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.

DECEMBER, 1916

Hammond's New Radio Boat Completed

AFTER several weeks' delay in hull and machinery construction, the 53-foot radio powerboat H-4, built at City Island for John Hays Hammond, Jr., and the United States Government, reached the Charlestown Navy Yard on October 23, and at last reports was awaiting favorable weather to proceed to her Gloucester destination.

The "ghost ship" was nearly a week coming down Long Island Sound owing to unfavorable weather, and was still further delayed at New London by easterly gales. When the craft started for Gloucester it was estimated that she would be capable of reeling off a 24-knot gait with her 400-horsepower gasoline engines, but an accident caused a hitch in calculations.

As the little craft was passing Race Rock Lighthouse, a lobster buoy or similar piece of flotsam struck the H-4's thin manganese bronze propeller blades. Thereafter the boat was compelled to limp at half speed along the Connecticut and Rhode Island shores, through the Cape Cod Canal and up Cape Cod Bay to Boston, which was finally reached about 7 o'clock Sunday night.

The H-4 is not, as yet, equipped for night piloting, her compass not having been adjusted and electric lights have yet to be installed. The future wireless wonder is practically an unfinished steel hull. Captain Marsters, who was in charge of the boat, deemed it advisable to lie to under the lee of Fort Warren over night, and again started for Gloucester at daybreak. The northeast breeze was kicking up such a high sea outside Boston Lightship that the powerboat cavorted like a bucking broncho and Captain Marsters returned to Boston Harbor, later shifting to the Charlestown Navy Yard, through orders of Mr. Hammond. The boat is moored alongside the old frigate Constitution.

The H-4 has none of Hammond's wireless mechanism installed on board, but it is said several valuable pieces of electrical apparatus have been constructed and are waiting the boat at Gloucester.

According to the description obtainable, the vessel is a radio-dynamic torpedo craft and is a practical development for army or navy use of the experimental vessels which for years Mr. Hammond has had in operation off his home at Glaucester, Mass., the courses of which were controlled by wireless from a shore station. The means for transmitting power to drive this craft as it has been described by Mr. Hammond is: "A wireless station of special design is located at a point where it will be indestructible or out of range of the fire of the enemy. Then that is connected by land lines to a number of observers situated in concrete turrets along the coast. Each of these observers is enabled through his wire connection to operate a wireless transmitter at the station so as to send out energy to control one torpedo (or vessel). A dozen or more torpedoes may be controlled simultaneously from one station, but each observer will control one. Under the system which we have worked out for some years at Gloucester the accuracy of control is such that we are enabled to strike a bamboo rod one inch in diameter, standing upright, ten out of fifteen times at a distance of three and one-half miles."

With regard to possible outside interference in the way of wireless energy coming from the enemy, Mr. Hammond said some time ago: "I have evolved a system which, when there is interference present in the way of wireless energy coming from the enemy, will cause the torpedo (or vessel) to turn around and face that source of energy and move toward it. That has been demonstrated experimentally."

The new vessel, painted in war gray, with H-4, Gloucester, on her transom, is 50 feet long, with a beam of 10 feet and a draught of less than three feet, while her main power plant consists of a 12-cylindered Van Blerck motor that develops 450 horsepower, at 1,400 r.p.m. She is built of 10 and 12 gauge steel, has three water tight bulkheads and a steel conning tower, with a steel trunk aft, over the maneuvering apparatus. She has two rudders, and has clamps on both sides, at the bow, apparently to hold a torpedo. In her trial it was evident that the motor was not tuned up to more than 900 r.p.m., but she attained a speed of more than 25 miles an hour.

Petty officers and members of the crew of the battleship Michigan declare that John Hays Hammond, Jr., inventor of the unmanned wireless boat, narrowly escaped being killed or injured when a 12-inch gun was blown to pieces during experimental gun practice on September 20th. These assertions were made while a board of inquiry, ordered by Secretary Daniels, was making preliminary arrangements for an investigation.

Yeoman Robert W. Cooper, of Baltimore, was struck by a fragment of the shattered gun and suffered a compound fracture of the left arm. Extensive structural damage was done, it is said, to the big battleship.

Men of the crew said a huge fragment of the gun carried away a section of the bridge close to where Mr. Hammond and several officers of the ship were standing. They had gone to the bridge to watch the results of the experimental shot, and the jackies call their escape remarkable.

The crew and petty officers said that the most powerful explosive known—twenty times more powerful than nitroglycerine and said to have been invented by Hudson Maxim—was used in the experiment. They asserted that instead of the shell containing this powerful charge sailing off in the direction of the target, the old monitor Miantonomoh, 2,000 yards away, and exploding after it had penetrated the steel hull of the monitor, it exploded within the gun, shattering the entire 25-foot section that protruded from the turret.

Had the gun burst near the breech, it is asserted the twelve men in the turret would have been blown to pieces.

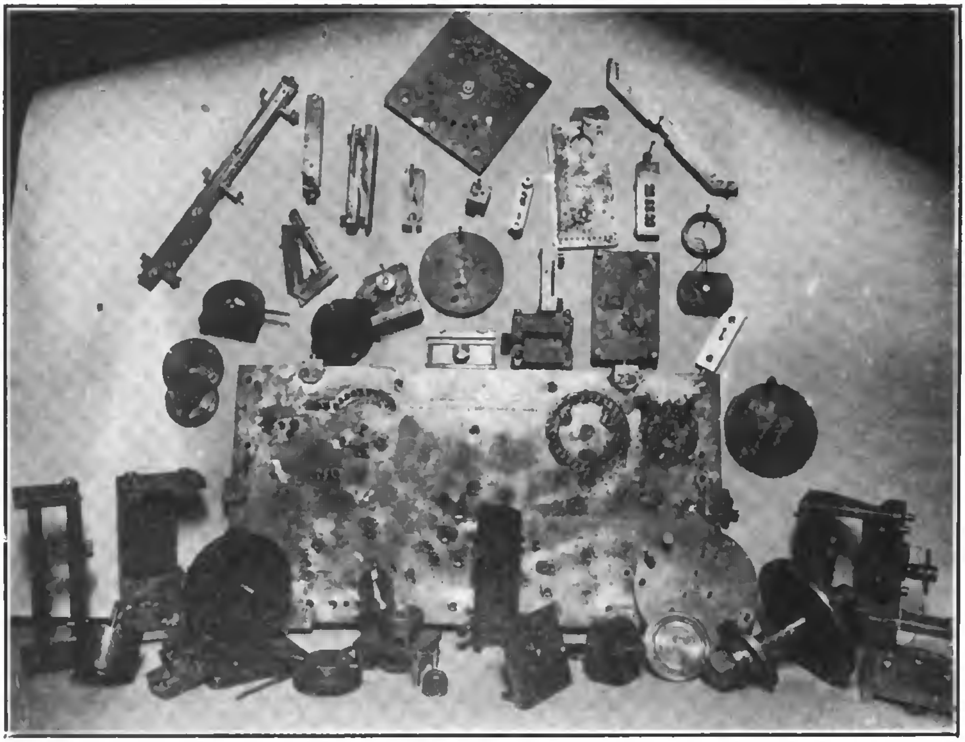
One portion of the big gun was blown through the main deck on the port side. It passed through a bulkhead, whisked through the galley where several men were at work, and finally wedged in a ventilator leading to the fire room. Another piece ripped through the after fire control mast, brought the wireless clattering from aloft and dropped on the deck.

NATIONAL ELECTRIC SIGNALING CO. AGAINST ATLANTIC COMMUNICATION CO.

A suit of the National Electric Signaling Company against the Atlantic Communication Company has been on trial before Judge Julius M. Mayer in the United States District Court, New York City, for several weeks past. This suit alleges patent infringement and involves a sine wave generator of radio frequency directly in the antenna. The proof of infringement involves a transformer between the dynamo and the aerial. Among those called as witnesses are John Stone Stone, John L. Hogan, Jr., Nikola Tesla, Professor Michael I. Pupin, Professor J. Zenneck, E. F. W. Alexanderson and other men well known in radio work.

The suit of the National Electric Signaling Company against the Atlantic Communication Company, for alleged patent infringement involving the heterodyne system of reception, will be heard before Judge Mayer in December.

The control of the installation of wireless on French mercantile ships has been placed in the hands of a commission of nine, who will act in conjunction with delegates of the French Navy.



The assortment of jigs, fixtures, punches and dies necessary to low cost manufacture of one type of receiving tuner. There are similar tools for all other apparatus

Making Wireless Sets

A Visit to the Marconi Factory

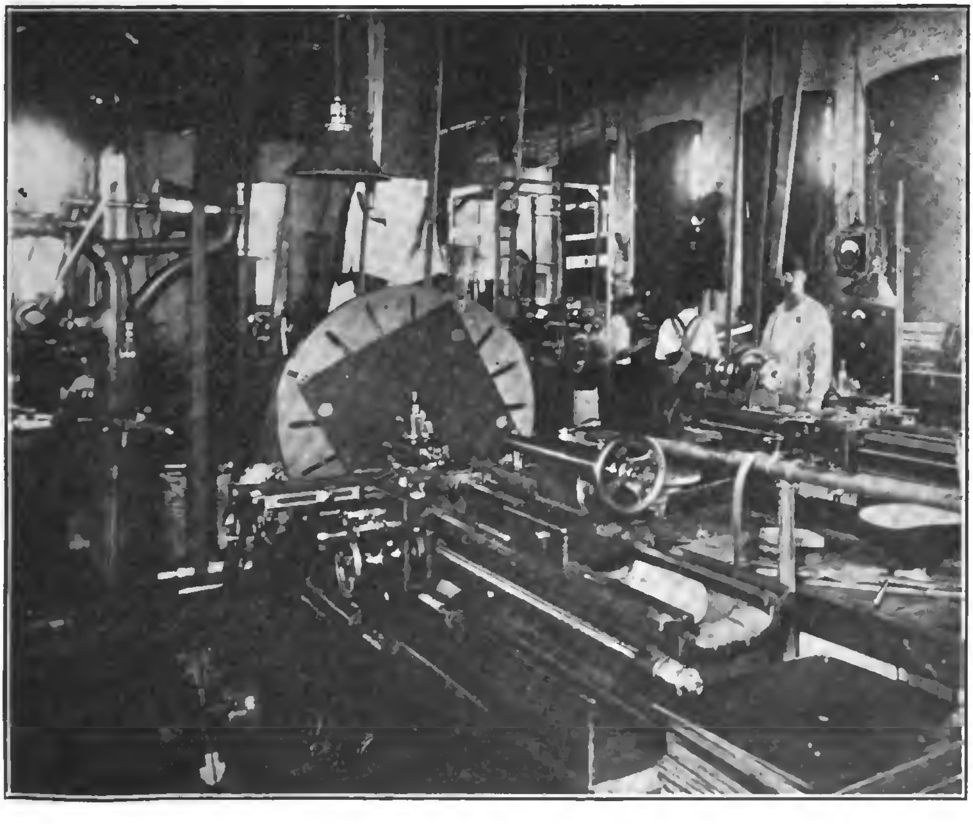
By James W. Valandi

MY first interest in wireless and its attendant mysteries dates back five years, but my first knowledge of how the sets which carry the burden of the world's ether-waved intelligence are made, is but as many days old. I had always wanted to see the wheels go 'round, it seems to me, and from the beginning of my interest in the art it had been my intention to visit the factory where sets for ship and store stations are made and learn a little from observation. I have now seen, step by step, how Marconi sets are machined and assembled, and the processes of manufacture disclosed to me have left the distinct impression of thoroughness that parallels the activities of the entire art, experimental and commercial, and accounts for the rapid progress of radio communication throughout the entire civilized world.

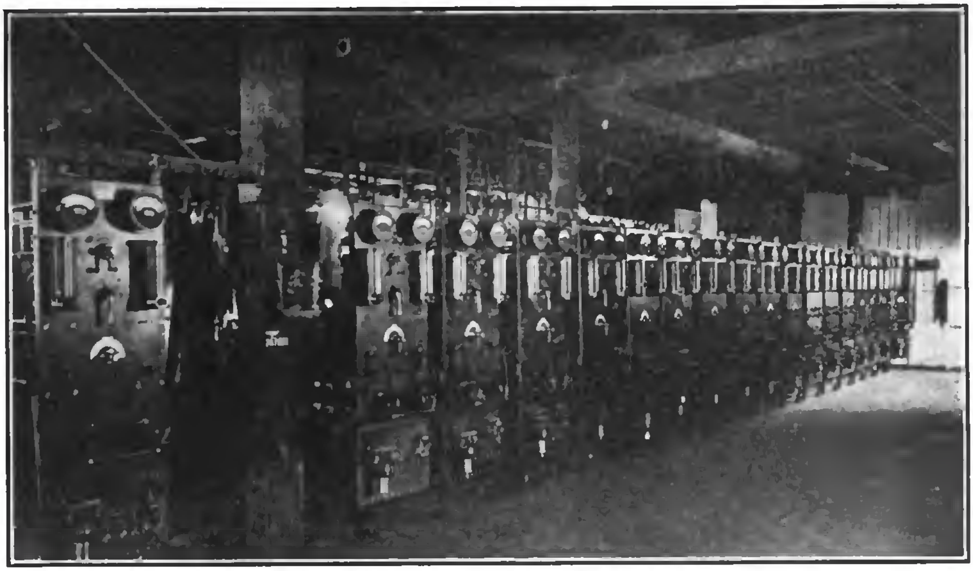
Efficiency — accuracy with speed, and progress without friction—are the dominant notes in the working of the Marconi plant at Aldene, N. J.; men and machines move with the same directness of purpose and to a common end. On all sides may be noted the value of standardization of processes and apparatus, even the raw material which figuratively flows in at one end of the hopper has the appearance of identical sameness that is so striking in an observation of the finished product as it comes rolling through the shipping department's wide open doors and on to the waiting freight car.

Just as there have been many changes in the art itself, so have industrial revolutions been effected in the creation of apparatus for everyday use. Efficiency engineering and systematizing of every step in manufacturing and business administration have left their mark in all departments of the 20,000-square foot area of this birthplace of life-saving and money conserving instruments. Cost-keeping systems and leak-proof requisition forms save many thousands of dollars annually, explained the courteous official who showed me through. "We are down to bed-rock business now," he said. "There is no guesswork in this plant. Every step is planned in advance by the executive heads and we are very proud of the fact that our overhead expense does not have to take into account that insidious time thief best described by the mechanical term, 'lost motion.' This is very gratifying —and surprising, too—in an infant industry."

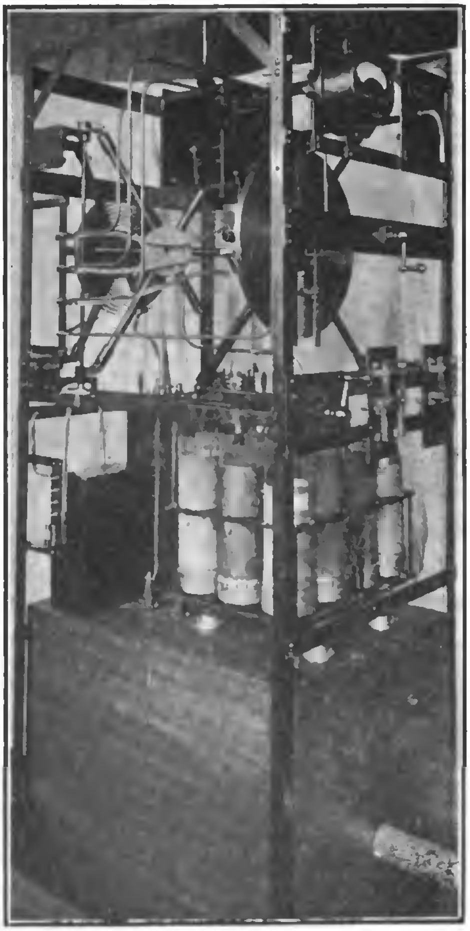
It was a very healthy and thriving infant from all appearances. The place hummed with activity from foundation to rafters; every man was busy. Those at the machines followed the task in hand with that surety of action which makes the skilled mechanic at work one of the most fascinating sights on earth. Men moved here and there, but nobody ran. There was no hesitation; not once did I see a single individual look about him in perplexity, bewilderment, anxiety or impatience; it was evident that each one knew exactly where an article wanted was to be found and, when occasion demanded something, the worker walked unerringly toward the proper location. My visit lasted several hours and the only inquiries made during that time about any phase of the work, as near as my trained sense of observation could detect, came from me as a curious spectator. My investigations embraced



One of the special lathes fitted to cut spirals. This machine was designed in the factory as there was nothing in the market to perform the function required at the speed desired.



