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September, 1916

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THE WIRELESS AGE

An Illustrated Monthly Magazine of RADIO COMMUNICATION

Incorporating the Marconigraph

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

Volume 3 (New Series) — September, 1916 — No. 12

CONTENTS

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N. A. W. A.

Protection for Purchasers

of Wireless Equipment

From June N. A. W. A. Monthly Service Bulletin.

"During the last few months we have received a number of complaints from members who have purchased wireless apparatus from different supply houses. In most cases the complaints were to the effect that they had ordered such and such a piece of apparatus and made remittance on such and such a date, and that they received an acknowledgment of the order, but had never received the apparatus; nor could they get any satisfaction from the companies, although repeated complaints had been made. We have taken up these cases of members, have written the manufacturers and have secured prompt action and satisfaction in several cases.

In a recent case, one of our members in Massachusetts wrote, "I received shipment of my transformer one week after you wrote the company on this subject and wish to compliment you for accomplishing with one letter what I could not accomplish with a half dozen."

If members will exercise a little care in placing their orders and place only with reputable concerns who manufacture dependable goods, they will have little trouble. It is the small, "fly-by-night" concerns, here to-day and gone to-morrow, who put out cheap apparatus at prices too low to make it possible for them to deliver anything worth while who have cheated hundreds of amateurs out of their money. Study the catalogs carefully. See if they give any sort of guarantee. Note how long they have been in business and note the publications in which they advertise.

THE WIRELESS AGE and most other good publications refuse to accept the advertisements of new and small concerns without being assured that the concerns are all right and will meet their obligations. If you have had any trouble receiving goods ordered, write us, and we will take up the complaint."

From July N. A. W. A. Monthly Service Bulletin.

"The item in our last bulletin about protection for members has called forth considerable correspondence. Assistance will be given members in every case. A considerable number of complaints against one small concern in New York City shows it to be the worst offender. It seems more than likely that with the accumulation of complaints and with the aid of the Post Office Inspectors that this particular concern will be compelled to make good. Practically all other concerns about which complaints were made have been found to be all right and we feel confident that the houses will straighten out claims when properly presented to them.

We are glad to know that our members appreciate that this protection work is one of the tangible evidences of the value of membership in the N. A. W. A."

Since the publication of above notices to N. A. W. A. members the Secretary has received numerous complaints, most of them against two or three concerns. A small percentage were against houses of good repute and were due to clerical errors which were at once corrected when brought to the attention of the houses concerned. The bulk of the cases concerned irresponsible concerns doing business with apparatus of little or no value. Redress is practically hopeless. The only solution is by an accumulation of evidence by means of which the Post Office Department may find it possible to issue a fraud order which will put such concerns out of business. Send in your cases with full details. Many requests have been made that we publish the names of these houses. This we are unable to do until the evidence brings action on the part of some one to recover losses and damages.

SOME LETTERS RECEIVED

Sec. N. A. W. A., 150 4th Ave., N. Y. C.
Rec'd ——— from ——— which I wrote you about and thank you for your trouble, one letter of yours being more effective than half a dozen of mine.

GILBERT E. MAUL, Chatham, N. J.

Sec. N. A. W. A.
I received the equipment.——— Thank you for your quickness in securing results.

ROY MACKIN, San Francisco, Cal.

Sec. N. A. W. A.
This morning received check from ——— in refund. Had written a dozen times but could get no results but one letter from you made them come across.

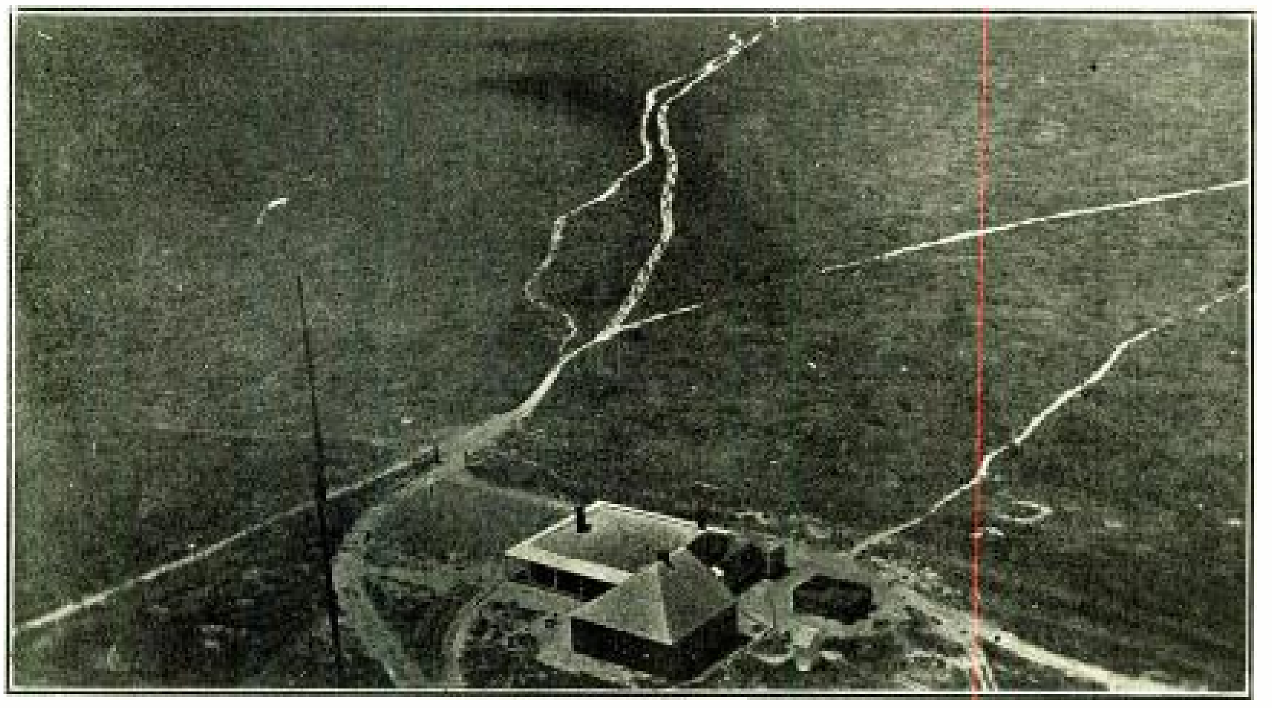
PHILIP BOST, Statesville, N. C.

It Pays to Be a Member of the N. A. W. A.

THE WIRELESS AGE

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

SEPTEMBER, 1916



A birdseye view of the operators' dwelling and annex. This photograph was taken from one of the wireless towers

Where Wireless History Was Made

The South Wellfleet Station Which Marconi Used to Conduct Early Trans-Atlantic Experiments

By Irving Vermilya, Manager of the Station

RISING high above the sand dunes of a bluff overlooking the Atlantic Ocean, sixteen miles from the tip of Cape Cod, are the towers and masts of WCC—the Marconi station at South Wellfleet, Mass.—which, from the historical wireless viewpoint, has more than ordinary interest. For it was known at the time it was built as the only high-power station in this country. Moreover it was this station that Guglielmo Marconi used to conduct some of his early trans-Atlantic experiments.

South Wellfleet is a part of Wellfleet, which in years gone by was known as a thriving fishing town. Oyster dredging has now taken the place of fishing, however, although the community numbers among its residents many seafaring folk who talk interestingly of the times when big catches were made. In those days sections of the Atlantic Ocean and Cape Cod Bay adjacent to South Wellfleet were dotted with fishermen's craft of various kinds, the streets of the village reflecting the activities on the waters. Today South Wellfleet does not lack life nor interest, but they are of a different variety. During the summer months the village is able to boast of more than 1,000 inhabitants, while in the winter its entire population does not total more than one hundred. This wide variance is due to the fact that South Wellfleet has considerable attraction as a resort.

The wireless station and the dwelling of the operators are about three-quarters of a mile from South Wellfleet, the village being reached by a walk through picturesque woods. The newly-arrived wireless man at the station will find much to interest him in South Wellfleet and the neighborhood. And when he has tired of walking through the woods and wandering about the thoroughfares of South Wellfleet he can, if he chooses, go "clamming," or, when the tide is not too strong or the water too rough, bathe in the ocean in front of the station; if favorable conditions do not prevail on the ocean front he has the choice of swimming in the bay.

Irving Vermilya, author of this article, dressed to weather a storm

Strikingly different from summer conditions are those in which the operator lives in the winter. For when the icy blasts sweep across the Cape and the snow falls and accumulates in great drifts, he remains during the greater part of the time at his set or in his living quarters.

A winter's night at South Wellfleet with a storm raging is described as thrilling indeed. The wind whistles through the aerial wires with terrific force, producing unearthly sounds without number, and the boom of the surf on the beach is like that of cannon. The violence of the storms can be determined by the experience of a Marconi man who left his quarters one night in the midst of a gale which was accompanied by a heavy snow fall. He had gone only a short distance from the bungalow when he became lost in the storm, and was compelled to walk blindly about the fence-enclosed station property for thirty minutes before he succeeded in making his way back to his quarters. However, the long winter evenings with the resultant opportunities for reading compensate for discomforts.

All the conveniences of a modern dwelling are provided in the bungalow and annex built for the station men's home. The bungalow is one story in height with an attic, and is divided into a parlor, bed room, manager's office, dining room, kitchen and bath room. The annex contains six bed rooms. Running water and electric lights are among the advantages of the quarters.

Chief among the objects of interest in the bungalow is the bed which was occupied by Mr. Marconi while he was conducting his experiments. A newspaper man, detailed by his editor to send the first wireless message across the Atlantic, who was at South Wellfleet at the time of the tests, has told an interesting story of what took place.

"There was a wait of a week or more at Wellfleet for Marconi to get the apparatus adjusted to trans-Atlantic work," he said. "One evening, after supper, Marconi telephoned: 'Can you come over right away?'

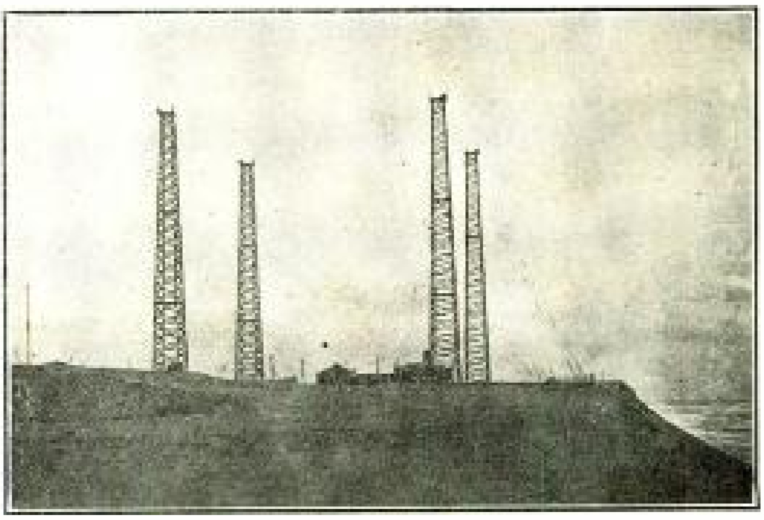
"It was a particularly dark night and the wind was blowing across the Cape at about forty miles an hour. 'We shall get it across tonight,' said Marconi. 'The instruments are very well adjusted and we got a signal across to the other side a little while ago. We have been receiving their signals for two or three days. I think that some time between now and midnight I shall be able to get that message out for you.'

The operators' home viewed from the front, showing the verandas

"It did not take us long to draft a dispatch addressed to the editor of the London Times congratulating him and the English people on this new bond of communication between the great English-speaking nations, and signed William R. Hearst. It was arranged that I should be in the post-office all the rest of the evening, where Marconi promised to call me up as soon as he had the news I was waiting for. It seemed like hours before the telephone bell rang. Marconi himself was on the wire, so jubilant and excited he could hardly speak.

"'I have just got your message across,' he said. 'The President wanted to send a message to King Edward. We sent that and Mr. Hearst's message and got a return signal that they had been received. Mr. Hearst's message was sent the longest distance a wireless message has ever been (transmitted at that time), for the President's message was picked up by our station at Cape Race and relayed from there, while Mr. Hearst's went directly across the ocean.'"

The beach adjacent to the station which Mr. Marconi employed to such good advantage, is approximately one hundred feet in length, and a short distance from the edge of the cliff stand the four towers. Each is 210 feet in height. There are also two masts. The wireless plant is housed in a large building divided into several large rooms. The spark room contains the condenser which is made up of eighty tanks, the rotary spark gap, oscillation transformer, various choke coils and a large solenoid key.



South Wellfleet's tall towers, which can be seen far out at sea. The station buildings are also pictured in this photograph

Adjoining is the operating room. A thick sound proof door with a glass window in it to enable the rotary to be seen while in operation, separates the two rooms. In the operating room is the perforater, on which all press and messages are punched on a paper tape, and the automatic transmitter through which the tape runs, thereby operating the key.

The work shop, which is about fifty feet away from the operating room, can be reached by means of a hall. Here are tools of various kinds and also two lathes, propelled by an electric motor.

In the engine room, which adjoins the workshop, is a fifty-horse-power engine used to drive a large alternator which supplies current for the 40 k. w. transformer. A small seven horse-power engine drives a direct current dynamo to supply the storage batteries and the field circuit of the large alternator.

The rotary spark gap is quite large as compared with the average gap. It is operated by a five horse-power electric motor, the disc, which is three feet in diameter, turning over rapidly. A strong air blast directed on the spark keeps the latter from arcing across the points of the rotary. The side discs also are movable and consist of two solid metal wheels, turned by two small motors.

South Wellfleet differs from the operation of apparatus in the majority of stations, in that the key breaks the secondary circuit instead of the primary, the latter being kept closed. The key which breaks the secondary current has two large spaces between the contacts, the first named piece of apparatus swinging about one inch and three-quarters. This gives the circuit an opening of more than three inches when the key is opened. A 50 k. w. secondary current of course would leap across this space but for the fact that there is an air blast on each side of the key at the openings. This air blast will sometimes carry the flame from the secondary current six to eight inches away from the contact points.

From the station, which has a transmitting range of 1,500 miles, are flashed to steamships at sea, every night at ten o'clock, bulletins containing news of the day. It is also employed to transmit messages to vessels which are beyond the range of the average coast stations.

How well the station has stood the test of time, the stress of storm and the wear of operation, can be judged from the fact that although it was built approximately sixteen years ago, the principal parts of the equipment installed at the time it was erected are still in use.

The Désilets Wireless Organ

A Simple Apparatus for Transmitting Music By Radio

THE Rev. Georges Désilets, of Nicolet, Quebec, is the inventor of an apparatus for producing musical notes in wireless receivers. It operates on the principle of the rotary spark gap, the note of which, it is well understood, depends mainly upon the number of sparks made per second. In the simplest form of the Désilets apparatus, eight rotary spark gaps emitting notes corresponding to the musical octave are mounted on a single shaft, which is revolved by a motor. The current is switched through one or more of the gaps by means of an arrangement like a piano key-board.

The inventor writes that his music has been heard by trans-Atlantic liners in the St. Lawrence River and by the Marconi stations at Montreal, Three Rivers, and Quebec. At present, however, his set is silenced by the war regulations.

A more complete understanding of the Désilets apparatus may be gained from the accompanying drawings and the explanation of them. Ordinary wireless sending and receiving apparatus is employed, except that in place of the ordinary sending key, a plurality of keys are employed, the operation of any one of which will cause a certain musical note to be transmitted, different notes being obtained according to which key is operated. The various musical notes are obtained through the medium of annular rows of rotating spark gaps, each row producing sparks of greater or less frequency than the adjacent rows. A most convenient way of obtaining this result is to provide the annular rows of spark gaps in the form of points or studs projecting radially from the surface of a conical or frusto-conical rotor, the points in one row being the same distance apart as the points in any other row. Thus, the points in the row of greatest diameter would be more in number and would travel at a greater speed than the points in the row of smallest diameter and produce sparks with greater rapidity. In order to produce a regular scale of musical sounds the number of points on each row is determinated by the following relation between the number of points in two adjacent rows well known in acoustics:

1, 9/8, 5/4, 4/3, 3/2, 5/3, 15/8, 2.

The invention will be better understood with the aid of the accompanying drawings in which—

Figure 1 illustrates a diagrammatic view of the apparatus. Fig. 2 a diagrammatic perspective view of one of the operating keys and Fig. 3 an end view of the rotor. Fig. 4 illustrates the diagrammatic view of a modification of the apparatus. Fig. 5 illustrates a diagrammatic view of the regulators for producing pianissimo, fortissimo, etc.

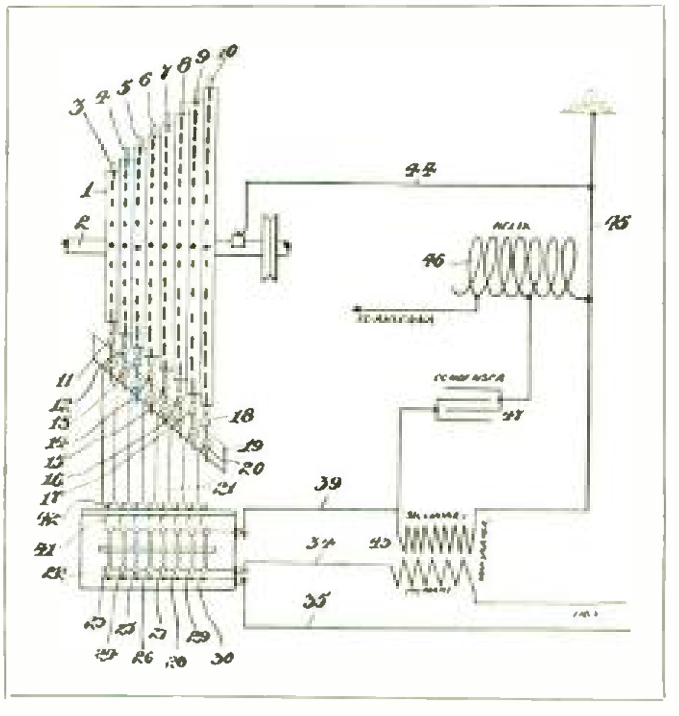


Fig. 1

Referring to the drawings, which, of course, do not show the receiving apparatus, which is the same as any ordinary outfit, 1 indicates a rotor in frusto-conical shape supported on a shaft, 2, rotated by an electric motor. The rotor is here shown as provided with eight annular rows of radially projecting points 3, 4, 5, 6, 7, 8, 9, and 10 corresponding in number to the natural notes in an octave, though it must be understood that the rotor could be of such length as to include more than one octave, but in order

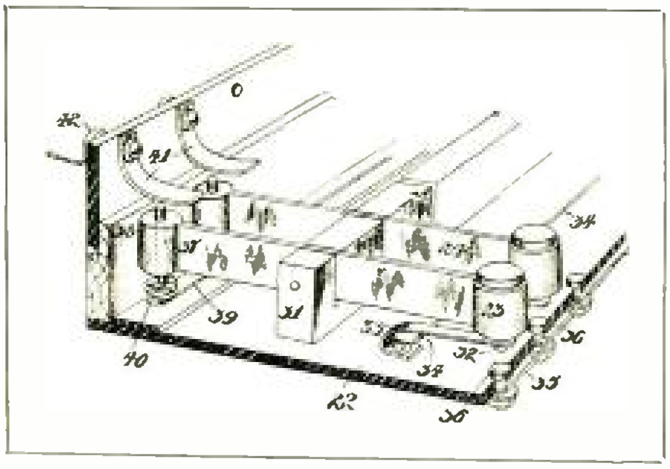


Fig. 2

to keep down the size of the apparatus, it is preferred to provide the semitones and additional octaves in the manner hereinafter described.

The points belonging to each of the annular rows and the different rows before mentioned are electrically connected to each other and to the shaft 2. Further, the points of one row are the same distance apart as the points on the other rows and as an example, it may be mentioned for purposes of comparison that if the row 3 contains twenty-four points, the row 4 contains twenty-seven, the row 5 thirty, the row 6 thirty-two, the row 7 thirty-six, the row 8 forty, the row 9 forty-five and the row 10 forty-eight, according to the relation before mentioned.

The points form poles and operate in conjunction with a plurality of fixed poles 11, 12, 13, 14, 15, 16, 17 and 18, one for each row of spark gaps and carried by a suitable insulator 19 provided with terminals 20 to which, and the fixed poles, are connected electric wires 21 leading from the key board 22.

The key board, 22, comprises a set of keys 23, 24, 25, 26, 27, 28, 29 and 30, each of which is pivoted intermediately to a fixed wooden bar, 31. The underside of the outer end of each key carries a contact, 32, electrically connected by means such as the spring, 3, to one of the wires, 34, of the line circuit and the other wire, 35, of the line circuit being provided with a contact, 36, beneath each key adapted to co-operate with the contact, 32, to close the line circuit. Both ends of a key are insulated from each other by the joining arm made of suitable insulating material.

The outer end, 37, of each key is provided with a contact, 38, at its upper end, which is also connected, beneath the key to one of the high tension wires, 39, by means of the spring, 40. Forty-one are spring contacts insulated from each other, respectively extending from terminals 42 to which the wires 21 are connected. All the contacts, 38, are normally away from the contacts 41 and in pressing a key, the contacts are adapted to be closed just a little before the contact, 32, of the other end of the key touches the contact, 36. Thus, the high tension contacts are closed before the low tension and opened after the opening of the low tension contacts, which prevents sparking at the high tension contacts.

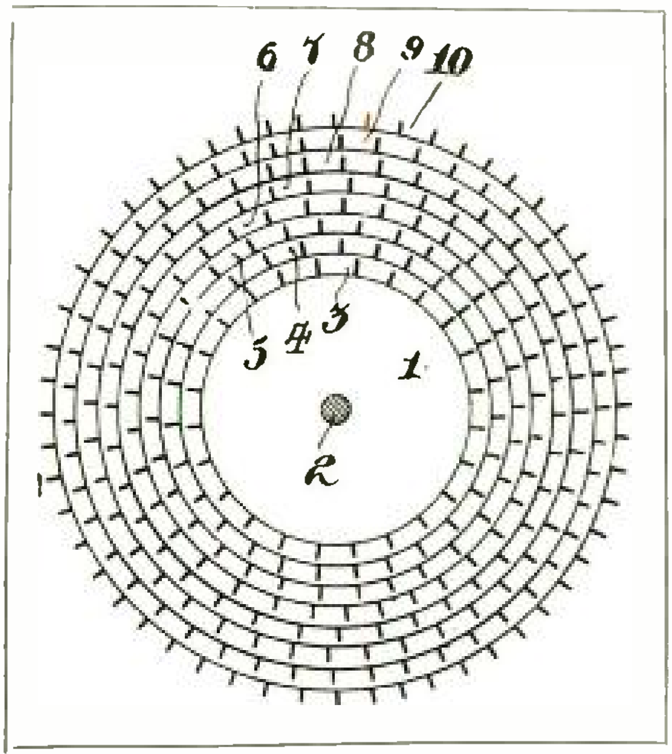


Fig. 3

The wire, 34, is connected with the primary coil of a transformer, 43, while the wire, 39, supported by an insulator is connected to the secondary coil of the transformer. The shaft, 2, is also connected by a wire 44 to the ground wire, 45, of the ordinary wireless outfit while the usual helix 46 (an oscillation transformer may also be used) and condenser 47 are employed, the former being connected with an antenna in the usual manner.

It will thus be seen that a series of sparks can be obtained at any one of the fixed poles, 18, by reason of the closure of the high tension circuit consequent upon the pressure of the key corresponding to that particular fixed pole and, as before explained, musical notes will be produced by the difference in the frequency of formation of the various series of sparks.

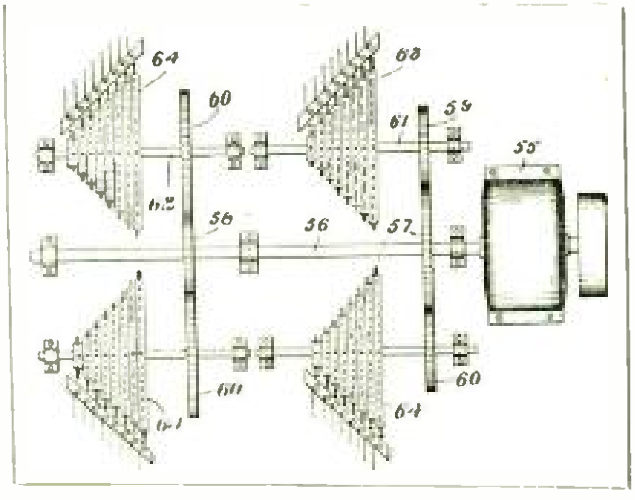


Fig. 4

Obviously, in order to produce chords, it is only necessary to supply a current of sufficient intensity to permit different sets of sparks at the same time, consequent upon the pressure of the corresponding number of keys. Further, regulation in the volume of sound for producing pianissimo, fortissimo and similar effects can be provided for by the inclusion of a rheostat in the primary circuit which may be regulated by the foot illustrated in Fig. 5 in which 48 is a foot push-button having the stub, 49, which comes in contact when the push-button is pressed downward with the contacts, 50 and 51, is a wire connected at one end to one of the contacts and at the other end to a rheostat, 52, which is connected to a wire, 53, leading from the rheostat and connected in series with the primary of a transformer.

Fifty-four, is a wire connected to the other contact and at its other end in series with the primary of a transformer.

In order to produce an octave higher, the preferable form is to use an exactly similar rotor and revolve it at twice the speed of the rotor, 1, and similarly an octave lower could be produced by rotating a similar rotor at half the speed of the rotor, 1. The semitones are obtained by a set of rows exactly corresponding to the rows 27, 30, 36, 40 and 45 traveling at a rate of speed 1/20 less than the rotor 1. For example, if the rotor, 1, is revolving at 500 r. p. m., the semitone rows must revolve at 475 r. p. m. The different speeds of rotation may be obtained by gearing and, of course, there will always be a fixed pole and key for each row and similar to those already described. This modification is illustrated in Fig. 4 showing a motor, 55, rotating shaft 56, which is secured to the driving gears, 57 and 58.

Fifty-nine and 60 are spur gears mounted on the shafts, 61 and 62 and 63 and 64 are the rotors, these being similar in construction to the rotor, 1, illustrated in Fig. 1.

It will be noticed that the gear, 60, is of larger diameter than the gear, 59, and that

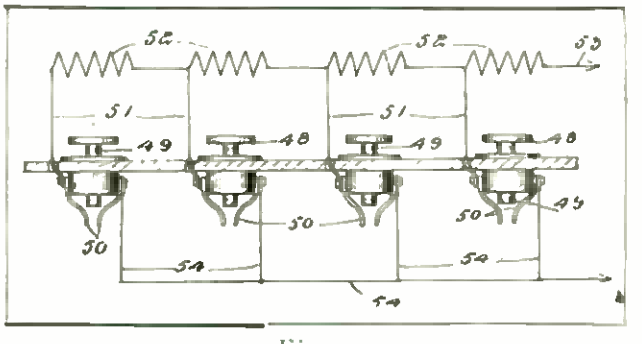


Fig. 5

the gear, 58, is of smaller diameter than the gear, 57. It will, therefore, be readily understood that the rotor, 63, will be driven at a higher speed than the rotor, 64, the result being that the rotor, 64, will be of an octave lower than the rotor 63.

Speaking of the apparatus, the inventor remarked: "This system is quite simple, and may be operated with any sending station using a transformer. Moreover, it can be constructed with any number of notes and of any size to suit the power of a particular station. I have a home-made working model playing thirteen notes on one rotor: do, mi, sol, la, si, do, ré, mi, fa, sol, la, si, do.

"Those who have heard it agree that it is real music. Chords are produced by pressing two or three keys, and if the feeding transformer can supply the necessary power we have surprising results and pleasant effects. Obviously, a more elaborate machine, constructed on the lines suggested, would given even better effects.

"Unhappily, my station was closed last year on account of the war, and my organ is now silent. I hope to resume my experiments later on; meanwhile, I wish I could, for a time, live on the free soil of the United States, paradise of the wireless amateur."

Canadian and United States patents on the invention have been issued to the Rev. Mr. Désilets, who stated: "I must say that I am indebted to The Wireless Age for many hints in my wireless experiments."

The Written Radiogram

A French Professor's Novel Experiment

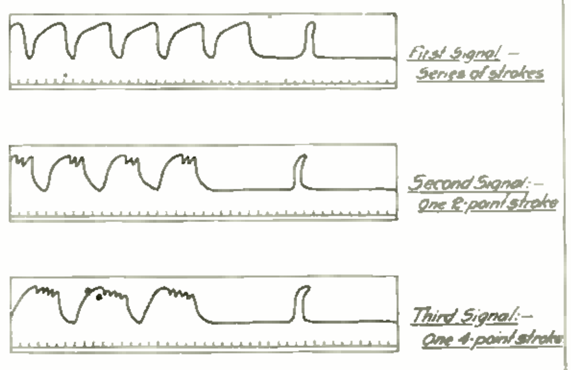
IS it possible to write a wireless message in script? How may it be done? What will it look like?

These problems were propounded by a Frenchman, Dr. Lefeuvre, professor of physiology in Rennes, who found the solution by adopting the method based upon Galvani's well known frog's-leg experiments far back in 1791, which led to the important experiments and discoveries of Volta.

Dr. Lefeuvre's frog's-leg transcriber is based on the principle that, if the movement of a muscle is stimulated through an electrical current, a contraction of the muscle ensues. He attached to the frog's leg a pointer, or needle, moving on a tiny axle, and which was held in a definite position by means of a weight. The needle was thus enabled to record, with every muscular contraction, a distinctly visible sign, which was automatically reproduced on a rotary drum.

The professor was successful in applying this principle of "muscle-writing" in a highly interesting way to the reproduction of radiograms in the script or cursive form of writing. The signals he transcribed were the Paris time signals, which are reproduced in the accompanying drawing. These reproductions give the best evidence to the theory that, in the automatic recording of time-signals by wireless, only an instrument, slow in movement and of low activity can be utilized.

Dr. Lefeuvre states that in spite of the fact that the muscle responds to the electrical stimulus with a rapidity of scarcely one-hundredth of a second, it accelerates the motion of the needle so as wholly to obscure the time period of the individual signal drawings.



Paris time signal, recorded by means of a "frog's-leg-muscle writer."

This method of transcribing wireless messages, while it has no practical value, is nevertheless regarded as highly interesting as a laboratory experiment. The results are taken as proof of the drawbacks attending the use of the mirror galvanometer in the automatic recording of time signals, namely high inertia and overperiodical damping. In this respect it is reasoned that a movable system is not enabled to follow the individual impulses and there occurs no record of the individual spark transmissions, as takes place by means of the "muscle-writer."

However, Dr. Lefeuvre has shown us how a wireless message looks in script, and that is interesting, even though it be only the record of a Paris time signal written by a frog.

Members of the Signal Corps Regiment of the New York Division of the United Boys' Brigade of America operating a field wireless station

ANOTHER MOVEMENT FOR PREPAREDNESS

With the idea of mobilizing the wireless and signal enthusiasts of Brooklyn, Queens and Nassau Counties in the State of New York, Colonel T. C. Halbert, of Lynbrook, has organized the Signal Corps Regiment of the New York Division of the United Boys' Brigades of America. It is essentially a union of the companies of the various local churches with a present membership of 250, including companies in Brooklyn, Valley Stream, Lynbrook and Freeport, while additional companies are being planned in Brooklyn, Rockville Center, East Rockaway and Rosedale.

Besides individual stations of amateur members, the regiment has equipment consisting of field wireless, telephone and buzzer carts and the necessary equipment of flags for wigwag and semaphore signaling. In addition the members are uniformed in regulation style.

The wireless division is under the charge of Lieutenant Norman E. Cowper, of Lynbrook. At prearranged times signals and military messages are exchanged between stations, a system which will teach the requirements of military work much better than the usual inconsequential talk that amateurs generally send through the air. A line of these stations is planned from Freeport and Hempstead to Brooklyn. Alternating with social meetings of the various units, are others where lectures and special work on army wireless fill the program. Enlistments of amateurs qualified either to teach telegraphy or to become active members in the line are of course always welcome and the prospects for advancement in this branch of the "service of communication" are excellent. Colonel Halbert is building up an organization that will be of much use in a time of national need.

BLIND FRENCH SOLDIERS FOR OPERATORS

It is an established fact that the blind far excel in acuteness of hearing and sensitiveness of touch their fellow men who have unimpaired sight. The French, with their usual foresight, have taken this into consideration, in planning occupations for French soldiers after the war, according to a recent news report. French scientists after careful investigation, have decided that blind soldiers will make good wireless operators.

The qualities most needed by a wireless operator are highly developed faculties of touch and hearing. In most cases, people who have been rendered blind not only retain those two faculties intact, but develop them to a remarkable degree of acuteness and sensitiveness.

What of the Sealers?

How Wireless Answers This Question When Peril Overshadows the Ice Fields

By C. S. CARTER

"WHAT of the sealing fleet? Are the men and ships safe?"

This is the question that is on hundreds of lips when storms sweep the Newfoundland coast. For at such times many stories of men lost on the ice or of vessels jammed to wreckage between the floes come to the minds of the families and friends of the seal hunters. In years gone by the question was asked in vain and there followed weeks of anxious waiting and worry which could not be relieved perhaps until the arrival in port of some vessel from the ice fields.

Part of the day's work

Wireless telegraphy has been the means of alleviating much of this apprehension consequent upon a sealing voyage. From day to day the newspapers of St. Johns publish wireless messages from the ships telling of the positions of the latter, the progress of the seal catching and any untoward events, so that the members of the families of the humblest members of the crews can be as well informed as those of the captains of the vessels. The commanders of the sealers also have the advantage of receiving storm warnings by marconigram, thereby being enabled to prepare a considerable time in advance for the protection of their men and ships.

In calling attention to these facts I have in mind a voyage of the Florizel and the other vessels of the fleet which accompanied her to the ice fields. No great disaster occurred on this cruise. It was not uneventful, however, and the folk on land were kept well informed of what occurred.

I was wireless operator on the Forizel, one of the fleet of eight sealers composed of the Eagle, Neptune, Samuel Blandford, Terra Nova, Sable I., Bloodhound and Erik, when she steamed away from St. Johns at four o'clock one morning in March, bound for the sealing patches off the upper Atlantic coast of Newfoundland. For two days we proceeded without incident of consequence, and at the end of that time we found ourselves fairly in the ice fields—jammed tight in fact between the floes. There was only one way to free the vessel and that was by the use of blasting powder, the latter being placed in cans and set under the ice. Once clear of the floes, we resumed our voyage and reached a sealing patch one evening a few days later.

