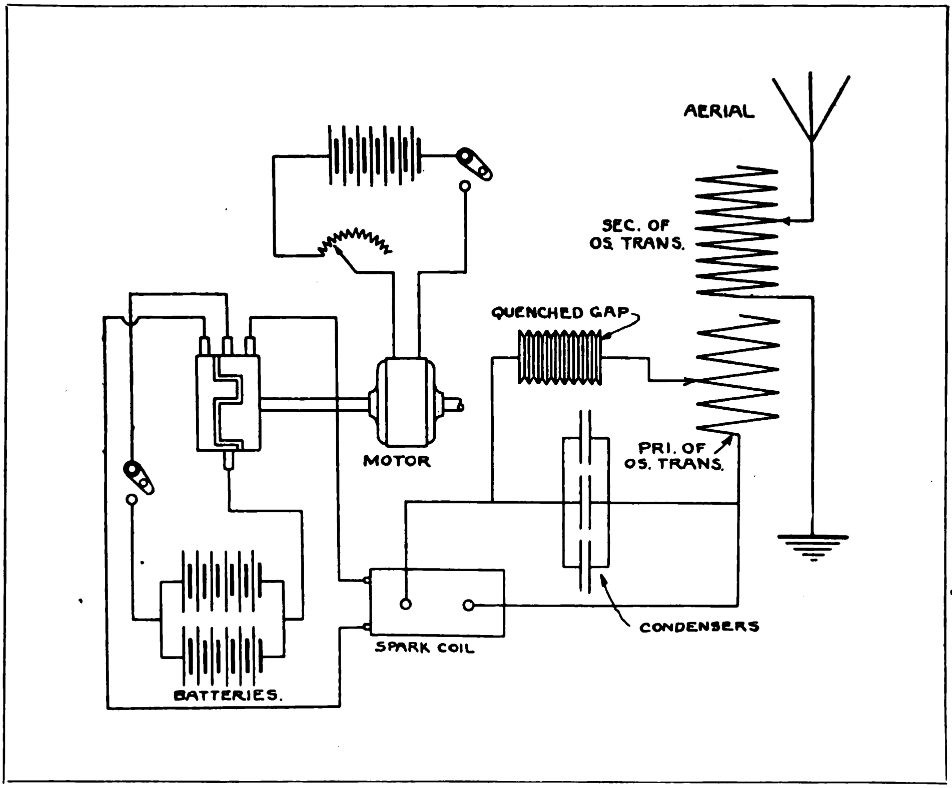


Fig. 4, Honorable Mention Article, Peter Coleman

in such a manner that they opened the circuit when current was in the magnets, and then attached a small extension of hard rubber about 1½ inches long to the front of the key, on which I fastened two contacts, one on each side; next I made a small fibre support to hold the two upper contacts, as shown in Fig. 3. These two sets of contacts must be adjusted so that they both make contact, and stop the upward motion of the key. One set of these contacts operates the relay, the other set opening and closing the detector circuit.

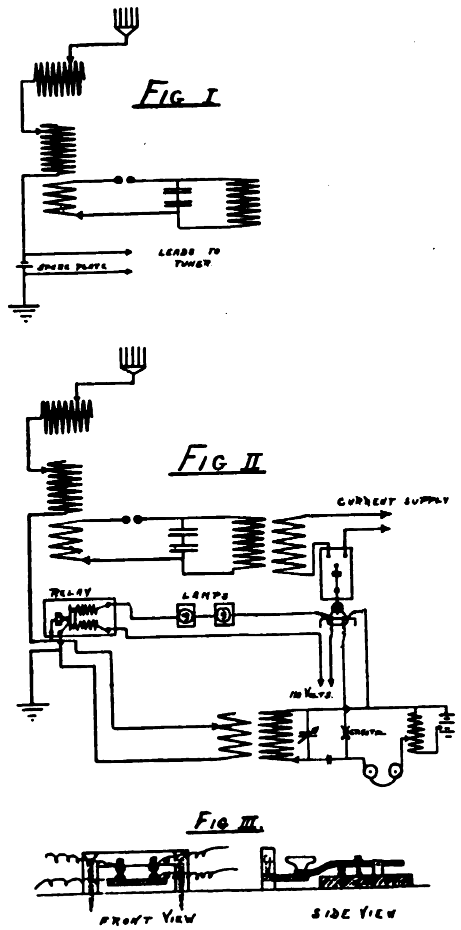
The writer is using a 175-ohm relay on 110 volts, with two 16-c. p. lamps in series, but batteries may be used instead. If this system is to be used with a large transmitting set it will be found advisable to put heavy silver key contacts on the relay, having quite a stiff spring pulling them together. The armature of the relay need have but very little play, as no current is broken at the contacts.