Long rows of completed panel sets stood ready for inspection and test



... 2 k.w. non-synchronous set

workmen well over a hundred in number, and in every case they seemed as much a part of the organization as the cogs in the machinery they directed. I inquired the extent of the operations laid out before me. The "principal" work in hand, the superintendent explained, embraced the construction of 400 or more complete ship sets, numerous shore station equipment and countless accessories such as tuners, wave meters and direction finders. "Rush deliveries—practically all of them," he added with an easy air of assurance that the work would be done on time.

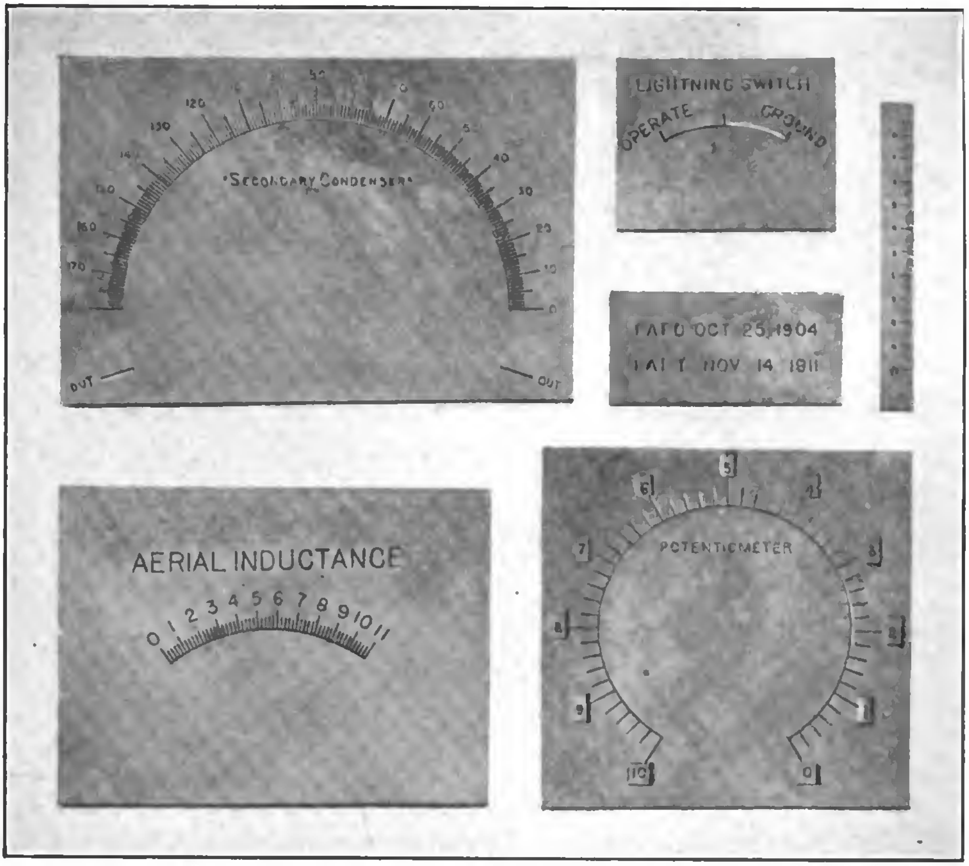
The figures astonished me. The quantities of wireless apparatus which this man had mentioned so casually seemed to me sufficient to supply the needs of the whole wireless universe at one fell swoop. I asked where they were all going. "A few hundred sets will be shipped abroad, England and Italy have sent us some orders lately," my informant explained, "but there are some sizable orders from the United States Government, too, and we are always making better equipment for our own use. The American Marconi Company is strong on standardization of apparatus, now that the art has advanced sufficiently to make this practicable, and every ship under its control gets the latest and best type of equipment as fast as we can turn them out here."

An interesting detail caught my eye as we strolled through the works. Men with ladders and planks were distributed about the machine shop on the second floor. They were preparing, so I was told, to whiten the whole place, the application of paint with high refracting qualities and overhead distribution lighting by nitrogen lamps, being the latest aid to the betterment of working conditions. Nothing was to be stopped, or even retarded, by reason of the improvement; little things like this were constantly executed without interference to routine. Constant changes for the better were going on imperceptibly, year in and year out, said Superintendent George Hayes; new tools had recently been added, better communication between departments was then being effected, dumb-waiter lifts to convey small parts were being installed, in another week a new 50 h.p. high pressure boiler was to be added, and a chucking and turning machine, entirely automatic and able to do the work of four ordinary engine lathes, had just been purchased. Time and labor-saving devices that kept down the cost paid for themselves in savings very quickly.

The L-shaped building has been arranged to secure the greatest efficiency and economy of space; all of the departments have light from all sides and are laid out on what might be termed a gravity basis; that is, the work of fashioning the apparatus begins on the second floor, where machine shop, tool rooms and research laboratory are located; finished work then goes down to the floor below to assembly and testing rooms, thence out to the railroad siding at the door of the shipping room.

Making the fine recording scales and dials of the wireless instruments on a machine which operates on the pantograph principle. Various forms of engraving tools are used, according to the fineness or coarseness of the lines

The machine shop is a fascinating spot. A hundred different types and styles of machines are constantly revolving, grinding, turning and shaping the numberless small parts that are later to be assembled into apparatus for sending and receiving



Models from which graduating scale plates are cut by the pantograph machine; sometimes the models are several times larger than the work and, in simple work, are the same size, or even smaller

wireless messages. A skilled foreman of wide experience heads this department and directs the operation of a comprehensive checking system that apparently leaves nothing to chance. A section is given over to the milling machines, upon which are cut, shaped and formed the intricate parts of irregular form and design. Then there is a long row of precision lathes designed to handle the parts which require almost microscopically accurate machining; mechanics specially picked for their skill are entrusted with this delicate work and accuracy to the thousandth part of an inch is required of them at all times.

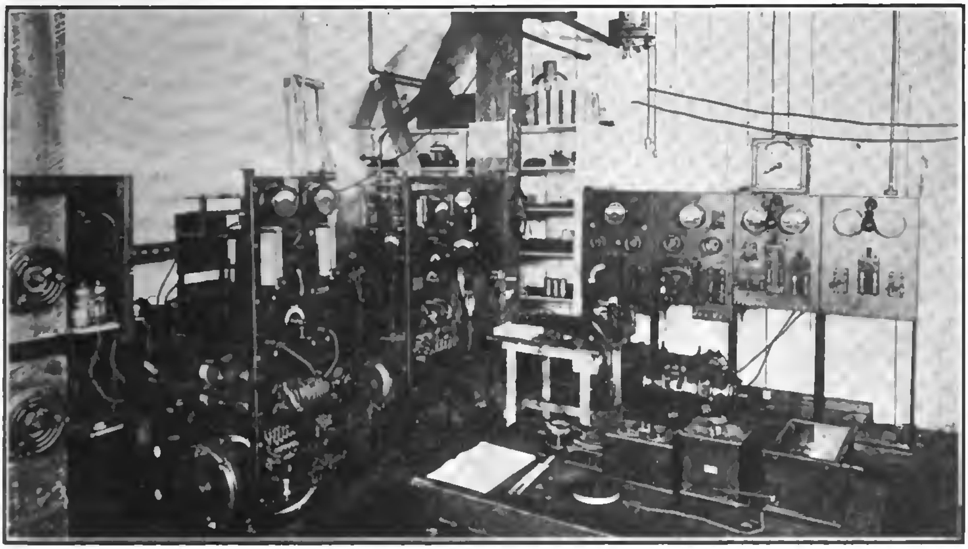
On the floor below can be seen transformers in all stages of construction. A visit here would prove a revelation to any power or illuminating engineer who had never penetrated the mysteries of transformers used in wireless transmission of signals. Thousands of feet of very fine wire are wound into the "pancake" coils, then taped with linen and impregnated with a high-insulating compound under vacuum in apparatus specially designed for Marconi use. Baking in a special oven follows, and several hours elapse before the coils emerge from the high temperature electrically and mechanically strong.

In another section of the factory is a room that reminds one of nothing so much as the shop of a manufacturer of finely engraved jewelry; here are made the fine recording scales and dials of the wireless instruments.

For use in engraving various forms of scales used on instruments of its manufacture, the Marconi Company employs machines operating on the pantograph sated on plates or dials composed of a black compound resembling hard rubber, and in order to make the graduations as easily read as possible, zinc oxide mixed with a sufficient quantity of paraffine to give the required consistency is rubbed into the graduation marks after they are cut on the machines. This mixture hardens through exposure to the air, giving a high degree of durability, and as it affords a combination of white graduations on a black background, the scales are very easily read. The illustrations show an example of one of these graduated plates and graduating machines producing work of this kind.

These machines operate on the pantograph principle. A model is made in which graduations are cut to correspond with required graduations on the work, and in use this model is set up on a holder on the machine so that a tracer point can run over it. This tracer is secured to an extension of one arm of the pantograph and the engraving tool is supported at the opposite side of the pantograph linkage. Various forms of engraving tools are used according to the nature of the work; where fine lines are to be cut the tool is generally in the form of a pointed "cannon drill," while for heavier classes of work end mills of various forms are employed.

The size of model used also varies according to the character of the work. In cases where fine graduating is to be cut over a relatively small area, it is desirable to make the model several times larger than the work, owing to greater convenience in making the model, while in the case of simple designs the model may be of the same size or even smaller than that of the work. Adjustment of the pantograph linkage is provided in order to obtain any required ratio between size of the model and that of the work produced from it. The models are made of brass and it will be evident that they can be conveniently cut on a milling machine equipped with a circular attachment.



A portion of the test room where the faultless construction of each panel set is verified. It is in this department that the future radio engineer starts on his three-year course of training

In operation of these graduating machines the work is clamped to the main table and the model is strapped down on a copy table. The tracer point is drawn over successive graduations on the model and this causes the cutter to automatically follow corresponding graduations on the work, the relative size of work and model being controlled by setting the pantograph mechanism as previously mentioned. Operation of the machine is semi-automatic; it is necessary only for the operator to draw the tracer point over successive graduations on the model, and as a result work can be done very rapidly.

There are a great many cases where circles have to be divided into degrees, examples of this kind being shown on scales marked "Primary Condenser" and "Secondary Condenser." In order to avoid the necessity of having to make special models for this purpose, the expedient has been adopted of producing a universal fixture. This fixture is secured to the work table and has a pivoted disk with 360 equally spaced teeth cut in its periphery. On the model table there is a simple plate with graduations cut in it of the required lengths for the scale to be produced on the work. The work is strapped to the top of the pivoted plate of the fixture and indexed space after space by means of teeth in the periphery of this plate. After each setting of the work has been made, the tracer point is drawn over the graduation mark on the model, which which governs the length of graduations cut on the work. This fixture can be used for graduating any scales requiring circles or parts of circles to be divided into degrees.

When I had viewed the various stages of manufacturing a wireless set I was naturally impatient to reach what might be termed the verification point, the testing room, in other words. This department's location I found immediately preceded that of the shipping department, the last stop on the way out. Long rows of complete sets ready for installation on board ship stood ready for inspection and test. Those I was most interested in were the 2 k. w. panel sets, the equipment which marks the first real standardization of apparatus known to the wireless field. My eye took in an aisle of these and I made a quick count—thirty-six powerful equipments, good for ranges up to 500 miles, each one absolutely identical in appearance with those alongside it, were in transit through the inspecting and testing room. I gave a fleeting thought to industrial preparedness; it was a very comfortable feeling to realize that this important industry had grown to such proportions, almost over night.

Operations in the test room further confirmed my confidence; it was evident that no mistakes were made in these equipments. There were two panel sets

An instance of the unusual experiments in a day's work. An automobile used to try out current generation by aero motor for an aeroplane wireless set

undergoing test, one of 2 k. w. power and another ½ k. w. The equipment had been set up complete, just as is done on shipboard. Actual working conditions were cleverly counterfeited in the six-hour, full load test; readings were taken on all circuits, the sets started and stopped at frequent intervals to insure good working of all parts, the temperature was taken regularly of all current-carrying parts, particular attention being given to the bearings and armature field and wherever there might be a tendency to overheat. It was all very thorough, for after the completion of the tests the equipment passes on for a general inspection of its workmanship, under the eyes of a man carefully chosen and assigned chiefly to this job. Not until it has been passed by him, is the equipment ready for delivery.

There is a human interest appeal in this department, for it is in the testing room that the future radio engineer begins his three-year course of training. Under the supervision of a chief qualified by wide knowledge of design and operation of wireless instruments, the aspirant for engineering recognition is required to test not only transmitters, but intricate apparatus such as transformers, receiving panels, telephones, wavemeters, motors and motor generators, in fact, all of the apparatus manufactured in a plant that is running to full capacity all the time.

The experience thus gained is of the most practical kind. For example, in the testing of a tuner, a special standard instrument and one of its own type is set beside the new arrival. Through the use of specially designed transmitting apparatus wave-lengths over the entire range of the tuner are emitted and, before it can be passed, the new instrument must respond to every indication on the scale.

On every hand there were evidences of how well worth while it is for a young man to rise up in this new profession. Problems absolutely new are solved every day in the year, and once a position on the laboratory staff has been attained, there is seemingly no end to the opportunities to exercise ingenuity in the creation of apparatus that is making the technical history of the day. As an instance of the unusual experiments that are carried on, I call to mind my surprise at noting, as I was about to leave, a party of factory engineers drive up in an automobile. On a frame suspended from supports that once had held a windshield was a miniature aeroplane propellor attached a generator. At a speed of fifty-five miles an hour this automobile had been dashing over the New Jersey roads for the greater part of the afternoon, the force of the wind driving the propeller on the generator and it in turn delivering energy to apparatus in the rear of the car to a maximum capacity of 1 k. w. It was a test—a successful one, incidentally—of the proposition to generate current by aero motor for an aeroplane wireless set then in course of construction. Incidents of this kind are a daily occurrence; there is always something new to be learned, some new problem to be brought to a speedy and satisfactory solution.

It didn't take me long to understand how the men themselves felt about their

(Continued on page 199)

A view of the Marconi plant at Aldene, N. J., taken from the elevated tracks of the railroad, showing the west side of the factory building, a portion of the laboratory, oil house, tank for sprinkler system, one of the wireless towers and the surrounding grounds

Wireless Ideas by the Thousands

Something About the Applications Filed in the United States Patent Office

By J. B. Brady

A typewriter attachment which translates the wireless code and sets it down on paper, whether or not the receiving operator is familiar with the signals; an apparatus for recording wireless messages when the operator is absent from the set; these and thousands of other devices attesting the inventive activities of wireless men are indexed in the Radiant Energy Division of the United States Patent Office in Washington.

The rapid growth of wireless has greatly increased the work in the Patent Office, three examiners being engaged in analyzing the ideas of those who file applications. On these men devolves the responsibility of granting and denying applications for patents.

The public is permitted to examine the index of all wireless telegraphy and telephony patents. A search through these patents is interesting as well as profitable, for here are found ideas that are unknown in the commercial field and can be experimentally developed by the amateur.

The broad class of Radiant Energy is divided into a number of subclasses to include the various apparatus and systems. Patents granted for instruments which have a similarity of function are placed together in one subclass. Those granted for apparatus disclosing a particular structure are also classified together in one subdivision. In making a preliminary examination of the records, which is the first step taken in determining the question of granting a patent, it is necessary to analyze the several subclasses and select a division which appears to be pertinent to the function or the structure of the new instrument.

The official classification of Radiant Energy is substantially as follows:

CLASS 250—RADIANT ENERGY

Subclasses

41. Condensers.
1. Miscellaneous.
36. Oscillation circuits—
37. Disruptive discharges—
38. Spark gap.
34 Special ray—
35. Tubes.
2. Teledynamic—
16. Apparatus—
33. Antennæ,
20. Receivers—
21. Detectors—
22. Electro-dynamic,
23. Electrolytic,
27. Gaseous element,
28. Liquid element—
29. Capillary,
24. Magnetic,
30. Solid element—
31. Crystal,
32. Granular,
25. Thermal,
26. Thermo-electric,

Teledynamic—

Apparatus—

17. Transmitters—
19. Controllers,
18. Sustained oscillation,
3. Earth transmission—
5. Telegraphy,
4. Telephony,
8. Radio-telegraphy—
13. Complete station,
10. Co-operative wave,
11. Directive,
12. Group frequency,
9. Multiplex,
14. Portable sets,
15. Repeaters,
6. Radio-telephony—
7. By light waves.