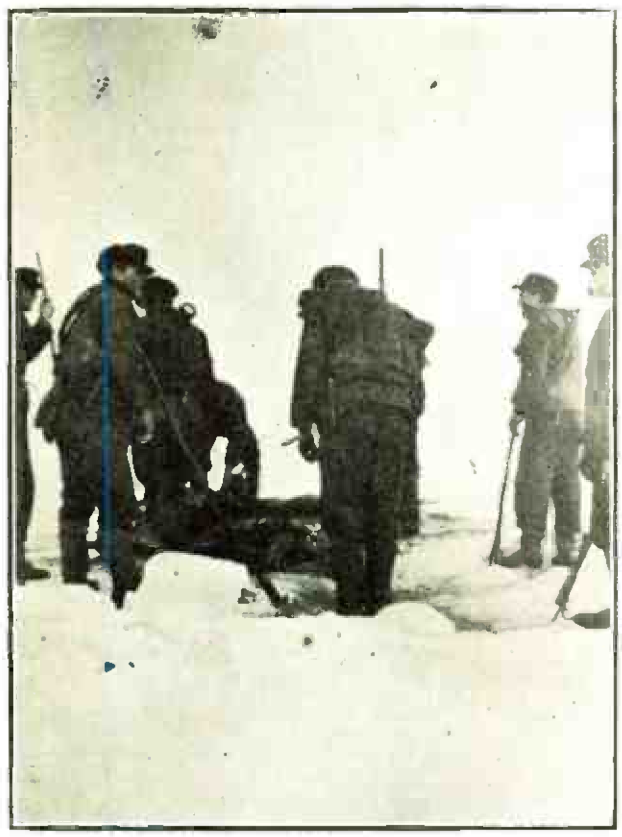
Following closely after the Florizel on her cruise was the Erik. So when the men from our ship tumbled over the sides on the ice, eager for the hunt, they found the Erik's crew also making ready for the kill. There was no little rivalry between the members of the two crews and this doubtless accounts for the fact

An old hood family just killed

Hauling a seal on the floe

that the Florizel's men brought 500 seals aboard the ship before the night's work was ended.

A series of articles published in previous numbers of THE WIRELESS AGE described in detail the work and excitement incidental to catching seals, so I shall not attempt to narrate the particulars of how we made our kill. It is enough to say that at the end of three weeks we had some 37,000 seals on board and the owners of the vessel, upon receiving a wireless report of what had



Scalping one of the catch

been accomplished, ordered us to return to St. Johns.

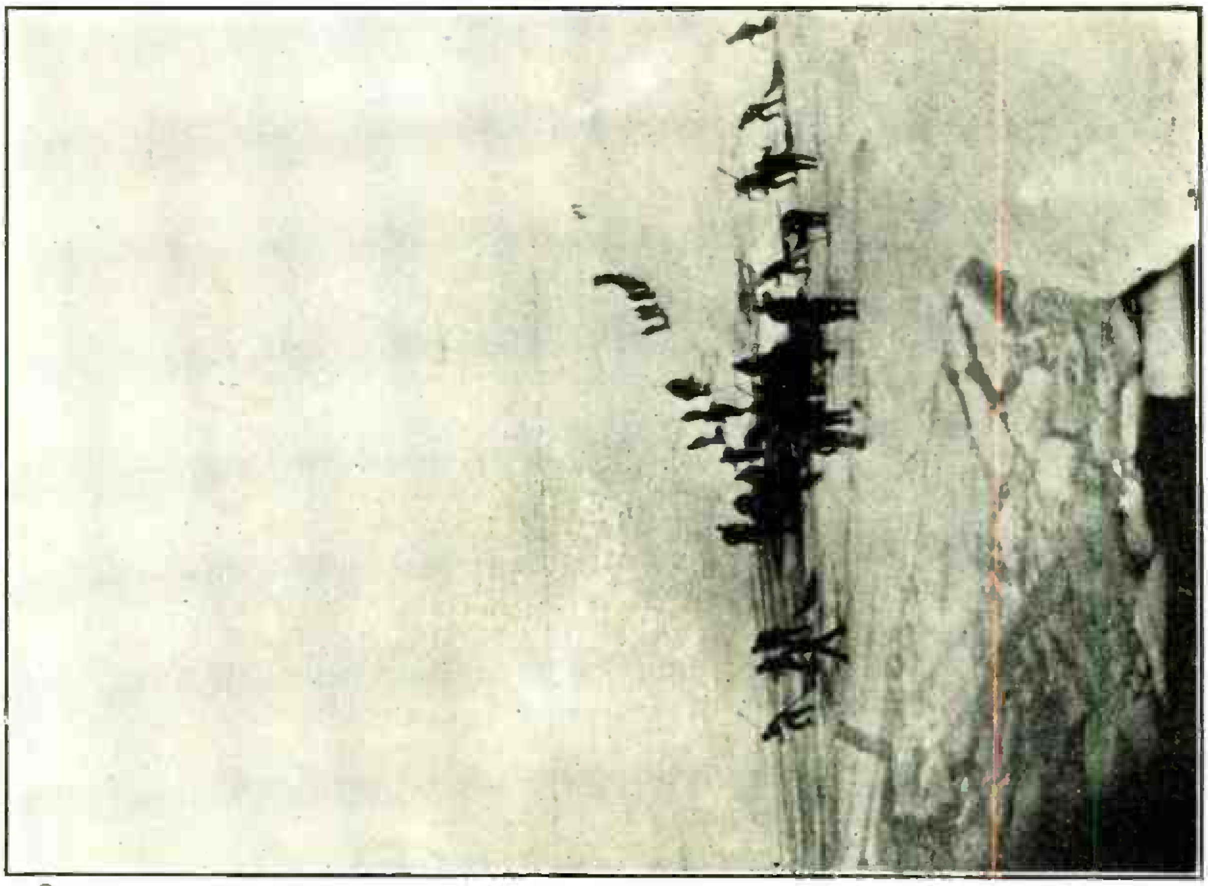
In the meantime the families and friends of the men on the Florizel, and the other ships of the fleet had been told by wireless of events in the ice fields. The following messages published in the newspapers of St. Johns illustrate the manner in which this was accomplished:

"Florizel—Stormy day, men have panned (killed) today 7,500 seals—total stowage, 24,000."

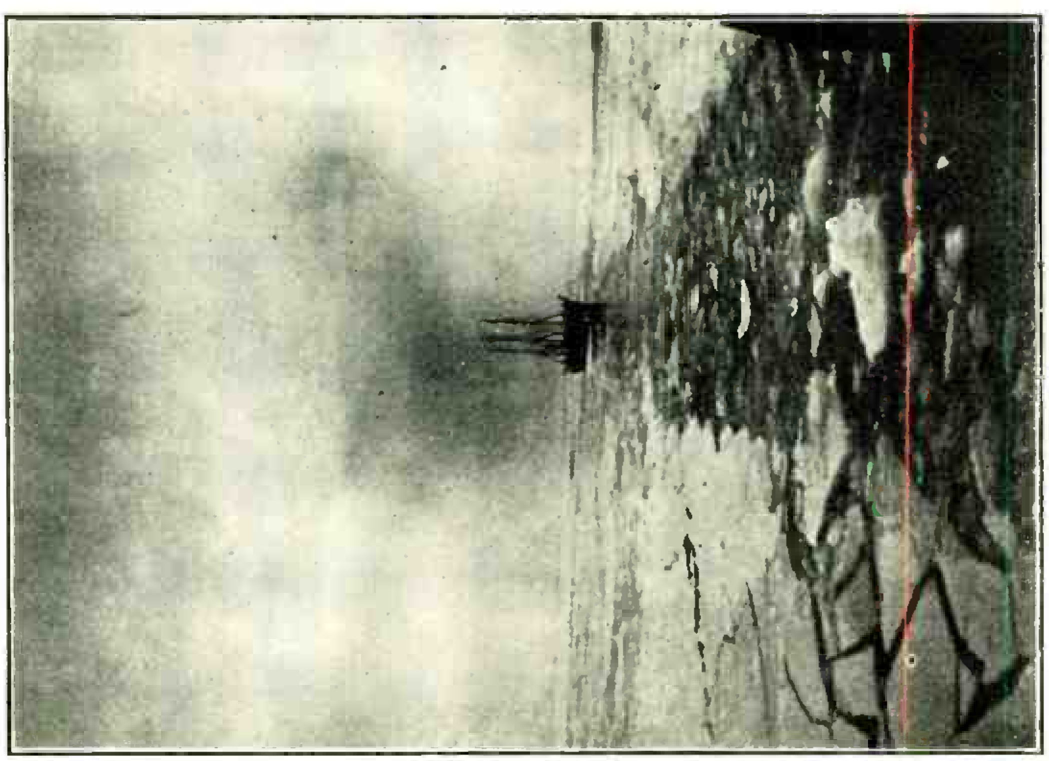
"Via Fogo—Cable I., Eagle, Bloodhound, Erik, Neptune, Florizel, Samuel Blandford, report their crews aboard and well."

"Eagle—Total on board today, 21,000; weather dull; blowing a gale from the S. E.; all well."

"Viking—Twenty miles W. by N. By-



Making ready to load the seals



The Erik following in the wake of the Florizel

·on Island, blowing a gale from E. N. E., snowing hard at intervals; too thick to see far; now in patch; whitecoats (young seals), are larger size. Ranger, Diana and Seal here."

"Terra Nova—Fifty miles S. E. by E. Groasis Islands; on board and stowed down, 14,000."

"Neptune—21,000 on board; bad storm with E. S. E. wind and rain; ice very tight."

Following these reports came this message from Cape Ray, signed Marconi station, containing a hint of peril:

"Viking, Ranger and Seal all well, no men on ice. Diana reports ship badly squeezed and ice rafting heavily. Have ordered all other ships to stand by."

A later message said: "Diana reports still in heavily rafted ice, but considers danger over for the present. Other three sealers stood by all night to render assistance if needed. — Marconi Station."


The Florizel jammed in the ice

Another chapter of the fleet's cruise is related in these reports:

"Eagle — Blowing a gale from the eastward; ice tight; ship jammed.

"Terra Nova—Position seventy miles S. E. half E. Northern Groasis Islands; 1,000 today; working ahead; ice very heavy; prospects good.

"Florizel—Very stormy day; hard getting along; total stowed, 15,700; 3,000 on deck; 50 flags still on the ice; all well."

"Ranger—Fifteen miles W. N. W. of Byron Island; ice tight; ship jammed; tight ice as far as can be seen; Diana, Seal and Viking in sight.

Came this reassuring wireless from the Diana a short time after she had been reported in danger:

"Think ship O. K., prospects not bright as jammed in heavy; coming home loaded."

There is a marked contrast between the conditions which the sealers work under today and those which prevailed before wireless came into use. In telling of a voyage made to the Newfoundland ice fields in 1862, a sealer said:

"After leaving St. Johns I succeeded in getting out through all the ice and kept beating to windward. When I was three miles north of Partridge Point in White Bay, I took the ice with a heavy wind and a tremendous sea running. The ice was so heavy that one fully expected to lose the vessel during the night. I have seen some six or eight go down the last few days among which are the Emily Tobin, the Melrose and the Margaret, besides several others I cannot name. While I am writing there is so much sea and the ice is so heavy that I cannot tell the moment the sides of my own vessel will be driven in."

Many letter of this kind telling of peril to ships were doubtless written only to be carried beneath the waters with the vessels on which they were penned, and if they did reach the hands for which they were intended it was probably, in no few instances, due to chance. No longer, however, does the element of luck or circumstances have to be taken into consideration in getting word of distress to land, for the radio provides a sure and infallible means of conveying appeals for aid, despite the difficulties and barriers which the Far North places in the way. So has wireless revolutionized conditions in the ice fields and bettered the lot of the men who visit them.

When the Ramos Went Down

Operator Green, one of the central figures in the adventure he describes

An Account of a Ship Wreck and a Perilous Cruise in a Small Boat

By Ray Green, Operator on the Ramos

WHEN the Ramos steamed away from Philadelphia on July 8 bound for Cartagena, Columbia, it did not occur to me that I was beginning the most adventurous voyage which I had ever taken, for the Ramos looked substantial and seaworthy enough to withstand seas kicked up by a good-sized tornado. And staunch she undoubtedly was, although she could not stand up under the pounding which she received. But that is going in advance of my story. To start at the beginning:

The voyage proceeded without incident for three days, when we struck a heavy nor'east gale with high seas and a barometer that the mate said had no bottom. The waters drove the members of the crew out of the quarters in the forecastle, and my room being one of the two dry cabins on board, the first assistant engineer and the bo'sn took shake-downs on the floor. The seas continued to run high and at about nine o'clock that night the pressure-guage on the boiler burst. The engineer left the cabin to investigate, returning in an hour to tell the bo'sun to nail an awning over the bunker hatches, which were leaking badly. Soon the engineer sent up word that he was having trouble controlling the leak, and I went on deck to see the situation myself. The gale was roaring in an alarming way; big, black seas would rise slowly till they appeared like a range of hills, dark against the storm clouds, then topple over at the crest in an ugly white swirl that immersed the forecastle.

The engineer reported at three o'clock in the morning that he could not handle the leak and soon after, the captain handed me this message to be flashed broadcast: "S O S Ramos 310 miles north one-quarter west Watling Island sinking."

I immediately began to operate the set, but in the middle of the message a terrific sea struck the steamer, smashing in the window of my cabin and drenching the apparatus. I worked like mad to dry off the water and fan away the dampness and when the damage had apparently been remedied I called Miami, a station I could hear working some ship. While I was flashing the signals, the captain came to the cabin with word to change the position of the ship to latitude 29.25, longitude 75.19, "heading southwest by south at five miles per hour."

Meanwhile, the engine had stopped and the crew set to work on the launching of a lifeboat. I had been sending an appeal almost without interruption and finally I received an answer, the response coming from the Van Hagendorp. She broadcasted our message and the Miami then responded asking the captain of the Ramos if he wanted to communicate with New York, but the suggestion was declined. The tanker Illinois and another tanker, both of which were distant about 130 miles, wirelessed that they were racing to our aid. A few minutes the Van Hagendorp signalled again.

"KER," she called, "we are 100 miles south, coming full speed, reach you about 3 P. M."

I replied by asking her to send us her position every hour.

The Ramos was now filling rapidly, and it was decided to lower the lee lifeboat. But when it was hauled up at the falls, the roll of the steamer swung it wide and sent it crashing back against the side of the wireless cabin. After several attempts, however, it was lowered into the water.

With a life-belt adjusted below my shoulders and a coil of rope tied about my waist, I stood waiting orders when the captain came along. He was holding to the boat-deck rail, for the Ramos was rolling heavily in the trough of the seas. He made some inquiries and then informed me that "you have done your duty and you may go."

That was the last I ever saw of him.

I went on deck, and from the windward lifeboat someone called to me to jump in, although there were twenty men aboard already. Just then the steamer rolled, first to leeward then to windward again taking a great swell and dumping it into the lifeboat which immediately turned over. Some of the men jumped for the steamer rail and others down into the sea, I being among the latter.

When I came to the surface the capsized lifeboat was above me, so I climbed under the seats and remained there for several minutes, lashing myself to a thwart with a rope. Suddenly the boat turned upright again, for the chief engineer had tried to crawl on top of it. The men on the Ramos saw me and shouted.

I threw out the seine-floats for the chief engineer and the others to hold on to, and began to bail vigorously, my efforts being accelerated by the knowledge that a school of sharks was nearby. As the boat gradually righted four of the men climbed aboard; some had gotten on the steamer, others—two of them—had been dragged down by the sharks.

Then began our cruise over the seas through the darkness in a small boat in search of a rescue vessel. At midnight the gale was blowing with terrific force. but the men at the oars managed to hold the bow of the boat head on to the seas. At dawn they were still pulling tirelessly at the oars. They would watch big white-caps as they curled over the top of a wave and came roaring down the long slope, wait, dip their oars deep, and pull with steady force till the crest passed under us. Then we would race down the side and look up the front of another wall of water. I tried to take an oar but a wave hit it and knocked me over backwards into the boat, so I was made steersman. Half a mile away we could see the Ramos, rolling water-logged in the trough of the waves. Suddenly her bow heaved slowly up showing the red painted bottom, a cloud of coal-dust puffed upward as the pressure of the air blew off the hatch-covers, and she slid stern first underneath the waters and disappeared.

We hunted for provisions, but the water keg and all our supplies, except a loaf of wet bread and a bottle of pickles, had been lost when the lifeboat rolled over. One of the men rigged a sail from a piece of canvas some four feet square, which he tied to an oar. We unlashed the compass, divided the day into watches of three hours on, and three off, and laid our course toward Charleston, 350 miles away, on a route that would carry us across the paths of coastwise steamers. Soon the sun appeared and at the same time the gale moderated slightly. With the increased warmth, however, came thirst, which made the men dip their hands in the sea water to moisten their mouths. Hunger added to the hardship and by five in the evening we were all eyeing that loaf of bread and bottle of pickles with the utmost interest.

Sunset was at hand when we sighted smoke in the distance. As we mounted the crest of a roller, we saw a black-painted steamer with gray upperworks, ploughing through the waves toward us. When we were within 500 feet of the vessel, however, she swung around and steamed away at full speed on a zig-zag course, apparently mistaking us for a submarine. Presently it was suggested that we dine. The idea was approved, and never did I taste anything more delicious than that salty bread, dried out in the sun on a seat, and one water-soaked pickle.

It was my trick at the tiller again after "dinner" and while the others slept, I sat propped up in the moonlight, guiding the boat between the crests of the huge waves, all the time fearfully watching the big sharks that played about us. One, larger than the rest, swam within ten feet of me and rolled over showing his white belly and wicked V-shaped mouth.

About three in the morning, another man took the tiller, and I fell asleep. Suddenly the shout, "A light!" brought me scrambling to my feet. We all gazed intently out over the seas, and when the boat mounted the crest of a wave, the lights of a steamer were plainly visible, read ahead. Our last red Coston light was brought into play, and the men pulled vigorously at the oars while I shrilled on the bo'un's whistle. All this was not without its effect for the vessel stopped and waited for us. As we pulled under her stern we saw one of our lifeboats near her bow. We learned later that it had left the Ramos nine hours after we set out and had been drifting about near us.

The steamer that picked us up was the Jose. Once on board, we learned from the occupants of the other lifeboat that the captain of the Ramos, the mate and five men who had taken to our third boat were missing. The Van Hogendorp was sighted soon after we reached the Jose and the latter, which is without wireless equipment, signalled by flag that the Ramos had sunk and that a boat was adrift. The Van Hogendorf searched for thirty hours without success, and the tanker Illinois also scoured the seas in vain.

The Ramos' men were taken to port by the Jose, all being thankful enough to set foot on land once more. Such is the story of the wreck. For me it held not a little of hardship and danger, but it was an experience not without benefit, for it has been truly said that it is only the unknown circumstances inspire fear. Therefore, I feel that I should be able to face any perils born of the sea unflinchingly.

WILD ANIMALS FED BY WIRELESS

Probably no form of communication created by human ingenuity has been put to such a variety of uses as wireless telegraphy. The most novel use on record, however, was the feeding of a sea menagerie by means of the radio service.

One day a radio message reached Philadelphia from the British steamship West Point, bound to that port from London, with a cargo of starving and fighting wild animals. The message stated that the supply of food for a large consignment of bears, deer, wolves, lions, monkeys and other animals on board had been exhausted several days before, and that the hungry animals were at that time fighting amongst themselves. The consignment was intended for the Brooklyn Zoological Gardens. The message stated that the ship expected to arrive in Delaware Breakwater that night. A fast tug was at once loaded with fresh meat and started to meet the West Point early the next morning.

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The U. S. Signal Corps Stations

The Equipment at Fort Sam, Houston and the Radial Counterpoise at Fairbanks

THE United States Signal Corps has installed ten radio stations in Alaska, varying in size from 1 k.w. at Petersburg, Wrangell and Kotlik to 10 k.w. at Fort Gibbon, Nulato and Nome. Stations of from 3 to 5 k.w. have been installed at St. Michaels, Circle, Fairbanks and Fort Egbert.

In the Philippines stations have been installed at Manila, Fort McKinley and Fort Wint, and a station of 10 k.w. at Corregidor.

In the United States a 1 or 2 k.w. set has been installed in several of the Coast Artillery districts; 3 k.w. sets at Fort Wood, Fort Omaha and Fort Riley, and a 10 k.w. set is to be installed at Fort Leavenworth. Sets of from 1 to 5 k.w. have been placed on fourteen transports and three cable ships, and sets of from one-eighth to 2 k.w. on the harbor boats consigned to Coast Artillery districts that have a shore station.

All the Alaska and the Philippine stations, except Corregidor, have their generators driven by gasoline engines. The generators in the artillery districts and on the harbor boats are nearly all driven by motors from local electric power. The Fort Wood station may be operated either from a gasoline engine or the local electric light plant. The Fort Omaha, Fort Riley and Fort Leavenworth sets are operated directly from city power.

Two types of portable field sets have been issued by the Signal Corps. The smaller size is furnished to the organized militia, as well as to the field companies. The range of these sets, under normal conditions, is about twenty-five miles over land, but much greater over water. Thus one of the one-eighth k.w. sets, with a 100-foot mast, at Havana has worked with the naval station at Key West, a distance of about 110 miles.

The larger size of field sets is of 2 k.w. output and is carried on a two-chest pintle wagon, one chest with the engine and generator and the other with the transmitting and receiving apparatus. The range of these sets varies from 75 to 800 miles, depending on favorable weather conditions, time of day or night, character of the land between the sets, etc.

The following description of the Fort Sam Houston station is given as an illustration of the type of the 10 k.w. sets installed by the Signal Corps in Alaska and elsewhere in the United States.

Towers: These are of structural steel, about 200 feet high, 28 feet square at base, and 4 feet square at top. The towers are supported on concrete piers, each leg resting on a cribwork of timbers, 12 inches square, painted with insulating compound for preservation and insulation.

Timbers are bolted to the piers and to each other, the bolts from the towers not extending down into the concrete. The towers are about 350 feet apart.

Antenna: The antenna is of the T type, the flat top part of which is composed of four wires, each 475 feet long and 8 feet apart, the wires being carried beyond the towers to backstays.

Both ends of these wires are insulated with 18-inch electrose insulators. The details of the insulation, spars, bridles, etc., are shown in Fig. 1. The vertical wires reaching from the center of the flat top to the station are each 180 feet long, separated 8 feet, and at the bottom are joined together and carried as a single wire for about ten feet into the station through a porcelain wall insulator.

Counterpoise and Ground: Connections are made to the waterpipe system as a ground, but the most dependence is placed on a counterpoise, which covers about half an acre of land. the wires are bare, hard-drawn copper, No. 12, B. & S., about 210 feet long, and spread out into two arcs, each of ninety degrees. A counterpoise is particularly efficient in case the soil is very dry, as at Fort Sam Houston, and also where there is a heavy snow-fall, as at Fairbanks. At the latter station both a ground and a counterpoise have been installed. In the case of the Signal Corps wagon sets, radial counterpoise wires mounted on temporary poles, carried as a part of the set, were used at first, but these now have been replaced by the same type as that of the pack set, that is, rubber-covered wires,

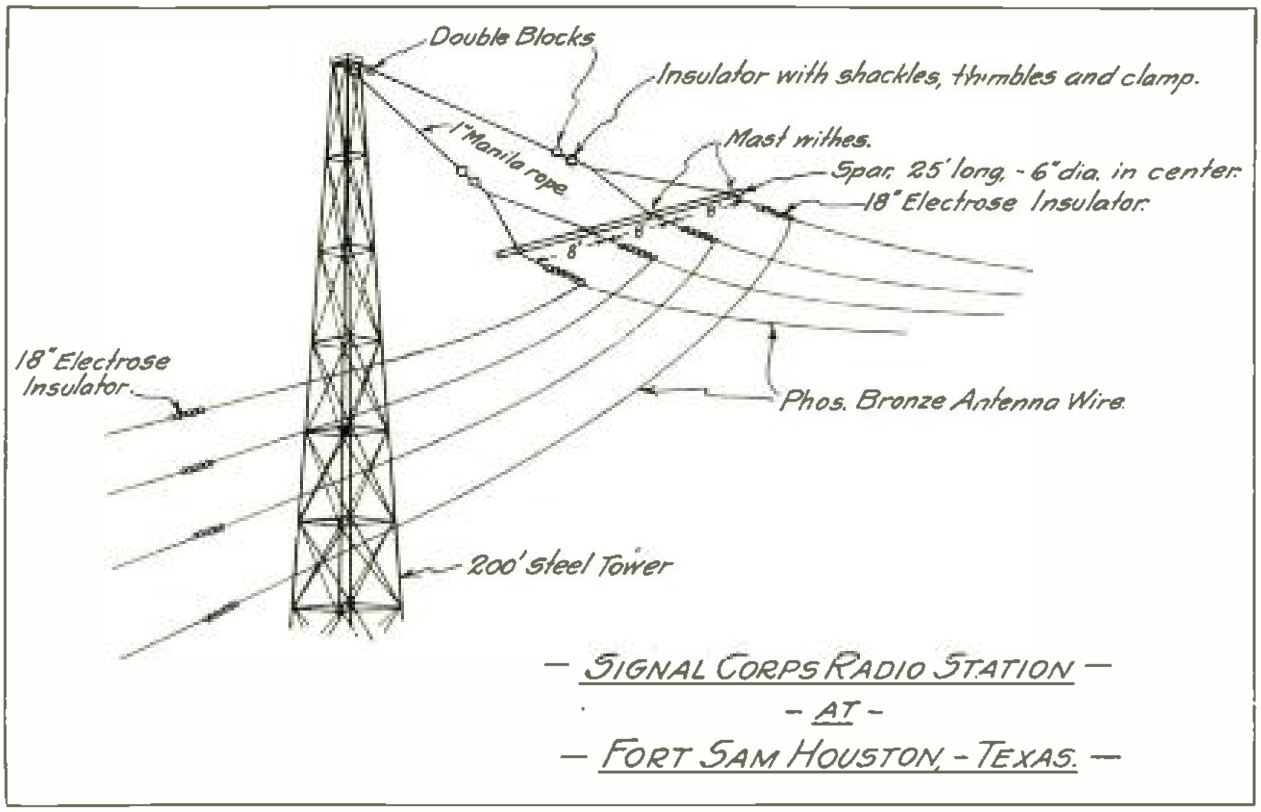


Fig. 1

In the permanent stations this consists of a set of bare horizonal radial or parallel wires, which are supported by insulators on posts 7 feet or more above ground. A counterpoise of a fan type has been installed at Fort Sam Houston, Tex., in which bare wires, No. 10, B. & S. gauge, 190 feet long, extend outward from the station under the antenna, being spaced 6 feet apart at the station and 20 feet at the distance ends.

A counterpoise of the radial type has been installed at the Fairbanks (Alaska) station, as shown in Fig. 2, where each 100 feet long, laid out radially on the ground. Although not directly connected with the ground at all, these wires really constitute one plate of a condenser, the ground being the other.

Power Equipment: To continue with the description of the Fort Sam Houston station set. The alternator is belted to a single phase sixty-cycle, twenty-horsepower induction motor driven by electric power furnished from San Antonio. The motor can be automatically started by closing a switch on the operator's table. In places where such power is not avail-

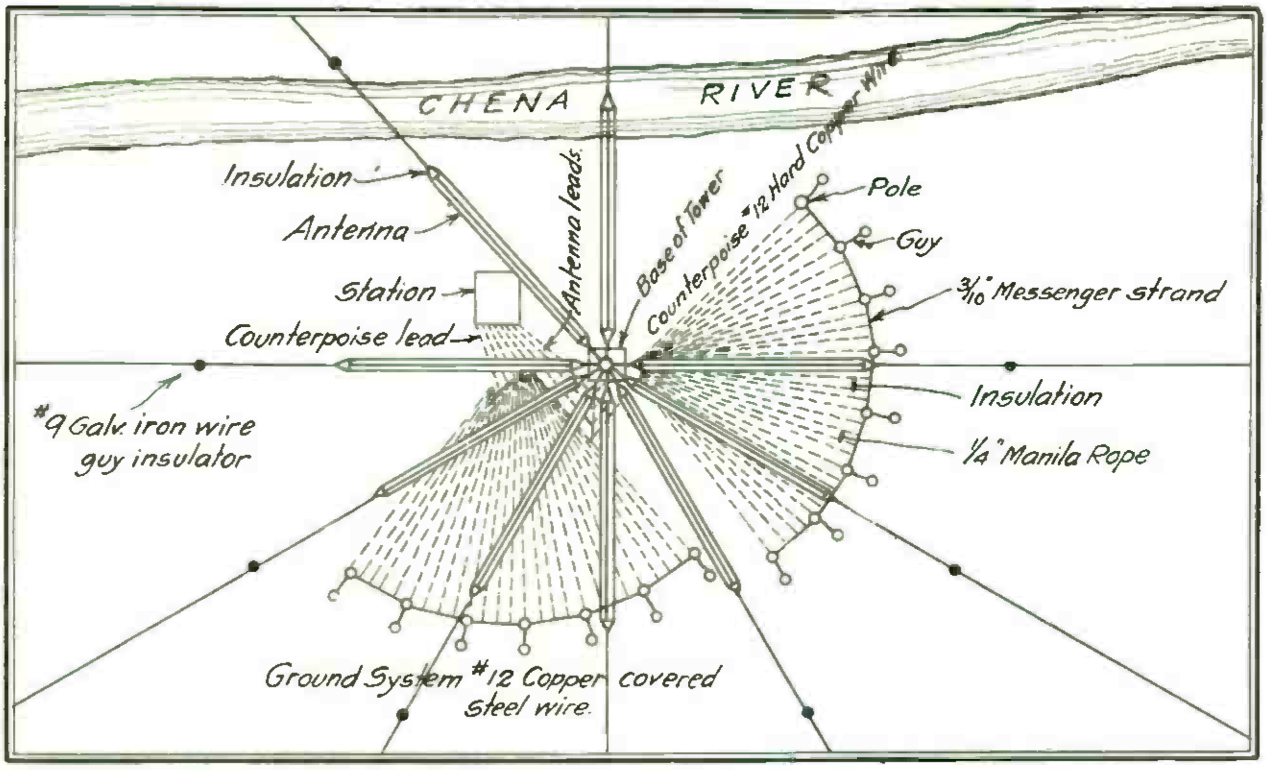


Fig. 2

COUNTERPOISE AT FAIRBANKS (ALASKA) STATION, TO OBVIATE EFFECTS OF HEAVY SNOWFALL.

able, as in Alaska, a Fairbanks Morse twenty-horsepower gasoline engine is generally used. The generator is of the inductor type, separately excited by a 15-k.w., D. C. exciter on the same shafts as the A. C. armature, and delivers the power of 10 k.w. at a frequency of 500 cycles and at 220 volts.

Switchboard: The switchboard is mounted close to the operating table and contains the 500-cycle frequency meter, A. C., ammeter and voltmeter, D. C. ammeter and voltmeter, and generator field rheostat for the adjustment of the alternator voltage. The 500-cycle wattmeter and the antenna hot-wire ammeter are mounted elsewhere.

Transformer: The transformer is of the open magnetic circuit type with dry insulation, with a reactance in its primary circuit for the proper adjustment of these circuits.

Key: The key is of the relay type, controlled by an ordinary Morse key, which uses the direct current from the exciter to operate the relay. The Morse-key contacts are shunted by a condenser to cut down the sparking.

Condenser: The closed-circuit condenser consists of five leyden jars, covered with foil, each of a capacity of 10.000 c.m. or 0.0111 m.f.

Inductance: The closed circuit inductance is in the form of a helix wound with flat strip and adjustable only by steps for certain predetermined wave-lengths, contact being made on the step corresponding to the desired wave-length and the secondary or open circuit tuned to resonance with the closed circuit.

Spark Gap. The gap is of the quenched type with plates of copper, but with a heavy plate of silver for the sparking surface. The separators are of mica. The gap is cooled by a blower driven by an electric motor taking power from the direct current exciter.

Open or radiating circuit: As this set is of the directly connected type, the closed circuit inductance is included in the open circuit. The coupling can be changed by the use of antenna loading inductance, variable by steps for approximate resonance and an antenna variometer for fine adjustment between these steps.

Receiving set: Two sets have been provided, both being of the inductively-coupled type. In the receiver of the first set, two primary coils are furnished so as to secure a wide range of wave-lengths, and in addition a primary condenser that can be connected by a switch, either in series with the coil for short wave-lengths or in parallel for long ones. Similarly three secondary coils are furnished, one when no secondary condenser is used and the circuit is only broadly tuned and the other to be used with the secondary condenser when the circuit is sharply tuned. The detector with the telephone and the fixed condenser is not permanently connected across the terminals of the secondary condenser or coil as in many circuits but across a variable number of turns in the coil.

The circuits in the receiver of the second set, known as the 1-P-76 set, are similar to those in the other, except that the primary circuit has no condenser and hence cannot be tuned to wave-lengths shorter than the fundamental wave-length of the antenna, unless an extra condenser is provided. For very long wave-lengths a loading inductance, normally not connected in circuit, can be inserted and varied until resonance is obtained. The secondary circuit has a variable coil and condenser, across the terminals of which the detector, etc., is connected. As the perikon detector furnished with this receiver is more sensitive when a small electromotive force is applied to it, a potentiometer is included as part of the set.

The telephones are of the adjustable pole-piece type.

THE WRECK OF THE MATATUA

Rolling off Cape Race in a wild gale and the worst fog of the season, a tremendous sea crashing over the reefs to port and thundering at the foot of beetling cliffs to starboard; among treacherous currents that had piled up six big steamers in two months, and with 200 seasick passengers below—such was the situation on the Red Cross liner Stephano when the Matatua flashed her S O S through an abnormal static and Marconi Operators C. B. Ellsworth and G. Emberton on the former vessel picked up the wavering call: "Steamship Matatua, beached seven miles S. Saint Mary's light."

It was eight o'clock on the night of July 22, when Ellsworth brought the message to Captain Clifford Smith, of the Stephano and the Red Cross liner was at once swung around and began to feel her way toward the distressed Matatua.

At length she was found, a 6,000-ton steamer flung clean over the outer rocks and stranded a hundred feet above the normal high water mark. At daylight the fog still held. The Matatua had shot a line ashore and taken her people off, but the ship had left her bottom on the reef and her cargo of munitions was mixed with the rocks that the undertow was heaping around her—and piling up at the foot of the overhanging cliffs. So, while the passengers and crew were safe, the ship was beyond Captain Smith's aid. Therefore, he groped his way out to sea again, giving aid on the way to the patrol boat Canada, which was also in distress.

SURGEON CALLED BY WIRELESS

Another example of the swift aid furnished by wireless has been reported by Operator H. W. Underwood, of the steamship Centralia. While transferring cargo in the harbor of Mazatlan, one of the crew was hit by a sling load of freight and knocked into the hold, sustaining a broken left arm and a serious fracture of the ankle. Underwood immediately called the United States gunboat Annapolis, lying at anchor a short distance away and obtained surgical aid in a few minutes.