The action is as follows: When receiving, the current is flowing through the magnet coils of the relay, thereby holding the aerial and earth contacts of the relay apart, and the signals pass into the tuner. When the key is touched these contacts meet. This action causes the tuner to be cut out of the circuit, short-circuited and grounded (before the A. C. contact is made); the detector circuit is also opened. When the key comes up the contacts on the extension and the fibre bridge meet again, closing the circuit in the magnets of the relay, which in turn separates the aerial and earth contacts of the relay. The detector circuit is again closed. This action is very rapid and will work perfectly, even if the A. C. key is operated by a vibroplex automatic speed key at 30 to 45 words per minute.

This system has been used successfully for several months by the writer in connection with a 2-K. W. radiating, 20 amperes in the antennæ, with the tuner but 2 feet from the aerial inductance. With this system and carborundum detector I have worked a "break-in" while communicating with stations at a distance of 1,000 miles many times, adjusting detector but about once a week to make sure that it was giving maximum strength signals.

HOMER B. BLACK, New York.

Note.—The arrangement of circuits, as shown, is not new, having been used a number of years ago. The article, however, has been printed on account of the number of inquiries received from



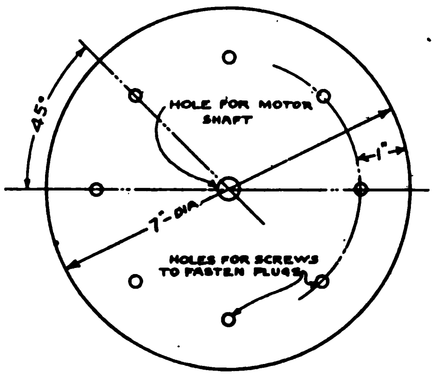
Diagram, Honorable Mention Article, Homer B. Black

amateurs on the subject of "break-in" devices. It should be known that the Marconi Wireless Telegraph Company of America has abandoned the use of all anchor gaps and ground spark plates from the antennæ circuit.—*Technical Editor*

HONORABLE MENTION

Rotary Spark Gap

As an improvement on Mr. Hengerer's rotary spark gap, described in the

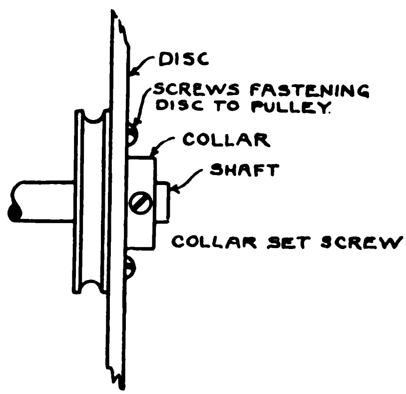


LAYOUT OF DISC.

Fig. 1, Honorable Mention Article, H. Haines

January WIRELESS AGE, I am submitting an account of a gap that is probably a trifle more expensive, but I think will give much better results.