40. Tuners.
39. Wave-meters.

The beginner in radio will appreciate the typewriter attachment to translate and set down on paper the wireless signals. The patent covering this appliance is classified in subdivision of "Miscellaneous." There are two main levers attached to the typewriter, one to be depressed for the dots, and the other to be operated upon the receipt of dashes. At the end of the code word the shift key of the typewriter is depressed, actuating all of the type which has been locked into place by means of the dot-and-dash levers.

The records show that early in 1913 an apparatus for recording a wireless message when the operator is away from the apparatus, was patented. Two sensitive relays are connected in series at the point usually occupied by the telephone receivers in the ordinary receiving set. One relay controls a circuit through a battery and the magnetic clutch positioned upon the motor of a phonograph. The receipt of a signal automatically sets the phonograph cylinder in revolution by means of the magnetic clutch. The second sensitive relay acts as an intensifier through a telephone receiver circuit, so that the sound vibration of the signal in the receiver is strong enough to be reproduced by the sound box of the phonograph to which the receiver is coupled. Hence the wireless wave automatically sets the phonograph into operation and permits a record of the message to be made.

A rotary spark gap which is entirely non heating has been designed. The rotor consists of a spirally grooved cylinder which rotates between two flat bars positioned adjacent the length of the cylinder. A new sparking surface is continually presented to the fixed electrodes as the cylinder revolves, the sparks beginning at one end of the cylinder and traveling throughout the length thereof between the spiral groove and the stationary electrodes.

One patent suggests a stationary spark gap in the form of two cones, one cone within the other. The idea is that a large surface is presented for the sparks. The inventor claims that in the ordinary spark gap the discharge occurs at substantially the same points, forming minute globules of metal which shorten the sparking distance between the surfaces. Thus the resistance is lowered, and the condenser which is to discharge its energy across the spark gap is discharged at a lower capacity; hence the resonance of the primary circuit is materially effected. The new cone spark gap does not have this undesirable feature.

Another patent of considerable interest is one recently issued on a wireless safety ship signal. A multiple wave receiving antenna, comprising a series of long induction coils vertically disposed about a circle at eight points of the compass, is provided. Each induction coil is made up of the ordinary antenna wire, the primary of which is wound close together, one end thereof being connected to the earth. Each secondary coil which surrounds the primary is connected through a coherer circuit with an electro-magnet. The magnets connected to each of the eight induction coil circuits are positioned in an indicator box around a sensitive compass. The compass needle is deflected by the magnet coupled in the induction coil circuit which lies in the most direct line with the ship transmitting a signal of distress.

Several inventors have been working to perfect means whereby the arc of the wireless telephone may be made steady. The simplest solution of the problem is apparently to surround the arc with an atmosphere of alcohol. This is accomplished by placing the arc electrodes in a casing upon an alcohol tank. A wick passes from the alcohol tank to a point very near the arc and feeds alcohol by capillary attraction into the arc casing where it is vaporized by the heat of the discharge. The carbon from the denatured alcohol then deposits upon the arc electrode as it wears down, thus preventing any unevenness in note as a result of a variation in size of the arc. In some devices of this nature the alcohol drips between the arc electrodes from a pine connected with a supply tank.

The records show that there has been a constant tendency on the part of inventors to combine two or more instruments into one device. A combined tuning coil and condenser has been developed. The tuning coil is wound upon a semi-circular core which fits within the circular casing of a rotary variable condenser between the movable plates and the wall of the casing. The arm which rotates the condenser plates carries a

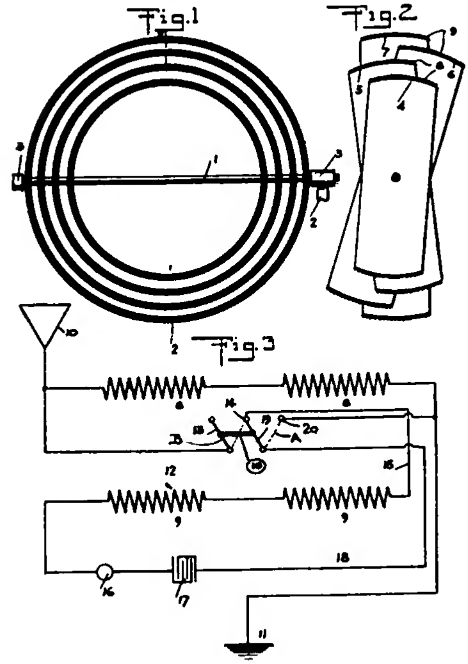


Fig. 1

slider engaging the coil. Another arm pivoted at the condenser shaft provides the second slider for the adjustment of the tuning inductance. Thus a means is presented for adjusting the capacity and the inductance of the receiving circuit in unison, and at the same time the condenser and double slide tuning coil are made into one compact unit. A crystal of silicon is carried in the ordinary spring-pressed tuning coil slider, a sensitive point upon the crystal engaging the turns of wire upon the tuning coil to serve as a rectifier and as an inductance adjuster.

A tuning coil entirely without mechanical or electrical variation in the length of winding has been devised. Four coils wound upon tubes about 1½ inches wide are mounted in concentric relation to each other; three of the coils being revoluble about one inner fixed coil. The two outside windings, 9 and 9, (Figure 1), constitute the secondary of a loose coupler, while the two coils within, 8, 8, make up the primary unit. The coils are connected as indicated in the drawing and permit the reception of a broad wave with switch 10 in position A, or the use of a loose couple circuit with switch 10 in position B. To operate, the primary coils are first adjusted relative to each other to the particular wavelength desired. The angle between the coils controls the number of active inductive turns. The secondary units are next adjusted with relation to each other, and then the pair as a unit rotated to obtain the coupling desired. The new loose coupler has many features not heretofore used in practice.

There have been no patents issued upon any type of tuning coil since the famous Pickard mechanically-fixed winding or contact type of coupler was invented.

The tendency in the vacuum valve field has been to discover means to increase the flow of ions in the partially exhausted bulb. Filaments have been invented by the score to increase the degree of ionization of the gaseous medium of the valve. The number of plate and grid elements have been increased by some inventors with the idea of intensifying the passage of signal pulsations through the sensitive ionized gas. One particular patent shows the arrangement of four sets of these electrodes about the ionizing filament.

The latest Hudson filament was patented in August. Hudson explains that the vacuum valve filament has two functions. First, it must heat the medium within the bulb and thus render the space sensitive to any pulsations; second, it must throw off ions. Some materials are good heating elements, but are not effective in throwing off ions. The filaments which do throw off a large number of ions usually erode quickly and burn out from the continued heat. The new filament invented by Hudson consists of two separate wires, tungsten, especially durable for heating, and tantalum, which possesses to a remarkable degree the property of throwing off the ions. The excellent properties of each of these wires are obtained by winding the tantalum wire around the tungsten heating filament.

In a vacuum valve recently patented a small coil is placed around the bulb of the vacuum valve and energized by means of a local battery circuit through an adjustable resistance. The inventor uses this arrangement in preference to the well known magnet usually placed adjacent to the plate electrode of the valve, and says the coil renders the vacuum valve far more sensitive.

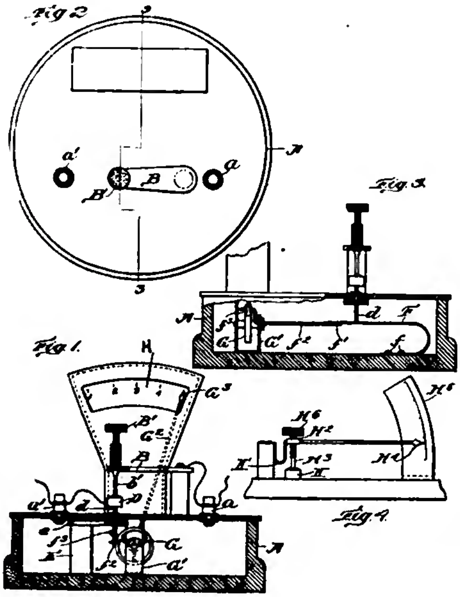


Fig. 2

The art of detectors is quite large. Figure 2 shows an interesting device used in connection with the usual crystal detector to indicate the amount of pressure placed upon the sensitive mineral by the fine wire contact. The usual crystal cup, D, is secured upon rod *d* which is adapted to indirectly actuate the indicating hand, G^3, over the scale H. By this arrangement the operator determines the pressure which places the detector in its most sensitive condition and at any time may bring the instrument again into operation if, through accident, the detector has been thrown out of adjustment. It is only necessary to adjust the contact to the proper degree of tension and search the surface of the mineral for a sensitive portion.

It has been predicted that at some future time the power companies will stretch great antennae over their plants and distribute electric current to subscribers without the aid of wires. Such systems have already been developed in the patent records. The negative pole of a direct current generator is connected with the antenna and a circuit made through a condenser from the positive pole of the generator to the ground. A series of spark gaps are placed between the aerial and the ground. The aerial is continuously charged in one direction only by the generator and is discharged by means of rapid unindirectional impulses through the plurality of spark gaps, causing the transference of energy through space to a considerable distance. The energy transmitted is in the form of a direct current and will actuate an indicating device at the receiving end without the aid of any form of detector. Thus the system is adaptable for signaling as well as for high-power transmission.

One inventor has reduced to practice a system of duplex wireless which has

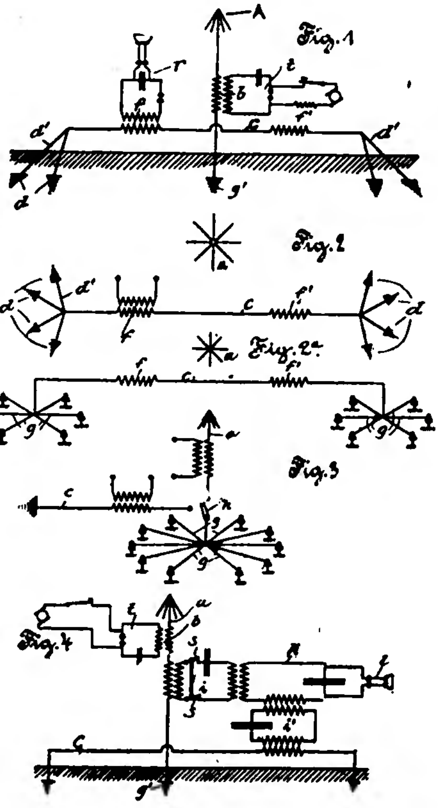


Fig. 3

gained favor in commercial use. He claims that for best efficiency in transmitting the antenna should be of large vertical extent, while for receiving the antenna should be horizontal and close to the ground.

The aerials are arranged as indicated in Figure 3. *A* is an umbrella shaped antenna for transmitting. Arranged symmetrically below this is the low horizontal aerial *C*, connected for receiving. Energy radiated from aerial *A* will not react with antenna C and hence this system permits transmitting and receiving simultaneously at the one station. It is advantageous to employ both aerials for receiving the oscillations when the station is not operating the transmitter.

Such are a few of the inventions of wireless men as found in the Patent Office. I believe that they contain suggestions from which the readers of THE WIRELESS AGE can develop new and valuable ideas.

THE BATTLE OF THE WIRELESS

Buzz, buzz, buzz, comes through the head phones. It is the Paris wireless station making a wireless charge against some statement of the central powers. Suddenly there are other sharp reports. "Tick-tick, Tick;" "Tick, Tick, Tick-tick." The Berlin station is replying to the attack. A few minutes later the London Marconi tower breaks in. Rome, too, enters, then Athens and Constantinople.

Within a few minutes the wireless battle is on. The allies and the central powers are fighting in the air. Charge after charge is made. The "tick-ticks" come as quick and sharp as "drumfire" at the front. It is between 3 and 4 o'clock in the afternoon and the battle has reached its height.

This brief description of a wireless battle was written on the battlefield in southern Hungary. These battles between the belligerent wireless stations to one who could understand telegraphy would be the most thrilling and fascinating of any battles in the war.

They are interesting because the weapons are bloodless, because the cannon are the wireless stations and because the shots are waves of sound, sent through the air.

Just as the men on the battlefields in France and Russia are fighting for victory, so the wireless stations are fighting for the same, but their immediate object is to reach the neutrals. Because France and Germany and Germany and England are at war these stations cannot communicate with each other. They must fight the air currents to reach New York. All their attacks are directed to neutrals, but in so directing them the attacks encircle the globe.

Day and night some wireless station is battling. But at three o'clock in the afternoons, European time, the greatest battles are fought, for at that time the official war announcements of the contending armies are announced. These are the ammunition for the battles. Berlin opens the attack with a statement regarding the fighting on the west and east fronts.

The Eiffel tower in Paris replies with a counter attack—the official Paris announcement. Later Vienna comes in, then Rome, Constantinople and London.

A correspondent visited a wireless station in the field where a lieutenant explained how a plunger in one cylinder changed the radius of the wireless sound so that Paris could be heard and a change in the plug made it possible to hear London. Another change brought Constantinople to the auditor's ears, and other changes took him to the battlefields of Athens and Rome.

Messrs. Cutting and Washington, two Harvard men, have evolved the idea of a brass helmet to be worn by wireless operators in flying machines for protection against the noise made by the engines and propellers during the receipt of messages. The helmet is designed so as to cover the head of the operator.

The Mutiny On the Santana

A Christmas Fiction Story

By Magda Leigh

THEY were talking in undertones, their voices filled with deep emotion.

"No tree for the little fellows! No toys! No Santa Claus! The Old Man says they're old enough to know there isn't any Santa Claus—and we've got to cut out the foolishness this year."

McGann, wireless operator, tapped the deck emphatically with the soles of his shoes as he talked.

"No Santy!" echoed the First Mate. "And you remember last year how the little shaver yelled for joy when he saw that hobby horse I made? Remember the way he used to drive Katy-Belle for months with the reins Olsen made him out of the old signal halyards?"

"And the doll I fixed up out of that old tarpaulin for Katy-Belle?" McGann broke in eagerly. "Her mother says she still turns in with it—and it's all rust stains and coal dust!"

"To think of the Skipper acting that way with his wife and kids along!" The First Mate shook his head dismally. "It's seven years since I was home in Brooklyn with the wife and kids for Christmas. I send 'em things from wherever we are—but that's not seeing their faces when they open the parcels!"

"And him with his kids right here wanting to cut it out!" and the wireless man sighed feelingly.

At that moment there came the sound of shrill voices from the starboard side of the deck house, closely followed by the sound of galloping little feet on the iron deck.

Katy-Belle, four years old and round as a butter-ball, was "horse" for her five-year-old brother, commonly known as Mickey-Dooley. She was harnessed in the old signal halyards, unearthed from an over-burdened locker full of discarded toys. Katy-Belle was galloping steadily, in spite of the long, slow roll of the deeply-laden Santana.

Discovering the two men, they sent up a glad shout and precipitated themselves upon McGann and the First Mate.

Katy-Belle's eyes were wide and serious. "Ithin't Thandy Clauth comin' to our ship thith year? My Daddy thayth he ithin't!"

McGann hugged Katy-Belle hungrily.

"Your Daddy's fooling you. Of course he's coming."

"But do you know he is?" insisted Mickey-Dooley, shrilly.

McGann glanced at the First Mate. Their eyes met. And in that glance a message of understanding passed between them.

"Mickey-Dooley," the wireless operator answered, weightily, as if registering an oath, "I *know* he is."

McGann and the First Mate had been with the Santana for a considerable time. In fact, the members of the ship's company were remarkable in their steadiness. The Santana had been a home—up to the present—and now the Old Man was beginning to change.

His intimates could have told of an unfortunate investment and the loaning of what remained of his saving to a friend who did not live up to his promise to repay. The loss of his little fund meant much to the Skipper, for he had fondly hoped to make of Mickey-Dooley something different than his father: in his vision there had been college days and perhaps a profession by means of which the boy might wrest a living from the world. The Skipper was now advanced in years—too old, he believed, to accumulate enough to carry out his plans. And with the loss of his savings came a disregard of some of the little things that help to smooth out life's rough places. His attitude regarding the Christmas celebration was an illustration of this. In fact, things were not as of old, and the first murmurings of discontent were beginning to be heard.