The Fighting in Tampico

An Operator's Experiences During a Brisk Fortnight While the Rebels Were Attacking the Mexican City

By A. G. Berg

Operator A. G. Berg of the Mexicano

THE Waters-Pierce tankship Mexicano, Mexican registry, tied up at Tampico on April 17. We had come in from Galveston to take on a cargo of oil for Vera Cruz, and, while sincerely hoping to keep out of trouble, I think everyone on board was prepared to dodge bullets. Thus far Tampico had been spared the worst of the wastage that has ravaged the country for the past six years, as all parties understand that the oil fields surrounding the place are by far the richest prize in the whole game of war and are to be preserved—each hoping to have the loot for themselves.

I had rather expected to see a badly battered city, but as we steamed slowly up the Penuco River, the great oil-tanks and refineries that line the shore showed no visible signs of warfare. The outgoing tide was streaked with oil; here and there tugs were towing storage-barges to their berths and there were a dozen tankers of varied size and conditions of paint filling themselves with oil at the several wharves. Out in mid-stream lay a dirty, slate-colored Federal gunboat with her guns slewed around at indifferent angles and a grimy awning over her decks. It was disspiritingly hot and muggy, and when the wind shifted around to landward it bore out to us varied odors of oil and other things too Mexican to mention.

The Camaguey, of the Ward Line, lay nearby with Operators Rice and Giles on board. We went ashore to take in the city, which we found a typical low-built, flat-roofed town with many broad plazas. Much of it was rather attractive but parts were unbearable. We had dinner (also a lemonade that made me ill for the next two days) then strolled about the plaza listening to the strains of a very good military band till it was time to go on board again.

Things began to get interesting on April 19, two days after we arrived. The gunboat ordered us to leave dock as the rebels were going to make an attack on the town, and, when the Captain anchored a little astern of the man-o'-war, made him take another position farther away so as to be out of the line of fire. On the same day, the American steam yacht Wakiva was refused clearance on account of her nationality. Her skipper immediately appealed to the captain of a British cruiser then at Tampico, to have the vessel placed under the English flag. This permission was promptly granted and the Wakiva steamed out of the river under the nose of the gunboat flaunting from her stern the red ensign of Great Britain.

Two days later I was awakened by the shock of a heavy gun fired close at hand. In a minute I was on deck in my pajamas. The gunboat was cleared for action, with a cloud of smoke pouring out of her funnel and her guns at high elevation pointing out over the city. As I reached the rail she let fly again. We could hear the shell tear out over the flat housetops till it burst in a cloud of black smoke in the fields three or four miles beyond. There, through a bridge telescope, I could see little groups of high hats running forward and now and then spits of fire from the Mausers. Wherever a shell hit, the high hats would scatter like a flock of sparrows. The rebels had no artillery and, considering the average shooting ability of the Mexican, we on board the tanker thanked our stars.

The gunboat steamed slowly about, firing her heavier guns till the rebels gave up the attack as a bad job. The crackle of the rifles died away, the hats disappeared and the gunboat took a rest.

Next day, April 22, the rebels dug up a cannon and came back to give it a try. That made things lively for us as two of their shrapnel whizzed through our rigging and burst with a big bang fifty yards overside. This was entirely too close for the captain's peace of mind, so he hove anchor and hunted a more peaceful berth up-stream.

Meanwhile they were moving a lot faster on board the gunboat than I have ever seen Mexicans travel before or since. Her guns were banging away every minute or two. Once in a while the rebel cannon would drop a shell somewhere in her general neighborhood and blow river-water all over the scenery. Then the gunboat would skitter off like a water-bug and begin to shoot again from her new position. From inshore came heavy bursts of rifle-fire tied together with a pretty steady popping from the snipers, punctuated now and then with a heavy thud when they took a chance with their cannon. On board the Mexicano we spent a lively day.

After dark the firing ceased for the night, and it was quiet during the two days following. On April 25, however, the gunboat sent word over that I would have to get off the ship on account of being an American. I was put ashore by the captain and took my grip over to the Camaguey, which was due to sail before long for New York. They had me spotted, however, for when I was ashore next day with Operator Rice, a Mexican customs officer with a rifle stopped us and abused me on the general grounds that I was a Yankee. We wanted to retaliate, but his rifle did not look very tame and he wouldn't let us get close enough to grab it.

On the three succeeding days there was some sharp-shooting ashore, but nothing very serious. On April 29, however, they went at it again in great style with another gunboat, the Zaragoza, to help the first vessel. The Zaragoza let fly a wild shot that exploded in an oil barge close to the Mexicano and set it on fire. For the next two days it burned with a tremendous cloud of black smoke, and at night the glare of the flames reflected in the water made a striking picture, one, however, which we were in no mood to appreciate.

This was the day that the Ward liner Antilla steamed in with her funnel and ventilators punched full of bullet holes, and her quartermaster shot through both legs below the knees. We learned that the rebels had caught her lower down in the stream and boarded her, expecting to get away with all her supplies. But in the midst of the proceeding one of the two Federal gunboats tore up at thirteen knots an hour in a cloud of smoke and sent them flying for cover.

For the next three days there was nothing doing except a shot once in a while out on the edge of town. It was hotter than ever and smelt worse than I ever imagined possible, even for a Mexican town.

When the Camaguey sailed for New York on the second of May, I was on board, only too glad to get out of Mexico.

The Year Book of Wireless Telegraphy, 1916

THE force contained in a pocket full of solar dust "would convey to the earth enough energy to run one of our large battle-cruisers at full speed for eighteen hours!" Such is one of the remarkable conclusions drawn by Dr. Fleming in his article on "Photoelectric Phenomena" in the 1916 Year Book of Wireless Telegraphy and Telephony, published by the Marconi Publishing Company, of 450 Fourth Avenue, New York.

There is an unusal amount of interesting reading matter in the volume. In spite of the "damping" effect of the war, which has shrouded in secrecy the most important developments in the radio field east of the Atlantic, much observation of scientific value has still been continued, and in the United States the establishment of radio-telephone communication between Arlington and Hawaii has marked a monumental advance in the science. This is covered by an article entitled "Radio Telephony in the U. S. A." with a diagram of the circuits that probably were used and an explanation of the utilization of the Fleming valve on telephone lines. Another device adapted directly from wireless telegraphy is Professor Pupin's loading coil.

The report of the committee of the Institute of Radio Engineers on the standardization of wireless terms is a feature of general interest to workers in the field.

For the benefit of the advanced experimenter, Dr. W. H. Eccles has written on the calculation of wave length and illuminated his text with several useful "Abacs." These are scales drawn in such form that to find an unknown quantity it is only necessary to prolong a light pencil line through the diagram from the position of the known quantities on two arms of the scale to the third arm, which is marked with the desired figures. The answer can then be read directly from the scale. As many calculations in the mathematics of wireless require the use of highly complex formulae, this method, simpler in its operation than a slide-rule or log. tables, will appeal instantly to the investigator, who is enabled to get a positive check on his solutions, or to avoid mathematics altogether.

Dr. Fleming's article on "Photoelectric Phenomena," previously referred to, is one that will make as powerful appeal both to the experienced scientist as to the youngest amateur, just beginning his struggle for the mastery of the code. For the savant there is a singuarly lucid exposition of a little known and rather obscure field of research that touches not only upon problems of wireless telegraphy, but affects even such fundamental considerations as weather, terrestrial electricity and the geological formation of the planet. For the amateur Dr. Fleming suggests the fascinating possibility of generating electric power direct from the sun in such tremendous quantities that all our present systems of steam and water power will seem but slight advances over the stone age. While millions of kilowatts of energy pour down upon the earth's atmosphere, man laboriously extracts from the rocks such coal and oil as he may, and by a complex and wasteful process recovers for his use a fraction of the stored potentialities. Such a condition will not last forever. Aside from suggesting such tremendous future developments, the article discusses some extremely practical problems of long distance wireless transmission.

The committee on radio-telegraphic investigation of the British Association for the Advancement of Science, under the chairmanship of Sir Oliver Lodge, contributes an "Analysis of the Records of Strays"—"strays" being the English equivalent of "static"—with special reference to "X storms," or the violent disturbances in the ether that cause so much interference in the radio service. The committee has taken many series of records made at widely separated points and is endeavoring to discover the relation between such phenomena as the aurora, thunder storms, hurricanes, the great cyclonic movement of the atmosphere and static interference in wireless telegraphy. While reliable conclusions can not be reached till several years have been employed in making thorough observations, the work is one that concerns everybody interested in wireless.

An amusing non-technical account of the development of marine signaling in the British navy is offered by the famous correspondent, Archibald Hurd. The beginnings of the science were not fortunate, as is illustrated by an incident from Sir John Barrow's "Life of Lord Howe":

One day a fleet of ships, supposed to be that of the enemy, hove in sight. The signals were resorted to; but . . . somehow or other they were not made so well as when made at leisure. Geary (the Commander-in-Chief of the Channel Fleet) at last grew impatient, and going up to Kempenfelt (the first captain of the Fleet), and laying his hand gently on his shoulder, exclaimed with good-natured earnestness, "Now, my dear Kempy, do, for God's sake, do, my dear Kempy, throw your signals overboard and make that which we all understand, 'Bring the enemy into close action.'"

This incident, Mr. Hurd explains, is typical both of the condition of marine communication at the beginning of the Revolutionary War and the attitude of the senior officers toward those who attempted to relieve the difficulty. At first the hoist system was developed and later the semaphore was brought to a state of efficiency in France where Napoleon was able to flash orders across the country at a speed that compares very favorably with ordinary modern telegraph service.

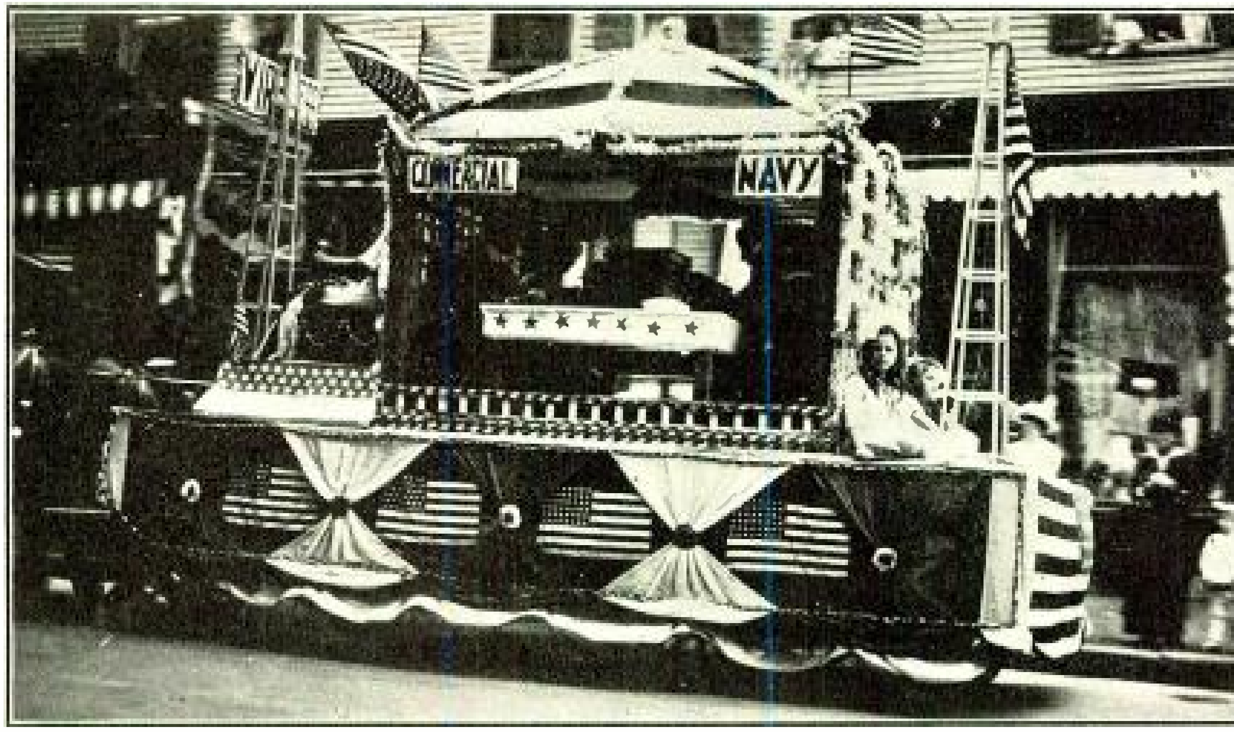
Col. F. N. Maude, who is already known to readers of previous issues of the Year Book, has contributed an article on the "Allies' Strategy in 1915."

In addition to these special contributions, the volume contains the usual list of ship and shore stations with their call letters and wave lengths, pages of formulæ, explanations of the various time and weather signals, and the great mass of data and useful information which the public has learned to expect in the wireless Year Book. One feature is a specially indexed section covering the wireless laws and regulations of all nations using the system, which means practically every civilized people on earth. Besides the contributions already mentioned there are several others of interest and scientific value, including an account by John L. Hogan, Vice President of the Institute of Radio Engineers, of the "Measurement of Signal Intensity" and Percy W. Harris on "Problems of Interference." As usual the book is profusely illustrated with handsome photographs, and contains 879 pages, bound in buckram. The price is $1.50.

Operator Went Down With the Provence II

The following details regarding the heroism of Joseph Huby, the wireless operator on the Provence II, which was struck by a torpedo, have been related by one of the survivors of the wreck: Huby remained at his post until he was drowned. When the torpedo struck the vessel, he sent the S O S and continued to flash the appeal incessantly while the ship remained afloat. The stern of the ship sank into the water and the passengers made their way to the fore part of the ship, which gradually rose out of the water, but Huby continued to operate the set, until the waters engulfed the vessel.

During the recent disturbances in Ireland the insurgents severed the telegraph wires which resulted in the loss of communication with England except by wireless. It is also related that when a rebel obtained possession of the wireless station at Stephen's Green he employed it to send broadcast the proclamation of an Irish Republic.



Floyd Manuel built this float as a wireless exhibit for the Newport, R. I., Preparedness Parade, July 4, 1916

With the Amateurs

The Mahoning Valley Radio League has been formed at Niles, Ohio, with a charter membership of eighteen. At a regular weekly meeting the following officers were installed for the coming six months: President J. William Kidd; vice-president, Chas. Thompson; secretary and treasurer, Luther Kovilik.

A special membership fee for members outside a thirty-mile radius of Niles has been arranged for. At a recent meeting of the club an application for membership from Newark, N. J., was considered.

At present the club has only a receiving set, but it expects to obtain a 1 k.w. transmitting set and a supersensitive receiving set soon. A practice table has been provided for student members of the organization. The club wishes to get into communication with other radio organizations.

The Hawkeye Radio Association, it has been announced, plans to have an excellent exhibit of wireless apparatus at the Iowa State Fair in Des Moines. Several complete modern stations will be shown, including some for the reception of undamped waves.

News reports will be sent to all stations several times during each day, which can be delivered to local newspapers.

The third annual convention of the Hawkeye Radio Association will be held during this time, and several meetings are to be held, all amateurs being invited to attend.

Material for the new wireless station to be erected on the roof of the Central Y. M. C. A., Albany, N. Y., has arrived. A report on the subject was made at a recent meeting of the members of the Albany Wireless club and it was decided to begin the work of installation as soon as possible. The station wil have two poles, each 20 feet in height. The poles will support four bronze wires each 125 feet in length which will be suspended between the roofs of the two buildings.

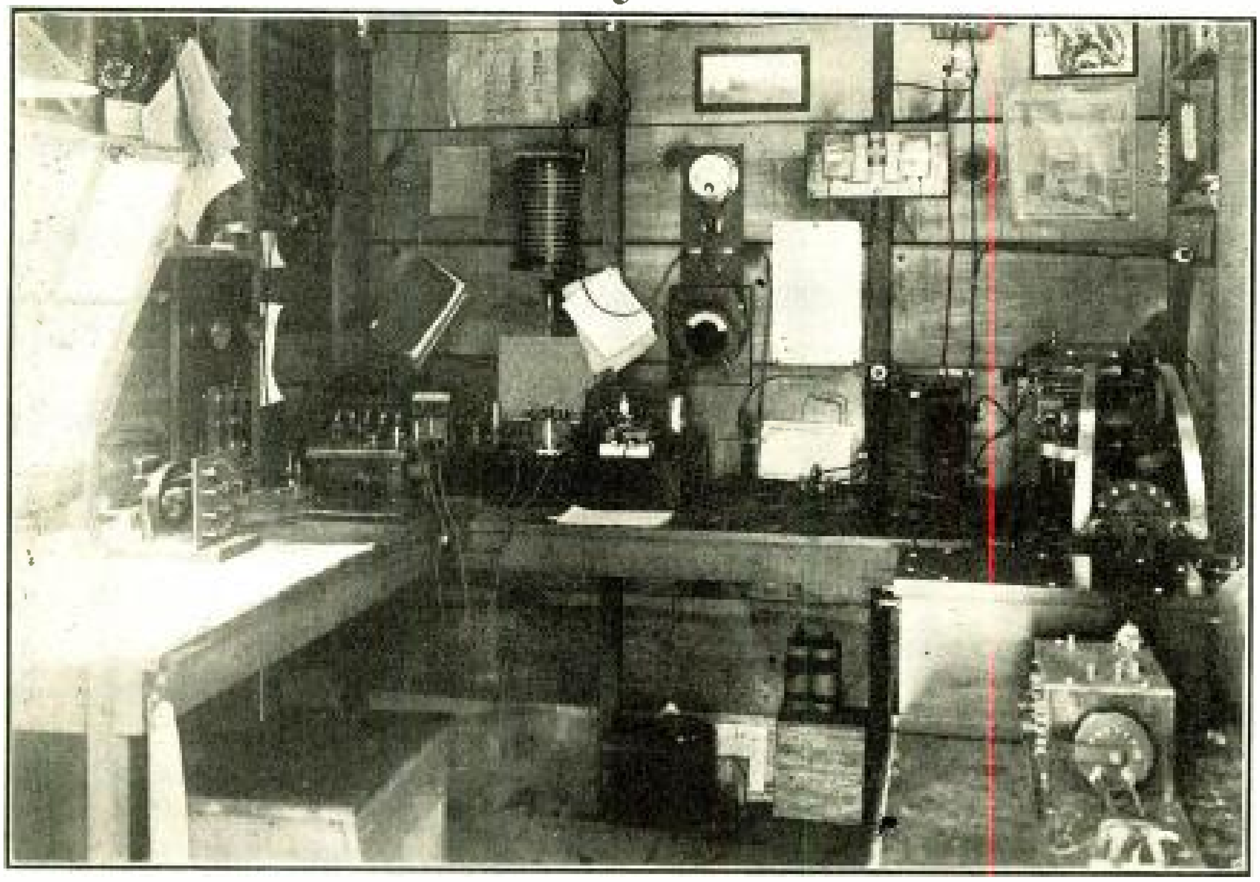
The Amateur Radio Association of

Buffalo held its first stag outing of the season at Ebenezer recently. A camp site was located at Mill Road.

Amateur wireless operators wishing to affiliate with the Association are requested to communicate with President Carver, Wesker Street, in person or via wireless, call letters 8ED.

J. G. McCollom of Salt Lake City, Utah, is the owner of the wireless station, a photograph of which appears elsewhere in this issue. It has a 1 k.w. transformer with a sending condenser made of sixteen plates of 8 by 10 inch glass and fifteen sheets of 6 by 8 inch copper foil, the whole being set in a zinc-lined tank filled with transformer oil. The oscillation transformer is built of edgewise-wound copper strips, eight turns on the primary and twenty-two on the secondary. For the rotary spark gap there is a hard rubber disk, 5½ inches in diameter with twelve lugs, actuated by a 1/30 h.p. motor turning at from 2000 to 4,400 r.p.m. that gives a very high pitched note. The set has a large sending key and two hot-wire ammeters, one reading from 0 to 5 amperes, the other from 0 to 10. The helix coil is used for the antenna inductance, appearing in the picture above the other instruments. For safety, the antenna switch is so arranged that it can be switched from sending to receiving without danger of the sending current getting over into the receiving side.

The receiving set is housed in a cabinet completely enclosing all the apparatus. There is a receiving transformer with dead-end switches capable of tuning up to 2000 meters, equipped with a loading coil and a switch, not shown in the photograph, that will permit tuning up to 6000 meters. There is also a pair of variable condensers, a fixed condenser of small capacity and a one-step amplifier. The vacuum valve detector shown in the picture had to be rearranged. To shift from the valve and amplifier to a perikon detector, shown on the right, there is a double-pole, double-throw switch. The receivers are Brandes 3,200-ohm Improved Navy Standard, connected through to an antenna composed of four silicon-bronze



J. G. McCollom's station at Salt Lake City stranded wires, 150 feet long and sixty-five feet high, spaced four feet apart. Practically the whole set is home-made.

McCollom receives signals from ships on the Pacific and Pacific coast stations, Panama and Arlington, and transmits 500 miles.

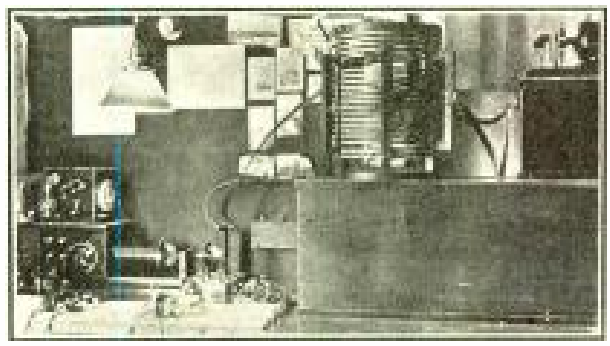
The Hillsboro Radio Association was organized on October 22, 1915, and then called the Tampa, Fla., Radio Club. For various reasons the name was changed. The officers of the Association are: President, P. H. Wall; vice-president, J. J. Fogarty; secretary, George Warner; treasurer, V. C. McIlvain; assistant secretary and treasurer, Ed Cole; Corresponding secretary, S. L. Boyett. The Association holds its meetings every Monday night at No. 707 Azeele Street, Tampa, Fla. When organized it had only five members, but now we have twenty-seven, two of whom have seen commercial service. The club is now preparing to make and install a club set and this will take up most of the members' time for some weeks.

Address all communications to S. L. Boyett, 1047 Green Street, West Tampa, Fla.

The present membership of the Grape Belt Radio Association includes stations in Erie, Chautauqua and Cattaraugus Counties of New York State only. However, amateurs in Western New York, including counties as far east as Cayuga, Tompkins and Tioga, are eligible for membership, as well as those in Erie, Warren and McKean Counties in Pennsylvania, or in fact, any amateur within the limits of the Second Parcel Post Zone, with Unit No. 1263 as a center.

G. E. Sabin at the key of 1ZL

The present cost of membership is fifty cents, twenty-five of this being the registration fee and the other twenty-five the amount of two assessments, which all new members are required to pay, in order that they may be on equal footing with former members. This entitles them to the loan of the property of the Association, upon payment of any transportation charges to and from the custodian of the property. The "non-participating" members, who do not have the privilege of the use of Association property, are only required to pay a twenty-cent registration fee, without any assessments.



The well-equipped station of J. N. Grossman

At present the equipment includes a Clapp-Eastman wave meter and two very good books on wireless. As rapidly as funds become available, through additions to the membership, or by additional assessment if deemed necessary by the directors, other books will be added.

All inquiries will be answered, either by R. H. Lilley, secretary, Eden, N. Y., or Herbert A. Hiller, president of the Association, Lilnes Creek, N. Y.

The amateurs of Hudson County, N. J., have formed the Hudson City Radio Association, the primary object of the organization being to establish a reliable intercommunicating club or a chain among the members and bring together all amateurs in the vicinity. Amateurs in Hudson County are invited to join the club. Applications should be made to the secretary, Frank V. Bremer, No. 3,613 Boulevard, Jersey City, N. J. Radio clubs in the neighborhood are invited to correspond.

What Wireless Means to Railroads

A Report Presented to the Annual Convention of Railway Telegraph Superintendents

THE advantages of the use of wireless telegraphy by railroads were pointed out in a report presented by the Committee on Wireless of the Association of Railway Telegraph Superintendents to the Association at its annual convention in St. Paul, Minn., June 20-23. The Committee, of which L. B. Foley, superintendent of Telegraph, Delaware, Lackawanna & Western Railroad is chairman, and David Sarnoff, assistant traffic manager of the Marconi Wireless Telegraph Company of America a member, called attention to the fact that different railroads with terminals in the same city can erect an efficient station and jointly share the expense of operating it. The importance of wireless to railroads when wire service is cut off was also pointed out. The report in part follows:

"Since the invention of wireless telegraphy by Marconi in 1897, continued improvements have taken place until now it is admittedly an efficient means of intelligent transmission, capable not only of being utilized as a supplement to existing means of wire communication, but also to provide reliable communication when all other means are unavailable, due to the prostration of pole lines by storm, or for other reasons.

"It was considered a feat when, in 1897, a distance of fourteen miles was covered by Marconi—then experimenting at the Needles station, Alum Bay, Isle of Wight. The American Line s. s. Philadelphia was the first vessel equipped (in 1900), and ship to shore communication was then proven to be possible. Thereafter numerous vessels were equipped with wireless apparatus and the accomplishments of wireless in the marine service are so well-known to all that more than passing mention need not be made of the matter in this paper.

"A new epoch in wireless transmission was marked by the erection of trans-Atlantic stations at Glace Bay, Nova Scotia, and at Clifden, Ireland, which were opened to commercial service in 1907. These stations have been conducting commercial business, in competition with the cables, ever since and at the present time every civilized country is erecting high-power stations for international communication.

"It was not until November 24, 1913, however, that wireless telegraphy received its introduction into the railroad world and the mind of the railroad telegraph superintendent, for it was on that day that the first practical use of wireless was made on trains and between trains and fixed stations, and this practical demonstration, which is now a matter of daily routine, was made on the train and stations of the Delaware, Lackawanna & Western Railroad, which are equipped with Marconi apparatus.

"If there is any doubt in the mind of any one here to-day that wireless telegraphy is not as reliable for the handling of train orders or other commercial railroad work as the ordinary land line Morse telegraphy, that doubt can be promptly dispelled by a trip over the Lackawanna road and an inspection of the radio system now in operation over a distance of 400 miles, with intermediate stations varying from sixty to 200 miles.

"The wireless telegraph serves as an auxiliary means of communication in the event of interruption to wire facilities. There is hardly a railroad in this country which has escaped an entire loss of wire communication on some parts of its line during the past year and during such interruptions almost any amount would be cheerfully expended if some means of communication could be found to ascertain the whereabouts of trains and the conditions existing at points entirely cut off from service.

"Early in August of last year wireless telegraphy was the only means of communication with the City of Galveston and other points in Texas during the great tropical storm that swept over the Gulf of Mexico and the southern part of Texas when communication by wire was impossible. The wireless relieved much anxiety and brought prompt relief. Were it not for the wireless the city would have been cut off from the rest of the world.

"The Galveston experience and the Dayton flood of several years ago where wireless also came to the rescue, suggests that every important city in this country should be equipped with a reliable wireless station, capable of efficient communication when, for one reason or another, the wire facilities are interrupted.

"Communication, to a railroad company, is as vital as locomotives and cars. In the east we are visited by sleet storms once or twice a year and sometimes more often. Poles and wires are prostrated; the railroads have difficulty in operating their trains because there is no means of communication available. After each occurrence of this kind we read in the newspapers that some particular railroad intends to spend a million dollars to place its wires underground. The sun shines again, the old service is restored, and the matter is forgotten until the next severe storm comes along. The Pennsylvania Railroad is the only road thus far that has placed its wires underground for telegraph and telephone purposes. This has been done for a distance of about thirty miles in New Jersey. The cost of placing wires underground is far beyond the resources of most roads and is therefore not likely to become universal. Moreover, telegraph engineers do not favor underground construction for many good reasons.

"The Western Union Telegraph Company, with which most of the railroads have agreements, is using shorter poles and a greater number to the mile, guying them in such a maner that they will stay in the ground, but the cross-arms and wires do not stay on the poles during some of the storms and even the modern and expensively constructed lines of the American-Bell Company failed to withstand the storm of March 1st, 1914. It is therefore evident that reliable and comparatively inexpensive communication is required by railroads and the experience of the past few years has demonstrated beyond a doubt that wireless supplies the need.

"Wireless telegraphy is no longer in its experimental state and its cost is by no means prohibitive. Apparatus can be purchased outright by railroad companies and the maintenance and operation thereof is a simple matter. Railroad companies need not go outside of their own organizations to obtain men capable of operating and maintaining the radio equipments; the regular Morse operators can do this work quite satisfactorily. Two stations, fully equipped with wireless apparatus, including towers of sufficient height to work over a distance of 400 miles, cost less than an ordinary locomotive.

"Many telegraph superintendents who have been present at the Association meetings when wireless was discussed, and who have also investigated the question for themselves, have unhesitatingly stated that they are in favor of installing it on their roads but find difficulty in convincing their superiors of the actual need for wireless service; of course this means that no appropriations are forthcoming for the purchase of the necessary equipment, but when viewed in the light of past history, it is but to be expected that new inventions, especially when intended for auxiliary communication, are slow to impress theirimportance on the minds of those who do not come in daily contact with the requirements of the service. Nevertheless, the telegraph superintendent who knows the many troubles which are his during the days when communication is unattainable, should give the matter serious thought and satisfy himself that these troubles can be obviated with the means suggested in this paper. The telegraph superintendent is the first one to be censored when wire communication is interrupted; he cannot borrow communication from his neighbors and if the telegraph and telephone companies have any to furnish, the cost is astounding.

"It is not absolutely necessary for each railroad to install towers and wireless equipment along its entire line, especially in territories where one or more roads parallel each other. The different railroads, with terminals in the same city, can erect an efficient station and jointly share the expense of operating it. A few such stations at the more important terminals, operated in this way, would soon convince them of the merits of the system and each railroad could then expand, erecting additional stations along its individual lines, as the service might require.

"A good deal of thought has been devoted to this suggestion by the Wireless Committee, and it was found entirely practicable. Details of the scheme will, of course, have to be worked out in each case, but the wireless company supplying the apparatus will, in conjunction with the railroads, lay out the best plan of communication. If this proposition is approached from the angle suggested, it will afford the advantage claimed for wireless as an auxiliary and at a very small cost to each road.

"Considerable space has been devoted by the newspapers to wireless telephony, and its achievements during the past year justify the belief that wireless telephony will be brought to a state of commercial efficiency before many years have passed; but the accomplishments of the last year have merely demonstrated its principles and possibilities. At the present moment there is not a wireless telephone on the commercial market capable of giving as satisfactory service as the wireless telegraph.

"It must be remembered, too, that if the wireless telephone has any advantages over the wireless telegraph, it will be due to the fact that the telephone can be operated by unskilled persons, whereas the telegraph requires telegraph operators, and until it is perfected to a point where the unskilled person can operate it, it will have no advantages over the telegraph; and up to the present time the wireless telephone has not reached this desired state.

"Wireless telephony, when perfected, will be more applicable to moving trains, especially as it will then not be necessary to employ a special man on trains equipped with the wireless system.

"Having thus reviewed the subject, it can only be said that preparedness is the slogan of the hour; sleet and wind storms are on the way and we should be prepared to defy the elements and maintain communication at all times.

VESSELS RECENTLY EQUIPPED WITH MARCONI APPARATUS

Names	Owners	Call Letters
D. G. Scofield	Standard Oil Co. of California	(Not yet assigned)
Balboa	Columbia Maritime Co., Ltd.	(Not yet assigned)
Bark Manga Reva	Brynhilda Shipping Corporation	KIP
Halcyon (S. Y.)	Dutee W. Flint	KZL

THE SHARE MARKET

New York, August 7.

Trading in Marconi shares was dull on the Curb for practically the whole month, although in London, American Marconi was bid up to 4½ in an active market. Several reasons have been advanced, but the interest in speculative munition stocks, in contrast to investment securities, coupled with the inability to sell American owned stocks in England under the British exchange ruling has kept prices in America lower than normal. English preferred, for example, is quoted 14 bid here and 16½ on the other side. In spite of the dullness the market is strong and, according to those who keep in touch with the situation, gains are to be expected.

Bid and asked quotations today: American, 3⅜—3¾; Canadian, 1¾—2¼; English common, 14—17½; English preferred, 14—16½.

Wireless Equipped Balloons

An Interesting Problem in Military Communication

NOTWITHSTANDING the importance of the wireless-equipped aeroplane in Europe's war, and the achievements of the wireless equipped dirigible, the balloon, both in its captive and free or floating form, is playing a significant role in the great conflict. The captive balloon is used extensively at the front, its position being as a rule directly behind the battle line, but naturally its range of observation is strictly limited. The free or floating balloon is being utilized in siege operations, or in the more thickly populated areas of the war, where observations of enemy positions are made necessary and can be executed best and transmitted best by reason of the peculiar advantages attaching to the wireless stations installed on this form of aircraft.

Many designs have been made for a receiving antenna attached to the free balloon. These have been experimented with exhaustively, and have served not only to establish excellent wireless telegraphic connections, but have been pursued more particularly in the effort to solve special problems connected with the effect of wireless telegraphy on atmospheric electricity. Dr. P. Ludewig has described an antenna form which is reproduced in Fig. 1. This consists of one or more circles of wire strung about the equator of the balloon, whose ends lead to the basket and over the receiving apparatus, the latter being connected with another wire, about 100 meters long, suspended from the basket.

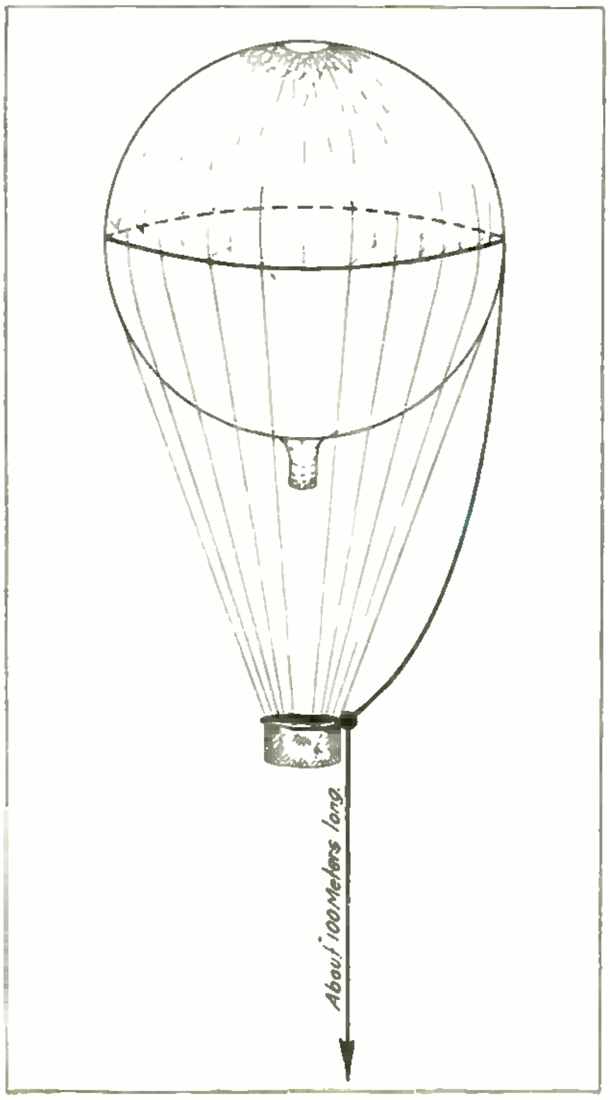


Fig. 1.—Wireless equipped balloon receiving station

This form has been used by other experimenters to determine the intensity of the reception in relation to the distance between land-sending stations and balloon-receiving stations; to investigate the dangerous atmospheric disturbances known to wireless telegraphy; to study the spread of electro-magnetic waves of wireless along the surface of the earth and also to establish proof that under special conditions, a strong decline in receiving intensity may be met with at high altitudes.