To make this gap, procure from a dealer in phonograph supplies one of the old 7-inch disc type Columbia records. The back is to be divided into eight



METHOD OF ATTACHING DISC

Fig. 2, Honorable Mention Article, H. Haines

parts, as shown in Fig. 1. Now measure 1 inch in on each of the eight lines, and place a cross as shown in the diagram. Here you will find that the distance between the crosses is 2 inches At each of the cross marks drill a hole with a 6/32 slip drill, but before doing this be sure that the cross marks are in

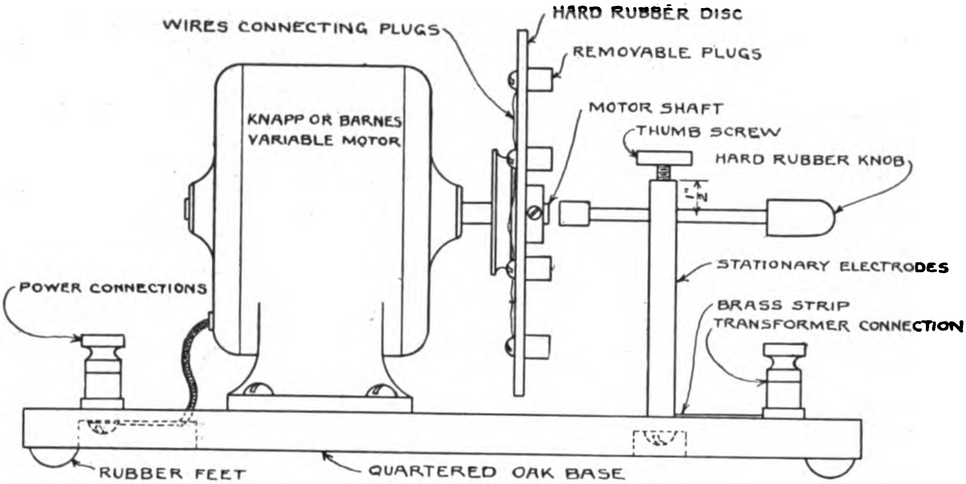


Fig. 3, Honorable Mention Article, H. Haines

their right places or you will spoil the disc.

Next turn out, or have turned out, 8 zinc plugs ½ inch long. Drill and tap these for 6/32 machine screws. These plugs can be made from battery zincs which are of the right diameter and serve the purpose admirably. The plugs should then be mounted, taking care that they bear a bright, even surface to the stationary electrodes. Brass or copper washers should be put on the machine screws, and they should then be connected on the opposite side with brass strip.

The disc may be attached to the motor by first procuring an aluminum or brass pulley wheel, as used on motor shafts for running small toys, etc. (Fig. 2); then the hole in the disc should be enlarged to fit firmly on the smaller part of the pulley wheel so that it will rest tightly against the larger part of it. When this is done drill two holes opposite each other with a 6/32 tap drill through the hard rubber disc and about half way through the pulley wheel. Tap these holes for 6/32 machine screws; these are absolutely necessary to hold the disc in place when used at the high speed required.

The stationary electrode posts should be made of ¼ inch square or ⅜-inch hexagon brass rod, cut ½ inch longer than the distance from the base of the motor to the center of the motor shaft to be used (Fig. 3). These electrodes should be drilled and tapped at the bottom for 8/32 machine screws; at the top they should be drilled and tapped to the depth of ½ inch for 6/32 thumb-screws.

When this is done, measure down 1.2 inch from the top of these electrodes and drill holes with an 8/32 slip drill right through the center of the rod. This is for the rod holding the stationary electrodes. Next cut two pieces of 8/32 brass rod about 2½ inches long, and thread on each end about ¼ inch. Then make two plugs the same size, as on the disc, only drill and top for 8/32 machine screws to the depth of ¼ inch. These should be screwed on the threaded brass rod, then put through the hole in the stationary electrodes, and 8/32 hard rubber knobs screwed on the other end.