Since Mickey-Dooley's second Christmas on the big freighter—and Katy-Belle's first—the holiday had been distinctly one of much rejoicing. McGann was a bachelor, but the three mates and most of the engine room force were married men, with families scattered to the four quarters of the globe. Many of the crew had children, too, and although presents were purchased throughout the year at the various ports of call and sent "home," wherever that might be, it was not like having the day with their own and seeing the fun when the parcels were opened.

There were only a few of the men, therefore, who did not have their family Christmas celebrations by proxy, as it were. Katy-Belle and Mickey-Dooley were totally unaware of the part they played on each holiday. In fact, perhaps only Mrs. Barbour, the Old Man's wife, realized what the celebration meant to these bronzed wanderers of the seas. Tears had crept slowly down her cheeks more than once, when she had seen the expressions in the hungry eyes of the men—and she knew each was picturing his "own kids" in their distant homes opening *their* Christmas gifts.

The change in Captain Barbour was a blow to his wife. And as for giving up Christmas, Mrs. Barbour was horrified at the idea. Not only for the sake of the little ones, but on account of the big, strong men of the crew, to whom the day was of more import than it possibly could be to the two little recipients of their fondly-lavished gifts.

There had always been some kind of tree bought at the nearest port to Christmas, or else the First Mate had manufactured one—a clothes-horsey affair, to be sure, but something upon which gifts could be hung. And gifts! Many had been purchased in out-of-the-way places, for the Santana was a tramp of the Seven Seas; and many were made by loving hands—crude things of canvas, wood or rope. But Katy-Belle and Mickey-Dooley invariably loved the home-made articles best—why, only a child could answer. They were more "playable-with" through their very toughness. They lasted longer than the Japanese dolls or the Danish harness with bells, or the easily broken toys labelled "made in Germany."

Had Captain Barbour been able to see through his wife's eyes, or had his wife been able to see just a little deeper into her man's mind, there might have been no such order given aboard the Santana as the abandoning of the Christmas celebration. Not for one instant did the Old Man appreciate what the day meant to his men. His whole soul was wrapped up in the successful running of his ship and in the making into a real man of his diminutive son. To this latter idea was due in part the root upon which sprouted his contention that Christmas festivities had no place at sea. He was afraid Mickey-Dooley would not grow into a manly man, like the First Mate, or McGann. He wanted Mickey-Dooley to throw aside his childhood at the age of five, and begin to "grow up." Had anyone put these facts before the Skipper in plain language he would have denied them vehemently. He scarcely realized the enormity of his own ambitions for the boy—and the present absurdity of them.

There were only a few days left before Christmas—and only one more port of call before the bleak passage of the Strait of Magellan. The port was Coronel, where the Santana would fill her bunkers with coal, and from there down to Cape Pillar she would battle her way against high winds and higher seas. A poor place for "Santy Claus" to find a ship and come down the foremast with his sack of toys; but the two youngsters understood that Santy wasn't afraid of storms. And McGann had assured Mickey that he just *knew* Santy would come this year. Wasn't that enough?

At Coronel, Mrs. Barbour, after a

whispered, yet lengthy conversation with McGann, persuaded the Skipper to take her and the children ashore for a day. It would be horribly dirty on the decks, she argued, with the coal coming aboard. There would be no place for the kiddies to play. And besides, there would be so much wet weather for a week after—the children needed a romp ashore. There was small amusement to be found in Coronel, but a lunch at the Rhoemheld Hotel would be a break in the everlasting routine, and it would do them all good.

Had Captain Barbour been able to see the strangely wild dance that took place on the ringing deck of his ship, after his small boat put off, he would undoubtedly have thought his crew either suddenly gone insane, or else suspected the presence aboard of a case of *chicha*. The dance was one of sheer, unadulterated joy, however, watched over by three grinning mates and a triumphant boson. There was mutiny brewing on the Santana.

An unusual amount of shore leave was granted certain members of the Santana's crew, during the absence of the Skipper. The shore-going party, be it known, was careful not to land in the vicinity of the Rhoemheld, and it went stealthily up side streets to its destination, returning to the ship along the byways rather than the highways, and with a large covered cart at its head.

When Captain Barbour returned, with his tired, but happy little family in the evening, everything was quiet and shipshape aboard the Santana.

The Santana had called at Coronel once or twice before, in the past five years, and although Coronel is anything but an Eden, Captain Barbour could well remember his crew's distaste for the putting to sea, when going southward, owing to the heavy weather which invariably set in and the consequent extra watches. But on this occasion there was not any of that usual distaste apparent.

After passing Santa Maria Light other matters took possession of the Skipper's attention. These matters consisted principally of rain and a slowly increasing beam sea.

yond words had he overheard Olsen, one of the sailors, at mess.

"Ay hope she bane blow like sin on Chris'mas Eve!" the big Swede remarked, gently, between mouthfuls of chow. A sentiment to which the entire assembled force of the Santana's deck department gave grinning assent.

And Christmas Eve it did blow—just like that. There was a head sea and a heavy wind, according to the entry in the scrap log. To the landlubber, this sounds prosaic enough. But to the man out on the southern Pacific it means the word Olsen used softly.

All afternoon the Santana butted sullenly into the huge seas that piled up and crashed down over her fo'c'sle-head. The well-deck was one seething broil of cascading waters. Through the ratlines the gale shrieked and tore like a relentless fury.

The Old Man was on the bridge. There would be no leaving the bridge for perhaps twenty-four hours. His meals would be eaten in the wheel-house—meals snatched to keep up his strength—whatever could be brought to him through the storm.

Katy-Belle and Mickey-Dooley had been put to bed. They had first listened, wide of eye and glowing of cheek, to the old rhyme about "'Twas the Night Before Christmas." To be sure, the dear old poem had little bearing on the way these two had been taught to picture Santa's approach, but they always demanded it on Christmas Eve. And this particular time Mrs. Barbour told it with a strange look of determination in her hazel eyes, and a firm set to her sweet mouth. After she had kissed her babies and had listened to their rapidly uttered prayers, which wound up with the inevitable "And please, God, let Santy find our ship," she switched off the light and made her way to the dining saloon.

It was a strange picture for such a place and such a night! The dining saloon of the Santana was filled with men—big, chuckling, whispering men—if one may call their gruff attempt at with greens. Greens of all sorts. The biggest of these was a tree—perhaps not the regulation Christmas tree, but a tree, as the Chief grinned, "for a' that!" One entire side of it was shaven and shorn of its foliage, so that it could be made fast to the bulkhead. This was the only way a Christmas tree could "grow," at sea, in such weather. The crew—every man not on watch—was engaged in decorating the room with the boughs and branches brought so surreptitiously at Coronel. That they were a trifle wilted, mattered not a whit. They were Christmas greens, and the spirit in them was fresh and fragrant. That was what mattered, Mrs. Barbour comforted the First Mate, when he bemoaned the fact that they were wilting.

The heavy freighter butted and rolled against the crashing waters without. Again and again the entire roomful of men went tumbling across from one side of the saloon to the other. But this was not work. This was "fixin' up" for Katy-Belle and Mickey-Dooley. And more, this was the Santana's first mutiny!

When the watches were changed men came in from the deck, dripping and shivering with cold. These were served with hot coffee, made by the chuckling steward and handed them by "the Missus" herself. Oilskins and sou'westers were discarded, and willing hands took up the acrobatic task of decorating the staunchly battened tree.

Mira Barbour, sitting on the settee along the table, could have wept. Wept for sheer thankfulness and love! As each man dug into some cavernous pocket and brought forth his little gift to the "kids," the big tears welled into her eyes. They were so happy—these big, crude men! So happy in their little gift-giving! Well did Mira Barbour understand how their hearts reached out toward their own little ones, across miles and thousands of miles of sea and distant land. There were dear, amusing explanations of why this or that wasn't "made as good" as it might have been, under different circumstances. As if that mattered! Mira Barbour could have hugged them all—from the big, faithful, homesick First Mate to the utterly unintelligible but broadly grinning Finnish mess boy. This was for Katy-Belle and Mickey—her kiddies, that they were disobeying orders. Just what Captain Barbour would say was something Mira scarcely liked to consider. The First Mate and McGann had told her they would look out for that. And like

All afternoon the Santana butted sullenly into the huge seas

Mickey-Dooley she accepted their word as final.

Evangelistas Light was not sighted until early Christmas morning. Somewhat heavy at heart, because of his having forbidden any celebration, and weary with his long watch, Captain Barbour made up his mind he would leave the bridge long enough to have breakfast with the wife and children.

And so it happened that as the breakfast gong sounded, Captain Barbour descended from the upper deck and struggled against the wind until he managed to get the door to the deck house open.

A strange whiff of woodsy smell greeted him. He sniffed—and then strode through the short alley to the saloon. As he paused at the door three figures came bursting through the door opposite him from his own quarters.

"Mewwy Cwithmuth! Mewwy Cwithmuth!" shrieked the unmistakable lisp of Katy-Belle, and he felt her two little arms tightly clutching his legs. He stooped and caught her to him, just as Mickey-Dooley came catapulting upon him, with repeated good wishes. Then he heard the words repeated in the low sweet tones of his wife's voice, while her lips met his and her two hands made a gentle pressure against his shoulders.

And then the peculiar mist which had gathered in his eyes, cleared, and he looked about him.

For a minute there was a horrible silence. Then the storm broke. Putting Katy-Belle down on the deck the Old Man faced his wife.

"What does this mean?" he asked, with sinister quiet.

Mira met his eyes steadily. "You'll have to ask some one else," she replied. "In fact, McGann has requested the particular privilege of explaining this to you."

As the Second Mate entered the saloon the Skipper turned on him. "I want all hands—at once!" he thundered.

The Second Mate turned and left the room without a word. In the silence that followed, Katy-Belle and Mickey-Dooley crept to the shelter of their mother's skirts. From this safe point they stole excited, yet anxious, glances at the tree. Mickey-Dooley almost choked in his effort to maintain the quiet which he felt was demanded of him, for his eyes had caught sight of the most marvelous swing hanging on the tree—a swing that might almost have been called a bosun's chair, had it not been meant as a Christmas gift to a little boy from a loving ship's carpenter.

Into the room filed the men of the crew who were not on watch. And with them was McGann.

"Mrs. Barbour says you will explain —*this!*" the Old Man sputtered, furionsly, sweeping a hand comprehensively toward the tree and the greens.

"Yes, sir! This——" the wireless man stumbled for a moment over his words, "this is Christmas."

"I thought I forbade any such shenanigans this year."

"You did, sir!"

"You mean you deliberately disobeyed my orders?"

"Yes, sir."

The answer came so swiftly that the Old Man was left, for a moment, breathless. Then he glared at the men shifting from foot to foot before him.

"Don't you know that to disobey orders is mutiny?"

"Yes, sir!"

The Old Man choked, suddenly.

"You mean—you mean this *is* mutiny? Now, come, what does this mean?"

"Oh—the little *fellows!*"

The plea was spoken softly, but the words carried a world of meaning. For an instant the Old Man hesitated. Then he capitulated.

"Mira, take them back to the room for a minute," he ordered, sternly. And after the woman had led away the two softly weeping children, who did not understand, but who knew something was all gone wrong, the Captain folded his arms and waited for McGann to begin.

But it was not he who spoke. A voice from behind the group in the doorway broke in upon the silence.

"As I am the one to blame for this whole matter, maybe you'll let me explain, sir!" And into the now wholly outraged Captain's sight came the First Mate, a pleasant smile in his eyes, but a strangely determined look about his lips.

"This was done with my knowledge and consent, sir," he began, quietly. "If it is mutiny, then there is not a soul on the ship, including Mrs. Barbour," with a sudden smile, "who is not guilty. We just couldn't keep Santy Claus away from the Santana!"

He paused and waited for his superior to make some comment. There was only a silence. So he continued, pleasantly: "One reason we have been able to keep the same men for so many voyages aboard the Santana has been this very sort of thing—this homelikeness. The men have been like members of one big family. They haven't had their own homes and their children to enjoy on Christmas, but they've had yours. They've been able to keep the Christmas spirit through this yearly celebration. The Mate leaned suddenly forward, his face closer to the Skipper's. "There's hardly a man among us who hasn't held Katy-Belle in his arms some time during Christmas day and crooned his own particular country's Christmas hymn to her. There's hardly a man who hasn't through some gift he's made Mickey-Dooley, helped that little chap a step along toward big generous manhood. That little chest over there for Katy-Belle's dolls' clothes has taken McGann the better part of a year to make. He cut all those little fancy figures on it himself. You see if Katy-Belle doesn't just go crazy over it! Did you think you could take things like that away from the men, sir? And away from the Kids? They need it—both sides! And as to the Missus—she's been working on this year's Christmas presents ever since the twenty-fourth of last December! Could you take that occupation away from her? There's been one day, every year that's helped make us put up with lots of things. That's been Christmas Day! If you really mean to take that away from us, you'll have to ship a new crew. We—we—need it!"

The Mate paused suddenly. There was a lump in his throat. His heart was in Brooklyn, with the three small stockings hanging over the familiar mantelpiece. And just as the Skipper was beginning to understand this, another voice broke into the conversation.

The Skipper looked thoughtful. "I had never thought of it the way you all think of it," he finally remarked, with most extraordinary meekness. "I was simply afraid Mickey-Dooley would be too much a baby if we kept up this Christmas business. I want him to be a real man."

"Real man? Real man?" The Mate shouted a derisive laugh. "Do you call *these* real men?" pointing to the crew, as he glared at his superior. "Then don't worry about Mickey-Dooley. These men, sir, are patiently waiting to get down on the deck and play—*play*—did you get that, sir?—with your two children! They've got to go on watch, some of 'em, in a few minutes. Don't you think you can countermand this order about no Christmas celebration, sir, and call off this—mutiny?"

The Old Man looked about at the grizzled, bronzed faces of his men. In every eye was a mute supplication. And somewhere in back of him, behind a closed door, there was a sound of sobbing. The Old Man swallowed hard and drew himself up.

"I'm a fool," he acknowledged before his crew. "The order about Christmas is countermanded!" Then, before anyone could speak, he strode over to the closed door and shouted, boyishly: "All hands come here and report to Santy Claus' Christmas tree! I've got to get back on the bridge—and I want to see what that old scamp, Santy, has brought me!"

As Mickey-Dooley and Katy-Belle, despite still-wet eyes, swept like a hurricane into the room, a great cheer went up from the throats of the men. Then, "Look, Kitty!" "Look Mickey!" "See what the old chap left for ye." "Oh! Kitty-Belle, the gran' box fer yer dollies' gear, now!"——and more.

Mira Barbour crept into the arms stretched out blindly toward her. "Mira! Forgive! I've been a fool!" the Old Man whispered, brokenly. "I'll be different."

And thus ended the mutiny on the Santana—save when Katy-Belle defied mother, father and heaven to take away from her bed that night the little carved doll's trunk McGann had fashioned with his loving hands.

A Half-Kilowatt 200-Meter Amateur Transmitting Set

By Elmer E. Bucher

Although the panel type of transmitting set appeals to the experimenter lacking space for the installation of a wireless equipment, a number of amateurs prefer apparatus of the open kind which, in the event of necessity for repairs, can be easily reached. Those favoring the latter type of equipment declare also that the station with exposed apparatus presents a more businesslike appearance than one in which the component parts are screwed to the board.

To assist beginners in the design of a small transmitting set that will not exceed the wave-length of 200 meters, the apparatus shown in Figure 1 will be described. It is of course understood that the design presented will not be strictly adhered to, but the general plan will in many cases be adopted.