This antenna was utilized only for the purpose of receiving. It is evident that the antenna forms of Fig. 1, as favorable as they may be for receiving purposes, are not adapted for the sending of radiograms, since the high tensions created on the wires attached to the body of the balloon would become a great source of danger to the craft and the persons it was transporting. The equipment of the free ball balloon with a sending station is intended for the solution of several interesting problems. An aircraft thus equipped may be sent out from a fortress or fortified city, make its observations over the positions of the enemy and transmit the information from a great distance to the land stations situated in the fortified area.

Another and purely scientific point is being studied by means of the aircraft thus equipped. The modern investigation of wireless telegraphy has shown that the mathematical data compiled on the wireless transmission between sending and receiving stations, are verified only under special conditions. At times in the communication between two stations, strong disturbances and sudden alterations of receiving intensity intervene, in which the dependence of the strength of the receiving current on daytime and night time plays a special role. The cause of these disturbances is not yet satisfactorily explained. At the present time this problem is the center of interest and it is not to be denied offhand by those who are investigating these phenomena, that an important step forward will be taken when wireless receiving and sending stations are made independent of the land.

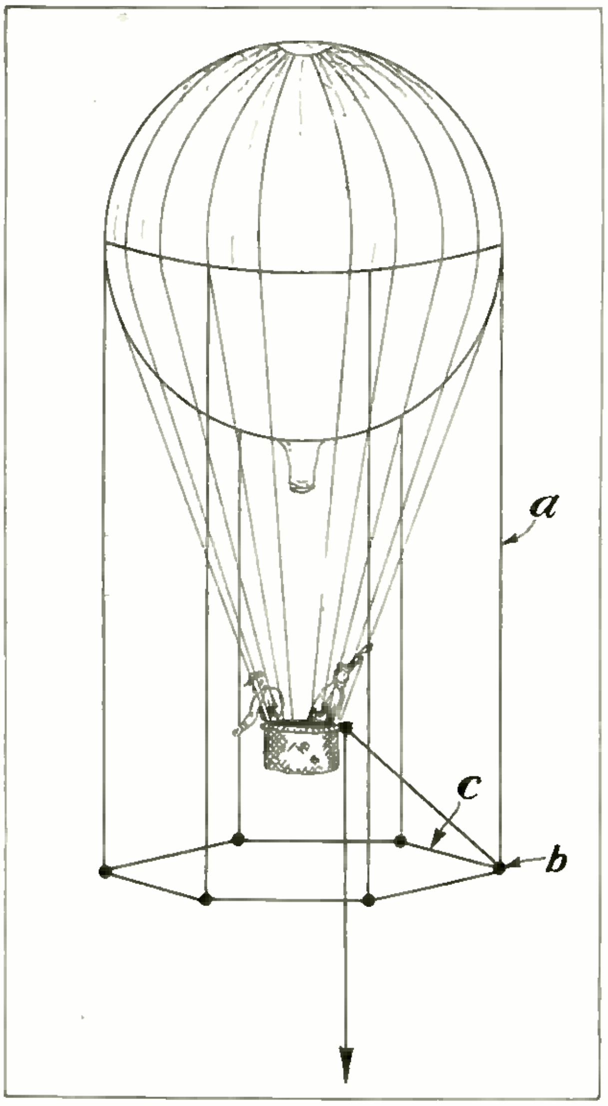


Fig. 2—Wireless equipped balloon with sending station

WIRELESS MEN IN PREPAREDNESS PARADE

Twenty-seven employees of the Marconi Wireless Telegraph Company of America, under the leadership of George J. Jessop, superintendent of the Southern District of the Pacific Coast Division, marched in the preparedness parade in San Francisco on July 22d. The Marconi men marched in the form of a rectangle, well spread out, with the Marconi colors on the outside arm of each line. The San Francisco Radio Club also appeared in the procession.

The explosion which killed six persons and injured many more occured at Steuart and Market streets just after the Marconi men had passed the junction of these thoroughfares. Ellery W. Stone, Government Radio Inspector, who was standing directly across the street from the scene of the explosion, narrowly escaped death, missiles of various kinds falling about him.

An excellent suggestion has recently appeared in the columns of an English periodical devoted to wireless. It is to the effect that ship operators study Spanish to prepare for the openings that may come in South America.

Italy May Use Wireless For U.S. War Reports

THE Italian government is reported to be considering the immediate establishment of an official wireless telegraph news service to the United States. It is to follow the methods adopted by the German semi-official service, the Overseas News Agency.

The motive for installing this Italian service is "to overcome the misinformation and lack of accurate knowledge in foreign countries regarding Italy's war and regarding the admirable attitude of the entire nation, in participating, despite innumerable sacrifices, in the great struggle which the Allies are conducting for the cause of justice and liberty."

Bitter complaint continues to be expressed in the Italian newspapers regarding the falsehoods which have been propagated about Italy, her army and her people, and her method of conducting warfare. The German news agency service is considered as largely responsible for this condition of affairs.

Incidentally it is hinted that in a military way the German officials in charge of the news distribution recently carried out a feat which almost had serious consequences for Italy.

It is being gradually revealed that the momentary success of the Austrian offensive in the Trentino, which resulted in an invasion of a section of Italian territory and a distinct menace against the city of Vicenza, one of the bases for the Italian offensive eastward, was due to clever work by the German disseminators of military news, who succeeded in hoodwinking the Russian army chiefs regarding the nature of the movement of troops which the Austrians were carrying out in the Tyrol, in advance of their onslaught against the Italian forces. The German scheme was to suggest that the Austrian movement in the Tyrol and in the Trentino was simply a realignment of troops, and, above all, that no forces were being moved from the Eastern zone toward the Italian front.

The detail of the whole scheme is declared by Italian military experts to be entirely clear to all at present, and the ingenious way in which allusion was made in the Austrian news bulletins to the movements on the Eastern front of certain divisions and certain regiments and battalions, the numbers and names of which were casually given, whereas these particular divisions had been already secretly moved to the Italian zone, succeeded, the Italians believe, in convincing the Russians that Austria had not designed any serious operation against Italy. The Italian staff, it is hinted, tried in vain to convince the Russians of the true facts and the seriousness of the threatened blow, and of the opportunity afforded to the Russians of hastening their offensive in consequence of the reduction of Austrian forces on the Eastern front.

The Italian government, it is understood, is considering the use of the powerful Marconi wireless stations at Coltano and at Centocelle for the purpose of transmission of news every day to the United States. It is regarded as doubtful, however, if either of these stations can supply the requisite facilities for a full news service such as intended, as they are at present almost constantly kept busy and, at times, they are overwhelmed with important messages.

Guglielmo Marconi himself on April 25 last, which was the forty-second anniversary of his birth, offered to install for the Italian government a new wireless station more powerful than any yet in existence at his own expense. The urgency of putting before the world the true facts regarding the Italian side of the current news was not then appreciated as it is today, nor had the various serious development of the German news propaganda then produced its effect in the Trentino, and Mr. Marconi's offer was taken under consideration by the government.

It is now suggested that his tender of services for the immediate construction of such a station be accepted, even if his offer personally to defray the expenses be not admitted.

While the German Overseas News Agency service seems intended for America almost exclusively, in reality its chief purpose is now considered to be to confuse the Allies with regard to facts touching the war and with regard to matters which may have military consequences. The news transmitted and addressed to the American stations is promptly caught up by the Eiffel Tower station in Paris and by British stations and is immediately circulated through the countries of the Allies. By the time that the official and semi-official news agencies of the latter countries have consulted the government authorities and have obtained permission to issue contradictions of the German statements a lapse has usually occurred and the German news item is liable to have accomplished its intended purpose before the contradiction is forthcoming. This is one of the defects which the Italians hope to remedy.

NEW YORK POLICEMEN GRADUATE AS OPERATORS

Sergeant Charles E. Pearce, who is in charge of the wireless branch of the Telegraph Bureau at the headquarters of the New York Police Department, has proved himself an efficient instructor of radiotelegraphy in the conduct of the wireless school for policemen, which was recently established on one of the upper floors of the Headquarters Building of the Department. Six of his pupils, three of them police lieutenants and three patrolmen, have just been made commercial wireless operators of the first class, and are prepared for the novel application of the wireless art to police duty.

In the July number of The Wireless Age the plans of Commissioner Arthur Woods, to introduce wireless telegraphy into the operation of the Department were described. A large Marconi 1 k.w. 500 cycle quenched spark gap set was installed at Headquarters, an aerial was constructed on the roof of the building, and the wireless school for policemen opened.

Fifteen policemen, including lieutenants and patrolmen, were assigned to attend the wireless telegraphy training school daily for a period of thirty days up to July 30. These men had been carefully selected from among the members of the Department: each one of them was a former railroad, press or commercial telegraph operator. The fact that they retained the knowledge of their former occupation, greatly expedited their instruction in wireless by Sergeant Pearce.

By the end of July, Sergeant Pearce's pupils were ready to take their examinations at the training school for radio instructions at the Brooklyn Navy Yard. Their instruction there continued for nearly two weeks, and the six men passed their examination on July 11 and 12. The successful graduates are Lieutenant John A. Altenbach, of the Atlantic Avenue police station, Brooklyn; Lieutenant George H. Quackenbos, of Police Headquarters; Lieutenant William H. Van Keuren, of the East Twenty-second Street station, and Patrolmen George Wolf, Emil Kopko and George T. Vale. These men have received from the Department of Commerce certificates conferring upon them the title of commercial radio operators of the first class, and all are now eligible for assignment to any wireless station.

Undoubtedly the officials of the police departments of every other large city in the country are watching the innovation of wireless at New York Headquarters with much interest, and it will probably be seen that the first successful application of wireless telegraphy in the detection of crime or criminals, or in the maintenance of order and public safety in some great disturbance or calamity, will cause the introduction of this useful service in the departments of many other cities.

How to Conduct a Radio Club

(Especially Prepared for the National Amateur Wireless Association.)

Receiving Detectors for Wireless Telegraphy

ARTICLE XXVII

(Specially Prepared for the National Amateur Wireless Association)

By Elmer E. Bucher

PERHAPS the most interesting types of receiving detectors in use at present are the variously constructed vacuum valves, the forerunner being the Fleming Valve, which is shown diagrammatically in Fig. 16. A tungsten or

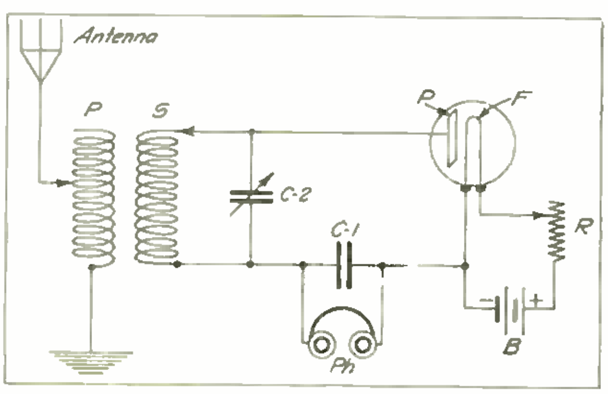


Fig. 16

carbon filament F is sealed in a glass bulb with a copper or nickel plate P, the bulb being exhausted to a high degree. The filament is brought to incandescence by the battery B, which may be of 4 volts or 12 volts. The incandescence of the filament is controlled by the rheostat R, which usually represents a resistance of about 10 ohms.

It is generally asserted that the vacuous space between the plate P and the filament F is conductive only to oscillations in one direction, hence when the condenser C-2 discharges into the valve elements, the alternating current of radio frequency is converted into a pulsating direct current which charges the condenser C-1 and thus actuates the head telephones.

The complete circuit for this detector, as shown in Fig. 16, includes the primary and secondary winding of the receiving couplers P and S, the secondary winding being shunted by the variable condenser of low capacity C-2. The telephones are shunted by the condenser C-1 which usually represents a value of .003 microfarad.

It is not difficult to bring this detector into a state of sensitive adjustment; it is only necessary to regulate the incandescence of the filament F by means of the rheostat R, until the best response is secured from the distant station.

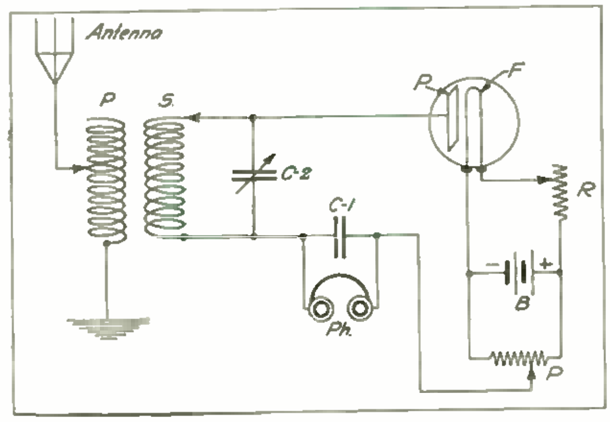


Fig. 17

The best results are obtained when the secondary winding S possesses a high value of inductance and the condenser C-2 a rather low value of capacity. Generally C-2 does not exceed .0002 microfarad.

The Fleming valve detector is sensitive and possesses the great advantage for commercial service of exceptional

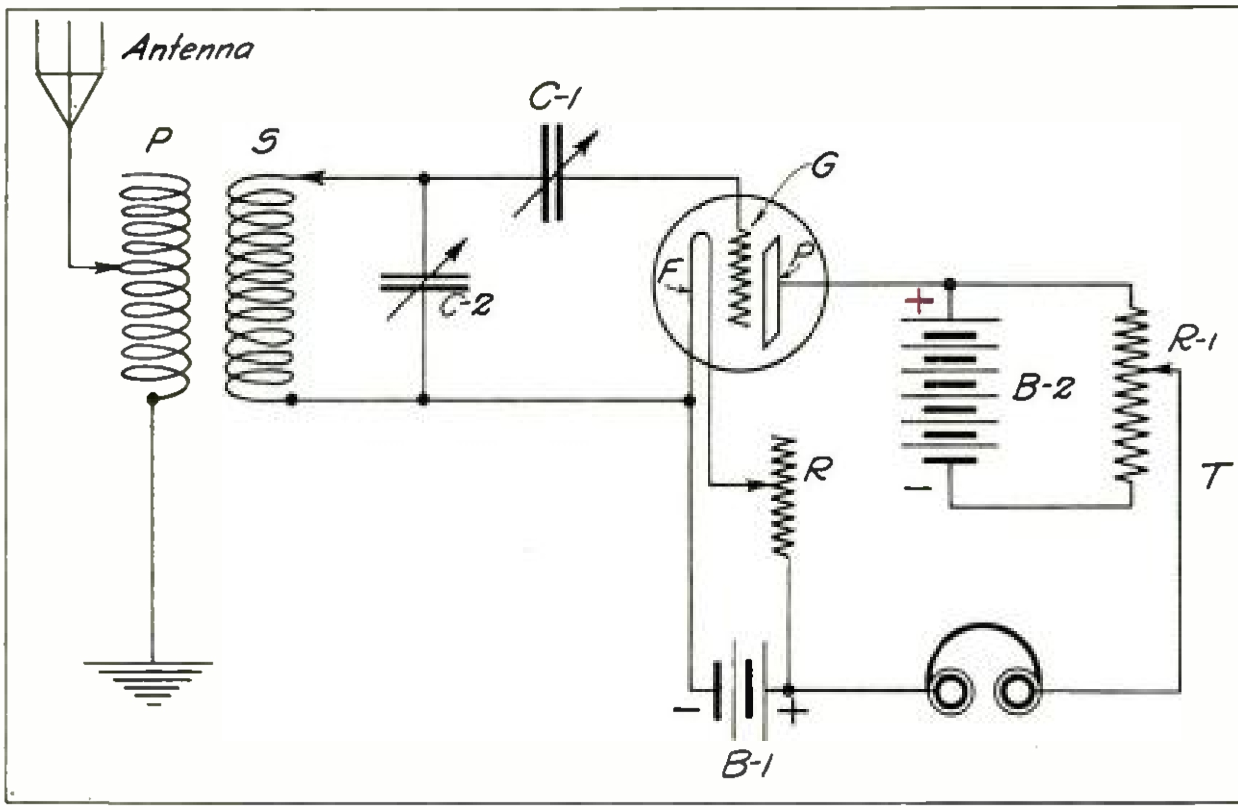


Fig. 18

stability and uniformity of action, being continuously operative as long as the filament burns. It is not easily influenced by the local transmitter, a highly desirable feature at a busy commercial station.

Another Circuit for the Fleming Valve

The circuit for this detector is sometimes altered as in the diagram, Fig. 17, wherein a potentiometer, P, is employed and a small value of potential sent through the vacuous space in the bulb between the plate and the filament. In this case the potentiometer has a value of about 400 ohms, the rheostat R about 10 ohms and the remainder of the circuit is identical with that given in the diagram Fig. 16.

To adjust the detector in this circuit, the rheostat R and the sliding contact of the potentiometer P are brought into action, corresponding adjustments being made of both until the loudest signals are obtained from the distant transmitting station. If desired a second set of batteries may be employed for the potentiometer circuit, but the same results are obtained with the connection given in the diagram Fig. 17.

The Three Element Valve

A modification of the Fleming valve is the three element vacuum valve, which, in addition to the elements indicated in Fig. 17, has a platinum grid G placed between the tantalum filament and the plate, as in Fig. 18. In this circuit, in addition to the lighting-battery B-1, we have the second battery B-2 connected in series with the head telephones, the circuit continuing from the plate P to the filament F through the space in the bulb. The battery B-2 is adjustable in value between 25 and 60 volts for ordinary work. Sometimes it is shunted by the potentiometer R-1 of 2,000 ohms resistance and then, by movement of the contact T, the current flow in that circuit can be very closely regulated.

Circuit for Operation

The usual primary and secondary windings are represented at P and S and the shunt condenser at C-2. The condenser C-1 may be of fixed or variable capacity but in any event it must not exceed .0003 microfarad for ordinary usage. The condenser C-2 also has low values of inductance at all

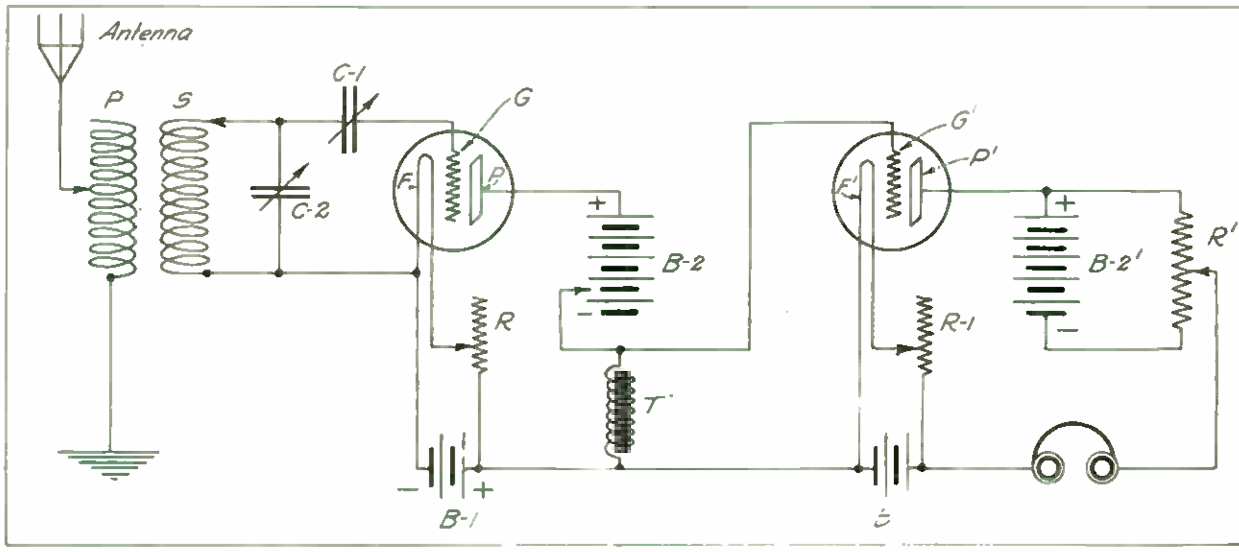


Fig. 19-a

wave-lengths for it is preferable in a circuit of this type to have inductance predominate.

When two bulbs are employed as an amplifier this condenser may be eliminated, but for certain classes of work the diagram, Fig. 18, is preferred.

It is important that the plus pole of the B-2 battery be connected to the plate P and that the negative terminal of B-2 be connected to the positive terminal of the lighting battery B-1.

If the vacuum valve is not highly exhausted and one in which considerable gas is present, the filament F is brought to a certain degree of incandescence by the rheostat R and adjustment made of the B-2 battery until the best response is secured. If too much voltage is applied at the Battery B-2, a characteristic blue glow appears which may or may not destroy the sensibility of the valve. Generally, however, the bulb is worked just below the blue glow adjustment and will then give the best response. When the bulb is highly exhausted the blue glow is not evident, even when very high voltages are applied to the local telephone circuit. The operator in adjusting a vacuum valve to sensibility should try various degrees of incandescence and various values of voltage at the battery B-2, until good response is secured, and to prolong the life of the filament he should hold to that adjustment which allows the lowest degree of incandescence.

Vacuum Valve Amplifier

Two three-element vacuum valves may be used for amplification purposes, as in the diagram Fig. 19-A. Two

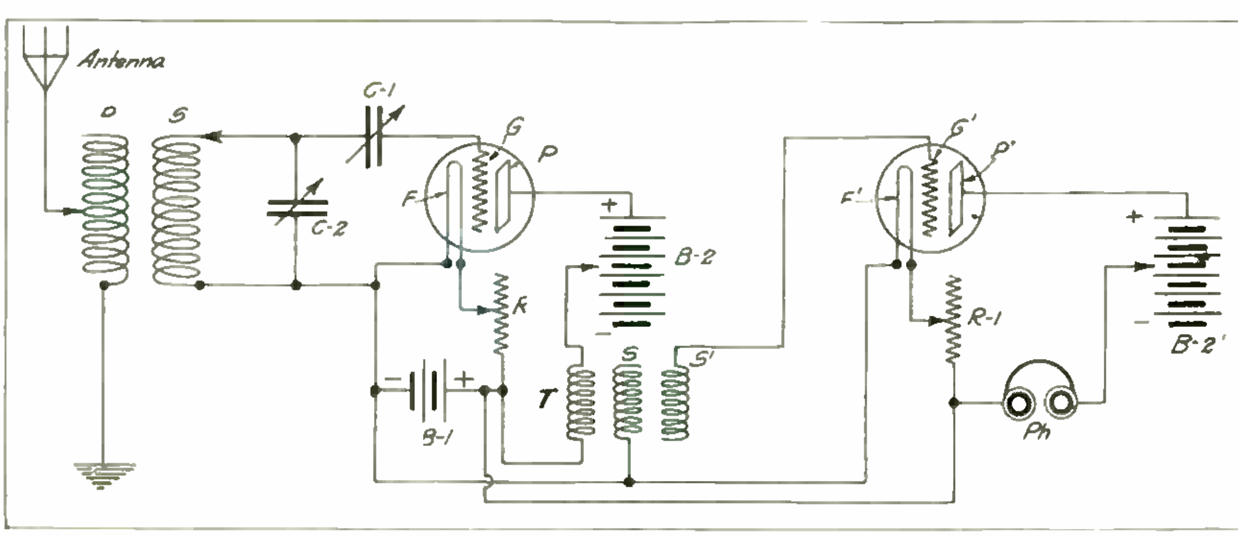


Fig. 19-b

bulbs, of standard construction, are connected in cascade, through the impedance coil or auto-transformer P, having a value between 5,000 and 10,000 ohms, (iron core impedance, No. 34 and No. 36 S. C. C. wire). By means of this coil any variation of current flow in the local battery circuit B-2 is transferred to the grid and filament of the second vacuum valve, wherein the pulses of energy are again amplified.

Some experimenters report better results by the use of an inductively coupled transformer at the point P. This transformer may have a one to one ratio of turns, or a slight step-up ratio; generally the primary and secondary windings represent a value of approximately 5,000 and 7,000 ohms resistance respectively. The windings are of course fitted with an iron core.

In a 2-step amplifier of this type, the first vacuum valve generally burns at a low degree of incandescence, while the second vacuum valve must be adjusted to a relatively high degree of incandescence.

The circuit indicated in Fig. 19-A may be altered as in Fig. 19-B and in this case the transformer T has two secondaries, S and S[1], which are left open at the ends and connected exactly as shown. This transformer may or may not have an iron core, provided the inductance values are the same in either case. Usually good results can be obtained by a primary winding having a resistance of about 5,000 ohms, while the secondary windings S and S[1] may have 2,500 ohms respectively. By means of this connection a single storage battery unit may be used for lighting all filaments without interfering with the sensibility of the apparatus.

Experiment seems to indicate that with 2, 3 and 4-step amplifiers, the successive filaments must be burned at various degrees of incandescence. Usually valve No. 1 may be burned at a rather low degree, but Nos. 2, 3 and 4 must be burned at increased degrees of incandescence successively; the local battery of each valve at the same time is adjusted just below the blue glow point and at a safe value to present complete ionization of the vacuous space.

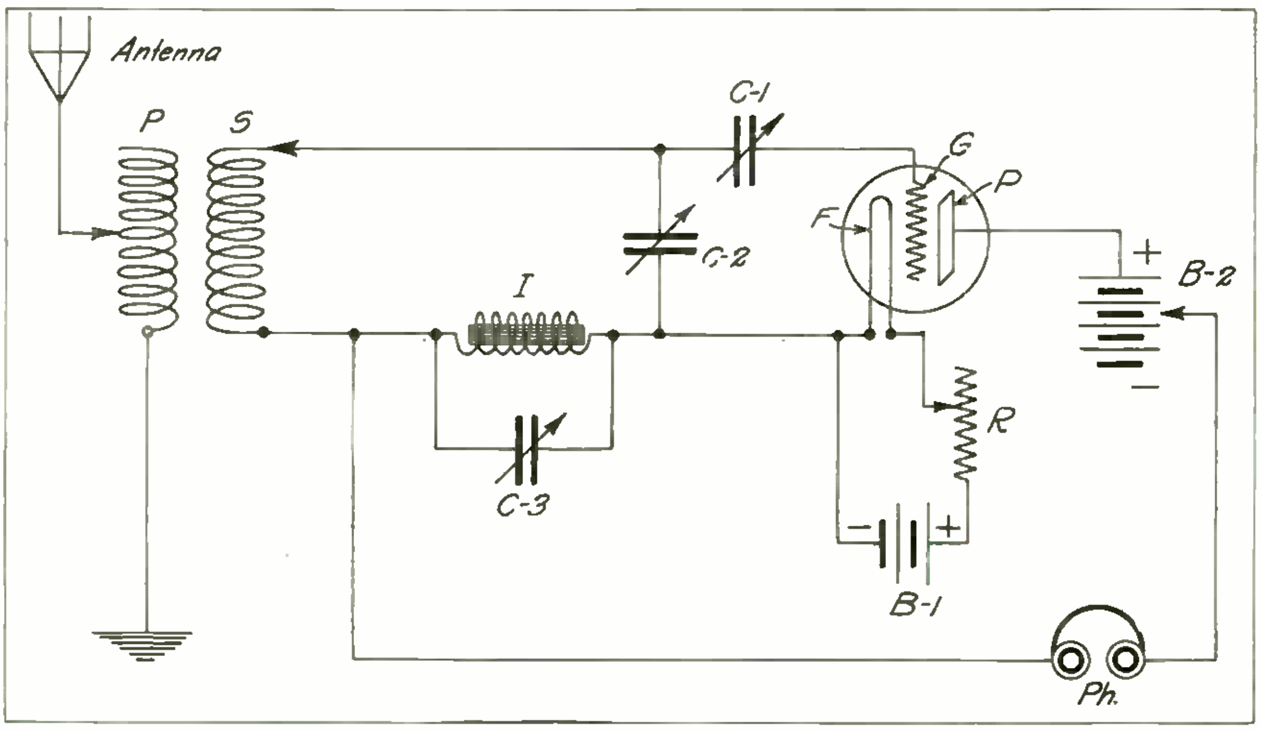


Fig. 20

Another Method of Amplification

While remarkable results can be obtained by the two cascade systems of amplification on spark signals described in Figures 19-A and 19-B, very good amplification can be obtained on a single three-element bulb by the use of diagram indicated in Fig. 20. Here the energy from the local battery B-2 makes connection with B-1 and the vacuum valve filament through the impedance coil I of 3,000 to 5,000 ohms resistance. This coil is in turn shunted by the condenser C-3, of .001 to .005 microfarad capacity, in order that the oscillations of radio frequency in the secondary circuit may be permitted to pass to the vacuum valve. Any variation of current flow in the telephone circuit is sent back to the grid circuit and thus amplified.

A modification of this circuit is shown in Fig. 21, where the grid circuit of the valve and the local telephone circuit are coupled together by the condenser C-3, which is connected in shunt to the telephone and the battery B-2. By very careful adjustment of the condenser C-3, and of the telephone circuit voltage at the battery B-2, and correspondence adjustment of the incandescence of the filament a point will be found where considerable amplification is obtained from either damped or undamped stations, but the best response with this circuit is secured at wave-lengths in excess of 1,000 meters.

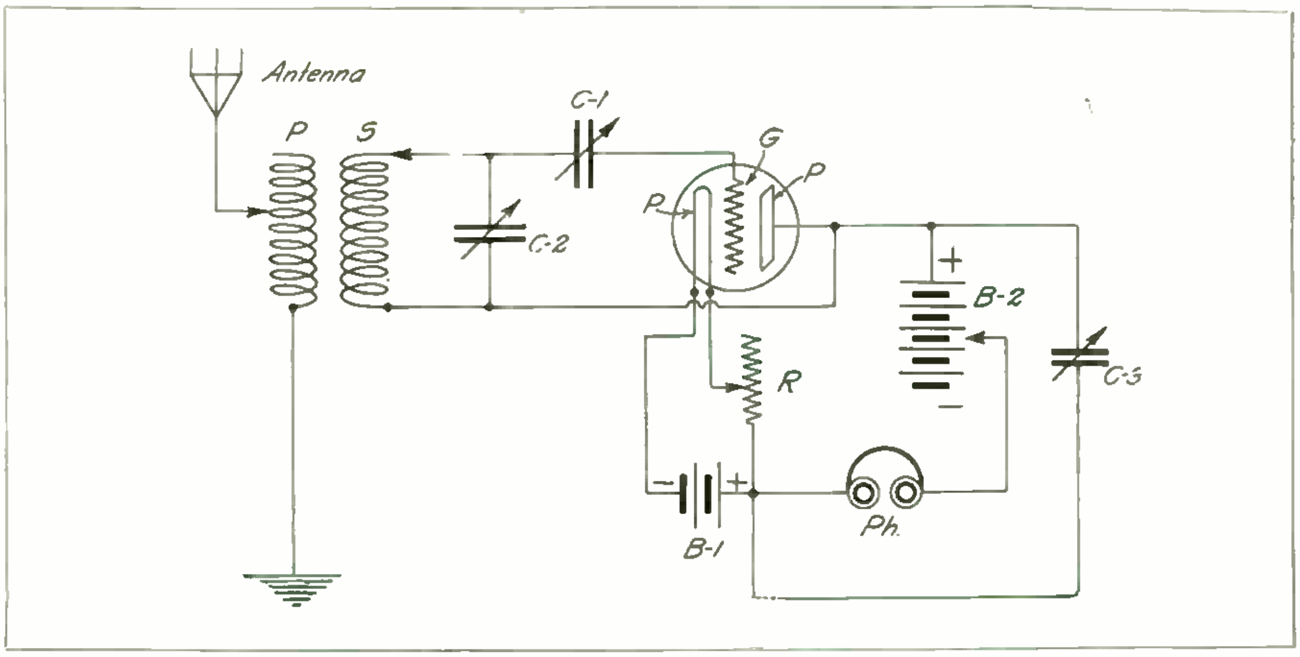


Fig. 21

"Beat" Receivers

As mentioned previously, ordinary crystalline detectors cannot be used for the reception of undamped oscillations nor can the vacuum valve detector, unless the circuits of either are interrupted by a ticker or a buzzer at a certain uniform rate ranging between 500 and 1,000 times per second. We can, however, in such systems make undamped oscillations audible by what is known as the "local interference" method, sometime termed the "heterodyne effect" or the "beat" phenomenon.

It is a well-known fact that if sound notes of slightly different pitch or frequency are made to impinge upon a given receiving medium, a "beat" note of increased intensity is produced at regular recurring periods—this note generally having a frequency equal to the numerical difference between the two applied frequencies.

A similar action takes place when two alternating currents of radio frequency but of slightly different periods are allowed to flow in the aerial circuit of a given receiving system. A "beat" note having a pitch equal to the difference between the frequencies of the two applied currents, is produced.

Now in a wireless receiving system one of these frequencies may be that set up by a distant transmitting station, and the other may be supplied by energy from a local generator such as an arc generator. The requirements of this system are indicated in the diagram, Fig. 22, where the aerial of the receiving station is represented at A, with the radio frequency coils P and S' connected in series. A standard receiving detector circuit is represented by the secondary winding, S, the secondary condenser, C-2, the fixed condenser C-1, the crystalline detector D, and the head telephones, PH. An arc generator for the production of sustained oscillations is represented by the arc gap G, the variable condenser C′, and the inductance coil P′, which is in inductive relation to the coil S′. The arc gap is fed with from 110 to 500 volts D. C. through the impedance coils T and T′. When the arc gap is set in proper adjustment, the frequency of the oscillation generator may be regulated by means of the variable condenser C′, and consequently any frequency with given limits supplied to the antenna system through the oscillation transformer P′, S.