For a base procure a piece of quartered oak, about 5 x 8 inches, and mount the motor firmly. Make power connections to binding posts at the rear of the motor. Drill two holes in the base about 2 inches from the disc, and mount the stationary electrodes. Connections for this should be made with brass strip on the upper side of the base to the binding posts provided.

The cost will probably figure up as follows:

Second-hand 7-inch record	.05
Quartered oak base	.10
Brass posts	.10
One wet battery zinc	.05
Pulley	.15

(Continued on page 685.)

One of the recent converts to the ranks of wireless telegraph enthusiasts is Master Reggie Sheffield, 13-year-old actor, who has rigged up a set in his bedroom. Master Reggie is regarded as more or less of a scientific prodigy, but is better known as Eric Desmond of the Cinema "movies"

Queries Answered

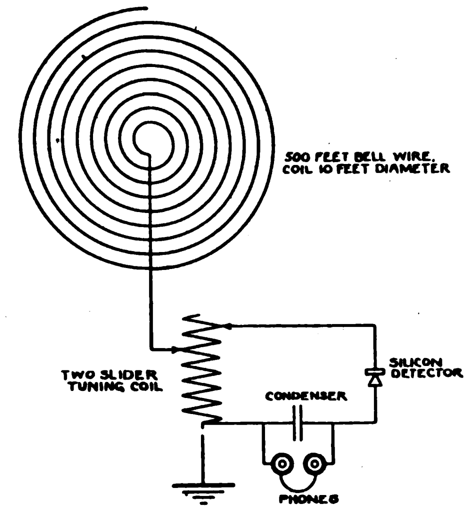
Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all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

H. A. L., Philadelphia, asks:

Ques.—(1) I live within a mile and a half of the Marconi station at Wanamaker's (WHE) and within a few miles of the League Island Navy Yard Station. I should like, if possible, to get them without an aerial and as few instruments as possible. Please tell me if this is possible, also the instruments needed. I am situated in a nest of high office buildings.

Ans.—(1) Wind up about 500 feet of No. 18 bell wire in a coil, on the ceiling of your room as per the accompanying sketch. Purchase a 2-slide tuning coil, a fixed condenser, a silicon detector and 1 pair of 500-ohm head telephones; connect them up as shown in the diagram.



Ques.—(2) Give the calls of the following steamers:—Mongolian, Carthaginian, Sardinian and Pretorian, of the Allan Line.

Ans.—(2) Mongolian, MON; Carthaginian, MHN; Sardinian, MDN; Pretorian, MFN.

Ques.—(3) What is the pay of second and chief operators on ships with Marconi apparatus and what is the lowest age at which young men are employed.

Ans.—(3) The pay varies according to ability and seniority. It ranges from $25 to $60 a month. In addition commissions on receipts are allowed. Lowest age, 18 years.

* * *

A. L. A., Brookes, Va., asks:

I have recently built a large receiving transformer and with it can copy Key West (NAR) on 1,500 and 4,000 meters in the day time. Now on a very long wave (apparently 7,000 or more meters) I hear a station working practically all the time. It seems to be copying from some other station until about one or two o'clock in the morning and then sends messages and SP'S. It never signs (to my knowledge), and I am quite anxious to find out what station this is. It sends a number of messages originating from Toronto, Montreal, New York, and other large cities. The station has a high frequency spark about the same tone as WSL. My aerial is 75 feet high at the highest end and 210 feet long; it is composed of 14 No. 12 wires spaced 5 feet apart.

Ans.—The station you hear on 7,000 meters' adjustment is very likely the trans-atlantic station of the Marconi Company at Glace Bay, Nova Scotia.

* * *

E. A. M. Jr., inquires:

Can you inform me where the wireless stations with the calls BCT, MBI, VBG, MMM and CDN are located? Does the Marconi Corporation publish a list or lists of call letters of stations in various parts of the world equipped with apparatus of the Marconi System or of other systems? If so, will you please forward information and prices of such lists.