The set shown in Figure 1 includes a ½-k.w. open core transformer, four standard copper plated Leyden jars of the type furnished by the Marconi Company (capacity .002 microfarad each), an oscillation transformer mounted directly above the condenser, a non-synchronous rotary spark gap, an aerial changeover switch and a hot wire aerial ammeter. The majority of the readers of The Wireless Age are aware that the connections in the closed oscillation circuit of an amateur

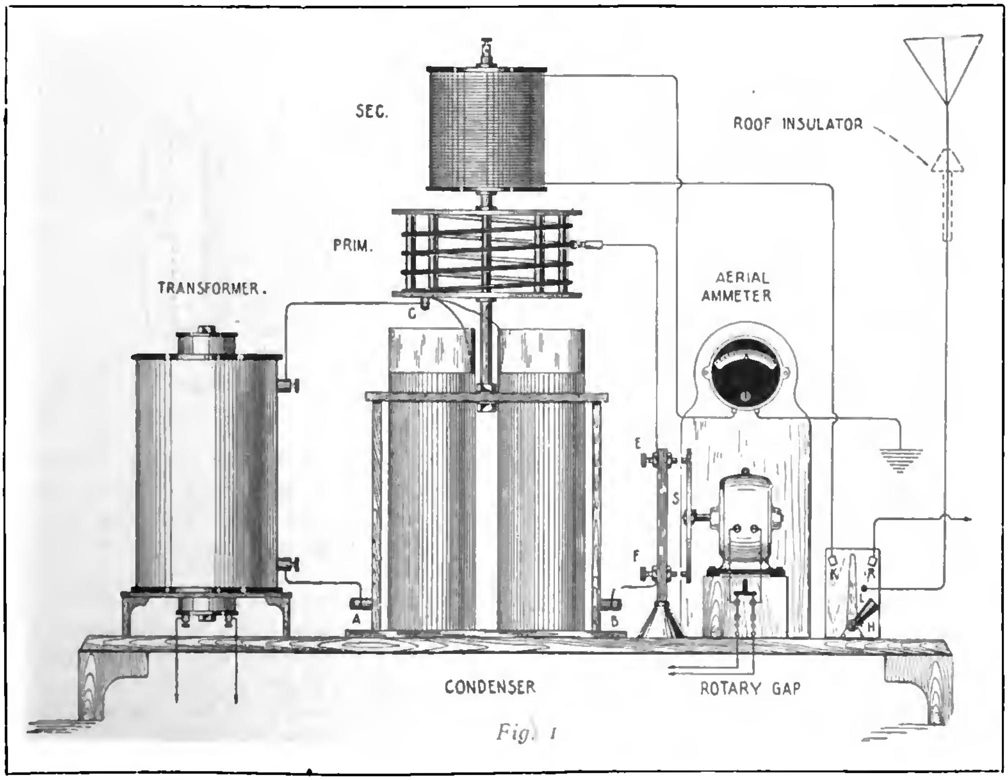
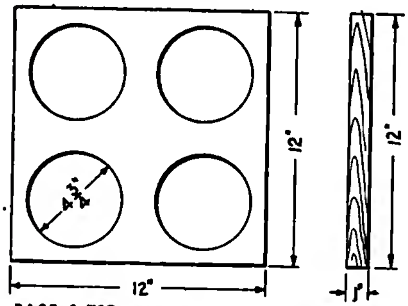


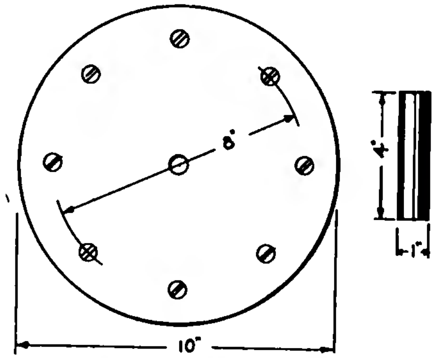
Fig. 1

wireless telegraph transmitter must be exceedingly short to permit the use of a condenser of large capacity for a given wave-length and since the experimenter is restricted to a condenser of .008 microfarad capacity, this value is used in the set described.

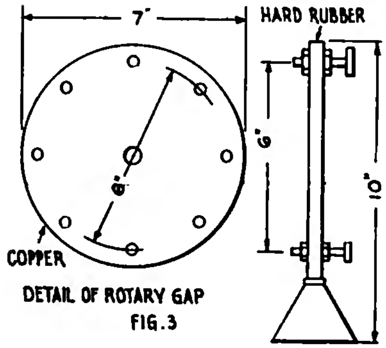
It is to be noted that the condenser jars are mounted in a wooden rack, the base of which is covered with a sheet of copper. Small upright posts having 4 holes 4¾ inches in diameter (cut out by a jig saw) to take the jars



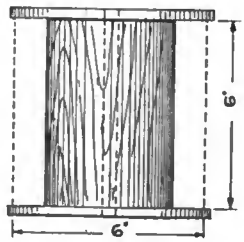
BASE & TOP JAR RACK
FIG. 2
WOODEN UPRIGHT



BASE & TOP OSCIL TRANSFORMER
FIG. 4



DETAIL OF ROTARY GAP
FIG. 3



DRUM FOR SECONDARY
FIG. 5

support the top piece shown in Figure 2.

Fastened to the top of the rack is an upright rod of metal, hard rubber or wood, that supports the primary and secondary windings of the oscillation transformer. It will be seen that with this arrangement of apparatus the connections in the closed circuit are exceedingly short and the complete closed oscillation circuit can be traced out in the following manner:

The four connections from the inside coating of the four Leyden jars are connected to the binding post, C, which is mounted on the base of the primary winding of the oscillation transformer. The circuit continues through the turns of the primary winding through the flexible contact, D, to the binding post, E, of the rotary spark gap. The circuit then continues through the disc of the gap, out the binding post, F, and finally makes connections to the binding post, B, which in turn is connected to the copper strip at the base of the jar rack. With this connection no more than two or three turns of the primary winding are required to obtain the wave-length of 200 meters.

The primary winding is made of copper tubing ⅜ inch in diameter and spaced 1 inch from center to center of the turns. This tubing is fastened to the hard rubber post by means of brass machine screws, the copper tubing and the hard rubber post being drilled accordingly.

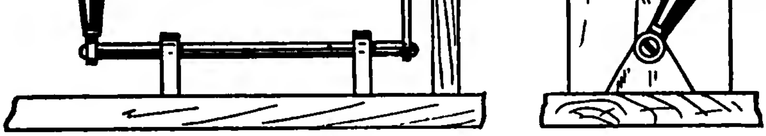
The secondary winding of the oscillation transformer comprises from six to twelve turns of No. 6 D. B. R. C. wire which are closely wound and the top terminal connected to one binding post of the aerial meter while the opposite terminal of the latter is connected to earth. The other terminal of the secondary winding leads to point K of the aerial change-over switch, then extends to the contact blade, L, and thus on to the aerial. When the switch is thrown to the contact point, R, the aerial is connected to the receiving equipment.

Drilling and over-all dimensions for the top of the jar rack appear in Figure 2, similarly for the rotary gap disc in Figure 3, while the top and base for the primary winding of the oscillation transformer are constructed as shown in Figure 4. Figure 5 gives the dimensions of the drum support for the secondary winding which may be of wood.

Specific dimensions for the wooden block upon which the rotary gap motor is mounted cannot be given, owing to the difference in the dimensions of motors, but whatever the make it should be designed to revolve at a speed of 1,800 revolutions per minute when connected to a sixty-cycle source of alternating current. The disc, S, mounted on the shaft of the motor, should be about 7 inches in diameter and should have eight sparking points equally spaced about 1 inch in circumference. These may be made of machine screws. The sparking points should be placed on a radius of 3 inches from the center and the stationary electrodes, B and F, should accordingly be separated by 6 inches. With this design 240 breaks or interruptions of the condenser circuit per second are obtained being about the equivalent of 120-cycle alternating synchronous sparks.

As will be observed, the transformer is of the open core type and is mounted in a vertical position, being supported by three wooden legs equidistantly spaced on the wooden base. The dimensions for the transformer are as follows: The primary core should be 14 inches in length, 2½ inches in diameter, consisting of a bundle of very fine soft iron wires which are taped in circular form. The core is then covered with two or three layers of empire cloth and afterwards wound with two layers of No. 14 double cotton covered wire. The entire primary winding is then inserted in a hard rubber tube of about 3/16 inch in thickness.

The secondary winding is composed of ten separate sections, each about 7 inches outside diameter 1¼ inches in thickness. The inside diameter is approximately 3½ inches. Each of the pancakes comprising a section should be wound with No. 32 S. S. C. wire which has previously been soaked in hot paraffin after the method



DETAIL OF AERIAL SWITCH
FIG. 6

described in a previous issue of The Wireless Age. The secondary sections may be separated from one another by micanite or paraffin paper washers.

The aerial ammeter is mounted on a board immediately behind the rotary spark and at such a height that the reading of the scale is directly visible. A suitable ammeter was described by the author in the preceding issue of The Wireless Age, or if desired one can be purchased on the open market.

The aerial change-over switch appears in Figure 6. A metal rod is mounted on the bearings and has a hard rubber handle. On the opposite end is mounted the switch blade which is 8 inches in length. The antenna connects to this rod by means of a stranded flexible conductor, but the opposite end makes contact with the stationary points, K and R, as in Figure 1. The upright supports for the contacts should be of hard rubber and they should be separated by at least 6 inches.

A simple roof insulator was described in the November, 1916 issue of The Wireless Age.

The receiving apparatus for this set is of extreme simplicity and is shown as assembled in Figure 8. It must be remembered that it is designed for the reception of signals at the wave-length of 200 meters and the construction is simplified accordingly.

Diagrammatically the circuit appears in Figure 7 wherein a variometer, V, is connected in series with the antenna system and in series with it is placed a crystal detector, D, and the fixed condenser, C. The latter is shunted by the head telephone, P. A suitable variometer was described in the book entitled "How to Conduct a Radio Club" and the dimensions for it are given in that publication. The placing of the apparatus is as follows: Alongside the variometer (See Figure 8) is placed a fixed condenser of .005 microfarad, and immediately to the right a suitable crystal detector. Two binding posts are furnished, one for the aerial and earth connection, the other for the head telephones.

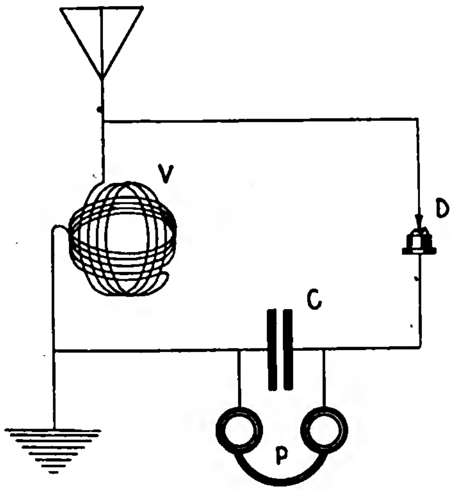


FIG. 7

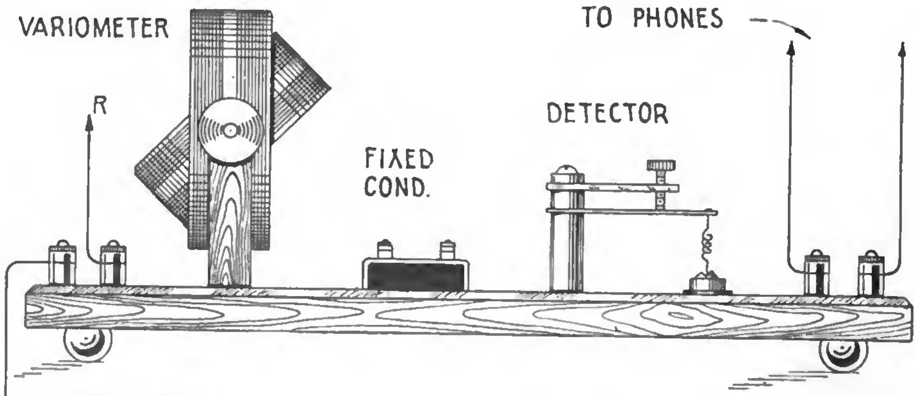


Fig. 8

Dimensions for the variometer are as follows:

Two cardboard tubes one, 6 inches in diameter the other 5 inches in diameter each being 2 inches in width, are wound with a single layer of No. 24 C. S. C. wire. A space should be left in the winding in the middle of the tube for about 1/4 inches. Care should be taken to get the same amount of wire on each tube. The tubes are then connected in series. A hole is drilled in both sides of each tube and through these holes is placed a piece of 1/4-inch round brass rod 8 inches in length. When mounting the variometer a small tube should be fastened to the brass rod so that it will revolve with the knob. A pointer may be fastened to the knob which will work over a scale.

In tuning to an amateur station it is then only necessary to vary the relative positions of the outer and inner coils of the variometer until maximum response is obtained.

To adjust the transmitting apparatus, the builder of this set should purchase a wave-meter (or if he desires, construct one) and then accurately adjust the closed circuit to 200 meters. The turns may be added or taken off at the secondary winding until the hot wire ammeter gives the maximum deflection.

An ammeter having a maximum range of three amperes is satisfactory.

A small fused switch may be mounted on the wooden block supporting the motor for turning the current on and off. By more elaborate design extra contacts can be added on the shaft of the aerial switch to start and stop the motor.

SPECULATION REGARDING INTERSTELLAR COMMUNICATION

A newspaper says that interstellar wireless communication may be a possibility of the future according to a belief now held by some scientists, and it has remained for M. Pierre Guzman, of Paris, France, to stimulate by the offer of a monetary prize the efforts of what may be called our astronomical telegraphers to get into touch with our planetary neighbors. M. Guzman has promised to pay $20,000 to the astronomer who first establishes communication with any planet or star other than Mars.

M. Guzman's elimination of Mars as a wireless station in the competition he is promoting is based upon his belief that experiments made by American astronomers in Arizona prove that a wireless expert who talked with the Martians would be overpaid if he received 100,000 francs. This performance, to his mind, is too easy, too lacking in romantic and sensational features to be worthy of the modest fortune he has dedicated to science. It may be that M. Guzman considers the Martians merely an insignificant lot of chronic canal builders, whose conversation over an interstellar wireless apparatus would be of no interest to us.

To the average person, nevertheless, it would appear that direct and authentic news from Mars might be of some value to us. The Martians appear to have solved various engineering problems that prove the ingenuity and technical skill in lines of endeavor in which we Americans are at present intensely interested. If the Martians have learned how to build canals without inviting landslides, have made of irrigation processes an exact science, and have, as various authorities contend, learned how to fly by their own motive power, there are numberless specialists in this country who would be pleased to call them up by long distance at once.

INSTITUTE HEARS A PAPER ON ENERGY LOSSES

At a meeting of the Institute of Radio Engineers held on the evening of November 1st at the Engineering Societies Building, New York City, a paper on "A Determination of the Energy Losses in a Radio Telegraph Transmitter," by Bowden, Washington and T. H. Boyster was presented. An interesting new method of determining heat losses in transmitters was described.

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
How a Type D Tuner Was Reconstructed

I should like to tell the readers of THE WIRELESS AGE how I reconstructed the former Type D United Wireless tuner into one of the inductively-coupled type without a great mechanical change.

While talking with experimenters I was surprised to hear many criticisms regarding the operation and results obtained from the carborundum detector. Many said that the efficiency of this detector is not to be compared with that of a piece of galena or silicon, but little did they realize that experience is necessary in order to obtain satisfactory signals with a carborundum detector.

Nine-tenths of the complaints were made by the users of the old reliable Type D tuner, using a common form of carborundum detector and potentiometer. Some of these experimenters undertook the task of reconstructing their sets; others, believing that the working qualities of the tuner would thus be spoiled, are still using the set in the manner originally designed. If the reconstruction is undertaken carefully these tuners are ideal in every respect; in fact, the type which is the subject of this article has given very satisfactory results, stations having been heard in Canada and Honolulu on a single wire aerial, 25 feet in length and 50 feet in height.

By studying the drawing it will be seen that use has been made of every switch and slider that the tuner originally possessed. But to rearrange the design, as per my suggestion, the potentiometer is dismantled, the circuits rewired, a galena detector employed and a loose coupler inserted in place of the original double slide tuner. (Figure 1).

All switches, contacts and metal parts should be removed from the box and the woodwork sand-papered, thus removing the original finish. A new coat of some high-grade varnish should be applied, allowed to dry, sand-papered and again varnished. This will give the cabinet a beautiful appearance, making the set look like new.

The potentiometer material should be discarded, as only the switch-arm and the points are to be used again. In place of the potentiometer we will use this switch for variation of the inductance value of the secondary winding. The latter is tapped at eleven points and flexible leads are soldered to the original potentiometer contacts as shown in Figure 2.

The detector holder should be slightly altered to allow the use of a galena crystal; this will be clear from Figure 3.