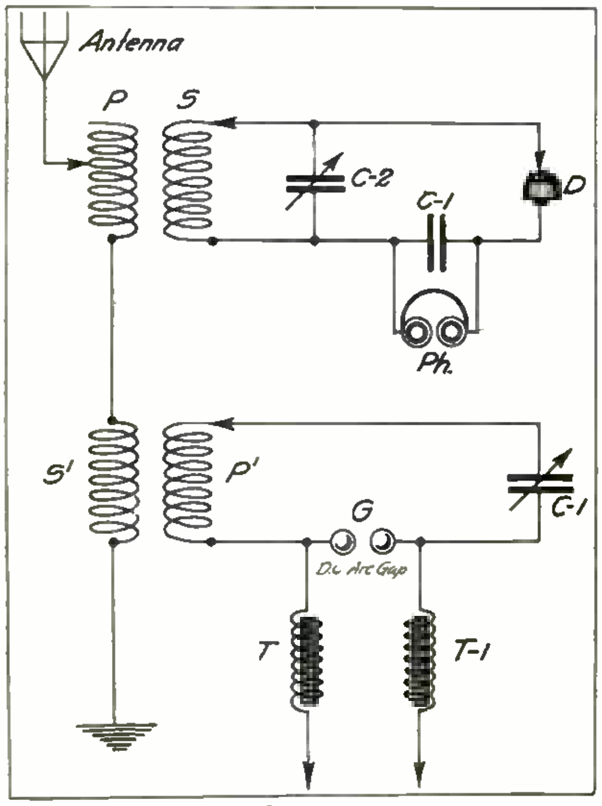


Fig. 22

Assume for example that the wavelength of the distant transmitting station using undamped oscillations is 6,000 meters corresponding to a frequency of 50,000 cycles per second. Then if the antenna system with the elements P and S is placed in resonance with the distant transmitting station, alternating currents of this frequency flow. Then if the arc generator is set at such values of inductance and capacity as to give a frequency of 49,000 cycles per second, forced oscillations will be set up in the antenna circuit through the coupling coil P¹ S′, and the interaction of these two frequencies will produce a pitch or "beat" note of 1,000 cycles. This current of audible frequency is afterward rectified by the crystalline detector D, which in turn charges the condenser C-1, the discharge of the latter causing a single sound in the head telephones By slight variation of the frequency of the local arc generator the pitch of the note may be altered over given limits; in fact, it can be varied from the equivalent note of a 200 cycle alternator up to and beyond the limits of audibility. In this system it is important that a certain critical degree of coupling be used in the transformer P¹ S′, and that the crystalline detector D be one of rugged adjustment and not easily influenced by the oscillations from the local generator. If the generator G, C¹, P¹ can supply 4 or 5 watts of energy, it will be sufficient for the functioning of this system.

A small high frequency alternator may be employed in place of the local arc generator, as indicated in the diagram

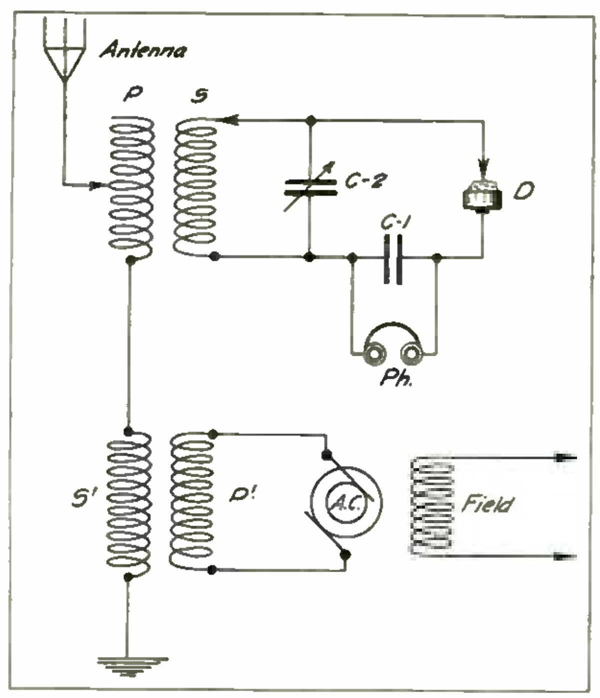


Fig. 23

Fig. 23, where an alternator of radio frequency (20,000 to 100,000 cycles per second) is connected to the radio frequency coil P¹ which is placed in inductive relation to S′. Then by variation of the speed of the alternator variation of the applied frequency is secured, which may be used to interact with the frequency of the distant transmitting station precisely as in the previous case. A generator having an output of 2 to 10

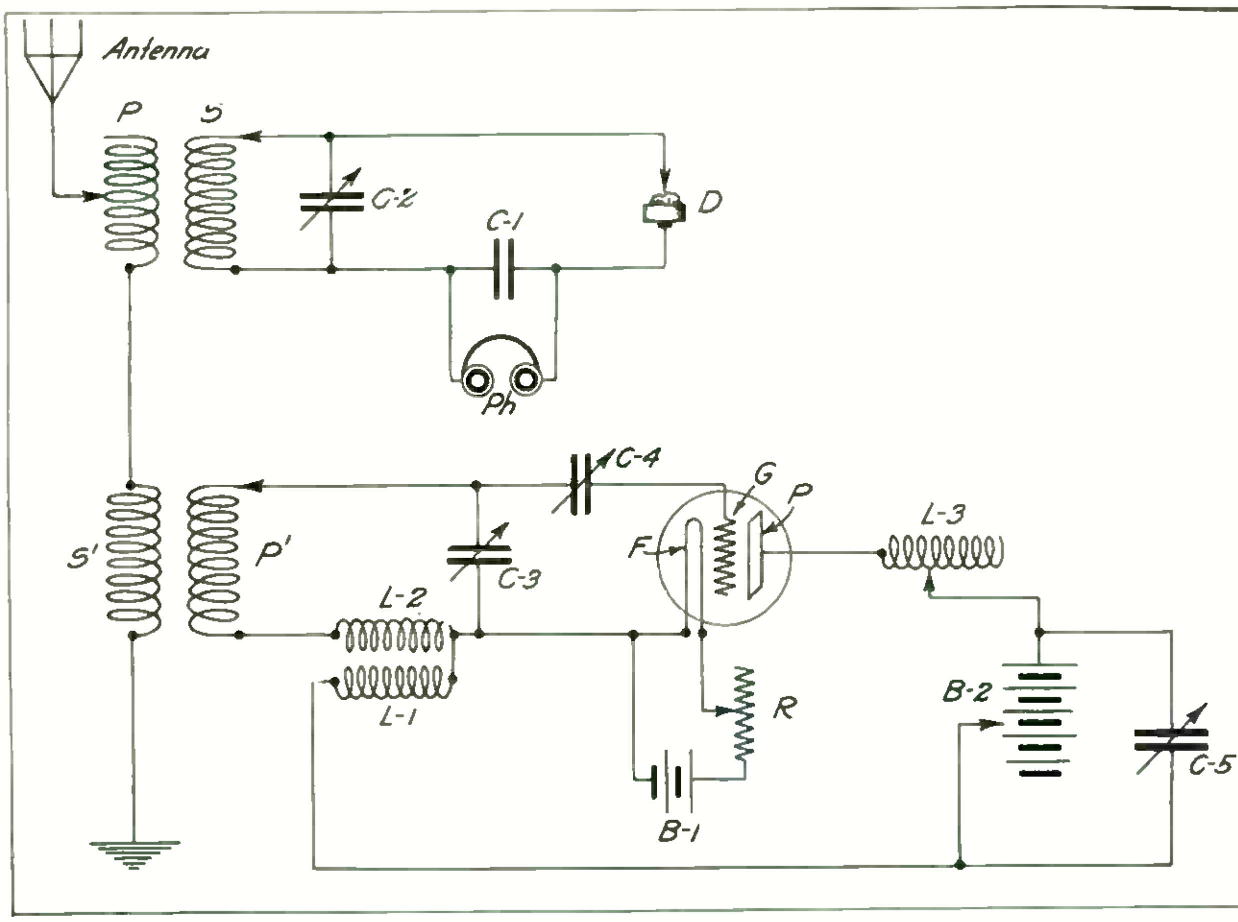


Fig. 24

watts is all that is required for this system.

Vacuum Valve Generator

Instead of the arc generator or radio frequency alternator just described, we may use the vacuum valve to generate undamped oscillations of any frequency desired. The circuits for this system (Fig. 24), are more complicated than in the foregoing methods, but good results have been obtained by various experimenters, signals having been received in the United States from stations located in foreign countries with marked intensity. Referring to Fig. 24: The standard crystal detector circuit is identical with that of Fig. 23, and contains the necessary elements for obtaining conditions of resonance, but the vacuum valve circuits are arranged so that the bulb becomes a fairly steady generator of sustained oscillations, the frequency of which may be varied in accordance with the requirements. It will be noted from the diagram that the B-2 battery, of the vacuum valve is shunted by the variable condenser C-3 in series with which is placed the induction L-3. When the correct degree of incandescence is obtained at the filament and proper variation of the voltage of the B-2 battery made, sustained oscillations flow from the condenser through the inductance L-3, across the vacuous space in the bulb at a frequency which may be altered by either the condenser C-3, or the inductance L-3. The amplitude of the oscillations generated in this manner may, however, be reinforced and the device perhaps made a more steady generator by coupling the local telephone circuit to the grid circuit of the vacuum valve through the radio frequency transformer L-1 and L-2. Then by placing these two circuits in resonance or near resonance, steady oscillations are produced which in turn can be sent into the antenna circuit through the radio frequency transformer P', S', that is to say, the best results are obtained when P', L-2, C-3 is in resonance or near to resonance with L-1, L-3, C-3.

It may be difficult for the beginner to obtain the correct adjustment for securing a steady state of oscillation in the vacuum valve bulb, but one accustomed to work of this type will have no difficulty in determining the condition. Usually the state of oscillation may be more quickly determined by connecting a head telephone in series with the battery B-2 and then when the circuits are in state of oscillation there will be found near to that point a peculiar thumping sound when the frequency of either the grid circuit or the local battery circuit is altered.

The vacuum valve bulb having thus been set into a state of oscillation, the current of radio frequency may be forced in the antenna through the secondary winding of the coupling transformer S-1 and this frequency may be made to differ by a certain amount from the incoming frequency, and the result will be a "beat" note of any desired pitch, from a low grumbling note to an extremely high tone. To obtain the best signals the coupling between P-1 and S-1 is critical and careful adjustment must be made.

For a more sensitive combination the crystalline detector D may be eliminated from the circuit and a second vacuum valve detector of a considerable degree of sensibility substituted. In fact the signals from this valve could be amplified by 2 or 3 additional valves thus obtaining an extremely sensitive receiving set which would permit the reception of signals over very long distances.

In previous issues of this series, also in the successive issues of the National Amateur Wireless Association bulletins, the dimensions for coils suitable to the vacuum valve generating circuit are published.

(To be continued)

Successful Commerical Tests With Japan

The third and final series of tests for trans-oceanic service between Honolulu and Japan by means of the Marconi station in Hawaii and the stations of the Imperial Japanese government at Funabashi, has just been completed. Telegraphic reports indicate that these tests were by far the most successful of any so far made, communication having been maintained night and day in both directions.

The Director-General of Posts and Telegraphs and his suite visited Funabashi recently and sent the following messages to E. J. Nally, Vice-President and General Manager of the Marconi Wireless Telegraph Company of America:

"We are hurrying to conclude arrangements and came here to see final test and find same satisfactory. We send you our best compliments on this occasion.

"Best operators in these tests will be appointed within a few weeks and inauguration of commercial service will be announced as soon as possible."

Operator Balks Mexicans

That Mexican bandits failed to add another American life to the long list of their victims is due to the coolness of Marconi Operator Outtner of the C. A. Canfield. On June 25th, while the steamer was lying at Tampico, William Green, manager of the Hausteca Petroleum Company, begged to be hidden from men who were seeking to kill him. A few minutes later a Mexican officer boarded the ship with a squad of soldiers and informed the captain of the Canfield that Carranza officials had given him orders to shoot Green on sight. But here the wireless entered into the situation.

In the radio cabin Outtner was calling the U. S. S. Machias, lying nearby, and a surprise was arranged for the Mexicans in the shape of a lieutenant from the Machias, backed up by bluejackets armed with rifles, who quickly drove the Mexicans from the Canfield.

Cuban Telegraph Experts Here

The Cuban government has sent a commission consisting of Messrs. Frenando Aenlle, Manuel Mallo and Arturo Novo, to study the telegraph, telephone, and wireless systems of the United States. The Marconi Company has extended to the Cuban representatives the privilege of inspecting its ship and shore stations, as well as the high-power stations at Belmar and New Brunswick, N. J., and the school of construction and general methods of conducting radio-traffic.

Long Distance Transmission on Low Power and Short Wave-lengths

By A. S. Blattermam, B.S.

PART I

THE attention of wireless telegraphists must have been attracted to the numerous recent reports of long distance transmission by amateur transmitters using low power and very short waves, and there is no doubt that there are many well authenticated cases where transmission over very considerable distances is being regularly conducted on the 200 meter wavelength and 1 kw. of power allowed by the federal statutes. The writer's personal observations support the general trend of the claims put forth by certain successful operators, and though a great many of the reported records have probably occurred in the nature of freaks and probably a considerable number on wave-lengths greater than 200 meters, yet it is likely that in many cases there existed a happy combination of circumstances which has resulted in successful communication on a fairly regular schedule over distances quite above the average figure usually given for the range of amateur sets. It is the purpose of this article to present the probable reasons for the highly satisfactory results obtained at some stations and to reduce them through proper analysis to data and formulas which will enable experimenters to reproduce the several enviable results already reported; in short, it is proposed to give directions for obtaining the maximum range of an amateur set operating on the very restricted wave-lengths imposed by legislation.

There are a number of features embodied herein which are not thought to be generaly appreciated, and they will constitute an addition to the technical data at the average amateur's command. It is thought that the material following will be especially useful at this time in view of the increasing recognition given to the amateur, particularly by the government, and the desirability, therefore, as a potential government institution, of supplying the amateur field with information permitting the utilization of his restricted power and short wave to the fullest advantage.

Effect of Wave-Length on Range

In the August 15, 1914, issue of the Electrical World the writer showed by means of a graphical analysis of the Austin-Cohen transmission formula, that for a particular given distance between two stations there existed a certain critical wave-length which gave the strongest signals, and for a given transmitting aerial and given antenna current there was one definite wave-length which would give the maximum range. A method was also worked out whereby this particular wave-length could be accurately determined.

If the methods of the original paper be applied to the particular case of the short wave, small antenna, low-power amateur set, some interesting and very important results are obtained.

The Austin-Cohen transmission formula which was developed after an extended series of tests on the Atlantic Ocean, carried on under the auspices of the United States government, has been found to be very accurate in predetermining the range of wireless stations of

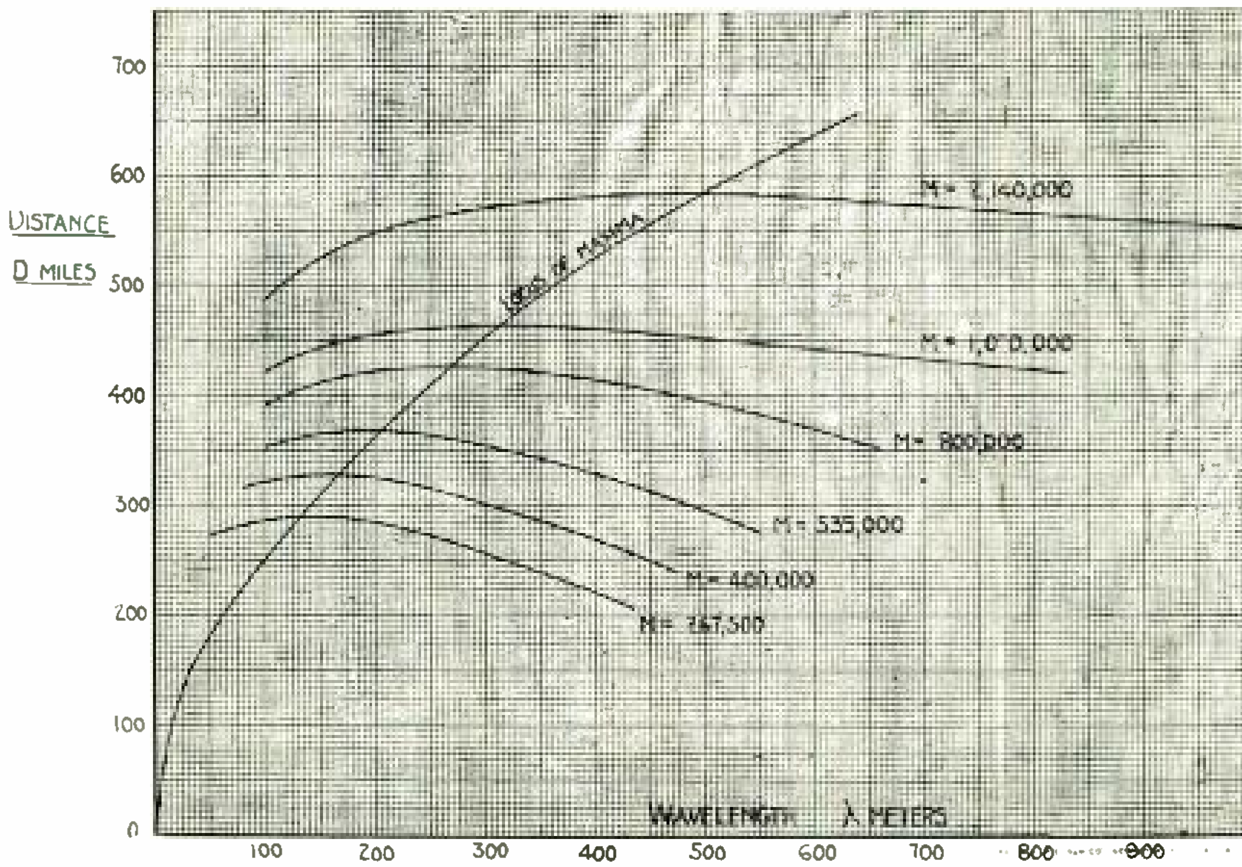


Fig. 1

the spark type and is accepted by engineers as the most reliable formula for this purpose now available. This formula is:

$$I_r = \frac{635\, I_s\, h_1\, h_2}{\lambda\, d}\, \epsilon^{-\frac{0.0762\, d}{\sqrt{\lambda}}} \quad \ldots\ldots (1)$$

where:

I_r = current in the receiving aerial in microamperes.

I_s = current in the sending aerial in amps.

h_1 = height of sending aerial in ft.

h_2 = height of receiving aerial in ft.

λ = wave-length in meters.

d = distance in miles.

The factor 635 in the above equation is only correct for a receiving antenna of approximately 25 ohms equivalent resistance, which is probably a little lower than obtains in most amateur stations on land. The factor 0.0762 is the absorption coefficient; that is, it is the measure of the rapidity with which the waves are absorbed in their travel. The above value applies to transmission over sea water. It is almost certain that when the transmission is over land, especially in daylight, the absorption is much higher than that indicated by the figure referred to. However, from tests* carried out recently between Washington University and the University of North Dakota, it appears that the oversea-water absorption coefficient is nearly correct for overland transmission in the twilight hours near sunset and sunrise if it be assumed that the transmission is unabsorbed near midnight. It is therefore very likely that the formula given applies closely as it stands to late afternoon and early evening transmission over land.

If we denote by M the quantity

$$M = \frac{635\, I_s\, h_1\, h_2}{I_r}$$

the equation can be reversed and written:

$$d - \frac{M}{\lambda\, \epsilon^{\frac{0.0762 d}{\sqrt{\lambda}}}} = O \quad \ldots\ldots\ldots\ldots (2)$$

This is the form of the equation we shall examine.

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* A. H. Taylor and A. S. Blatterman, "Variations in Nocturnal Transmission," Proc. I. R. E., April, 1916.

In calculating M it is necessary to know the value of the receiving antenna current I_r. Austin has determined that this is about 10 microamperes for signals of just readable strength on the apparatus used by him in the 1912 tests, and 40 microamperes for fairly strong signals which can be read through moderate interference. It is likely that these values are about right for the amateur set to-day where the three-element vacuum valve is used.

Obviously, the value of M is a measure of the radiative power of the transmitting station and the strength of the length. For instance, if the value of M for a given station is 535,000, which is true if $h_1 = h_2 = 60$ ft., and $I_s = 2.45$ amperes for each 10 microamperes required in the receiving antenna, then Fig. 1 shows that the best wave-length to use is 200 meters; and for the assigned signal strength at the receiving station corresponding to 10, 20, or 40 microamperes in the receiving aerial which was used in calculating M, the maximum range is 370 miles.

The wave-lengths for which d is maximum at the different values of M in Fig. 1 can now be plotted against the

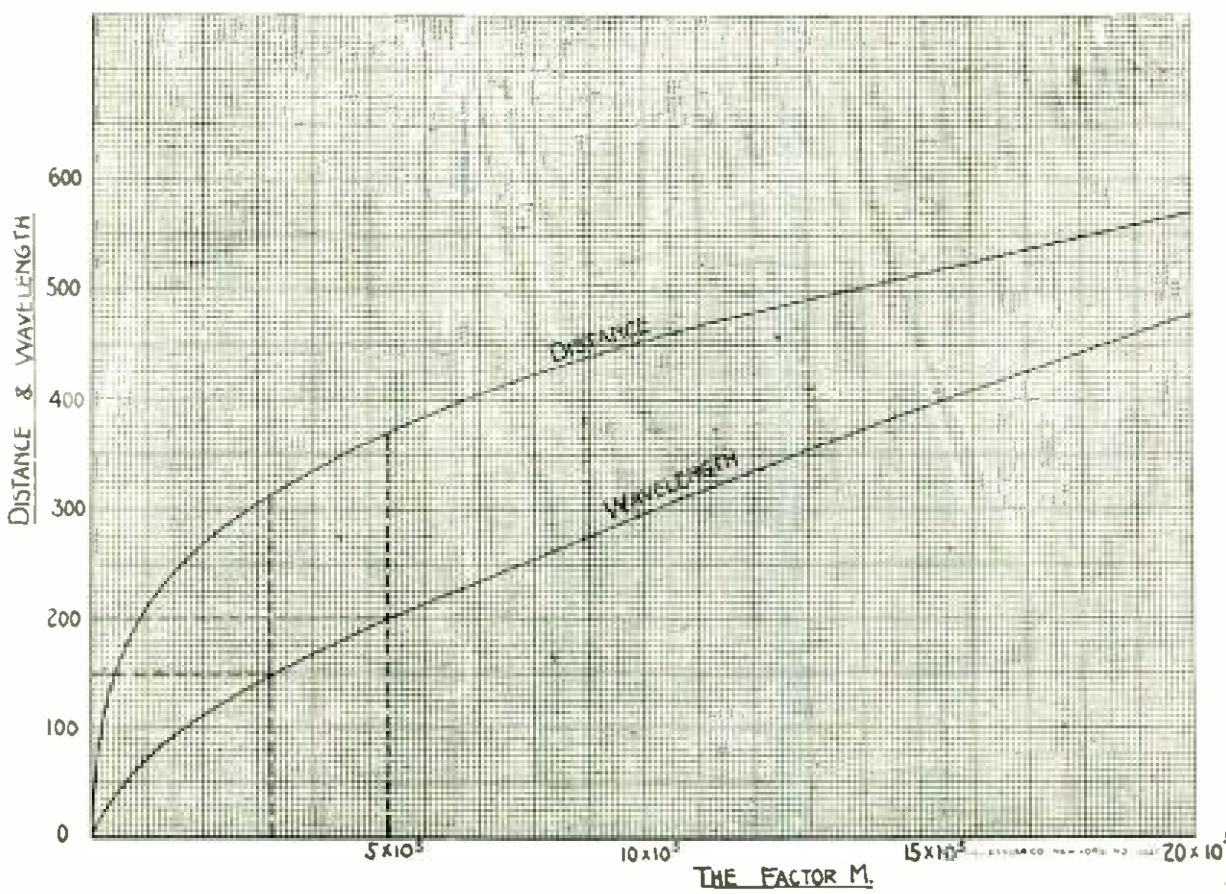


Fig. 2

signal at the receiver. If M be given different arbitrary values corresponding to different antenna heights and currents and the equation 2 solved* for distance in terms of wave-length and the results plotted, a set of curves are obtained as shown in Fig. 1.

The first important thing shown by these curves is that for any given value of M there is a maximum of distance corresponding to a particular wave-corresponding values of M and the curve marked "wave-length" in Fig. 2 obtained. This curve shows the best value of wave-length to use for different values of M. Similarly, the maximum distances of Fig. 1, at different values of M, which can be obtained by the proper selection of wave-length, can be plotted to M and the curve marked "distance" obtained, as in Fig. 2.

These curves of Fig. 2 can now be used to determine the proper wave-length for transmission over any distance up to 600 miles, which covers all

* A. S. Blatterman, "Determination of Wave-length," Electrical World, August 15, 1914.

that the amateur usually needs, and corresponding to this wave-length and distance the value of M required; or if M can be calculated from the dimensions of the sending and receiving aerials and the currents therein, the curves can be used to determine the greatest distance which can be covered with the assigned value of I_r, and simultaneously the wave-length which is proper to this distance and the power at hand.

As an example, suppose it is desired to transmit 325 miles. The "distance" curve of Fig. 2 shows that M must be 3.25×10^5. But the desired distance, 325 miles, can only be covered with this value of M when the wave-length is that read from the "wave-length" curve (Fig. 2) corresponding to this M, namely, 150 meters. A wave very much longer or very much shorter than this will reduce the range. These curves, therefore, are of great practical significance.

For any value of M a choice of antenna height and received signal strength immediately fixes the magnitude of the sending aerial current I_s, and this is a direct index of the power to be used at the sending station. There is, however, a certain limitation usually imposed on the amateur. That is, his range of wave-lengths is very restricted. He must, usually, not exceed 200 meters, and since this involves questions of antenna height, sending aerial current producible, antenna voltage and effective overall resistance of the antenna, the problem presented is not quite so simple as it is with the commercial and government station with less restricted wave-lengths and powers. In the amateur station the adjustment of antenna dimensions to wave-length and current, and the selection of wave-length for maximum distance is very critical. If the proper combination of these quantities is obtained the results are surprisingly good, while even small deviations from the correct adjustments lead to very indifferent results. We shall return shortly to a more critical examination of these details.

An important fact is shown by the curves of Fig. 1. This is that the wave-length giving extreme range does not necessarily produce the strongest signals at shorter distances. For instance, suppose $h_1 = h_2 = 75$ ft., $I_s = 3$, and $I_r = 10$, that is, signals are just audible and we are working at the extreme range.

$M = 63.5 \times 75 \times 75 \times 3 = 1{,}070{,}000.$ Referring to the proper curve of Fig. 1 for this value of M, it is seen that the best possible wave-length to use is 320 meters and the distance obtainable if this is used is 465 miles. At a station closer in to the transmitter, say at 370 miles, however, this wave-length will not produce the strongest possible signals; but we find, by referring to Fig. 1, that the strongest signals are produced at 370 miles, for the given values of h_1, h_2 and I_s by using the wave-length 200 meters.

We thus reach the conclusion that for the strongest signals at distances below the maximum range of the station short waves should be used.

And in general it appears that for a given aerial and power there is a certain optimum wave-length which gives maximum transmission, and it is therefore of great importance, especially where only a small power is initially available, properly to correlate the wave-length with the size of the antenna and the current produced therein.

To determine the best wave-length for any distance the following formula may also be used, which is the equation of the curve in Fig. 1 marked "locus of maxima."

$$\lambda = 0.00145\, d^2.$$

This, however, says nothing about the size of the aerial nor the antenna current. The curves above are therefore recommended for use when the latter quantities are wanted.

Form Factor and Radiation Resistance

It is well known that in an antenna oscillating in its natural period the distribution of potential and current along it are such as to produce a maximum of current with zero potential at the earth connection and zero current with maximum potential at the free end, and that the current and potential vary along the aerial from zero to maximum approximately according to a sine law.

Now picture a vertical aerial in which the current is the same at all points, a merely hypothetical case, in which an ammeter, if it were placed in the aerial at different points, would always read the same. If the height of this aerial be h meters, the wave-length λ meters and the current I amperes, then it can be shown that the power radiated in the

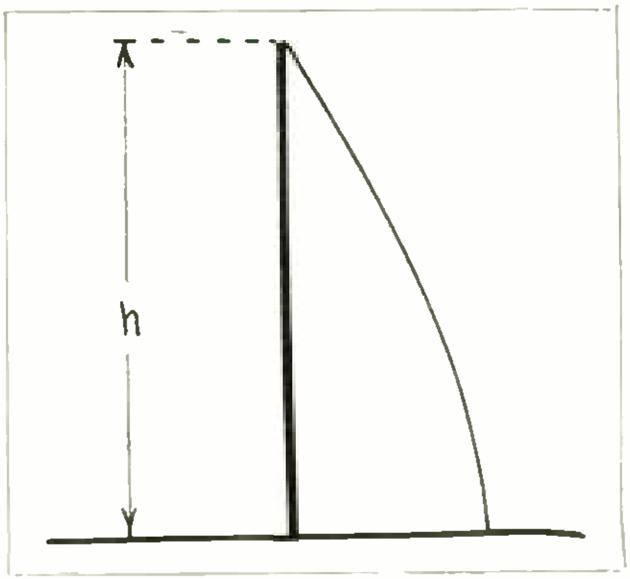


Fig 3

form of electromagnetic waves is:

$$P = 1600 \frac{h^2}{\lambda} I^2 \text{ watts} \quad \ldots\ldots\ldots\ldots \quad (3)$$

Actually, now, the current distributes itself along the aerial, as stated above, so as to have different values at different points, with a maximum at the earth and zero at the extreme free end. Its value at the earth is measured by a hot-wire ammeter. If we wish to calculate the power radiated, however, we must use, not the value at the base, but the average value along the whole aerial. This average value is, of course, less than the maximum value at the base. It is

where

$$I \text{ aver.} = \propto I$$

I = current at base of aerial.

$\propto$ = a quantity less than 1 depending on the manner in which the current is distributed.

If the distribution is sinusoidal, as in Fig. 3, the average current is $2/\pi$ times the maximum at the earthed end of the aerial; i. e., $\propto = 2/\pi$. If the distribution is linear, as in Fig. 4, the average value is ½ the maximum, $\propto = ½$.

Thus, the power radiated is:

$$P = 1600 \frac{h^2}{\lambda^2} \propto^2 I^2 \quad \ldots\ldots\ldots\ldots\ldots \quad (4)$$

This can be written:

$$P = 1600 \left(\frac{\propto h}{\lambda}\right)^2 I^2 \quad \ldots\ldots\ldots\ldots \quad (4a)$$

$\propto$ is termed the "form factor," and "$\propto$ h" the effective height of the aerial.

If the aerial is bent over at the top so as to form a flat-top then it is only the vertical portion, of height h, that is effective in radiating energy, and hence it is only the average value of the current in this portion which is used. In other words, the form factor $\propto$ only denotes the average value of the current in the vertical part of an aerial so constructed.

The following formula may be used to calculate the form factor for any flat-top aerial oscillating near its fundamental period.

$$\propto = 0.637 (1 + L/) \text{ Sin } \left(\frac{h}{h + L}\right) 90^\circ$$

where

L = length of horizontal part for inverted L aerials.

= half total flat-top length for T aerials.

h = Height of vertical part.

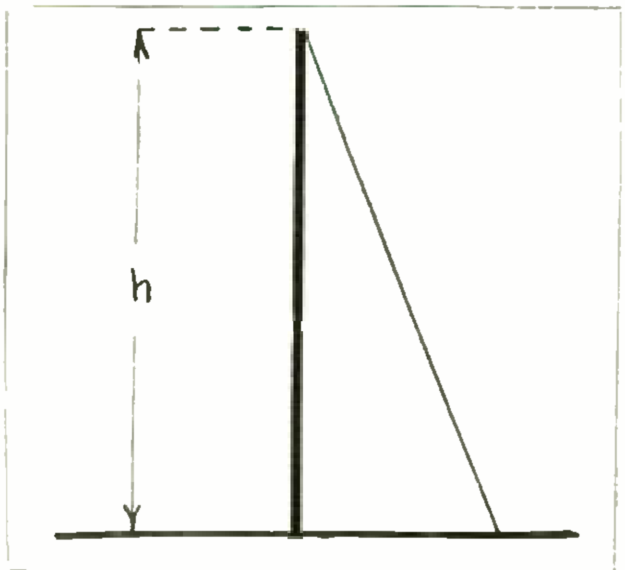


Fig. 4

When part of the aerial is inclined, as in Figs. 5 and 6, then the current distribution for the total height can be worked out as follows. Draw the light line curves a and b showing the current distribution in each part of the aerial. Then at each point in the height h, as at P, draw a line parallel to earth whose length equals the sum of all the currents

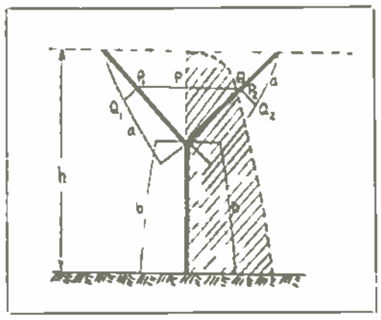


Fig. 5

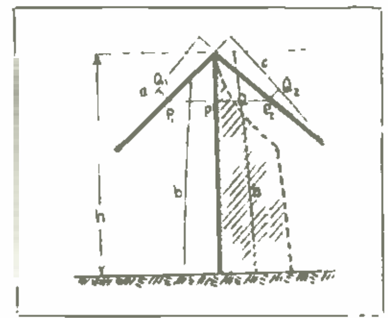


Fig. 6

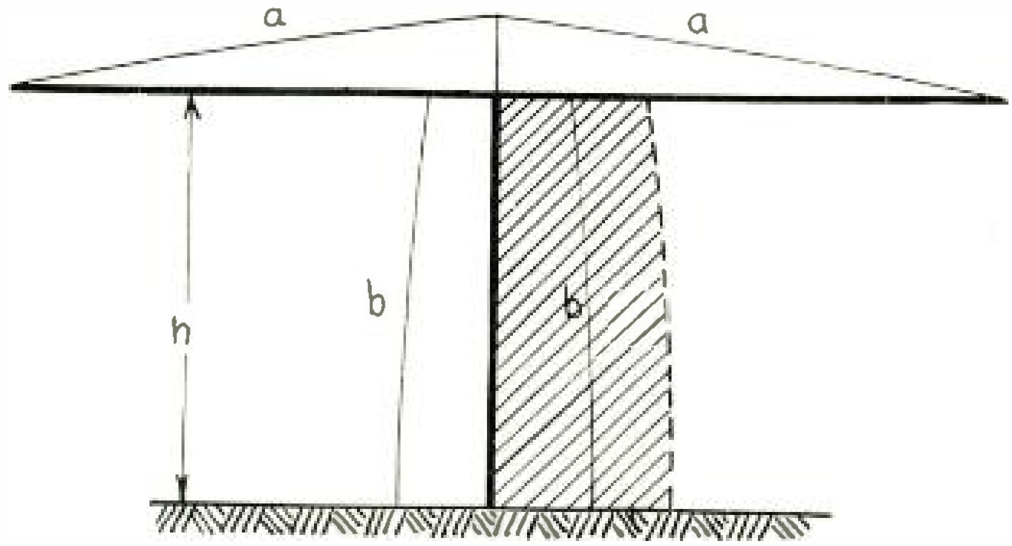


Fig. 7

in the different parts of the aerial at points of the same height as P. Thus, at P we get the length $PQ = P_1Q_1 + P_2Q_2$. If a line is drawn through the extremities of all the horizontal lines obtained in this way for every point in the height h, we get a curve which shows the equivalent current distribution throughout the height h.