Ans.—BCT, S.S. Buccaneer; MBI, not listed; VBF, not listed; VBG, not listed; MMM, Morro Castle, Havana, Cuba (Land Station); CDN, Clifden, Ireland (Marconi High Power). Copies of International Call lists may be purchased from the International Bureau at Berne, Switzerland. A limited number of copies may be purchased from the Traffic Department, Marconi Wireless Telegraph Company of America, 233 Broadway, New York. Price, $1.00 per copy.

* * *

H. G., Brooklyn, asks:

Ques.—(1) I have a 3-inch spark coil in which the secondary is separated from primary with empire cloth. If I immerse this coil in kerosene oil, will its insulation be improved?

Ans.—(1) The insulation may be improved, but kerosene oil should not be used on account of the danger from fire. Get in touch with Swan & Finch, New York. This firm will be able to supply you with first-class condenser oil having high insulating properties.

Ques.—(2) Which is most efficient for the coil referred to—a mechanical converter as described in the April issue of Modern Electrics and Mechanics, or a mechanical interrupter producing 6,000 sparks per minute? The mechanical converter in my case gives 200 cycles.

Ans.—(2) Difficulty in the nature of arcing is apt to be experienced with the mechanical converter, in any except very small sets. We advise the mechanical interrupter.

Ques.—(3) Will the capacity of a variable condenser (rotary) be increased if I immerse the plates in kerosene oil?

Ans.—(3) Yes, but it is not advisable to use kerosene. A good grade of castor oil will give the desired results.

Ques.—(4) An audion, when in use, requires about 44 volts; please tell me what fraction of an ampere is used.

Ans.—(4) One quarter to one half an ampere.

* * *

C. F. C., Freeport, L. I., asks:

Ques.—(1) How far should I be able to receive signals with the following: "T" shaped aerial and instruments, 74 feet long, 45 feet high; 4 No. 14 copper wires spaced 20 inches apart; leading, 2 No. 10 bare copper wires, 20 feet long; ground, 20 feet long attached to waterpipe; 1 small loading coil; 2 slide tuner, "loose-coupler," 2 fixed condensers, detectors (2 Galena and Silicon), and 1 variable condenser tubular?

Ans.—(1) Properly connected up you should have signals 1,000 miles at night time; in the day time you should have signals from 150 to 200 miles.

Ques.—(2) Will it improve my set to dispense with any of the instruments named?

Ans.—(2) It all depends on the "hook-up" at present in use. We can not understand the use of the 2 slide tuning coils in connection with the "loose-coupler." What is it used for? Unless it is employed as a loading coil, it may as well be dispensed with.

Ques.—(3) Should a "T" aerial be connected across the 4 wires at both ends?

Ans.—(3) Yes, preferably.

Ques.—(4) Is it any advantage to have a heavy wire or 2 wires for a lead-in?

Ans.—(4) The lead-ins are preferably equal in diameter and conductivity to the wires of the flat top; lead-in wires should be bunched rather than spread.

* * *

W. B. D., L. I., asks:

Ques.—(1) Will you please give me full instructions as to how to operate a "loose-coupler"?

Ans.—(1) A full answer to this query would require too much space in these columns. A complete explanation will appear in an article of the series on "How to Conduct a Radio Club." Have you read the articles entitled Operators' Instructions, appearing in this magazine? Complete instructions, fully covering various types of inductively coupled receiving transformers, have been given in these articles. We advise you to get in touch with some of your amateur friends who have back copies of the WIRELESS AGE and study the articles thoroughly. Circular 144B, issued by the Traffic Department of the Marconi Company, may be secured for ten cents a copy. It gives full instructions for the operation of "loose-couplers."

Ques.—(2) My wireless set consists of the following apparatus: Amco loose-coupler; ferron detector; fixed condenser, consisting of 15 sheets of tin foil; loading coil, 3 inches in diameter, 8 inches long, wound with No. 24 S. C. Wire; 2 250-Ohm receivers; ground, No. 14 wire about 18 feet long; aerial, 1 wire, about 250 feet long, 35 feet high. The only station that I have heard is Sayville, L. I., and its signals are very faint. Can you tell me what the trouble is and how I can increase my range?