The fixed condenser that was originally used with the carborundum circuit should be shunted across the head telephones. The left hand coil is permitted to remain in its original position, as wave-lengths as high as 3,000 meters can be tuned to using the average amateur's aerial with the loose coupler that will be described further on. The switch marked "Shunt" will be used to shunt the galena detector, one point being left dead as three points only are required. By tracing out the diagram of connections we notice that with this arrangement the detector may be either short circuited or open circuited. The switch marked "Battery" is to be used for a test buzzer; in fact, a buzzer of any type may be inserted in the box, as indicated in Figure 1, and in detail in Figure 4.

In place of the double slide tuning coil we insert an inductively-coupled receiving tuner, using one of the original sliders for variation of the inductance of the primary and the other to vary the coupling of the secondary. The slider on the top of the box should be used for the primary circuit and the one on the side of the box for the coupling adjustment.

The inductively-coupled receiving tuner should have the following dimensions: The primary winding is 3 inches in diameter, 5 inches in length, wound with a single length of No. 22 wire. The secondary winding is 2¾ inches in diameter, wound with a single layer of No. 26 magnet wire, tapped at eleven equidistant points.

A round piece of wood, ¼ of an inch in thickness, should be inserted in each end of the secondary tube, and a piece of ¼-inch inside diameter brass tubing fitted between the two end centers to allow the secondary to slide along the ¼-inch square brass rod, supported as shown in the diagram. The secondary taps should be fastened to machine screws arranged along the circumference of the secondary end piece, a flexible wire or tinsel cord being used to make contact with the secondary taps on the top of the box.

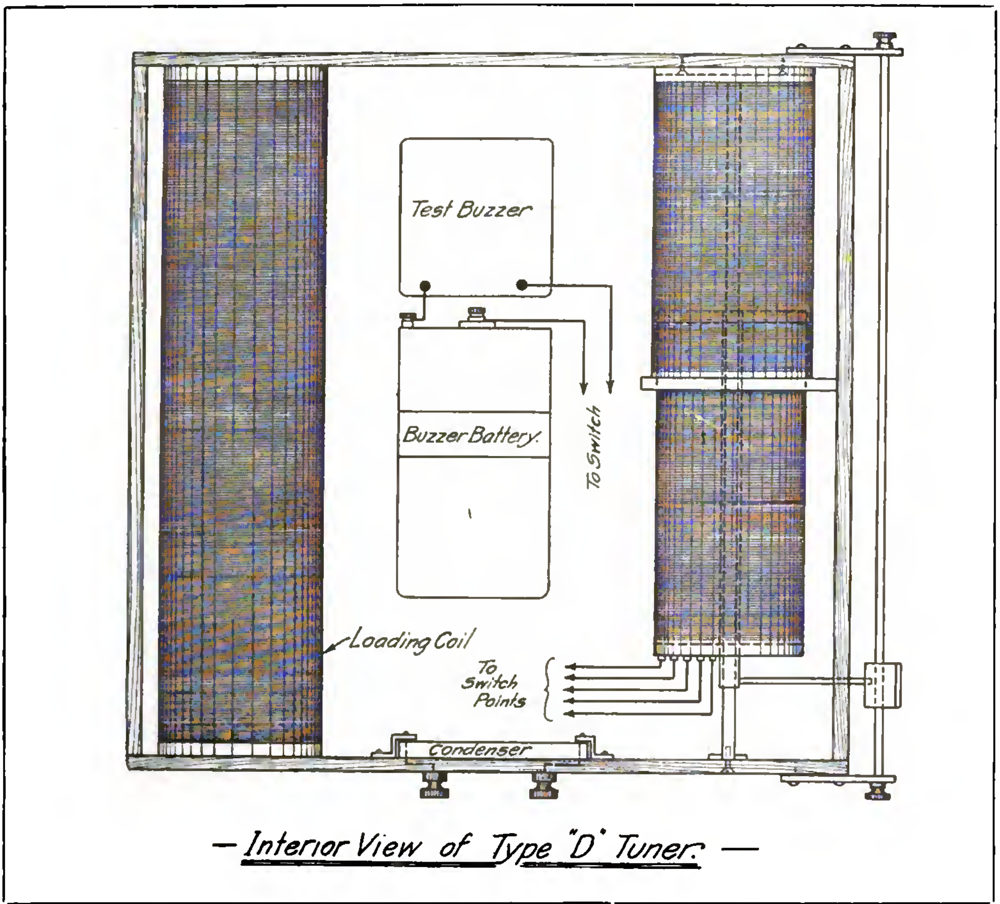


Fig. 1, First Prize Article

To shunt the detector the shunt switch must have the arm resting on two contacts, as will be seen from the diagram. To open the detector circuit, only one ... is required

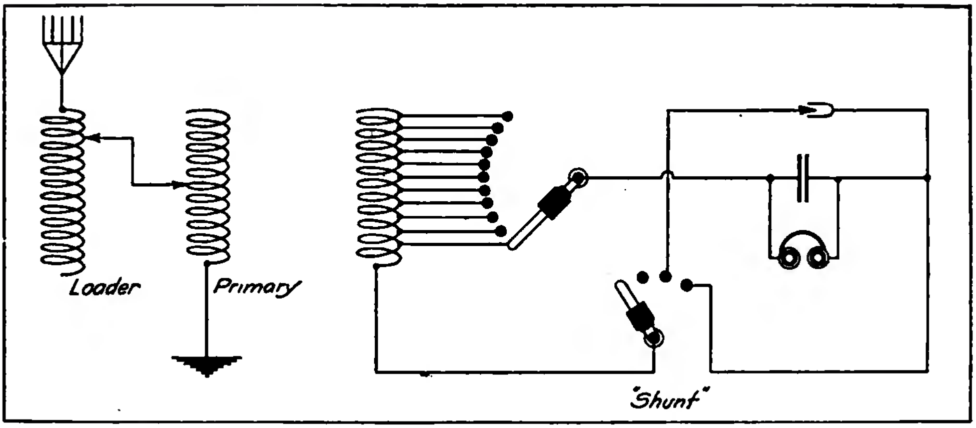


Fig. 2, First Prize Article

A variable condenser cannot be placed in the box as space will not permit it. However, two additional binding posts may be installed in some convenient place, the connections being extended to a variable condenser.

By carefully following out the foregoing instructions a receiving set of good appearance and notable efficiency can be constructed.

H. W. DICKOW, *California.*

SECOND PRIZE, FIVE DOLLARS

Directions for Making a Navy Type Receiving Set

Considerable interest has been aroused among amateurs by the announcement of a special type of receiving apparatus developed by Dr. Louis Cohen of the United States Bureau of Standards. Although the circuits of this receiver are somewhat radical, the results obtained by its use warrant the construction of the apparatus.

It will be noted particularly from Figure 4 that the apparatus comprises mainly two coils, one connected in the antenna circuit and the other connected to the terminals of the detector, which are coupled together by means of the two variable condensers (mounted in a single unit) No. 2. These two coils are mounted on a square base, leaving a space of about eighteen inches between them. The actual dimensions for the coil will vary with the desired range of wave-lengths, but with coils twelve inches in length and five inches in diameter wave-lengths up to 4,000 meters can easily be attuned to. Additional inductance may be added, if desired, in the antenna circuit, thus increasing the wave-length 12,000 or even 15,000 meters, without detracting from the efficiency.

The construction is as follows: Two cardboard tubes are obtained that will just fit inside the tuning box (Figure 1) and they are wound loosely with No. 30 wire, the entire coil being tapped at ten equi-distant points. These coils are then mounted on the inside of the box and a switch to control the inductance values placed on the end nearest to the operator. Care should be taken that the current in the tuning coil circulates in the same direction as that in the loading coil; otherwise the magnetic fields will neutralize and render the set inoperative.

The coils having been constructed, the construction of the coupling condensers is next in order. Two are required, which are operated simultaneously by the single handle. A general idea of the construction of these condensers will be clear from Figure 2. A wooden roller, 8 inches in length, 3 inches in diameter, has glued on it two sheets of heavy tinfoil as shown, with a space of one inch between. These sheets are 3 inches in length by 4½ inches in width and a connection is made from each to the nearest end of the core. The pivots for the roller can be driven into each end and thus be insulated from each other. A brass bushing in the wood end serves to make connection from the pivots to the remainder of the circuit.

The next step is to fasten tightly and smoothly a layer of empire cloth over

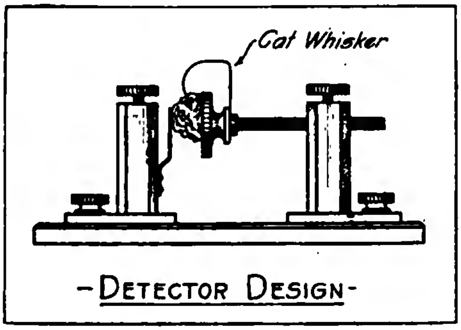


Fig. 3, First Prize Article

the tinfoil by means of shellac. This serves as the dielectric. Two sheets of aluminum are bent to fit around one-half the roller and a strip is extended from it to fasten to the inside of the box.

It is now apparent that when the roller is turned so that the tinfoil will be partly under the aluminum, the capacity is increased and when turned through 180 degrees it will be at the minimum value. The general idea of these condensers is not new, but the improvement lies in the fact that they are adjusted simultaneously.

The condenser can be enclosed in a box about 4 inches square and 9 inches in length. A handle and a scale may be arranged on the front to readily determine the relative amount of capacity in use.

Two additional condensers are required. These should be of the fan switch type. Six strips of paraffin paper, 3 inches in width and 24 inches in length, are required for each condenser and also four strips of tinfoil, 2 inches in width and 20 inches in length, are used as the active material. The entire units are mounted in a small box, 2 inches by 3 inches by 10 inches, for each condenser.

The construction of this condenser is as follows: Place a strip of paper on a flat surface, then a strip of tinfoil, followed by another strip of paper. Cut a length of tinfoil into three pieces, each 6 inches in length. These are fastened to the paraffin paper with a few drops of shellac under each piece. A space of one inch should be left between each piece. Connection is then made to each piece by laying a finely stranded piece of wire, 6 inches in length across the surface, with 4 inches of its length protruding.

A strip of paraffin paper is laid on these, then another long strip of tinfoil, followed by another layer of paper. The next strip of tinfoil is also cut into three 6-inch pieces and connection made to each. The two long strips of tinfoil are connected together and a wire extended therefrom.

The next step is to cover the top with a sheet of paper and roll it into a compact bundle. The condenser should be carefully tested for short circuits and afterwards pressed together by means of a moderately hot iron, which will thoroughly bind the sheets due to the melting of the paraffin.

The fan switches are mounted on the top of the boxes and are made out of thin copper with six contact points placed directly under each (S-1 and S-2, Figure 1). The leads from the small

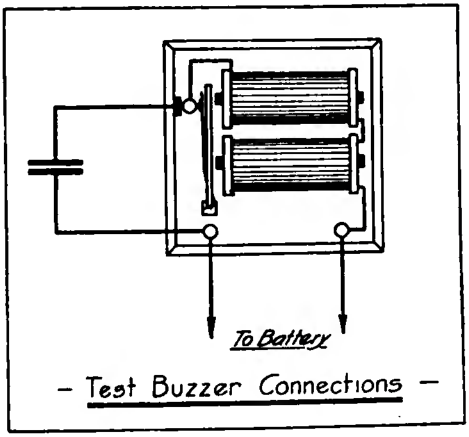


Fig. 4, First Prize Article

condenser sheets are connected to these contacts, after which the condenser unit is placed in the box. After the complete connections are made the condenser box may be filled with melted paraffin and the bottom nailed on.

To complete the cabinet one or more detectors are required; a double pole, double throw lever switch, 2 single pole,

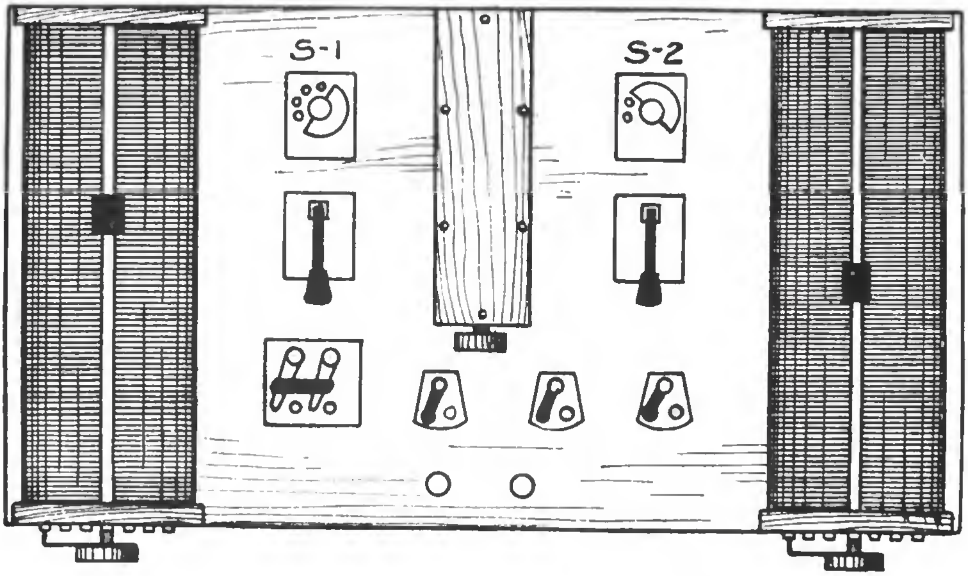


Fig. 1, Second Prize Article

single throw switches and one single pole triple throw lever switch. The detectors, two in number, on the set shown, may be of any crystal type, but the writer prefers the easily adjusted and rugged type shown in Figure 3.

The foregoing having been completed, the instruments are then mounted on the board and wired as shown in Figure 4, and the operation of this set is similar to that of the standard Cohen set.

Switch B is open, switch C is placed in the center or dead contact. The detector to be used is selected by the switch, D, and for short wave-lengths the variable condenser, I, is placed in series by throwing switch A in the downward position. The apparatus then functions like a single slide receiving set and all adjustments are made on the left hand tuner and loading coil with condenser. With this adjustment the duplex roller condenser is set at the minimum value of capacity.

When the station is picked up, the second tuner is thrown into the circuit by means of the switch, C, with a corresponding readjustment of the left hand slider, if necessary. The capacity of condenser 2 is then reduced until all interfering signals are eliminated. For long wave-lengths the condenser 1 is shunted across the tuner and condenser 3 is connected into the circuit. When switch C is on the right hand point the detectors are short circuited. The condenser connected across the head telephones is easy to construct and is similar to all small condensers used for the same purpose in other sets.

At first sight it may appear that this apparatus is complicated and difficult to handle, but as a matter of fact its operation becomes second nature after a little practice. Should the constructor desire to purchase variable condensers for the linking circuit, the following information will be of value to him: Condensers 1 and 3 should have a capacity of .004 microfarad and condenser 2 a value of .0004 microfarad. This value, of course, is rather small, but it will be found that the lower the value at this point, the more selective will be the test.

Robert Kennedy, *New Jersey.*

THIRD PRIZE, THREE DOLLARS

A Transmitting Key that Can Be Made at Home

My drawings (Figures 1, 2, 3 and 4) show the details of a transmitting key that will easily take care of a 1-kw. transmitting set. A general view is shown in Figure 1 and, as will be seen, the key is of very simple construction. Perhaps the most difficult part for the amateur to construct is the base, which is made of marble.

Many amateurs are under the impression that it is difficult to work marble, but after a trial they will soon become familiar with the method. The base of this particular key is made of white marble and practically every amateur will have access to some of the same grade, as it is of the kind used on the tops of the old style bureau, table, etc. The base is preferably ¾ to 1 inch in thickness.

The base may be cut out of a slab with a hack saw, and with a little patience the job can be completed in about half an hour. Care must be taken during the sawing process when nearing the end of a given cut, as it may break off and also might break out the base on the side and spoil it.

After the base is sawed the four corners and top edges should be rounded off as shown in the drawings (Figures 1 and 4), because if they are left sharp a piece might break off if it were given a sharp blow. The bottom edges should also be rounded off slightly. To smooth marble, place a piece of sandpaper on a flat board and sandpaper the surface in the same manner as a piece of wood. The holes may be drilled by means of a common twist drill, flooded with turpentine. A hard rubber or fibre base would also be satisfactory, but I am aware that many amateurs prefer marble.

It may interest them to know how I had the marble base for this key polished. After drilling was complete, I took it to a shop where marble was polished and the entire base was finished smoothly at a cost of 25c.