The shaded curves of Figs. 5 and 6 were obtained in this way. It will be noticed that the average current, that is, the form factor, is much better for the aerial of Fig. 5 than it is for the umbrella type aerial of Fig. 6. It is still better for a large flat-top aerial, as will be seen by referring to Fig. 7; it is practically unity when the flat top is very large, because in that case the current is practically the same at all points of the vertical portion.

Thus, where the total overall height is the same, a flat-top aerial or one like Fig. 5 produces a higher average current distribution and is, therefore, a more powerful radiator than the umbrella type. This is because the current flowing down in the inclined portions of the umbrella partly neutralizes the current flowing up in the vertical part.

(To be continued)

AN UNUSUAL SHIP RECEIVING RECORD

The Oceanic Company's steamer Sonoma, which recently arrived at Sydney from San Francisco, was not out of touch with land from the time she cleared the Golden Gate till she entered Sydney Heads. Throughout the voyage the vessel was able to obtain news of the war and other important world events from the American side, no news being available from any of the stations in Australia or Fiji. At a distance of 4,700 miles she was able to keep informed, while the receipt of news at a distance of 2,300 miles was quite an ordinary performance. This is very creditable as the distance between the two ports is about 7,000 miles.

From and For those who help themselves

Experimenters' Experiences.

The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.

FIRST PRIZE, TEN DOLLARS
A Transmitting Station of Moderate Cost

The apparatus and aerial system which I am about to describe can be constructed at moderate cost and with the materials available in the usual amateur's workshop. The panel type of transmitting apparatus has proven very popular to readers and I am sending, accompanying this article, a complete set of drawings for one which I have actually constructed, and which may prove of interest to the experimenter. An assembled view of the equipment appears in Fig. 2, and the dimensions for the panel and the supporting angle arms in Fig. 1. At the bottom of the panel indicated in Fig. 2 is a three-point switch for regulating the number of turns in use in the primary winding of the high potential transformer. In the lower right hand corner is a small double-pole switch for starting and stopping the rotary gap motor. To the left is a double-pole, double-throw switch for disconnecting the alternating current power mains from the primary winding of the transformer.

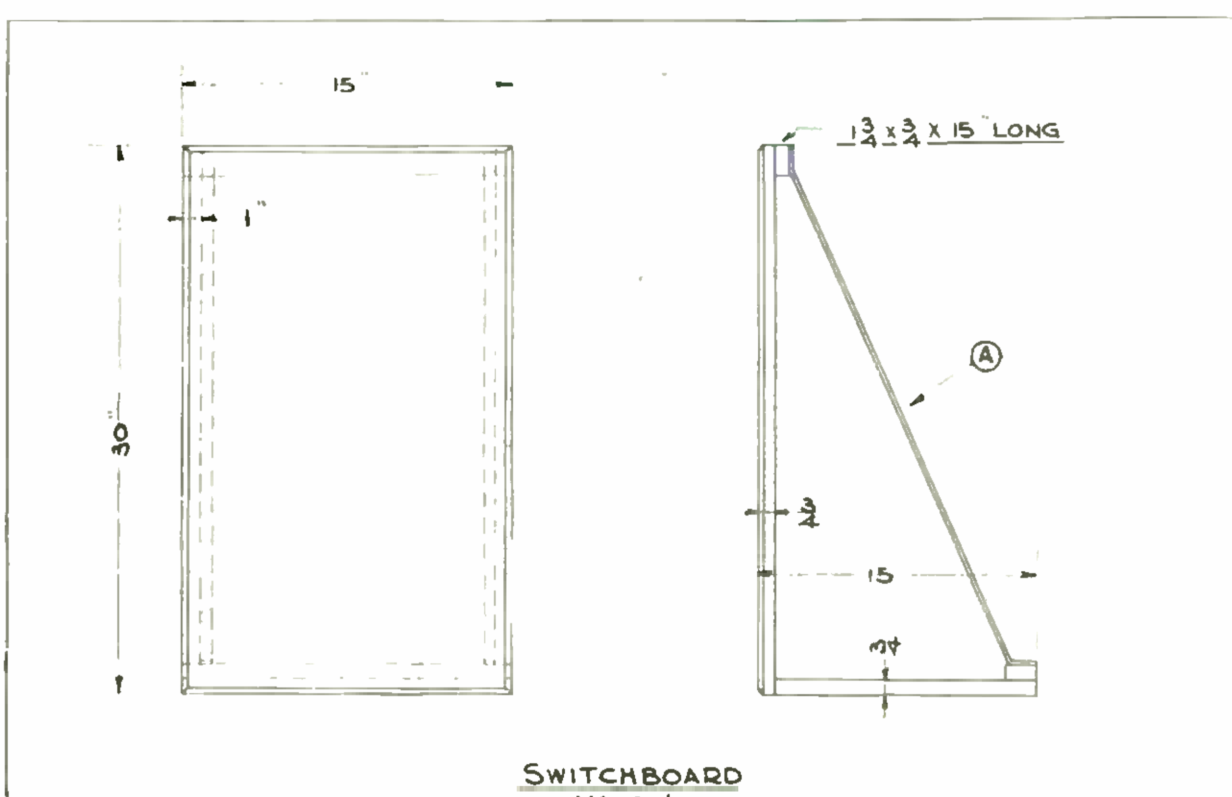


Fig. 1, First Prize Article

The set is fitted with two spark gaps, one being of the rotary type which is mounted in a soundproof case immediately behind the board with a peep hole as indicated at C. A straight gap is also mounted to the right of the board which may be used in case of accident to the rotary discharger. The switch, D, permits either the straight gap or the rotary gap to be connected in the primary oscillating circuits.

A suitable motor-controlling rheostat is indicated at B and is shown in detail in Fig. 4. The tube of this controller is 1 inch in diameter and is wound with a single layer of No. 28 resistance wire.

The construction of the case for holding the rotary spark gap is shown in Fig. 5, for which detailed dimensions have not been given as every amateur has a different size of motor and will therefore have to change the dimensions to suit whatever apparatus he may have at hand. This spark gap containing case should be fitted with a cover that could be easily removed in order that the motor may be oiled as required. The switch shown at E serves the purpose of short-circuiting the aerial hot wire ammeter when it is not in use, for on account of the opening and closing of the primary circuit by the transmitting key the pointer is set into violent oscillation and will soon destroy the jewelled bearing. The small switch, F, is for connecting into the circuit the pilot lamp which is mounted directly over the hot wire ammeter.

The switchboard panel proper is made of white wood which has a good appearance and does not have to be filled before staining. In the construction of this board the use of black shellac should be avoided as I have found that it contains a very large quantity of lampblack which is a conductor to high frequency current and it may result in a considerable loss of energy; in fact it may burn out parts of the low frequency apparatus. There are other grades of black paint also which contain ore or less lampblack and they may prove rather expensive in case of accident to the apparatus.

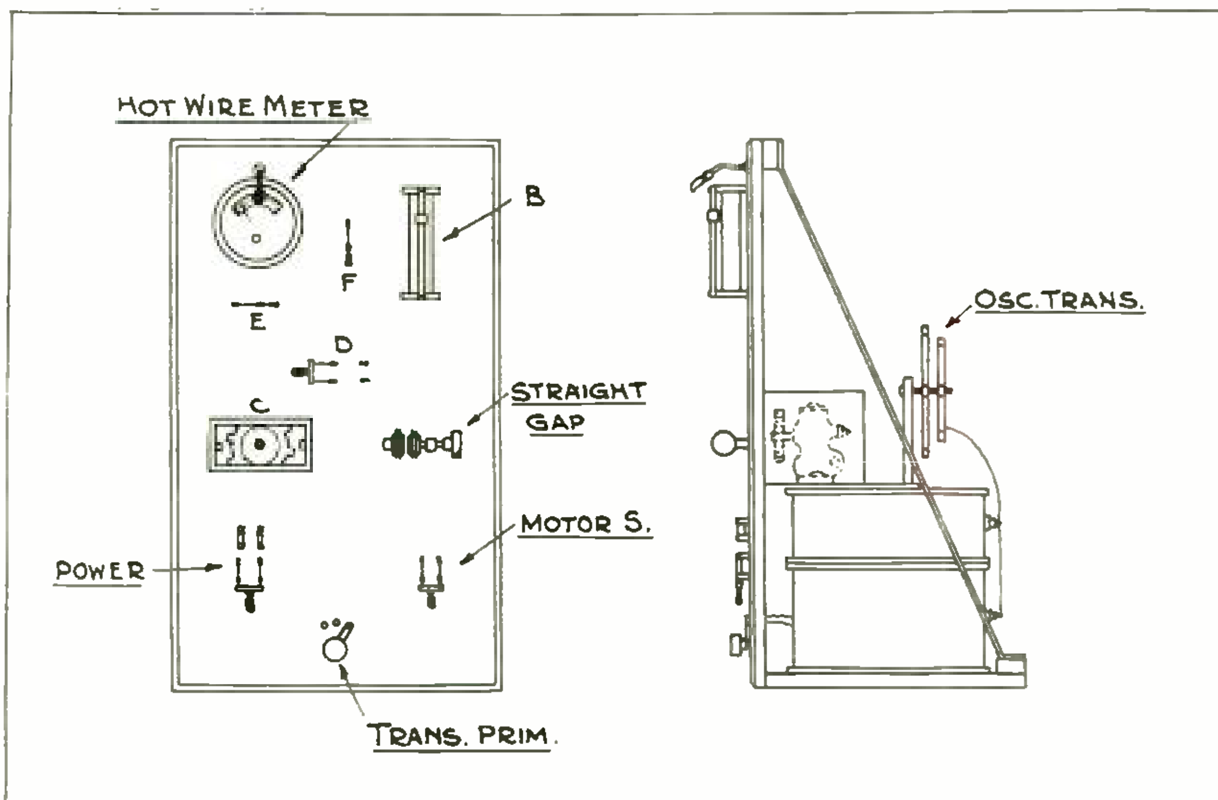


Fig. 2, First Prize Article

I finished my panel board in the following manner: Having sandpapered the surface with a very fine grade of sandpaper (I was careful to rub it with the grain so as to avoid scratches), I gave it a coating of oak filler stain and left it to dry for about fifteen minutes after which it was rubbed off with a cloth. If

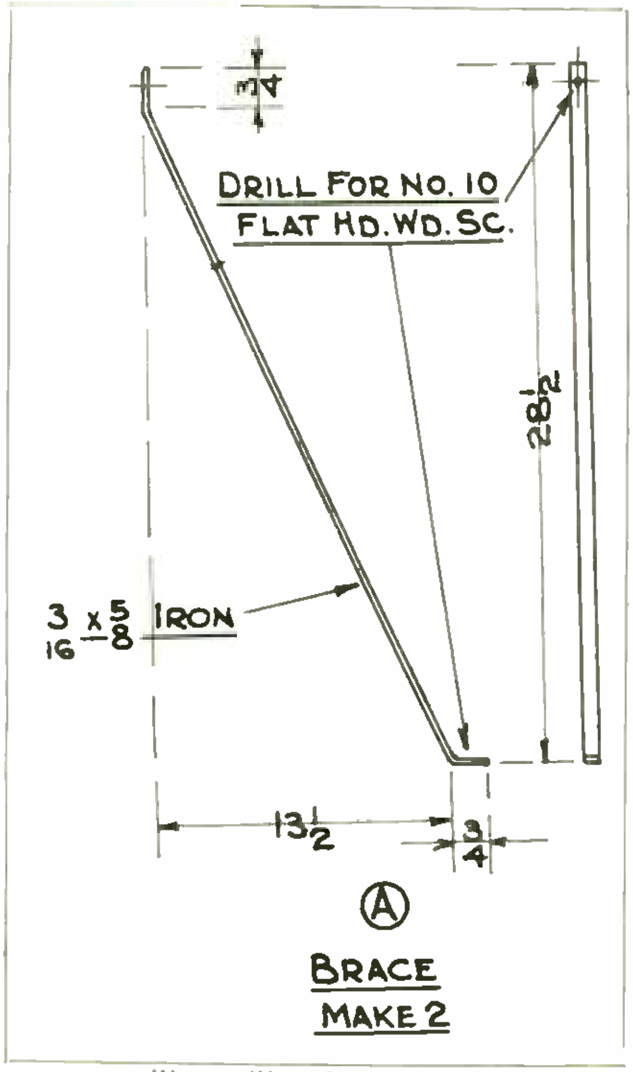
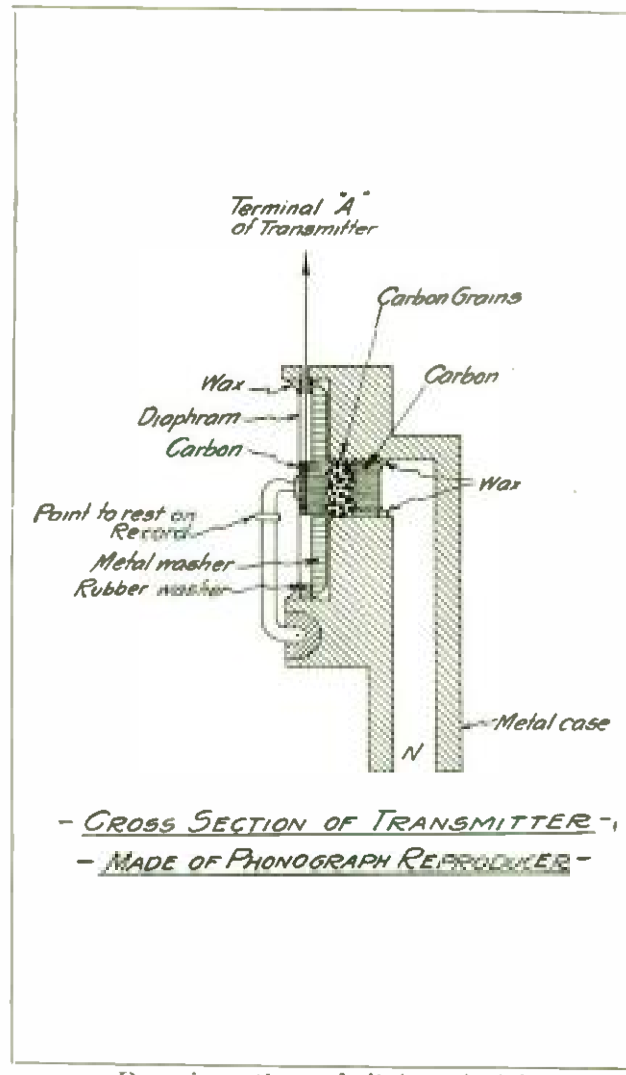


Fig. 3, First Prize Article



Drawing, Second Prize Article

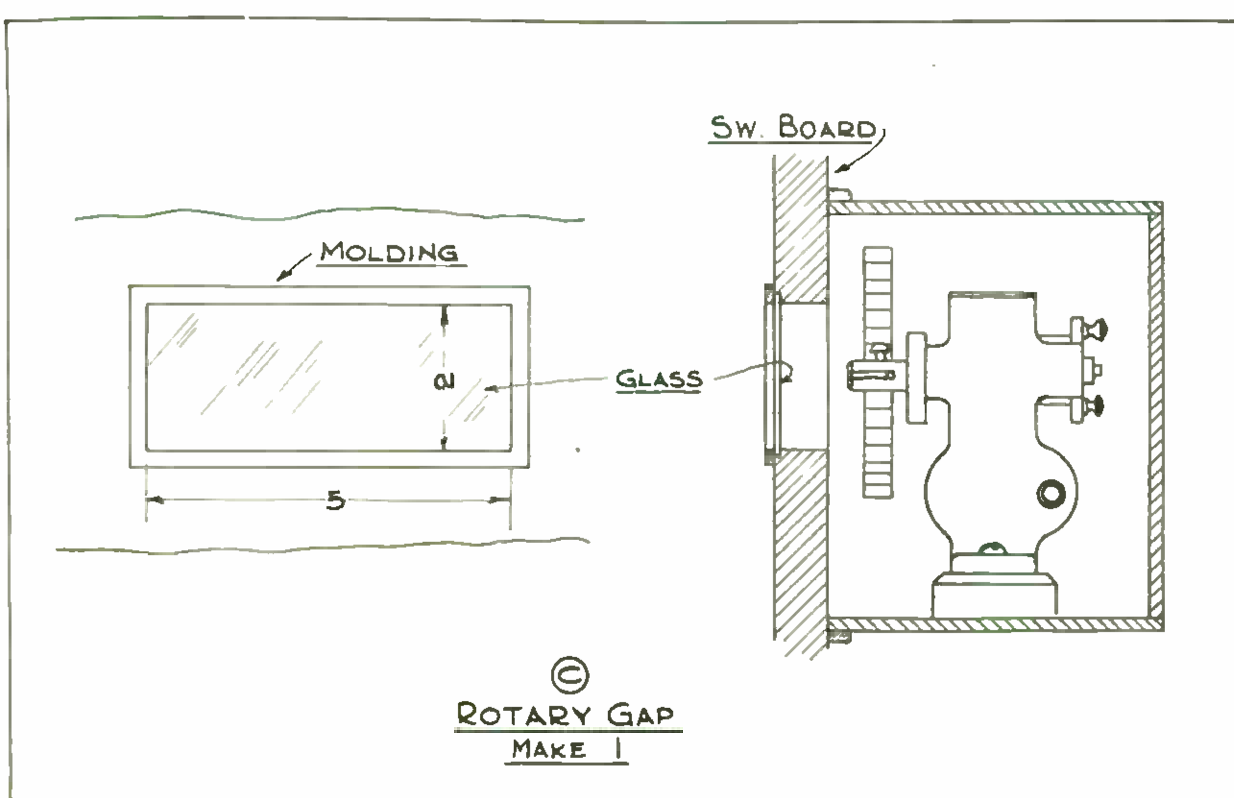


Fig. 5, First Prize Article

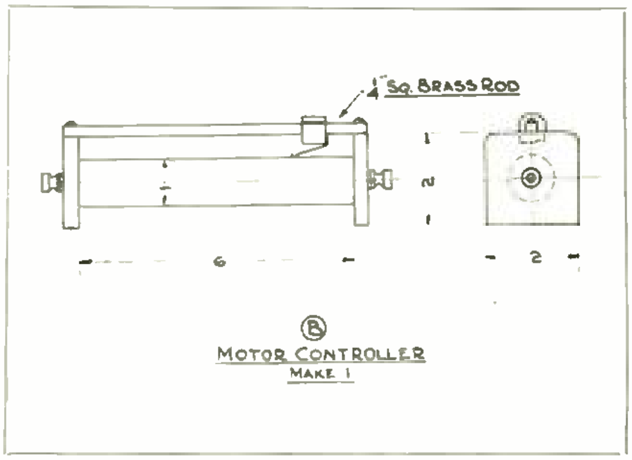


Fig. 4, First Prize Article

that work is done carefully it will remove the stain from the top of the grain which will make for an improvement in appearance. The panel board is now allowed to stand for a day or two, after which it is to be rubbed with a rag until a bright surface appears. This method is far superior to the use of shellac for as is well known, shellac has the properties of absorbing moisture and therefore is not desirable for high potentials.

Should the amateur wish to mount this transmitting board flush with the wall he may eliminate the braces, A, but otherwise the braces must be employed, as the panel would soon loosen up from the pulling and pushing in of the switches. For the switches I used the small Trumbull 15-ampere type, which are inexpensive. The porcelain base was removed and the clips placed flush with the panel for the sake of appearance.

I found by experiment that the range of an amateur station can be increased by the use of a balancing capacity instead of a ground connection. It is simply a two-wire aerial stretched underneath the aerial proper, care being taken to place it near to the ground. I have also found another type of simple counterpoise to be very efficient. It consists of a piece of common wire chicken-fence, pegged out flat on the ground, directly underneath the aerial and experiment would seem to indicate that it gives better results than the counterpoise which is stretched at a distance of a few feet from the earth. However, in the usual amateur station the fence wire would be in the way and consequently the counterpoise first described is the one to use.

O. Cote, *Rhode Island.*

SECOND PRIZE, FIVE DOLLARS
Details of a Novel Wireless Telephone Transmitter

The readers of this magazine may be interested in the details of a wireless telephone transmitter which may be attached directly to the reproducing carriage of an ordinary phonograph and thus used for transmitting the voice of a singing and talking record to a considerable distance by means of wireless waves. It is believed that the suggestion outlined herein may lead to further development, as the device has proved by experiment to be particularly effective in creating very loud signals over a wire telephone line.

The fundamental principle upon which my transmitter is based will be observed from the accompanying drawing in which a sensitive telephone transmitter has its diaphragm attached to a sharp phonographic reproducing needle which, in turn, rests directly on a record. The drawing is, in fact, a cross-sectional view of the transmitter. The wax which usually holds the diaphragm in place is removed and a carbon button with the back surface smoothed and the face filed rough, (ground to fit the hole back of the diaphragm), is attached to the diaphragm by means of small bits of melted wax. Electrical connection is made to the carbon by means of an insulated wire of the required degree of conductivity. This wire passes out through a hole in the rubber washer shown in the drawing.

Next, a carbon button is constructed like the first one and fitted to the bottom of the hole in the rear of the diaphragm. The surface of this hole may be roughed with a pointed instrument and the carbon wedged in. If this does not prove sufficient to hold it, it may be further supported by wax, at the rear through the opening, X.

The sides of the hole in which the carbon is placed should be carefully insulated with mica or wax and filled with carbon grains (made by pounding a good grade of carbon to the desired fineness). The other terminal of the transmitter case which, of course, is constructed of metal, completes the circuit.

The diaphragm proper is then put into place and waxed, after which the transmitter is ready for use. The full value of my design is best realized by experiment. I have constructed a transmitter exactly as reproduced in the figures and find that with a 2,000-ohm receiving set connected in series with an old dry cell, music can be transmitted over two wires for a long distance. The distinctness with which it can be heard is governed by the strength of the battery. I consider this a fair test of the device and I believe that it could be successfully used in wireless telephone work.

L. G. BARRETT, *New Hampshire.*

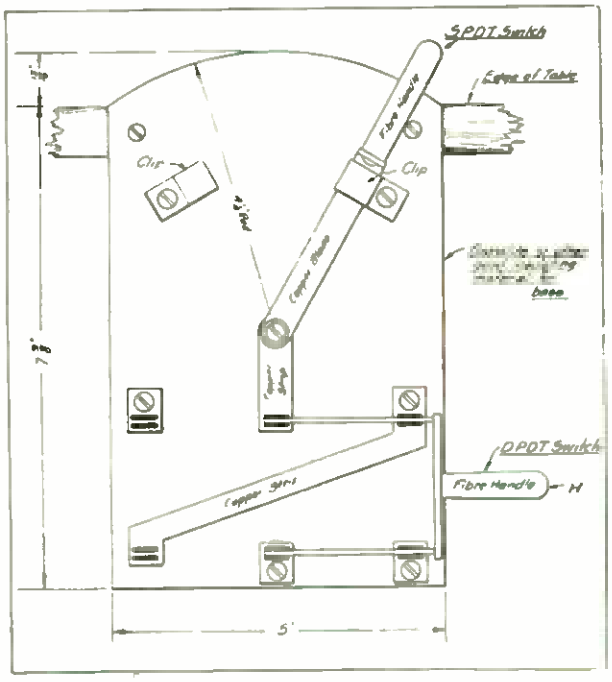


Fig. 1, Third Prize Article

THIRD PRIZE, THREE DOLLARS
A Handy Combination Aerial Change-over Switch

The low wave-length to which amateurs are restricted makes it necessary for them to employ an aerial of limited dimensions for transmitting purposes. It is the usual custom to make use of a large aerial for purposes of receiving, but in amateur stations the best results are obtained by the use of the smaller aerial for both transmitting and receiving.

I therefore found it very desirable at my station to erect two aerials, one of which was used for transmitting and receiving on amateur wave-lengths and the other for receiving signals from the higher powered stations.

The aerial change-power switch shown in the accompanying drawings was designed to give a quick change to either aerial system, and to effect this it is only necessary to move the small aerial switch to shift the connections from sending to receiving or vice-versa. The diagram of connections for this system is also very simple—a desirable feature.

The base shown in Fig. 1 should be made of some good insulating material, such as hard rubber, bakelite, etc. A 2-point, knife switch is mounted at the bottom which is fitted with a special fibre handle, H. Auxiliary contacts may be added to this switch for starting and stopping a rotary spark gap or operating any other necessary device in connection with the complete apparatus. My drawing shows the parts of the double-pole double-throw switch mounted directly on the main base, but if desired an ordinary porcelain switch may be mounted as a unit.

In the diagram of connections (Fig. 2), the black dots represent the points of the two switches and are arranged in exactly the same order and position as the points in Fig. 1.

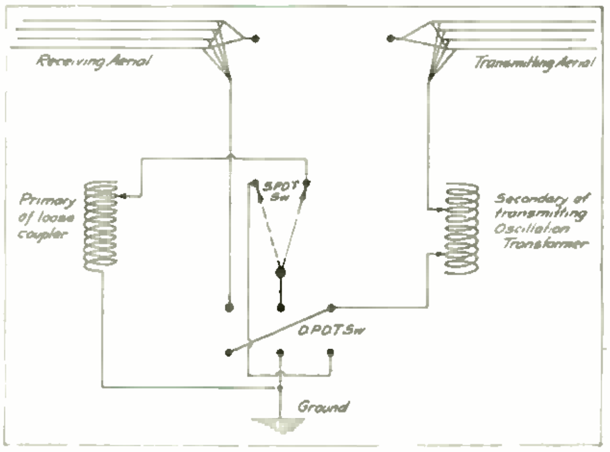


Fig. 2, Third Prize Article

The operation of the complete switch is as follows:

When the double-pole double-throw switch is thrown to the left, the large aerial is cut in for receiving and the transmitter connected to its aerial and the ground. Then, with the single-pole switch thrown to the right, the receiving circuit is completed through the larger aerial. When thrown to the left, the large aerial is completely disconnected from the instrument and is thus ungrounded. Upon placing the double-pole double-throw switch to the right, the larger aerial is entirely disconnected from all instruments. A complete receiving circuit is made through the transmitting oscillation transformer secondary and the primary of the inductively-coupled receiving tuner when the single-pole switch is thrown to the right. When the single-pole switch is thrown to the left, the transmitter is directly grounded and the receiving circuit opened up. Thus it will be seen that no matter in what position the double-pole double-throw switch may be, the transmitting circuit is complete when the single-pole switch is thrown to the left and then the receiving circuit is always complete in the opposite direction.

The handiness and usefulness of this switch will be apparent to your readers and will amply repay all trouble and expense of construction connected with it. A switch constructed after this design is in daily use at my station and gives complete and perfect satisfaction.

Ralph Chase, *California.*

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

The Construction of a Non-Synchronous Rotary Spark Gap

Readers of The Wireless Age may be interested in the details of construction for a non-synchronous rotary spark gap which I have found to be extremely efficient. Amateur experimenters are accustomed to construct a rotary gap with a revolving disc, but I prefer the type where the disc is stationary and a small arm is attached to the shaft of a motor for making electrical contact with the various portions of the disc. In addition I find that a gap of this type is much easier to construct and a smaller motor can be more readily used than with the usual type of gap.

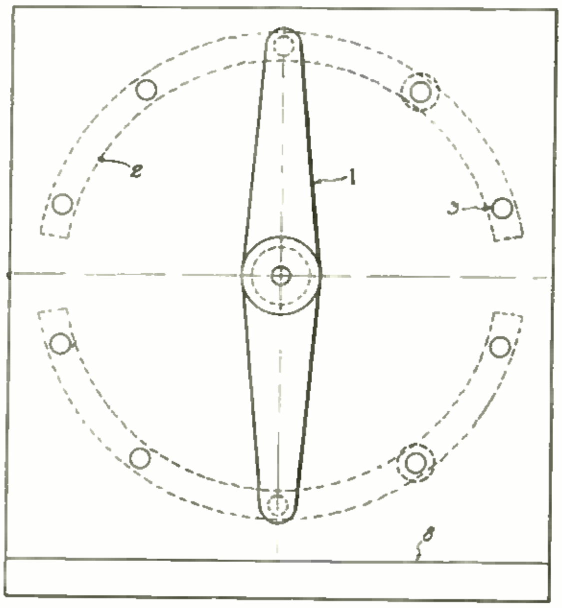


Fig. 1, Fourth Prize Article

Referring to Fig. 1, which is a front view of the gap with the motor removed: Detail No. 1 is a rotating arm, which measures 6 inches from the center of one spark electrode to the center of the other. This arm is a brass casting, the pattern for which the writer constructed in about three hours.

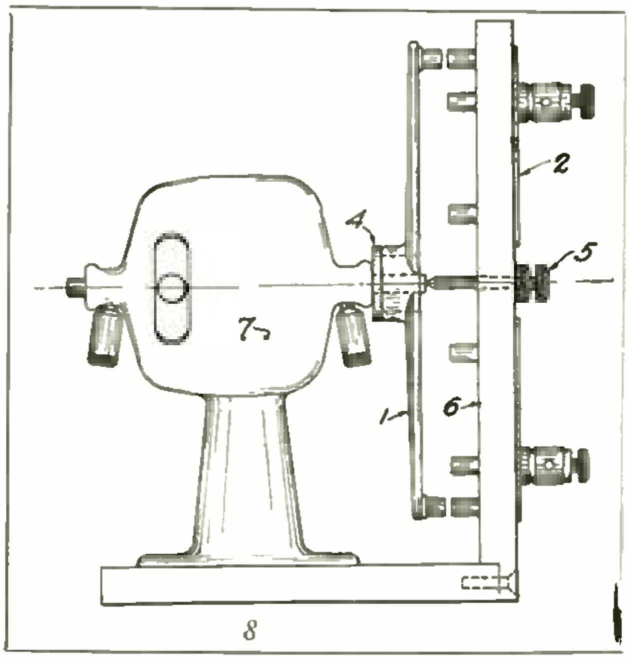


Fig. 2, Fourth Prize Article

Detail No. 2 shows the brass ring, which connects the spark points together. These sectors are ⅜th of an inch in width and 1/16th of an inch in thickness.

Detail No. 3 shows one of the spark electrodes of which there are ten in all, spaced evenly on a circle 6 inches in diameter. The plugs are ¼ of an inch in diameter and ⅜th of an inch in length.

Referring to Fig. 2, detail No. 4 is a fibre bushing, which insulates the rotating arm from the base of the motor.

Detail No. 5 is an adjustable screw with check-nuts, which keeps the motor shaft the required distance from the stationary spark electrode and prevents excessive vibration at higher speeds. It of course also prevents the stationary and the moving electrodes from coming in direct contact. This feature is important as the average motor is constructed to have a considerable end play.

Detail No. 6 is a panel for holding the stationary spark electrodes. It is constructed from a piece of Bakelite, ½ inch in thickness, 7¾ inches in length and 7 inches in width. It is attached to the base by means of suitable machine screws. Care must be taken to have it in a straight, vertical position in order that there may be equal distances between the rotating arm and the spark points.

Detail No. 7 is a standard commercial direct current motor sold by a dealer in wireless telegraph apparatus. It is rated at 1/20th horsepower and has six variable speeds from 4,000 to 9,000 r. p. m., which gives quite sufficient range for the average rotary gap.

Detail No. 8 indicates the base for the complete structure, which is made of Bakelite and is ½ inch in thickness, 7 inches in length, and 5½ inches in width.

A gap constructed after this design will give longer life to the bearings of the motor than one of the usual construction. Care must be taken before putting it into service to see that there is no direct contact between the stationary electrodes and the rotating arm. The final connections from the spark gap to the condenser circuit are made by means of 2 binding posts mounted on the panel as shown.

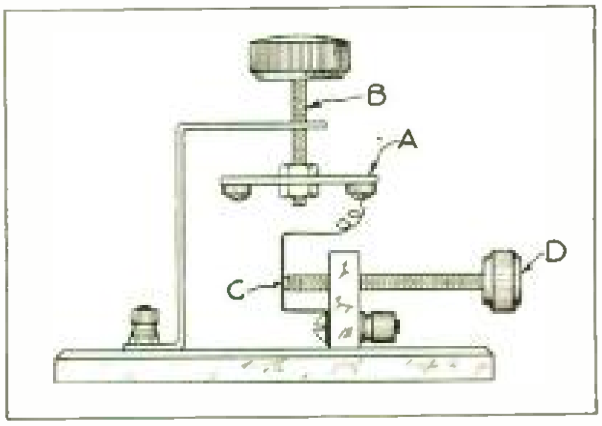
The best note is obtained from this gap by having the distance between the sparking electrodes very small, in fact, 1/50th of an inch will give the greatest value of current in the antenna circuit and the clearest note.

RALPH H. HOAGLUND, *Massachusetts.*

HONORARY MENTION

A Radical Dust-Proof Design for Wireless Detector

As is well known, radio detectors of the mineral type, rapidly lose their sensitiveness when they become covered with dust. A great many, of course, endeavor to overcome this by covering the instrument with a glass bell or by submerging the mineral in oil, etc. An entirely new scheme is shown in the accompanying drawing, which should prove efficient, and, as indicated, the mineral cups are placed on a brass bar or disc, A, supported by an adjustable threaded rod, B. A "cat-whisker" contact point of the usual type, may be placed on a brass spring, C, which has its tension adjustable by means of a threaded rod and knob, D, in drawing.



Drawing, Honorary Mention Article, William Wannecke

At first my design may seem quite impracticable, but on second thought you will see that this is just as easy to adjust as if the mineral cups were facing upwards, as in most detectors. This is because you cannot (naturally) "see" the sensitive spot on the mineral, and it must be found of course by placing the "cat-whisker" contact point on the various parts, until the most sensitive spot is ascertained, as manifested by the loudest buzzer-test signal heard in the receivers.