Ans.—(2) The hook-up shown in the sketch accompanying your query is quite correct and can not be improved upon, with the exception that your drawing does not show the secondary winding of the "loose-coupler" as being variable. It is quite important that this circuit be accurately tuned to the aerial. Why you do not hear stations other than Sayville, we can not say, because we are not familiar with the local conditions.

Ques.—(3) A certain firm is marketing a single pole 1,000-ohm phone which it sells at a reasonable price. Has it an advantage or a disadvantage over the double pole 1,000-ohm phone?

Ans.—(3) A well constructed single head phone may give better signals than a poorly constructed double head set. But in every instance a double head set is the most preferable, provided it is sensitive. We are not familiar with the head phone you mention.

Ques.—(4) Why do the land operators get more salary than the ship operators? The latter stand a chance of losing their lives, thereby cutting off the support of parents or those under their care.

Ans.—(4) Because the duties of land station operators require greater skill, and labor. The land station operator must be familiar with both the American Morse and Continental telegraph codes. He must be able to work the wire lines and wireless apparatus with equal facility. He is required to have knowledge in many instances of gasoline engines or other prime mover power equipment. His work is more laborious than that of the ship operator, for he is required to handle wireless traffic from all ships within radius. The land operator does considerable more actual operating and routine work than the ship operator. Commercial land stations must be manned by men who, possessing both initiative and ability, have had wide experience in wireless matters at sea.

The land station operator, provided he possesses the proper qualifications, is invariably recruited from the ship service. It is right that he should be properly compensated for his experience. Furthermore, let it be remembered that the land station operator is required to pay for his food and in some cases for his lodging; he is also under other incidental expenses from which the ship operator is totally free.

The actual risk incurred by the operator aboard ship or the chance of losing his life is exceedingly small. When one considers the thousands of ships equipped with wireless apparatus, and the actual number of operators who have lost their lives while at their posts, it will be evident that the percentage of risk is close to a negligible quantity.

* * *

F. A. T., San Francisco, writes:

Ques.—(1) In the Wireless Engineering Course in the November issue of THE WIRELESS AGE, H. Shoemaker, the author of the article, states that the maximum voltage is 1.41 times the effective voltage. Does this hold true on all powers, frequencies, and voltages?

Ans.—(1) The statement holds good under all these conditions provided the current is of pure sine form; otherwise it does not. For instance if the generator gave a very peaked wave form, the maximum voltage may be considerably more than 1.41 times the effective voltage.

Ques.—(2) If the statement in my first query does not hold good under all conditions, kindly give the formulæ for finding the maximum voltage from the transformer secondary voltage.

Ans.—(2) Note page 508, the March issue of THE WIRELESS AGE, where a method is given for obtaining the maximum voltage of a transformer by measuring the length of discharge when it takes place between two brass balls ½ inch in diameter.

Ques.—(3) If the closed or condenser circuit of a transmitting set is tuned for 300 meters and the antenna or open circuit is tuned for 200 meters, the coupling being very loose between the secondary and primary, what wave-length will be tuned at a distant receiving station?

Ans.—(3) It is doubtful whether a transmitting set under such conditions could be heard at any considerable distance, as the circuits are so far out of resonance that the antenna current would be very slight. We have recently made some tests under the exact conditions you propose and have found that frequencies, corresponding to both wave-lengths were present in the antenna circuit.

* * *

J. F. W., Roanoke, Va., inquires:

Ques.—(1) What is the approximate wave length of the following aerial, used for receiving only: 4 single strand antenna wires, 140 feet long, spaced two feet apart, elevated 50 feet above ground; lead-in about 40 feet long? Please give an example of how to figure the length in meters.