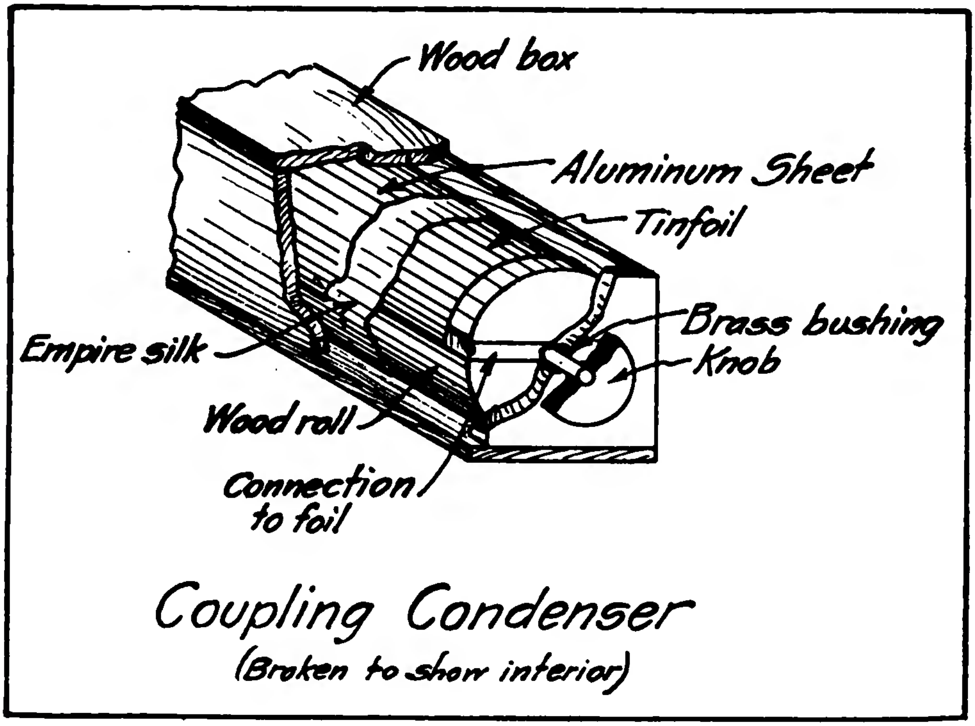


Fig. 2, Second Prize Article

The lever indicated in drawing No. 3 is made of cast bronze. A pattern should first be made and then taken to the foundry. The standards are also of cast bronze and are to be made in the same manner as the lever. The bearing shaft shown at H (Figure 2), is of brass and should be a drive fit or soldered in the lever. The contact points are made of ⅜-inch brass rod, with a piece of coin silver soldered on the ends.

The spring is wound on a 3/8-inch arbor and made of No. 18 piano wire. The thumb screws and nuts shown at E and G (Figure 1) can be bought from an electrical supply house or taken from an old telegraph sounder.

The binding posts and knobs are left to the taste of the maker. It will of course improve the appearance to have all metal parts nickle-plated.

O. E. COTE, *Rhode Island.*

appearance. After the base has been bevelled and drilled, attention should be given to the bearings, shown in Figure 2. These consist of two uprights, R and U, of square brass rod, separating the cross bar, T, and the base plate, B, which hold the bearings proper. The adjustable bearing screw, Z, (fitted with a thumb-check-nut) is screwed upon the cross bar, T. The end of this screw has a conical hole drilled in it, to receive

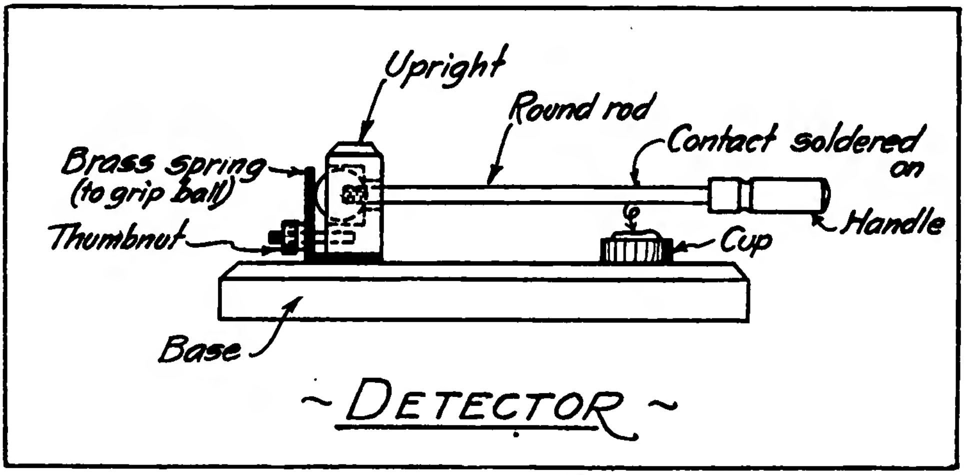


Fig. 3, Second Prize Article

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

High Speed Vibrating Key Which Is Easy to Construct

An instrument of great value to the wireless operator, amateur or professional, is the high speed vibrating key, since it permits extremely high speed in transmission with but comparatively little effort. There are several well-known makes of this type of key on the market, but the price prevents many amateurs, who would otherwise be glad to experiment with it, from owning one. The key here described and illustrated, although it may seem complicated, is really very simple and can be readily constructed from parts generally found about the experimenter's work-shop.

The first part to be constructed is the base shown in Figure 2. It can be made of almost any non-conducting material, but marble will no doubt give the best the pointed end of the pivot, to obviate the drilling of this hole, which is a somewhat difficult job, the bearing screw from an old sounder was used. The lower bearing consists of a conical hole drilled in the base plate, B.

At the back, in order to check the return stroke of the swinging rod and also to protect the latter, is mounted the upright, H, given in detail in Figure 3. It consists of two pieces as shown, one forced into the other. A screw, I, carrying a thumb-check-nut is mounted, as shown, to check the return motion of the vibrating bar. In order to stop the sharp sound which occurs when the bar strikes the end of the screw, a small piece of rubber is glued to the end of the screw.

The next part to be constructed is the vibrating mechanism for producing the dots, shown in detail in Figure 2. This consists of an arm, A, which is 5/16 of

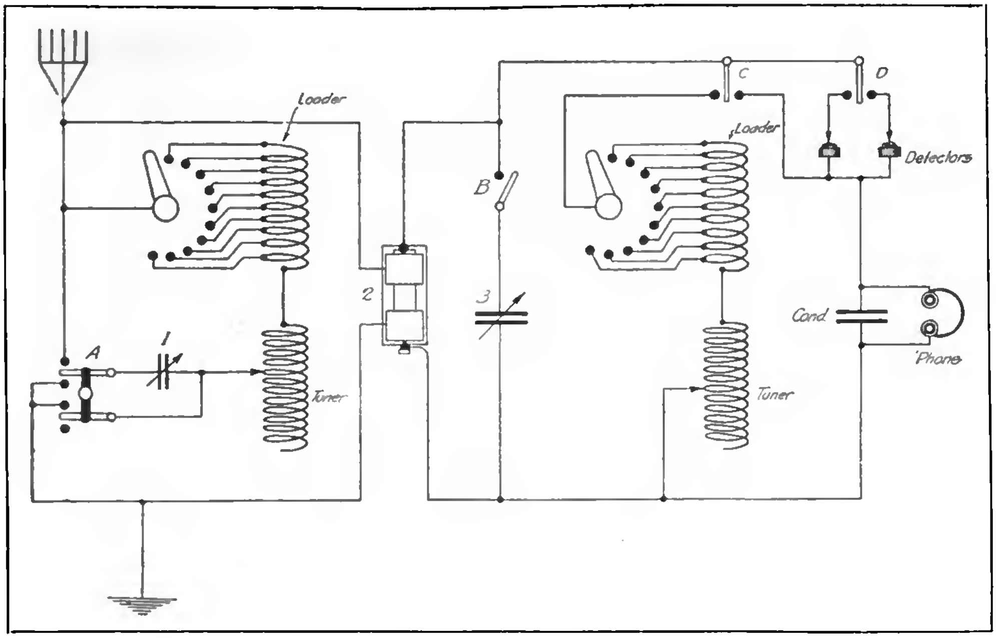


Fig. 4, Second Prize Article

an inch square. To this is attached by means of a small bolt and nut the hard-rubber manipulating handle, L. An ordinary key knob, K, is attached to the handle, L. A pivot is next fitted to the arm, A, and should be made of steel. At the other end of the arm a slot is cut with a hack-saw to admit a small piece of clock-spring or corset steel, C, which is soldered in place. Over the other end of the spring is forced and soldered a small length of 5/32-inch round brass rod, V.

In soldering these parts great care should be taken not to heat the spring too highly, as it will lose its elasticity and cause trouble if an excessive amount of heat is applied. In the same slot a small bent piece of spring brass, N, carrying the contact point is also soldered. The contact point consists of a small silver disk about ⅛ inch in diameter and 1/16 inch or less in thickness, soldered to the spring, N. A small brass block, S, acting as a weight, is pushed over the rod, V, and should have a small set-screw so that it may be fastened any place on the rod. This block is used to regulate the speed at which the dots are to be made.

In order to limit the motion of the arm two stops, F and G, are provided which are made of two short lengths of ⅜-inch square brass rod, and two short lengths of ⅛-inch round brass rod with a hard-rubber or composition handle at the end of each. A spring is compressed over the rod of stopper, F, to keep the arm, A, to the right when no pressure is exerted on the operating handle.

Another post similar to G, is provided at E, and it carries a contact point of silver on the end of O. A contact point is also soldered on the end of the rod, P, and one on the arm, A, as shown in the sketch.

The vibrating mechanism can now be mounted in position by unscrewing the bearing screw, Z, a short distance, placing the lower pivot in its corresponding conical bearing, and then screwing Z down over the upper point of the pivot.

All parts should now be finished, the metal parts being either lacquered or nickel-plated. The finished instrument is connected in the same way as any other ordinary key and is operated in the following way: For making dots the lever is pressed to the right and held there until the required number of dots are made. For dashes the lever is pressed to the left and held there as long as the dashed is desired.

E. C. ERIKSEN, *California*.

HONORARY MENTION
A Transmitting Set that Will Give Satisfaction

The construction of an efficient amateur transmitting set that will permit communication for several hundred miles during the more favorable months of the year depends on several factors, which taken singly perhaps are of small importance but collectively make the difference between a possible range of forty or fifty miles and one of 600 or 700 miles. The following suggestions refer to what is commonly called a 1-kw. set as it is the most popular among the better class of amateurs. While equal results are often secured with ½-kw., they depend on a finer attention to detail and it is also more difficult to secure the close adjustment that is necessary to secure maximum results.

The best results seem to be secured with a T type antenna as high as possible, the combined length of ground, lead in, and one half the length of the flat top not exceeding 100 or 110 feet. The aerial is preferably of six or eight wires and from point of expense and utility second-hand hard drawn copper wire can usually be obtained at a slight advance over junk prices. If all connections are made with copper ½ sleeves (any lineman will show you how to make these connections), and no soldered connections are used, this wire will be found strong enough to resist the worst sleet storms likely to be encountered. The strength of hard drawn copper wire lies in the surface film and if care is taken to avoid scratching the surface and making short bends or kinks in it, no difficulty will be experienced.

For successful long distance working it is essential that the aerial be as high as possible above all surrounding objects. An antenna a few feet above the roof of a tall building is seldom satisfactory. The lead should be of the same kind and number of wires as the flat top, twisting or lacing them together.

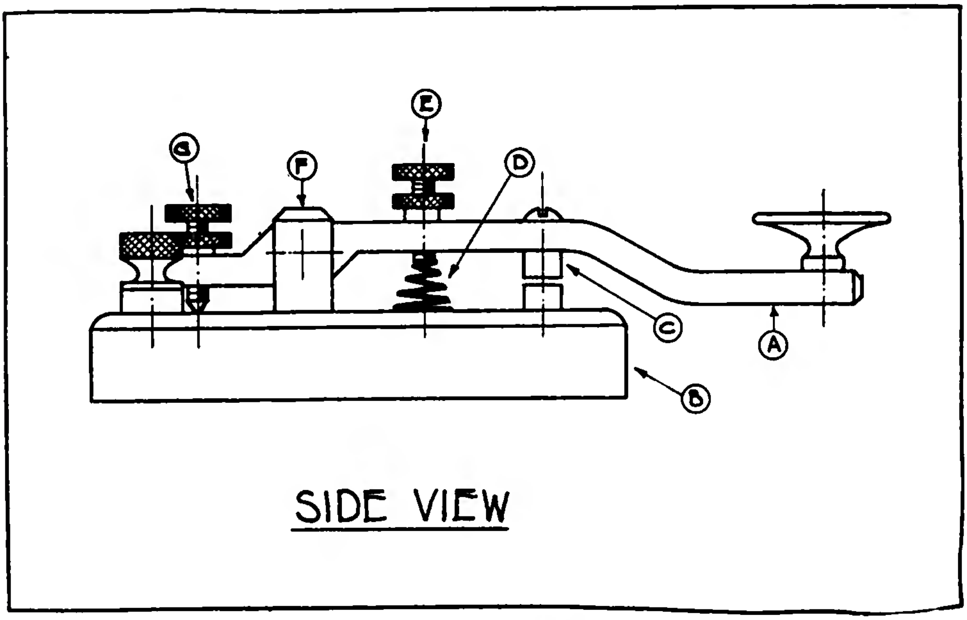


Fig. 1, Third Prize Article

The earth connection is very important. Connecting to a water pipe that wanders for 50 or 60 feet around the basement before entering the earth is not a good ground connection. Make the ground connection as short and heavy as possible; it should not exceed 5 feet in length to the nearest actual connection to the earth. Then run additional wires to everything within reach; the tin pipes of

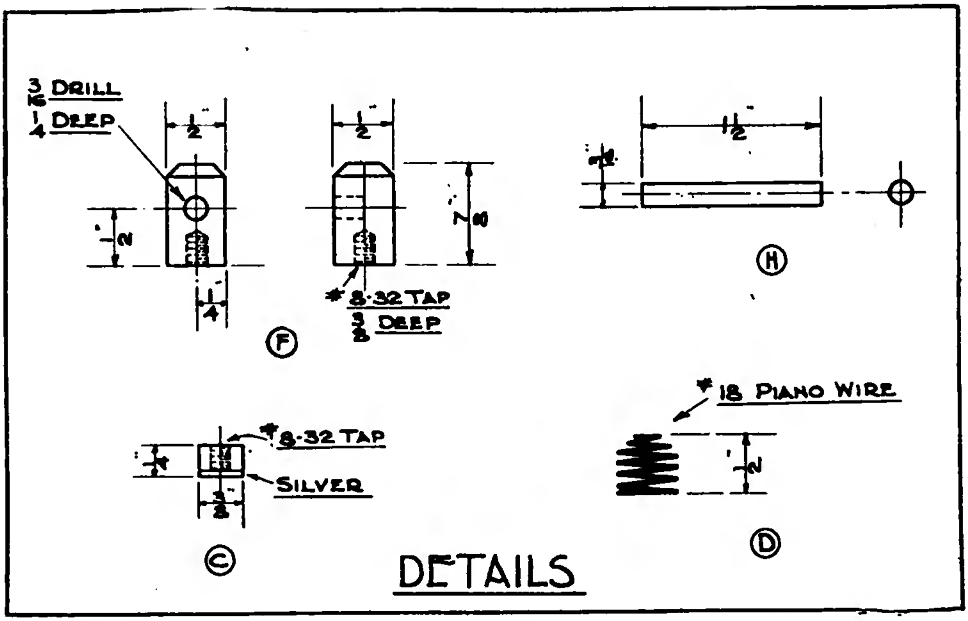


Fig. 2, Third Prize Article

The brass bearing shaft is indicated at H in Figure 2. It can be a drive fit or soldered in the lever. Brass rods, 3/8 of an inch in diameter, with a piece of coin soldered on the ends make the contact points. The spring shown at D is made of No. 18 piano wire wound on a 3/8 inch arbor.