The base on which the detector is mounted may be of marble or of hard rubber. The drawing and the action of the adjustment are almost self-explanatory.

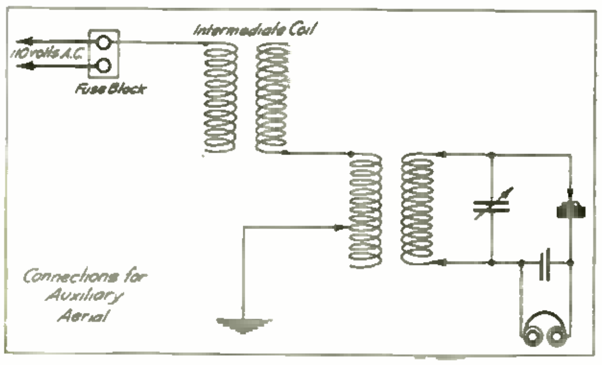
WILLIAM WARNECKE, *New York.*

HONORARY MENTION

A Method of Overcoming Trouble With Aerials

Most wireless experimenters have more or less trouble with their aerials. One evening when I was particularly anxious to receive the signals from Arlington I could not hear that station and on tracing the trouble I found that it was due to an earthed aerial. Not wishing to stop and remedy the trouble at night, I discovered the following method which brought Arlington much clearer than my regular 95-foot aerial had done and Cape Cod came in twice as loud as formerly. It will be worth your time to try this stunt out.

An Edison electric lighting system is the first requirement. Having brought the two sides of the Edison



Drawing, Honorary Mention Article, Willis T. Brown

wire in my house to a fuse block for convenience, I next found an unused spark coil and connected the secondary winding of it to the aerial binding post of my inductively-coupled receiving tuner, from which I had just disconnected the regular aerial wire. From the primary winding of the spark coil I connected a lead to one side of the electric light wires at the fuse block. By a few experimental determinations one can determine which of the wires connection should be made to; one of them will cause considerable hum in the head telephone, but the opposite one will be relatively quiet. If the connection is now moved to the proper fuse the induction is practically eliminated and the signals are strong and clear. No current is consumed by this connection as this is the side of the Edison system connected to earth.

Signals are received equally as well with any other coil that has a primary and secondary winding substituted in the circuit I have described.

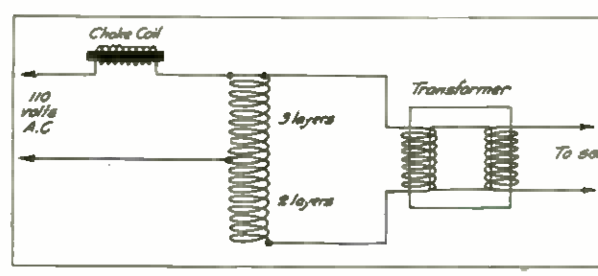
By experiment I find that if a variable condenser is used in the same manner it has the advantage over the coil in that it can be used as an auxiliary tuner. This system has proved so reliable that I have used it in preference to the usual aerial. Difference in electric wiring seems to have little importance, as I have tried this method of connection with various electrical installations in different localities, always with the same results. With a crystalline detector and a home made receiving set I have many times copied Cape Cod with my 2,000 ohm head telephones lying on the table.

Willis T. Brown, *Massachusetts.*

HONORARY MENTION

Increasing the Efficiency of an Amateur's High Voltage Transformer

The majority of amateurs are aware of the fact that in order to be efficient their high voltage transformers should have a potential lying between 15,000 and 20,000 volts to permit the use of full power on the 200-meter wave. Many experimenters own transformers of the Blitzen type or other manufacture which only give from 5,000 to 10,000 volts at the secondary winding. I have found by experiment that it is possible to supply these tranformers with 200 volts in the

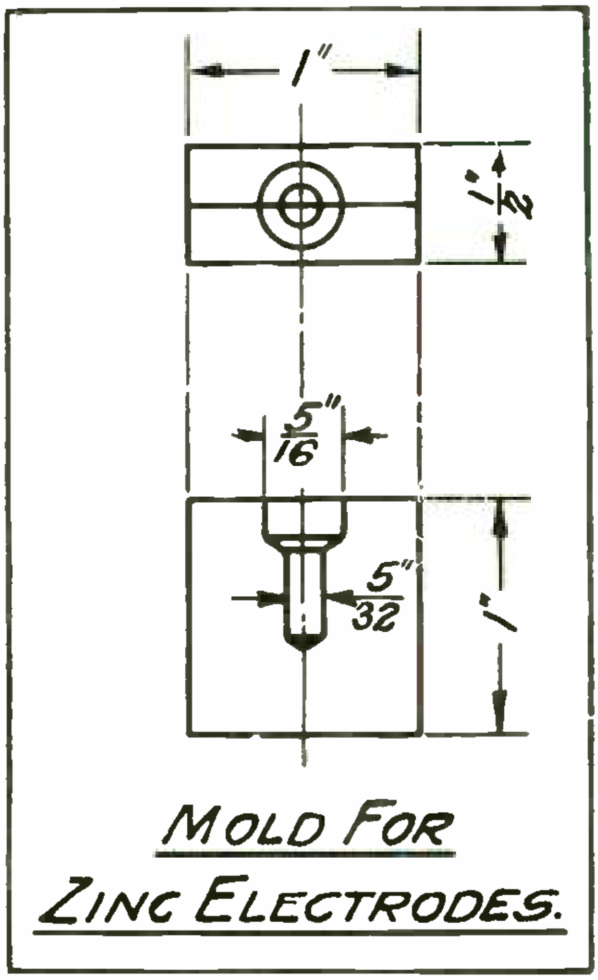


Drawing, Honorary Mention Article, Paul D. Flehr

primary without danger of burning them out. The necessary potential is obtained by constructing an auto transformer consisting of an iron wire core two inches in diameter, twelve inches in length, wound with five layers of No. 14 or No. 12 cotton covered wire with a tap taken out on the third layer. This is then connected to the transformer proper as shown in the accompanying drawing. A choke or a reactance coil must be connected in series with the 110-volt line to regulate the flow of current.

I find that by this method transformers may be safely overloaded without heating.

Paul D. Flehr, *Ohio.*



Drawing, Honorary Mention Article, F. W. Nunenmacher

HONORARY MENTION

A Mold for Casting Rotary Spark Zinc Electrodes

A mold for casting zinc electrodes for a rotary spark gap is easily made from a small piece of wrought iron. The iron is cut to the desired size and drilled as shown in the drawing. It is then sawn in half lengthwise whereupon it may be held tight in a vise or a clamp for the pouring. When the melted zinc is being poured, care should be taken to see that the mold is level and that both sides line up evenly.

After a sufficiently number of electrodes have been cast for a given gap, an 8/32 inch die should be run over the smaller ends, and the rough edges should be taken off the remainder by means of a fine file. The electrodes designed after the accompanying sketch work very well indeed and have also been used as switch points in a multipoint switch.

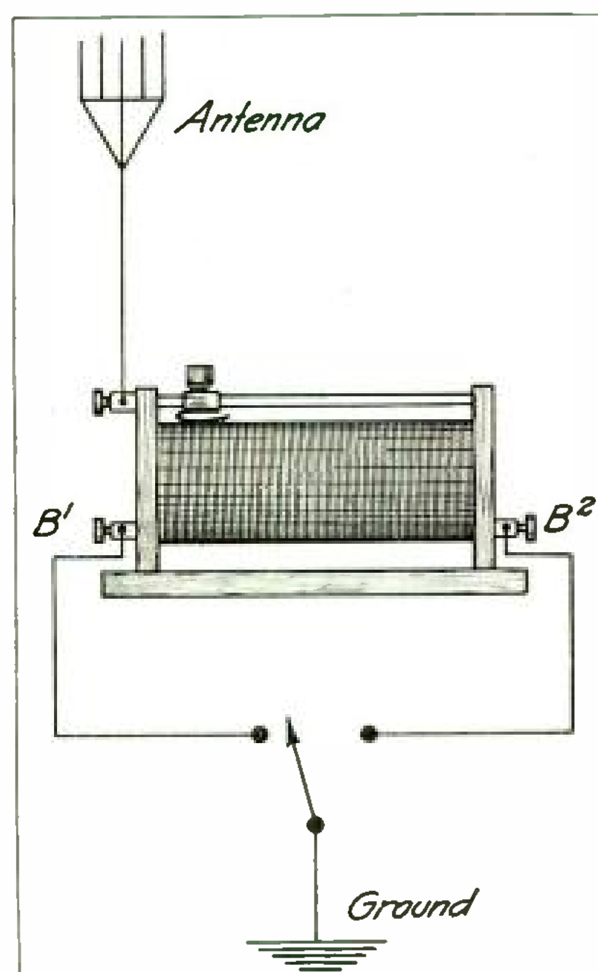
FRANCIS W. NUNENMACHER, *California*.

HONORARY MENTION

Making Use of All the Turns in a Tuning Coil

A two-slide tuning coil which I have been using at my receiving station, was so constructed that the sliding contact would not permit the operator to reach the last turn of inductance. The difficulty was overcome by fitting both ends of the coil with a two-point switch, as indicated in the accompanying drawing. It is plainly evident that the B' end of the coil cannot be reached by this slider, but by throwing the small switch to the right, the B-2 end can be touched to the last turn.

RALPH B. BEAUMONT, *California*.



Drawing, Honorary Mention Article, Ralph B. Beaumont

HONORARY MENTION

Directions for Preventing Trouble With Phone Cord

The unavoidable bending back and forth of the telephone cords at the point where the cord enters the metal tip, in a short time causes the tinsel wires to part within the insulation, leaving a defective or completely broken circuit, the source of which is not easily ascertained. The amateur will often blame his detector, or the receiver, and will examine every connection on his set, but seldom does he trace the trouble to faulty telephone cord.

To eliminate all future possibility of trouble of this sort, it is only necessary to follow my suggestion. Obtain 12 inches of small rubber tubing (not more than 3/16 inches in diameter) and cut it into six pieces, each two inches long. Slip a piece of rubber over each of the cord tips. This can be done without removing a tip as the smaller tubing will stretch and when in place should fit snugly over the cord and the end of the metal tip.

When the cord is thus fitted, the bending which formerly took place at the joint of the tip and cord will now be evenly distributed over several inches of its length and the life of the cord will be more than doubled.

WALKER S. KRAINKA, *Missouri.*

HONORARY MENTION

An Adjustable Sending Condenser for Spark Coils

My experiments reveal that spark coils of different construction require condensers of different values of capacity. It is also a well known fact that the capacity of the condenser in shunt to the secondary winding must vary with the speed of interruption of the vibrator. Many amateurs are accustomed to use a capacity of .002 microfarad in shunt to the secondary winding, but in some of my experiments I found this value to be excessive.

With the condenser I am about to describe, one can get any desired value of capacity in a simple manner. The condenser is suitable for a ½-inch or 1-inch spark coil. It will be found to be of considerable value to the experimenter who changes the dimensions of his aerial frequently.

Referring to Fig. 1: The glass tube is 8 inches long, 1⅞ inches outside diameter, 1/16th of an inch in thickness. This tube is covered with tinfoil on the outside for a distance of 4 inches, the

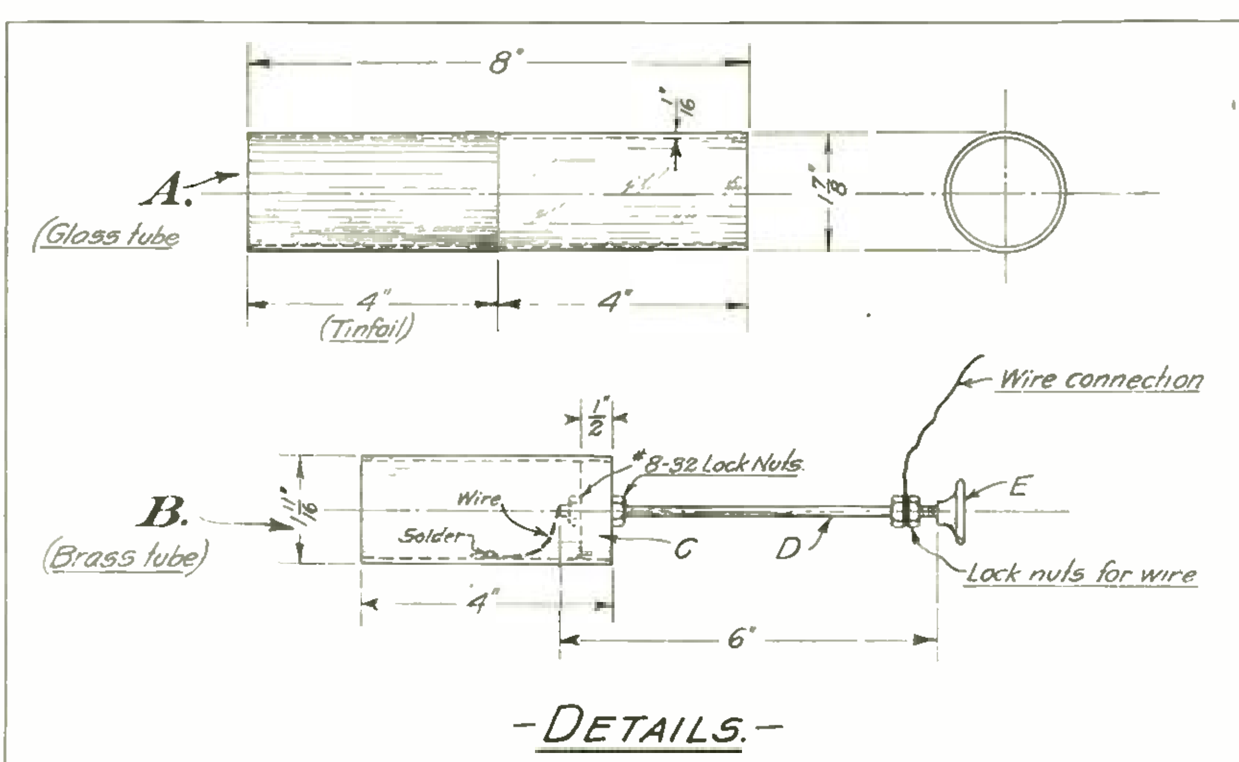


Fig. 1, Honorary Mention Article, Newton W. Weeller

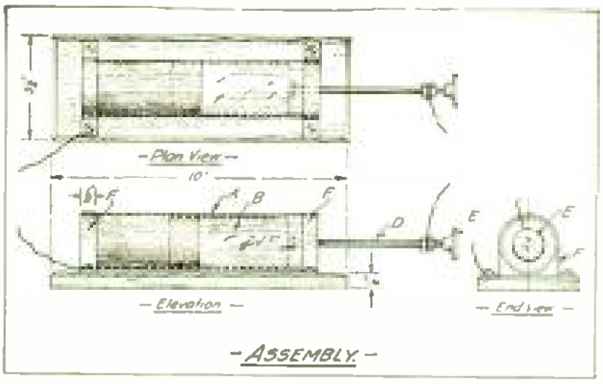


Fig. 2, Honorary Mention Article, Newton W. Weeller

remaining space being left clear. For the inside surface of the condenser a brass tube, B, is employed, which is 4 inches in length, and a trifle less than 1¾ inches in outside diameter. A tube of any thickness is suitable, but care should be taken to have it move freely in and out of the glass tube.

A wood plug C, is placed at the end of the tube, B, and cut to make a snug fit. An 8/32 inch brass rod passes through the center of C, and is threaded for a distance of ¾ inch to take 2 lock nuts for holding the rod. B. The latter is 6 inches in length. At the opposite end of D a thread is cut for a distance of 1 inch, which is fitted with 2 additional lock nuts to which the flexible wire is attached. A hard rubber knob, E. of any convenient size is mounted at the extreme end. To make connection with B, a wire is soldered on the inside of D and then fastened to the lock nut on the inside of the plug, C.

The base for this condenser may be 10 inches in length, 3 inches in width and ½ inch in thickness. Practically any kind of wood will do that is dry and possesses sufficient insulating qualities for high potentials. The entire condenser may be fastened to the base by means of brass strips, as at F, one strip being placed at each end of the tube. The connection to the tinfoil will be made by means of a wire fastened under the screw which holds the brass straps in place. When completed, the tinfoil is connected to one side of the spark gap and the opposite electrode of the gap is connected to the lock nuts near the hard rubber handle, E.

NEWTON W. WEELLER, *New York.*

HONORARY MENTION

Linking Circuits Adapted to Receiving Transformers

The linking circuit, as described in THE WIRELESS AGE by E. E. Butcher, may be applied to inductively coupled receiving transformers as well as to "straight tuners."

A few turns of insulated wire, such as No. 20 silk rubber insulated lamp cord, are wound about both primary and secondary, and connected together. For convenience in using, these coils should be wound on tubes of cardboard or other material, of such diameter as to permit their being moved easily over the primary and secondary windings, in order that their respective couplings may be varied. In operation the secondary of the transformer is drawn clear of the primary; there should be as much space between primary and secondary as possible, so as to avoid direct inductive action between the original windings. The number of turns employed in linking circuit is best found by experiment.

In case the variation of primary inductance is accomplished by means of taps taken from outside of winding, it will be impossible to use a sliding tube over same, and the linking coil will have to be wound directly about the primary in the best position for average working.

All circuits to the transformer remain as before and the number of turns employed in both windings will generally be the same as in the usual method.

Fairly good results may be obtained. If the set be rendered less efficient, the loss will probably be due to usual losses of transformation. The increased selectivity obtained surely repays one for the trouble in making.

H. N. UMBARGER, Michigan.

TELEPHONE COMPANY ADOPTS WIRELESS AUXILIARY

The Pittsburg-Allegheny Telephone Company had its poles and wires wrecked last winter by the sleet. Owing to the trouble then experienced in repairing the lines, an emergency wireless system with eight branch stations has been installed.

OPERATING UNDER ADVERSE CONDITIONS

A severe electrical storm swept over Illinois, Ohio, Indiana and Pennsylvania on April 12. The static conditions were so bad that my vacuum valve detector was continually polarized and several Ohio amateurs later informed me that sparks were leaping the anchor gap from their aerial wires to the ground. It was raining hard in Chicago when I was scheduled to start the first message over the new American Radio Relay League's new cross-continent route. I gave my test message to 8NH (Mrs. Charles Candler, St. Marys, Ohio), 200 miles away and received her O. K. on it without difficulty. I later received a letter from her in which she said:

"I received your message through the worst static I ever tried to work through. At times the interference from this source was so loud as to make it uncomfortable to wear the head telephones. Nevertheless, I was able to copy your signals without much difficulty."

I worked 8AEZ at Lima, Ohio, on April 8 through a warm rain for one hour and a half without a single repeated word. I took down two messages from him and then worked 9PC at Fort Wayne, Ind., for three-quarters of an hour and took two messages from him and dispatched one to him. I received a letter next day from 9EP, at Kansas City, 425 miles away, saying that he had copied everything I sent out with a silicon detector.

I am in receipt of a letter from 2IC (A. J. Faraon, New York City), saying that he receives my signals at present much louder than he has ever heard them before. He refers particularly to my working 9GJ of St. Louis, Mo., on the evening of April 15, and says he received my signals through very heavy static.

A. C. Campbell (7BD) of Lewiston, Mont., declares that he often hears my signals very loudly. It should be taken into consideration that his station is 1,300 miles distant from mine with an intervening mountainous country.

I do not know whether or not this long distance work will continue throughout the summer months, but I can state that at this writing long distance stations are heard just as loud at my station as at any time during the winter. I have never had a chance to try summer work because of the fact that I am a wireless operator on one of the boats on the Great Lakes during the summer months and do not have an opportunity to operate my own set. However, last summer, while on the steamer Arizona, I frequently heard 8-NH and 8-AEZ using a galena detector. I shall attempt to make some long distance amateur records during the summer months and will inform you of the results.

R. H. E. Mathews, *Illinois.*

LONG DISTANCE WORK IN WISCONSIN

In reference to the articles by R. H. E. Mathews, N. B. West and Mrs. Charles Candler in The Wireless Age, I feel safe in saying that these reports are in every way true. In Wisconsin the amateurs have had wonderful results with long distance work. 9SP, 9DB, 9IC and 9BV, who are in my locality, consider it not uncommon to communicate with Mrs. Charles Candler (8NH) and N. B. West (8AEZ). I have interchanged signals with 9BD at Superior, Wis., a distance of 350 miles, with ½ k.w. set for periods of one hour at a time, using a galena crystal detector and in addition I hear amateurs throughout the Mississippi valley, including 5BJ in Dallas, Tex. Have heard 8AEZ twice as loud as nearby 2 k.w. commercial stations. Have communicated with 9LT in St. Louis and have heard 2JD in New York City for nights running a week or more, so do not consider the results a matter of luck or of freak conditions. As to summer conditions, I will not speak so strongly, but I have worked 9IK and 9KU in Chicago in midsummer and afternoons the year round.

I hope these letters will give other amateurs more confidence in the range of their sets and that they will "stand-by" and be more alert in long distance communication.

Richard J. Oetjen, *Wisconsin.*

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.

G. G. C., Grosse Point, Mich., inquires:

Ques.—(1) What make of transformer (1 kw.) would you recommend as the best type for amateur use? The closed core type is preferred.

Ans.—(1) The transformers sold by the advertisers in this magazine are reliable and operate satisfactorily. A transformer of the closed core type should be constructed to have a certain amount of magnetic leakage; lacking this feature it will possess undesirable operating characteristics for wireless telegraph use.

Ques.—(2) Upon widening out the spark gap of a small induction coil, a larger value of current is obtained in the antenna circuit than when the spark is discharging. Why is this?

Ans.—(2) This would seem to indicate that the insulators of the antenna are leaking badly and when the gap is widened out beyond the sparking distance the energy from the secondary winding of the induction coil possesses a greater current value than that obtained by the discharge of the energy stored up in the antenna. Try fitting the aerial with a new set of insulators.

Ques.—(3) What is the lowest possible cost of a 1 to 1 auto transformer and where can one be purchased?

Ans.—(3) Coils of this type can be purchased from the Manhattan Electrical Supply Company, New York City, at a cost of $12 each.

Ques.—(4).The other night I believe I heard NAJ (U. S. Naval Station, Lake Bluff, Ill.) operating with a spark gap. If I am correct, do you know what value of power is used?

Ans.—(4) We have not been advised that this station is equipped with spark apparatus, but we do know that it employs generally a 30 k.w. arc set. Further information concerning this station can be obtained from the Superintendent of Radio, Radio, Va.

* * *

B. H. M., Fort Monroe, Va., inquires:

Ques.—(1) About what frequency of interruption do vibrators of the type generally used in connection with the induction coil sets of the United States Signal Corps give? They are operated on an 18-volt storage battery.

Ans.—(1) These interruptors give from 50 to 100 breaks per second on the larger size sets and in the case of smaller induction coils, interruptions as high as 180 per second are obtained. Independently operated, magetic interruptors generally give a low speed of interruption, approximately 40 per second.

Ques.—(2) In the usual type of vibrating coil radio sets, open core transformers are employed. What would be the operating characteristic of these sets if supplied with alternating current at the same frequency and voltage?

Ans.—(2) If the precaution is taken to keep the A.C. voltage down, certain of these induction coils may be operated on alternating current as well as upon direct current. The usual induction coil constructed for operation on direct current has too much self-inductance in the secondary winding for alterating current and too little inductance in the primary winding. With certain types of coils it is possible to rearrange the design and to give the primary winding a greater value of inductance by the addition of one or two layers. The inductance of the secondary winding, of course, can be reduced by the removal of a portion of the pancakes.

Ques.—(3) Would the transformer be more efficient supplied with a higher frequency, say 100 cycles?

Ans.—(3) As far as the primary winding is concerned, better results would be obtained from the higher frequency, but the secondary winding still has too many turns for alternating current.

Ques.—(4) With the same value of coupling between the primary and secondary windings of a receiving tuner which gives the greater selectivity, tuning the receiving set by capacity or by inductance? Which gives the sharper tuning?

Ans.—(4) An increase of capacity in a radio frequency circuit has the effect of increasing the decrement. An increase of inductance, on the other hand, decreases the decrement at least up to a certain point. If abnormal values of inductance are added in the circuit the resistance is increased to such an extent that the good effects of inductance are overbalanced. The sharpest selectivity is obtained in the secondary circuit by variation of the inductance value, but owing to the fact that the usual secondary switch is connected to groups of the turns of the secondary winding it is necessary to use a variable condenser to secure close variation of the wave-length between the taps of the inductance switch. When loose coupling is employed between the primary and secondary windings of a receiving tuner, the greatest selectivity is obtained in the secondary winding by the use of capacity in shunt to that winding, but under conditions of tight coupling this condenser is a detriment to the strength of signals. In the antenna circuit an increase of inductance has the effect of reducing the decrement of the received energy, making it less difficult to separate interfering stations. In instances where the natural wave-length of the antenna is of such value that but a few turns are required at the primary winding of the receiving tuner to place it in resonance with the distant transmitting station, increased selectivity can be obtained by placing a condenser in series with the antenna circuit, thereby reducing its wave-length; the wave-length of the circuit is brought back to normal value by the addition of inductance in the antenna circuit. Owing to the fact that the total capacity of the antenna system is decreased and the inductance value increased, a greater degree of selectivity is obtained. This subject is discussed in the book "How to Conduct a Radio Club," published by the Marconi Publishing Corporation.

* * *

R. P. P., Newark, N. J., writes:

Ques.—(1) In the book "How to Conduct a Radio Club," Figs. 2 and 3 are facsimiles of my set. Would these two drawings be acceptable in the examination for a government license?

Ans.—(1) In the examination for an amateur first grade certificate these diagrams would probably be all that is required, but in the examination for an operator's first grade certificate a more complete drawing, one showing the circuits of motor generators, starting boxes, etc., is necessary. Satisfactory wiring diagrams are given in the book "How to Pass the U. S. Government Wireless License Examinations."

* * *

H. F. M., Jr., Cleveland, Ohio, inquires:

Ques.—(1) I read that the leyden jars used in commercial wireless telegraph sets were made of flint glass coated with copper by an electrolytic process. Inasmuch as glass is a non-conductor of electricity I do not see how this could be possible. Any information on the subject that you can give me would be greatly appreciated.

Ans.—(1) There are two processes by which a leyden jar can be coated with copper. One is to first cover the inside and the outside jar with a cold silver solution similar to that used on the rear of mirrors. The jar is then placed in a furnace and heated almost to the melting point. At this stage of operation the jar is removed from the furnace and allowed to cool slowly, whereupon it will be found that the silver is thoroughly burned into the glass. Since the glass now possesses a silver coating inside and outside it is only necessary to place it in an ordinary electro-plating vat and give it a good coat of copper. Another method is to coat the inside and outside of the jar with a paste made of graphite and shellac. The graphite possesses a sufficient degress of conductivity to allow the electroplating process to take place. The first method described is the superior one.

* * *

P. O. C., Middletown, Md.:

Your aerial, 170 feet in length with an average height of 45 feet, is apparently well designed and the disposition of the lead-in will in no wise interfere with its overall efficiency. The wave-length of the aerial is approximately 320 meters—the correct value for the reception of signals at waveyengths of 500 to 600 meters. For the dimensions of a receiving tuner suitable to this aerial you are referred to the article "How to Conduct a Radio Club" in the May, 1916, issue of THE WIRELESS AGE. Complete dimensions were given for receiving tuners of various sizes for various ranges of wavelengths. The article should be carefully studied.

* * *

L. B., Albion, Mich.:

Your 150-foot aerial with an average height of 50 feet has a natural wave-length of approximately 381 meters.

We advise you to study the wireless situation carefully before you begin the construction of a 25,000-meter tuner because there are no stations in the world that operate at this wave-length, nor is it proposed to operate any stations at this wave-length so far as we are aware. The longest wave-length used by any commercial station at the present is that of a wireless telegraph company at Honolulu, which occasionally operates at the wave-length of 12,000 meters. If, after having taken these facts into consideration, you still wish to construct the 25,000-meter tuner you are advised to purchase a copy of the book "How to Conduct a Radio Club" wherein is described the complete circuit for a receiving tuner responsive to wave-lengths of 10,000 meters inclusive. If you will then increase the dimensions of these coils, making them approximately four times their present length, or double the size of the coils and use variable condensers of larger capacity, you will have a receiving set adjustable to the wave-length of 20,000 meters. But after you have completed this apparatus there will be no stations to receive from and consequently it will be useless.

Regarding your third query: The difference between damped and undamped oscillations is so completely described in text books on wireless telegraphy that it hardly seems necessary to go over the matter again in this department. In a previous issue of THE WIRELESS AGE the facts and reasonings concerning this subject have been fully stated. It is also somewhat exhaustively discussed in Zenneck's "Wireless Telegraphy" and "The Text Book of Wireless Telegraphy," by Rupert Stanley.

The Arlington station uses both damped and undamped oscillations. The undamped oscillation set comprises an arc generator of 60 kw. capacity which is operated at wave-lengths between 6,000 and 7,000 meters. The damped set is of 100 kw. capacity and operates at a wave-length of 2,500 meters. There is also a small set used for short distance communication which operates at a wave-length of 1,000 meters.

* * *

J. A. O., Nephi, Utah.

It is rather difficult to diagnose your difficulties and those of your friends without being on the ground, but certainly a 1-inch spark coil in connection with an aerial of the dimensions you give should permit the transmission of wireless telegraph signals to a distance of one-half mile. However, it seems from your explanation that you receive better results from electrostatic induction than by the radiation of wireless telegraph energy. The signals your friend receives by means of a head telephone without a crystalline detector are merely those set up by electrostatic induction from your aerial and there is no reason why, if your set is properly set up, that you should not cover the desired distance. Both receiving sets are rather ill-proportioned for the work you require and it would be of benefit to study the diagrams in the book "How to Conduct a Radio Club" and also note particularly the article on "How to Conduct a Radio Club in the May, 1916, issue of THE WIRELESS AGE. A defect frequently found in amateur stations is due to the fact that the receiving tuners are designed for a wide range of wave-length and the majority of them do not have a small enough value of inductance to permit the circuits to be adjusted to the wave-length of 200 meters. In the book: "How to Conduct a Radio Club" a portable receiving set, specifically designed for the reception of signals at a wave-length of 200 meters, is described, and you would do well to purchase a copy and study it carefully. A 1-inch spark coil should transmit to a distance of five miles with little difficulty, and under more favorable conditions to a greater distance.

It is difficult for us to advise concerning your troubles with the electrolytic interruptor, but you had better write to the makers of this device. It is probable that you have not the correct proportions of acid to water in the solution, or that the primary winding of your induction coil has a very low value of resistance and therefore consumes an abnormal current. Remember that the electrolytic interruptor will only function at potentials above 80 volts and gives better results on direct than on alternating current. The diagram of connections you have furnished is quite correct and should give response from other amateur stations.

In our opinion the filings detector will give better results than the electrolytic detector made by another concern.

* * *

A. H., Little Rock, Ark., Inquires:

Ques.—(1) Considering the cost, what kind and size of wire would be best for a single-strand 3,000-foot aerial?

Ans.—(1) This span is rather unusual and we fear that you will require a heavy stranded copper cable which will have to be very strongly supported in order to stand the strain to which it will be subjected. Ordinary aerial wire certainly will not do and since you state that you desire this for long distance work we advise you that an antenna of this length is not apt to be required. High-power stations here and abroad can be heard with aerials 1,000 feet in length.

As you state in your second query, steel piano wire is very strong and will probably stand the strain. Of course, it possesses a lower degree of conductivity than copper wire, but if the cable is made up of several strands we believe that it will possess sufficient conductivity for the purpose.

The natural wave-length of the aerial which you inquire about in your third query will be approximately 4,600 meters. It will show directional effects and probably will respond best in the direction opposite to the free end.

Either of the transmitting sets referred to in your fifth query will give good results and the antenna current to be obtained in both cases is about equal. Many amateurs prefer the rotary quenched type of transmitting apparatus.

* * *

F. C. P., Sharpsburg, Pa., inquires:

Ques.—(1) Please give the dimensions for an inductively-coupled receiving tuner to be adjustable to wave-lengths between 7,000 and 11,000 meters. The secondary winding is to be used with a condenser of .0001 microfarad in shunt, in connection with the vacuum valve detector.

Ans.—(1) The secondary winding for this tuner should be 20 inches in length, 8 inches in diameter, wound closely with No. 34 S. S. C. wire. Shunted by the condenser of .0001 microfarad it will give the desired range of wave-lengths. It is difficult to give the dimensions for the primary winding without the dimensions of the receiving aerial with which it is to be used, but in the article on "How to Conduct a Radio Club," appearing in the May, 1916, issue of THE WIRELESS AGE, you will find the dimensions for primary windings for aerials of definite dimensions.

Ques.—(2) Please give the possible wave-length adjustment of the primary and secondary windings of the following described tuner in connection with a two-wire aerial 140 feet in length, 40 feet in height, with a lead-in 10 feet in length. The primary winding of the receiving tuner is 5½ inches in length, 5¼ inches in diameter, wound closely with No. 24 B. & S. S. S. C. wire. The secondary winding is 6 inches in length, 4⅝ inches in diameter, wound closely with No. 30 B. & S. S. S. C. wire. It is shunted with a variable condenser of .0001 microfarad capacity.

Ans.—(2) The inductance of the aerial is approximately 60,670 centimeters, the capacitance about .0005 microfarad, and the natural wave-length approximately 325 meters. The secondary winding, with a capacity of .0001 microfarad, will respond to wave-lengths of about 2,300 meters. The primary winding connected in series with the aerial described will permit adjustments in that circuit to wave-lengths of about 2,800 meters.

Referring to your third query We cannot calculate the wave-length of a spiral aerial and we see no advantage in using one of this type.

Ques.—(4) I have seen the published statement to the effect that the life of a vacuum valve bulb is extremely short when used in amplifying an undamped wave circuit because the filament must be burned at excessive brilliancy. Is this a fact?

Ans.—(4) The statement is not quite correct, for with the proper amplification circuit the vacuum valve can be burned at a degree of incandescence below the characteristic blue glow point. Hence the filament will last quite as long as in the ordinary type of vacuum valve circuit. If, however, the bulb is used at a degree of incandescence where a considerable blue glow is evident, then the filament will disintegrate rather rapidly.

We advise you to use a straight-away aerial in place of the proposed spiral aerial referred to in your fifth query. It is preferable to have either the receiving or transmitting aerial as nearly uniform as possible. No advantage is derived from coiling the wire up.

* * *

C. P. D., Statesville. N. C., inquires:

Ques.—(1) Does the height of an aerial have any effect on the amount of static accumulating in the receiving apparatus? I have an aerial 45 feet in height and I am continuously bothered with what I believe to be atmospheric electricity, but a friend of mine, whose station is located just a block away has an aerial 70 feet in height at one end and 50 feet at the other, and he rarely hears static.