Ans.—(1) The approximate wave length is 340 meters. Computation of the wave length of a flat top aerial can only be made by mathematical formulæ, the discussion of which would require too much space in these columns. Very roughly the wave-length of an aerial of the type you describe is 5 times the linear length of the entire aerial, including the flat top and the lead-ins.

The wave length of a single vertical aerial wire, when connected to earth, is 4 times its linear length, but when flat top-multiple wire aerials are used, the statement must be considerably modified, depending on the design, distance from the earth, etc.

In an aerial of standard construction like the one you describe the following formula has been proposed for amateur's use. It is only very roughly accurate:

$$W = V + \frac{L}{4} \times 4$$

Where W = wave length in meters

V = Vertical height of flat top

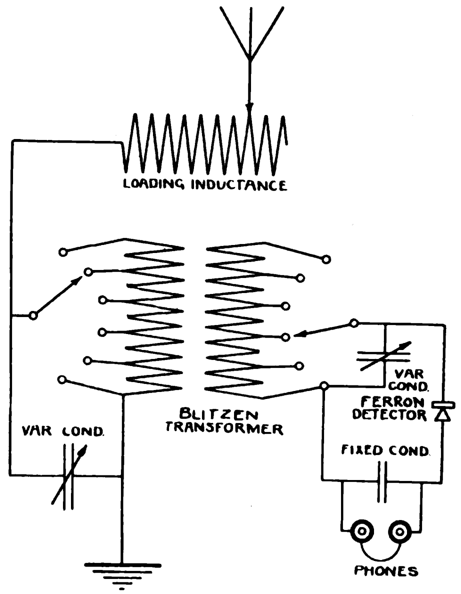
L = Length of flat top (4-wire aerial-wires spaced two feet apart)

In the case of your aerial,

$$W = 50 + \frac{140}{4} \times 4 = 320 \text{ meters,}$$

corresponding closely to our first statement.

Ques.—(2) Can you say as to about what I could do in receiving with the following set on the aerial referred to under normal conditions with ground connection 60 feet long, connected to water pipes? The set consists of a Blitzen receiving transformer, two Blitzen variable condensers, one fixed condenser, Ferron detector, Murdock loading inductance, and 2,000-ohm Brandes receivers. The receiving transformer is said to be capable of adjustment to 1,500 meters.



Ans.—(2) You should be able to hear signals 1,000 miles at night time.

Ques.—(3) Please give diagram of connections of instruments referred to.

Ans.—(3) Herewith is published a diagram of connections.

Ques.—(4) The Radio Apparatus Company of Pottstown, Pa., is turning out a new loose-coupler with one switch on secondary and two switches on primary, claiming a range of wave lengths up to 4,500 meters. Do you consider this any better than the Blitzen transformer?

Ans.—(4) Having had no experience with either, we can not answer.

* * *

H. M. C. D., Brooklyn:

We cannot give you definite data as to the wave-lengths you may expect to obtain with the receiving apparatus you have described as we do not know the capacity and inductance of the aerial at present in use. You should have given us the height of the flat top aerial above the earth and not the distance above the sea level. We have made some calculations on the assumption that the capacity of your aerial is approximately .0003 Mfd. and the inductance 76,000 Cms. The inductance of the coil which you are to use as the secondary winding of the receiving tuner is 3,600,000 Cms; the capacity of the variable condenser is approximately .001 Mfds. Therefore, this condenser when connected in shunt at its full capacity to the above coil will allow wave-length adjustments up to 3,600 meters.

The inductance of the loading coil is approximately 1,788,020 Cms. The inductance of the primary coil is approximately 1,132,660 Cms. Therefore, the combined inductance of the entire antenna circuit is 2,996,680 Cms. Assuming that the capacity of this antenna is .0003 Mfds, you may obtain wave-length adjustments in that circuit up to 1,800 meters. Of course, should you desire to receive wave-lengths of 3,600 meters, you will require a loading coil of increased dimensions for the aerial circuit.

* * *

L. K. Lawrence, Kansas, asks:

Ques.—(1) Can radiation resistance be determined or calculated in any comparatively simple way?

Ans.—(1) The following equation is sufficiently basic to cover your query:

$$R = K\frac{h^2}{\lambda^2}$$

Where R = radiation resistance of the aerial
H = height of a flat top aerial in meters
λ = wave length of the aerial in meters
K = 1,600 (a constant)

Ques.—(2) Does the formulæ for the capacity of concentric tube condensers give the capacity as directly proportional to the overlap?

Ans.—(2) Yes, all other things being equal.

Ques.—(3) There is on the market a rather curious high tension transformer of only 75 watts; the secondary potential is 20,000 volts. This is a true transformer and not a spark coil. Would 75 watts at 20,000 volts represent a sufficient amperage to make the charging of condensers for a 200-meter set possible?

Ans.—(3) On the assumption that the current supply is 60 cycles, the secondary terminals of the transformer should be connected to a condenser having a capacity of .003 microfarad. For a wave-length of 200 meters the condenser should be connected in series with a helix having an inductance value of 3,630 centimeters. You should obtain fairly satisfactory results with this set. You will probably find that it will be necessary to use small spark electrodes at the gap in order to obtain a uniform discharge.

* * *

W. G., Sayville, N. Y., asks:

Ques.—(1) Would it be possible to use No. 36 enameled wire instead of No. 34 in the construction of the auto-transformers? I have several pounds of the No. 36 wire on hand, and would like to use it if possible.

Ans.—(1) Yes, No. 36 wire will do.

Ques.—(2) If so, should the resistance be increased to make the number of turns approximately equal to the number of turns if No. 34 wire were used? A No. 34 wire having a resistance of 9,000 ohms would be approximately 35,000 feet long. A No. 36 wire of equal length would have a resistance of approximately 14,500 ohms. Would this resistance be too high to produce results?

Ans.—(2) It is not the resistance, but the value of the inductance obtained which determines the efficiency of this arrangement. We suggest that you wind up all the No. 36 wire you have on hand, dividing the winding between the contacts of a 5-point switch. You will find that a little experimenting with various values of inductance, to enable you to determine the most efficient arrangement, will aid you in your work.

The data given in the article in How to Conduct a Radio Club in the January issue of THE WIRELESS AGE, may be varied. It was not intended that the statements made should be taken as final; they were given to show the values used in certain experiments.

Ques.—(3) Would it be of advantage to decrease the length of the wire?

Ans.—(3) This question was replied to in the answer to your second query.

COMMENT AND CRITICISM

(Continued from page 666)

a peculiar fact that wave-lengths as low as 600 meters may be received with considerable success. It is found that the closed or detector circuit must then be tuned quite accurately to the wave-length of the distant receiving station, whereas the aerial circuit may be set at one value of inductance for a range of wave-lengths from 600 to 5,000 meters. In an open and unobstructed location aerial wires 3 feet from the earth will give surprising signals, particularly on the longer wave-lengths.

The use of an iron bedstead as an aerial has become so well known that it will not be discussed.

Good signals are and should be received on the gas pipes of New York houses; it is not generally known by amateurs that these pipes are insulated from the earth near to the meter in the basement by a fiber bushing.

FROM AND FOR THOSE WHO HELP THEMSELVES

(Continued from page 680)

Binding posts, brass strip, etc......	.25
Hard rubber knobs...............	.10
Soft rubber cushion..............	.10
	$.90

This, of course, excludes the cost of the motor, the make of which is at the option of the builder of the gap.

The motors best suited for this work and to operate on 110 volts are either the high-speed Knapp or a "Barnes" variable-speed motor.

This gap can be used on up to 3/4 K. W. without fear of ruining the electrodes. With a motor giving 3,500 revolutions this gap has a frequency of 467, which gives a very pleasing note in the receiver.

H. HAINES, New York.