Ans.—(1) Usually the higher the aerial the greater will be the effect of atmospheric electricity, but in your case it is likely that you are receiving induction from power or telegraph lines rather than from atmospheric electricity. If your trouble is due to local induction, it is difficult to eliminate. Usually it can only be overcome by completely removing the receiving aerial from near-by power wires.

* * *

J. B. K., Los Angeles, Cal., inquires:

Ques.—(1) Does a crystalline detector amplify the current received from a distant transmitting station or does it really act as a conductor?

Ans.—(1) If the crystal is one of the type employing a local battery, the signals from the distant station are amplified, but where the telephones are operated merely by the antenna energy, then the crystal detector does not amplify the incoming signals; in fact, it reduces their strength. You of course understand that the crystal is employed merely to make the signals audible and does, as you state further on in your query, rectify the alternating current in each group of oscillations into a series of direct current impulses of constantly decaying amplitude.

* * *

H. J. H., Los Angeles Cal., writes:

Ques.—(1) I have a 4-wire aerial of the inverted L type and would like to know if it is of the correct dimensions for operation at the wave-length of 200 meters. The flat top portion comprises four wires, spaced a little over 5 feet apart and is 83 feet in length, 65 feet in height at both ends, and is constructed of No. 14 copper wire.

Ans.—(1) The fundamental wave-length is about 270 meters, which is of excessive value for operation on the wave-length of 200 meters.

Ques.—(2) What would be the wave-length of this aerial if the lead-ins are attached to the center of the flat top portion?

Ans.—(2) The fundamental period will be about 180 meters, the correct value for operation at the wave-length of 200 meters.

Ques.—(3) What is the efficiency of the open core transformer of 1 k.w. capacity, described on page 32 of the book "How to Conduct a Radio Club"? What is the size of the secondary wire and what potential may be expected when the primary winding is connected to 110 volts a.c. mains?

Ans.—(3) This transformer represents an efficiency of about 75 per cent. and the secondary voltage will be about 20,000 if the secondary winding is made of No. 32 single cotton covered wire.

Ques.—(4) How many glass plates, 12 inches by 18 inches, with a thickness of 1-16th of an inch, are necessary for a condenser suitable to this transformer?

Ans.—(4) For operation at the wave-length of 200 meters the capacitance should be about .008 microfarad for the complete condenser. If the 12 by 18 plates are covered with foil, 10 by 6 inches, then four plates connected in parallel will give the required value of capacity, but owing to the potential of the transformer a parallel connection of plates will not be able to withstand the potential; in consequence you must use a series parallel connection, that is, eight plates should be connected in parallel in each bank and the two banks finally connected in series.

F. M. B. Clinton, Ia., writes:

You will note by the drawings attached to my query that I contemplate erecting two aerials on a single set of masts. The first aerial is to be 100 feet in height at one end and 40 feet in height at the other and the flat top portion is to consist of 2 wires 100 feet in length. Immediately underneath this I intend to erect another aerial, 55 feet in length, composed of four wires spaced 2 feet apart. It will be about 75 feet from the earth at one end and approximately 35 feet at the other. The small aerial is of course to be used for sending at the wave-length of 200 meters, while the large aerial will be used for the reception of signals at wave-length of about the value of 6,000 meters. Will this sending aerial exceed the Government restriction of 200 meters when connected to a 3/4 k.w. transmitting set? Also, what is the fundamental wave-length of each of these aerials?

Ans.—(1) The larger aerial will have a fundamental wave-length of approximately 300 meters and the smaller one 180 meters. You will thus see that the smaller aerial is of the correct dimensions for operation at the wave-length of 200 meters and if you connect a good sensitive receiving set to the larger aerial you will experience no difficulty in copying signals at the wave-length of 6.000 meters. You, of course, require a supersensitive receiving set like that described in the book "How to Conduct a Radio Club."

* * *

W. L. O., New York City:

You should purchase a copy of the book "How to Conduct a Radio Club" and construct a long distance receiving set after the designs given therein. The aerial you mention, 100 feet in length by 55 feet in height, is feasible for the reception of long distance signals with the Armstrong receiving circuit and should give fair results. The fundamental wave-length of your aerial is about 290 meters.

* * *

H. A. T., Jr., Hyde Park, Mass., inquires:

Ques.—(1) Please give full information concerning the power, insurance and electric light regulations for the installation of a 1/4 k.w. Blitzen set. May I connect the transmitting apparatus directly to a house lamp socket, provided a kick-back preventer is employed? Is it required that a separate line be run from the meter?

Ans.—(1) There is a slight variation of the Underwriters' code in various cities, but generally it is required that a separate power line be installed from the meter to the wireless telegraph apparatus, the circuits for which must be run in iron conduit, flexduct, or in certain localities, armored cable (lead covered) is permitted. No. 12 single braid, rubber covered wire should be employed for connecting up the primary circuit. It is generally the requirement that the antenna wires be connected to earth through a 100 ampere lighting switch, the earth connection being made of No. 4 D. B. R. C. wire. The earth connection must be insulated from all buildings or supports until actual contact is made with the earth and this connection, if attached to the water main, must be made on the street side of the meter. Care should be taken to insulate the outgoing wires from the transmitting apparatus to the aerial through high potential insulating bushings that will withstand the potential of the transmitter in wet weather.

Ques.—(2) Where can I procure a diagram for connecting up a double vacuum valve as an amplifier?

Ans.—(2) A complete set of diagrams is given in the book "How to Conduct a Radio Club."

* * *

A. W. J., Warren, Pa., inquires:

Ques.—(1) Is it possible to calculate the wave-length of a 6-wire aerial, 100 feet in length, the wires spaced being 2 feet apart? It is 48 feet in height at one end and 30 feet in height at the other.

Ans.—(1) The fundamental wave-length is approximately 250 meters.

Ques.—(2) How could I shorten this aerial so as to comply with the law?

Ans.—(2) If possible, the better way to do is to attach the lead-in wires to the center of the flat top portion. The fundamental wave-length will then be about 165 meters.

Ans.—(3) We can give no information regarding the relative sensibilities of various types of vacuum valves. A certain type of 3-element vacuum valves vary widely in sensibility, but the bulbs exhausted to a high degree, generally show practically equal degrees of sensitiveness.

Ans.—(4) A limited number of back copies of the Bulletin of the National Amateur Wireless Association can be obtained of the Association, 450 Fourth avenue, New York City.

The electrical symbol indicated in your fifth query represents a variometer, which is a device for variation of the inductance value in an oscillatory circuit by means of two concentric coils connected in series. In one position the inductance is maximum and in the opposite concentric position the inductance is at a minimum.

Your query regarding the number of Murdock condensers to be used with a one-inch coil cannot be specifically answered, because the designs of spark coils vary widely and the actual value of capacity is, to a great extent, dependent upon the ability of the interrupter. Ordinarily a single section of this condenser will be quite sufficient. Perhaps better results will be obtained by connecting two units in series. You can easily determine for yourself when you have the correct number of turns in the primary winding of the oscillation transformer for obtaining the wave-length of 200 meters. You may erect an antenna having a natural wave-length of close to 200 meters and then place a small glow lamp or hot wire milli-ammeter in series with the aerial circuit. The primary winding should be made up of at least a dozen or fourteen turns of double braided rubber covered wire, No. 6 or No. 8, and taps off taken from each turn. Then when the spark is set into operation, the inductance value of the primary winding may be altered until the aerial current indicating instrument shows the highest reading. The two circuits are then in resonance and will give the highest possible degree of efficiency.

* * *

V. S. (no address given) writes:

Ques.—(1) If the wave-length of a circuit equals 59.6 $\sqrt{LC}$, how is this formula applicable to finding the wave-length of the secondary winding of a receiving coupler when a variable condenser is not employed in shunt.

Ans.—(1) To carry out the calculation we must assume a certain amount of distributed capacitance between the turns of the winding. For purposes of calculation we may use a rather high value, namely, .0001 microfarad. We substitute this value in the formula you have denoted and the result is the value of wave-length near to which the secondary winding is adjustable. If you consider .0001 microfarad rather high for the value of distributed capacity, you may use the value .00005 microfarad. The usual receiving tuner, however, has a condenser in shunt to the secondary winding and if the capacitance of it is known at various degrees of the condenser scale it is easy to compute the wave-length of the circuit.

The formula for obtaining the possible wave-lengths adjustment of an antenna system when the primary winding is shunted by a variable condenser is rather complicated and would require too much space to be taken up in detail in this department. However, with inductance coils only, it is a simple matter to calculate the upper and lower range of wave-length adjustment of an aerial system. It is apparent from your communication that you already understand the method of calculation.

Ans.—(3) You do not require a step-down transformer for an electrolytic rectifier. It may be operated direct from a 110-volt source of current supply and if a parallel connection of incandescent lights is employed in series with the 6-volt, 40-ampere storage cell, the current flow can be carefully regulated. The manufacturers of the electrolytic rectifier will without doubt furnish you a satisfactory diagram of connections.

Ques.—(4) Would the strength of received signals be increased if a small potential were applied to the galena and silicon detectors?

Ans.—(4) Yes; provided the potentiometer is one that allows an extremely close variation of the current value and permits it to be reduced to a very small fraction of a volt. The ordinary potentiometer to effect this requires a fixed resistance of about 2,000 ohms connected in series with the potentiometer and a single dry cell. To say the least it facilitates the adjustment of silicon and galena detectors to apply a small potential, but care must be taken to have the polarity of the battery correct. The proper direction of current flow can easily be determined by a few experiments.

Ques.—(5) Should the formula $C = \frac{W}{NV^2}$ be employed to determine the capacitance of a condenser for a given transformer?

Ans.—(5) The formula is quite correct, but must be modified for commercial practice. It does, however, give an approximation of the condenser capacity and is highly valuable for simple calculations.

E. E. L., Bridgeport, Conn., inquires:

Ques.—(1) Concerning the undamped wave receiving set, described on page 94 of the book "How to Conduct a Radio Club," should the detector connection to the coil L-1 be adjustable?

Ans.—(1) It may result in a slight increase in the strength of signals to have it adjustable when the tuning coil is not in exact resonance with the transmitting station.

Ques—(2) Is this system as a whole very efficient?

Ans.—(2) It gives fair results from nearby stations, particularly those employing the arc type of generator. Results not so good are obtained from the high frequency alternators.

Ques.—(3) What is the derivation of the equation

$$\lambda = 59.6 \sqrt{LC}$$

Ans.—(3) It was derived from the formula

$$\lambda = V\, 2\pi \sqrt{LC}$$

Where λ = the wave-length of an oscillatory circuit in meters, V = the velocity of propagation of an electric current or electro magnetic waves in ether, or V = 186.000 miles per second.

L = the inductance of a circuit in henries.

C = the capacitance of the circuit in farads.

If the value V is converted from miles to meters, then the formula becomes

$$\lambda = 1.885 \sqrt{LC}.\ 10^9 \text{ meters.}$$

Now, if L is converted into centimeters (one-billionth of a henry) and C is converted to microfarads (one-millionth of a farad) then if you understand the solving of an equation you will see that

$$\lambda = 59.6 \sqrt{LC}$$

* * *

A. G., Los Angeles, Cal., writes:

Ques.—(1) I have the core for a closed core transformer that measures 8 inches in length, 5 inches in width, with the sides 1 inch square. I would like to use this for wireless telegraph purposes and desire to know the size of wire to be placed on the primary and secondary windings and approximately the number of pounds or ounces required.

Ans.—(1) The core is rather small for a transformer of ¼ k.w. capacity, but it may give fairly good results with about 150 watts consumption in the primary circuit. The primary winding should have fifteen layers of No. 16 D. C. C. wire, which weighs approximately 3½ pounds. The secondary winding should be made of No. 34 enameled wire, divided into seven sections, and will weigh totally about 8 pounds. For short distance transmitting work this transformer should give good results.

* * *

G. E. P., McKinney, Tex.:

An aerial 30 feet in length, 20 feet in height, is not apt to give good results in radio telegraphy and probably will do no more than permit the reception of signals from local amateur stations; you cannot expect to do long distance work with it. The apparatus you have described is efficient for amateur work and if properly connected will permit the reception of signals for a distance of 100 miles from high power stations. You should, if possible, erect an antenna of increased dimensions, making the flat top portion at least 50 or 60 feet in length.

* * *

R. F., Lewiston, Pa.:

From the data given in the article on "How to Conduct a Radio Club" in the May 1, 1916, issue of The Wireless Age, you should have no difficulty in selecting a receiving tuner winding that will respond to the wave-length of 4,000 meters. We believe that by careful reading of this article you will be able to construct a receiving tuner that will be highly suitable for your purpose.

* * *

G. S., Melrose, Mass.:

An inductively coupled type of receiving apparatus generally requires only one variable condenser connected in shunt to the secondary winding, with the exception that for the shorter wave-lengths another condenser of variable capacity is sometimes connected in series with the antenna circuit. Many amateurs prefer to connect a variable condenser in shunt to the primary winding of the receiving transformer, but it does not increase the strength of signals though it sometimes permits closer tuning. If you possess a variable condenser of large capacity, it probably had better be connected in shunt to the secondary winding.

Your aerial, 100 feet in length and 20 feet in height, has a fundamental wave-length of about 210 meters. The July, 1916, issue of The Wireless Age contains several circuit diagrams suitable for receiving apparatus such as you describe.

* * *

W. C. L., New Orleans, inquires:

Ques.—(1) Will a 1/4 k.w. transformer, having a secondary voltage between 15,000 and 20,000 volts, built in accordance with the specifications published on page 193 of the December, 1915, issue of The Wireless Age represent a transformer of efficient design and is it necessary to use a magnetic leakage gap when this transformer is operated on 110 volts A. C. to keep the lights in the circuit from flickering?

Ans.—(1) The article appearing in the issue of The Wireless Age referred to is an excellent one and is recommended to the entire amateur field in the design of an ordinary high potential transformer. The efficiency is high and the operating characteristics such that it may be operated on 110 volt A. C. circuit without causing excessive flickering of the lights. A magnetic leakage gap is not required.

Ques.—(2) Can you furnish me with the design complete of a 1/4 k.w. transformer and inform me if a magnetic leakage gap is required?

Ans.—(2) Why not design a transformer after the instructions given in the December, 1915, issue. The secondary potential may be increased by an increase in the number of turns in that winding or by a slight decrease in the number of turns in the primary winding. We should prefer, however, to increase the turns in the secondary. Read carefully the article and you will obtain information that is highly valuable to an experimenter about to build a high potential transformer. You may, however, make use of the following data for a 1/4 k.w. transformer which you will note does not possess the same dimensions as the one described in The Wireless Age. The primary core will be 1 3/4 inches square. The primary width, and when assembled the sides of the core will be 1 3/4 inches square. The primary winding has fourteen lays of No. 14 D. C. C. wire; approximately 5 1/2 pounds are required. The secondary winding is wound with No. 34 enameled wire, split into eight sections, which will require about 10 pounds of wire. In this design the primary winding is placed on one leg of the core and the secondary winding on the opposite leg.

We can see no value in the diagram accompanying your fourth query. Just why you desire to so connect the apparatus is beyond our understanding and without more detailed explanation of your requirements it is difficult to advise.

Ques.—(5) How many sections of a molded condenser, having a capacity of about .0017 microfarad each, should be used with a transformer the secondary voltage of which is 15,200? This set is to be employed on a 200-meter wave. How should the condenser be connected to give the best results? Also, how many plates should be used for a 425-meter wave?

Ans.—(5) The maximum value of the condenser cannot be more than .01 microfarad. Six or seven of the uits named will give the desired capacity. The actual value of capacity to be used in either case depends, of course, upon the size of the transformer available. For work at 425 meters we recommend a capacity of .018 microfarad. This capacity will allow the proper value of inductance in the primary winding of the oscillation transformer to attain the required wave-length. The number of watts of energy that will be absorbed by this condenser will depend upon the frequency of the secondary voltage of the transformer.

* * *

Ques.—(3) Do the steel masts of a battleship affect the sending range in the same manner a steel building on land does?

Ans.—(3) No doubt there is some absorption by these masts and the radiation would be somewhat increased if wooden masts were used.

Ques.—(4) Why does the Sayville station send at 11:30 P. M. and not at 9 P. M.? I have also noticed that it no longer sends press.

Ans.—(4) There are no German ships at present on the high seas and consequently it would be of no advantage to send press matter broadcast. The Sayville station is at present engaged in night communication with Nauen, Germany, at a wave-length of 4,800 meters, and can be heard any time after 9 P. M.

What advantage do you expect to derive by connecting four inductively-coupled receiving tuners in series to one aerial? Connect the four primary windings in series and the entire unit in series with the antenna itself.

* * *

R. J. F., Molalla, Ore.:

The fundamental wave-length of an antenna system for transmitting is reduced by inserting a condenser in series. Generally a condenser of this type has a capacity value of .0004 or .0005 microfarad and consists of four plates, connected in series. Four sheets of glass, 12 by 12 inches, covered with tin-foil 10 by 10 inches, the glass having a thickness of about 1/8 of an inch, will give a capacity of approximately .0004 microfarad.

Glass tubes are feasible for the support of the primary and secondary winding of a receiving tuner as far as insulation is concerned. Generally, however, the coils of receieving tuners are wound on hard rubber tubes. The thickness of the insulating tube will have no effect on the signals, provided the primary and secondary windings are not thereby too widely separated.

* * *

R. B., Milwaukee, Wis., asks:

Ques. (1) Is 1/4-inch glass to be preferred to 1/8-inch glass for the secondary condenser in connection with a 3/4 K. W. Thordason transformer and a rotary spark gap 8 inches in diameter, and how much of either kind should be used?

Ans. (1) Plates of 1/4 of an inch thickness will make a condenser too bulky. We cannot give any definite advice in reply to the remainder of your query, for you have not furnished us with the speed of the rotary gap, the number of points in the disc and the secondary voltage of the transformer. We require this information before we can give a definite answer.

Ques. (2) Is there any way to get rid of static?

Ans. (2) None has so far been devised.

Ques. (3) How can 2 loose couplers be hooked up so as to do very selective tuning, and is it better than one loose coupler?

Ans. (3) In an early article of the series on "How to Conduct a Radio Club," you will find a full reply to this query. A fair method for making use of 2 loose couplers is to employ the interference preventer circuits of Fessenden. However, the results are not so satisfactory as might be expected. The 1911 issue of the "Naval Manual of Wireless Telegraphy" gives the complete circuits of this tuning.

Ques. (4) Can insulators be made out of fibre to be used with a 3/4 K. W. transformer and if so, what size should they be?

Ans. (4) We infer that you intend to use these insulators for the secondary terminals of the transformer, and if so, we strongly advise against it. Use either glazed porcelain or polished high rubber. Fibre absorbs dampness and is wholly unsuitable for high potential work. If high rubber is used and the voltage of your transformer is about 20,000 the bushings should be at least 1 1/4 inches in diameter, with preferably a corrugated surface.

Ques. (5) Which type of aerial (as shown in the enclosed drawings) would you advise me to use?

Ans. (5) We prefer the inverted L flat top aerial shown in drawing No. 1.

G. W. K., Liberty, N. Y., writes:

Will a single wire aerial 500 feet long and 75 feet in height receive wave-lengths of 9,000 meters?

The aerial is too short for wave-lengths of this order. The wire should be at least 1,000 feet in length for efficiency.

In reply to your question concerning a receiving tuner for Glace Bay we advise that you avoid, by all means, winding the secondary in layers. The straight winding is preferable at all times. If you will use 1,500 turns of No. 32 wire for the second winding instead of No. 24, you will not require a double layer for the secondary winding.

A tuner suitable for Glace Bay wave-lengths is out of the question for amateur work. It is far preferable to design 2 separate and distinct tuners. However, if dead end switches were employed, the tuner could be used for amateur work as well as longer wave-lengths.

* * *

E. G., Hill City, Kan.:

Ques. (1) Explain the wiring of the buzzer employed in a radio-goniometer, in which a non-inductive shunt is used across magnet coils.

Ans. (1) The buzzer and battery are merely connected in series with the inductance coil of the wave-meter and the non-inductive shunt is connected across the terminals of the buzzer winding.

Ques. (2) Is there any difference in the oscillations set up in the primary of a "jigger" when the condenser is shunted across the secondary of a transformer and when it is in series with a jigger primary and spark gap across the secondary of a transformer?

Ans. (2) There is practically no difference in the oscillations set up in the oscillation transformer, but such a connection affords a certain degree of protection to the windings of the transformer ;that is to say, the condensers are not so apt to discharge into the windings of the transformer, burning them out.

You will find it rather difficult to work a 1-inch spark coil on a step-down auto-transformer. Spark coils are generally constructed to work on a direct current.

Readers who submit questions to this department will greatly facilitate the work of its editor by not requesting immediate answers. Many questions received do not appear in these columns because they are not of general interest. Every effort is made to give prompt service, but as we usually have on hand for each issue more than 5,000 queries, it is obvious that all cannot receive immediate attention.

National Amateur Wireless Association

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A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

MEMBERS' EQUIPMENT.

1st. CERTIFICATE OF MEMBERSHIP.

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

2nd. AERIAL PENNANT.

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

3rd. MEMBERSHIP PIN.

The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on the preceding page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

4th. LIST OF RADIO STATIONS OF THE WORLD.

Revised Edition just published. See advertisement. Regular 50c edition.

5th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.

Regular 50c edition of this popular book. Members who already have a copy, see concessions below.

6th. HOW TO CONDUCT A RADIO CLUB.

This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.

7th. MONTHLY BULLETIN SERVICE.

It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 18c a copy. The Government list is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere

8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.

THE WIRELESS AGE is the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Membership Equipment, may consider such payment as partial payment of Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. *Coupon subscribers receive no credit or trial orders.* Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through Membership dues a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

INITIATION FEE

An initiation fee of $1.00 is required of all new members to pay for the initial membership equipment, consisting of Nos. 1, 2, 3, 4, and 5.

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The annual dues are to be not more than $2.00. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. How to Conduct a Radio Club or equivalent.

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Charters—Out of the amount paid by each member for annual dues, it is purposed to allow organizations that have become part of the National Amateur Wireless Association a rebate of 50 cents out of each $3.00 for their own treasury—a fund to take care of local expenses. Please note that this is a rebate, not a deduction. In order to qualify for recognition as a unit in the National Amateur Wireless Association, a club must have at least five active members and at least one-quarter of its total membership become members of the National Amateur Wireless Association. Clubs securing a charter will have representation in the National Council; this means that they elect their own delegate and thus secure a voice in the management of the Association and in the planning of its future development and activities.

Clayton E. Clayton, Managing Secretary,
450 4th Ave., New York.

Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.

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Clayton E. Clayton, Managing Secretary,

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I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

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Signature .... Age.............

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Please credit me with $....... paid for.......................

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Index—Volume III.

October, 1915 to September, 1916

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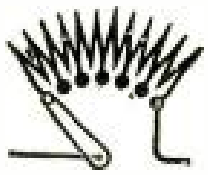

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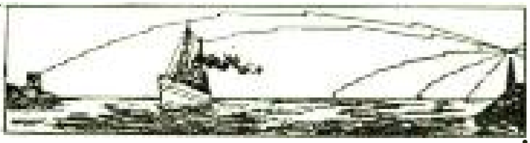

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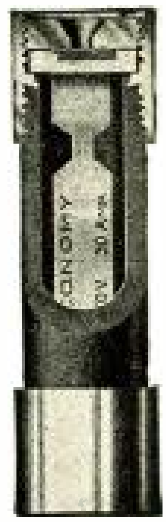

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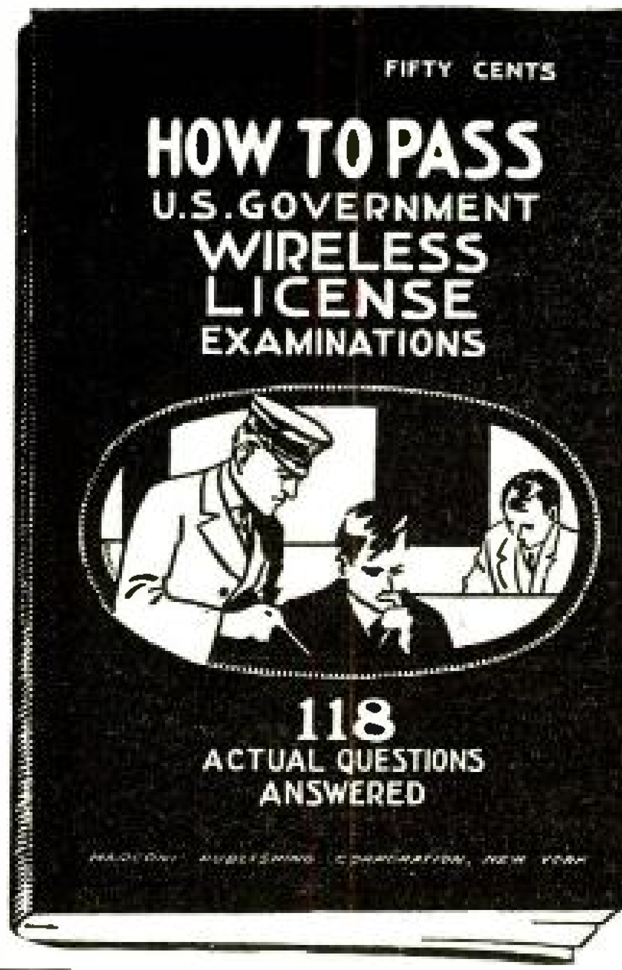

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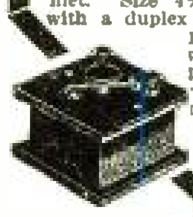

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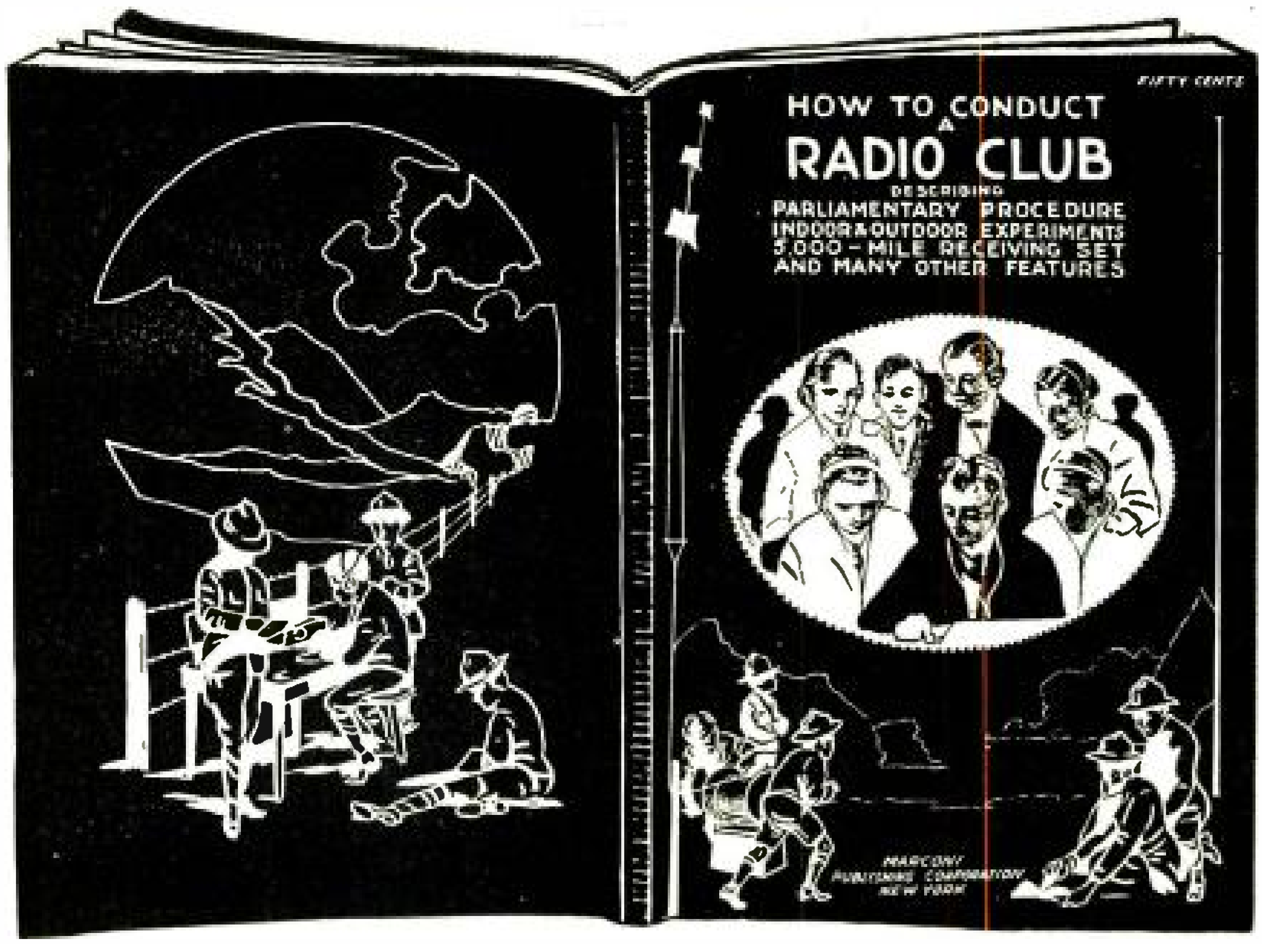

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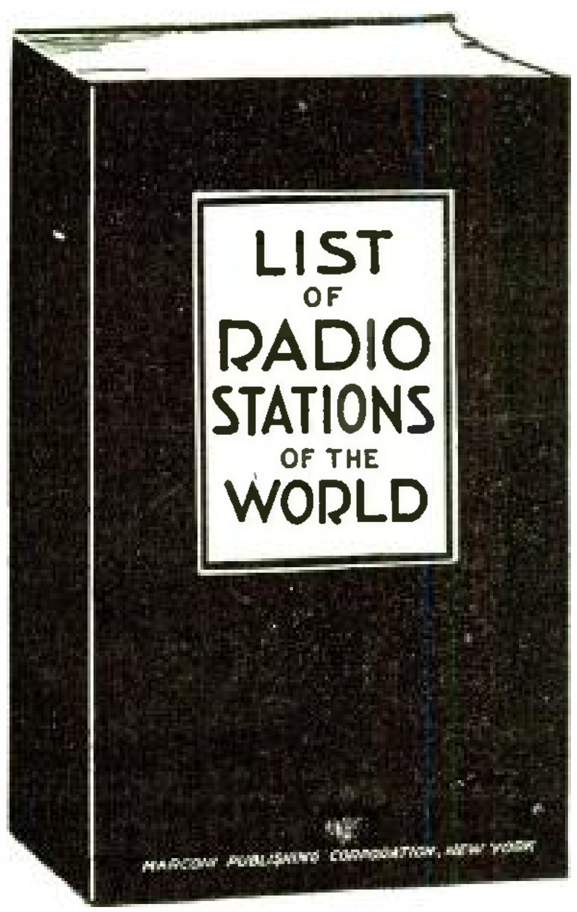

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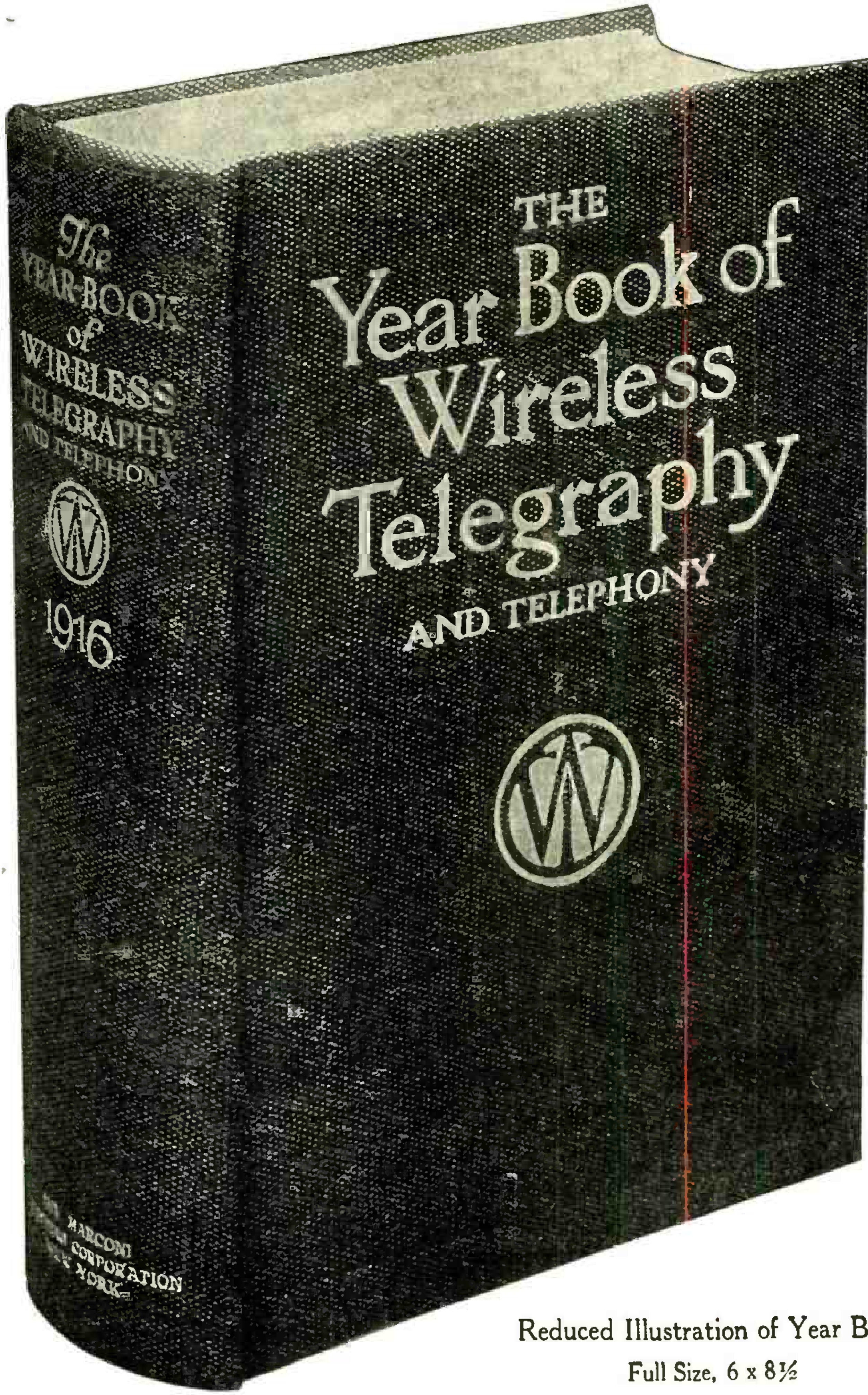

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