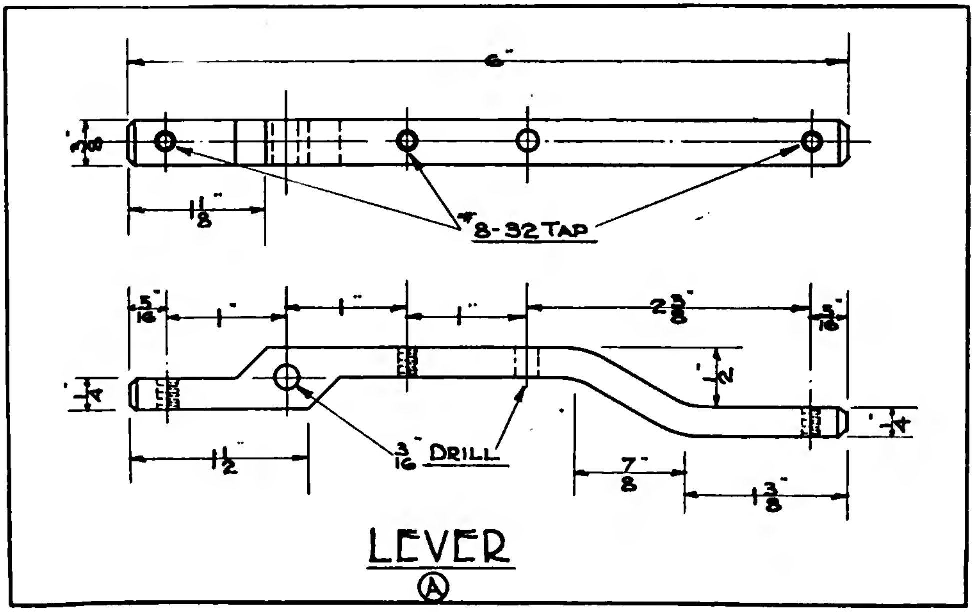


Fig. 3, Third Prize Article

the hot air furnace, metal plates submerged in nearby cisterns, gas pipes, metal waste pipes and anything that will give you a large metallic surface whether in actual contact with the earth or not. There is no place that low resistance counts for as much as in the ground connection. If you expect 6 or 6½ amperes radiation from a 200-meter set the resistance factor must be kept very low.

The oscillation transformer is the next consideration. As in a 200-meter set there is little room for complicated tuning devices a secondary of from 8 to 12 turns will give good results. The pancake type possesses some advantages and the ribbon, tubing or wire used should be at least equal in conductivity to the lead in. Simply connect one end of the secondary to the ground and the other to the lead in. Personally I prefer to connect the receiving set across an anchor gap in the ground wire and if some device is "rigged up" to short circuit the anchor gap while sending no loss will be experienced and a complicated antenna switch can be dispensed with.

The primary winding should consist of not more than six turns. Best results are secured with not more than 1½ or 1¾ turns of primary in use and by using a pancake type of oscillation transformer larger or smaller turns can be used, giving small variations of inductance which, together with adding to or subtracting from the number of plates in the condenser, gives very accurate wave-length adjustment.

If you wish to avoid condenser trouble as far as possible do not experiment with photo plates or window glass. Get plate glass (pieces from broken wind shields will do very well and can usually be secured for nothing) and coat each side of each plate with foil, soldering a thin brass ribbon to each foil long enough to reach to the coil of the primary in one case and the terminal of the rotary gap in the other. Round off the corners of the foil opposite the lugs as plates invariably puncture near where lugs are soldered. Then set the plates on end in a tank of oil. Automobile engine oil is as good as any, in fact, oil that has been used will give good results if allowed to stand until all sediment has settled.

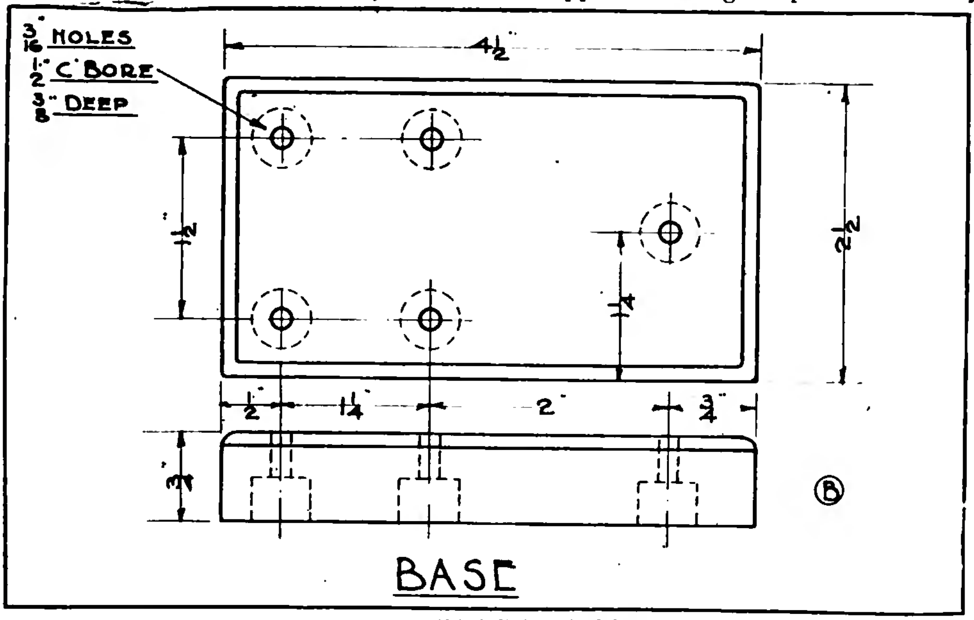


Fig. 4, Third Prize Article

Concerning the spark gap: Often you will see a rotary gap so arranged that the current has to turn six right angles and traverse a distance of eighteen inches from one terminal to the other. This would probably prove efficient on a 600-meter set but is out of place in a 200-meter set.

Personally, I prefer an eight-inch disk

with three or four lugs revolved at a speed that gives a spark frequency of from 250 to 300 per second. If the revolving lugs are not connected together but simply extend through the disk and the stationary electrodes are placed on opposite sides of the disk a very short path through the gap is secured, minus right angles. Very short connections

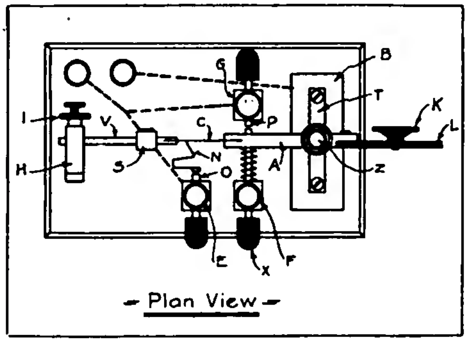


Fig. 1, Fourth Prize Article

can be secured by arranging the condenser, gap and primary in a triangle, if the three pieces of apparatus are set on different levels so as to bring the center of the primary on a level with the top of the condenser and the stationary lugs of the gap. Do not solder connections in the closed circuit with the exception of the leads from the foil in the condenser.

The high voltage transformer is preferably placed at some distance from the rest of the apparatus and the connections from it to the transformer are made of comparatively fine wire, say No. 20 or 22. If a considerable quantity of this wire is coiled around a form of, say, 2 inches in diameter and one of these coils is placed in each lead from the transformer to the condenser, the high frequency current is prevented from passing into the secondary of the transformer and in a very large measure prevents the "kick back." This also seems to raise the voltage to which the condenser is charged and will add to the clearness of the tone and also to the strength of the signals if other things are properly proportioned.

If a set is constructed along the lines suggested and sharply tuned, success is bound to result. However, maximum signal strength is secured when the voltage of the condenser is increased to the highest safe limit. A condenser of the type described should work with the safety gap set at 1½ inches without danger of puncture.

With the set in operation gradually reduce the speed of the gap until the spark jumps the safety gap across the condenser. If the lowest speed at which the gap will run and not permit discharge across the safety gap is too low for good results, remove one or more plates from the condenser and retune the closed circuit. In other words use a tone which is a low musical note with the smallest possible condenser. Assuming of course, that you are using at least a 20,000-volt transformer. With a rotary disk with few points far apart the magnetic leakage feature is of little advantage and if a transformer of the Thordarson type is used the yoke can be removed as it will be impossible to use the full 1 kw. with a condenser of this size. The slightly lower efficiency will be more than offset by the higher voltage and increased strength of signals.

The voltage to which the condenser

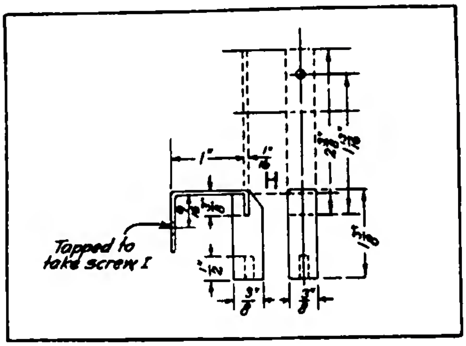


Fig. 3, Fourth Prize Article

can be charged is not limited by the secondary voltage of the transformer, but can be increased by making the condenser smaller, decreasing the speed of the gap and thereby giving it a longer time to charge. The increase can be effected to a lesser extent by placing choke coils in the leads from the transformer to the condenser. It is the short, quickly cut-off discharge of a highly charged condenser that adds more to the strength of the signals than any other one feature.

M. B. West, *Ohio.*

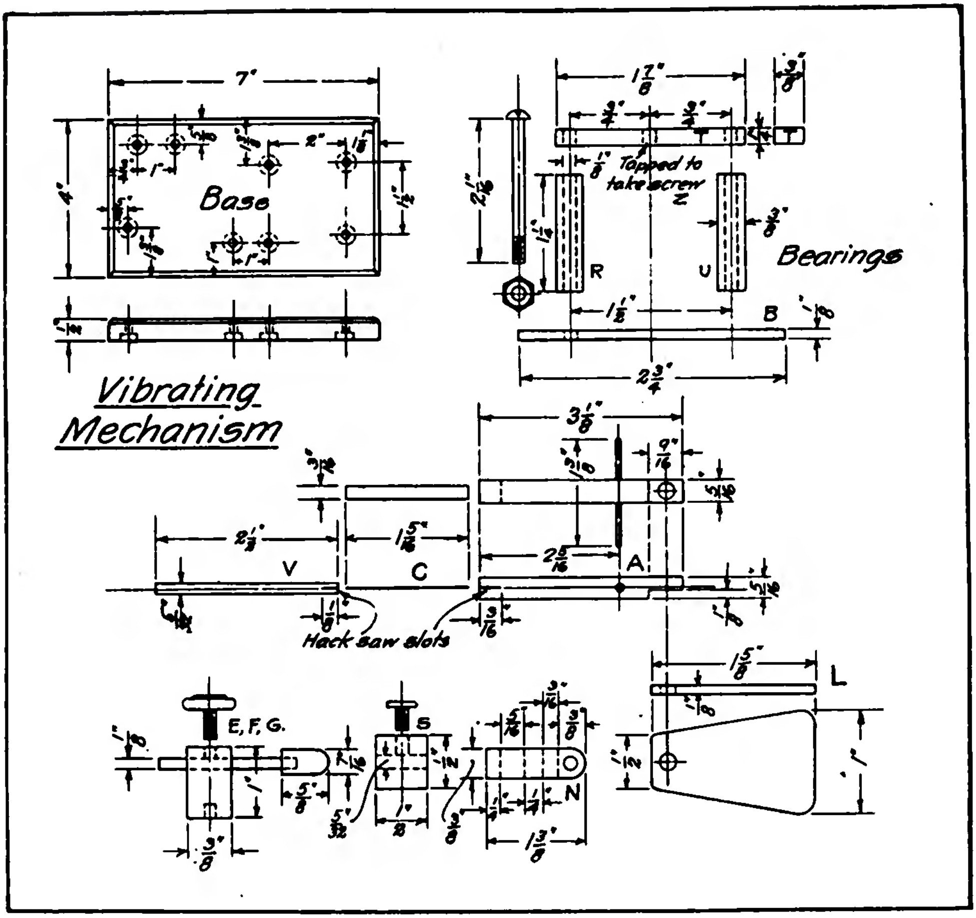


Fig. 2, Fourth Prize Article

LONG DISTANCE WORK

Noting the letters of other experimenters in the columns of your magazine, we thought we would express our opinion on the efficiency of certain amateur stations. At this season of the year amateurs over the entire country are fixing up their sets for the coming relay work and as a result many long distance records are bound to be made. In the matter of strength of signals and continuous communication we consider the sending sets of the following stations very efficient: 2-ZP, 2-IZ, 4-AA, 4-CL, 8-ER, 8-NA, 8-AEZ, 9-FY and 9-UZ. Perhaps the most efficient one of the list is 2-ZP, which is 400 miles distant. Although this station only uses a ½-kw. set, nevertheless the signals come in as loud as other amateurs located but eighteen miles away.

For receiving we use a navy type of tuner, a vacuum valve detector and Brandes superior head telephones. We have heard a station in Alaska which is approximately 3,500 miles away.

In addition to these stations we have also heard KIX, 9-ABD, 9-GHS, 9-BD, 9-DB, 5-ZT, 8-LQ, 1-LE, 2-FH and many others.

Our ½-kw. transmitting station has covered considerable distances during the past winter. Our maximum record is about 850 miles. We have worked 9-GJ, 9-PC, 8-XC, 8-WW, 3-WN, 2-ID, 2-IC, 2-DA, 2-ZE, 2-ZP, 1-ZL, 1-ON, 1-IZ and others. All the stations just mentioned are over 300 miles distant, with the exception of two. We expect to install a 1½-kw. sending set and will be glad to hear from anyone who has heard our signals.

Lot and Hodge Alexander.
Pennsylvania.

In the Wake of the U-53

By Oscar B. Hanson, Marconi Operator on the Steamship Stephano

As details of the sinking of six steamships by the U-53 off the New England coast on October 8th become known, it is discovered that the story is interwoven with wireless. It was wireless that brought the United States destroyers to the aid of the doomed ship's people and warned other vessels of the undersea boat's presence; it was wireless that gave the facts of the raid to newspapers, making a new chapter in the history of journalism as well as of radio.

"HAVE been fired upon by submarine. We are getting men into boats. Position, 40.25 north—69.00 west."

This was the message that I picked up at fifteen minutes after twelve o'clock in the afternoon on October 8th, while the Stephano was plying her regular run between New York, Halifax, N. S., and St. Johns, N. F. Flashed from the steamship West Point and repeated by the Kansan, it bore a harbinger of the fate which was to overtake us some six hours afterward.

The Stephano left Halifax at one o'clock in the afternoon on October 7th, carrying ninety-seven passengers, of whom forty-seven were Americans. I was the only operator aboard, the junior having left the ship at St. Johns. I copied the appeal as transmitted by the Kansan's operator and gave it to Captain Smith, the commander of the Stephano. The Stephano was at this time heading in the direction of the Nantucket Shoals lightship, thirty miles northwest of the position of the West Point. Believing that the submarine would submerge after she had sunk the West Point and not immediately attack any more craft, we saw no great risk in keeping on our course. We had hopes, too, of picking up the West Point's people.

Oscar B. Hanson, who tells a thrilling story of the attack on the Stephano

At the request of the captain I sent a message to the New York agents of the Stephano, telling them of the time that we expected to arrive in port. I called WSC (Siasconsett), which received the message. This station had previously sent calls broadcast, informing all ships of the position of the West Point.

This was about four o'clock in the afternoon. Soon afterward the Kansan was sighted on the horizon off our starboard quarter, heading south. She asked if we could see her and if we knew of the West Point's condition. I replied in the affirmative. From an American destroyer then came the QST, followed by another message from the Kansan to the effect that as she was not needed she had changed back to her original course and was proceeding to Boston. While these messages were flying back and forth, men stationed in the crow's nest of the Stephano were scanning the waters in a search for the West Point's boats. They looked in vain, however, and it seemed for a time as if the submarine were a myth when two United States destroyers were seen lying a short distance to the east. Beyond them was a grotesque, rakish looking craft which we who sail the seas now have much in mind—a submarine.

I made my way to the bridge where Captain Smith handed me the glasses and pointed out the hazy outlines of the underwater craft which was about one mile ahead of us. Darkness was approaching, however, and in the fading light her numbers could not be read.

Despite the nearness of the submarine there was no alarm on the Stephano. This was due to the fact that up to this time the passengers did not know of the raider's activities and the ship's officers, their minds put at ease by the sight of the destroyers, decided that the craft were going through manoeuvres. And so I went down to dinner, satisfied like the others that we were in no immediate danger.

But we had barely seated ourselves before we heard a shot and the ship shivered. Three more shots fired in quick succession followed, but the ship stood stanch and I concluded that they had crossed our bows.

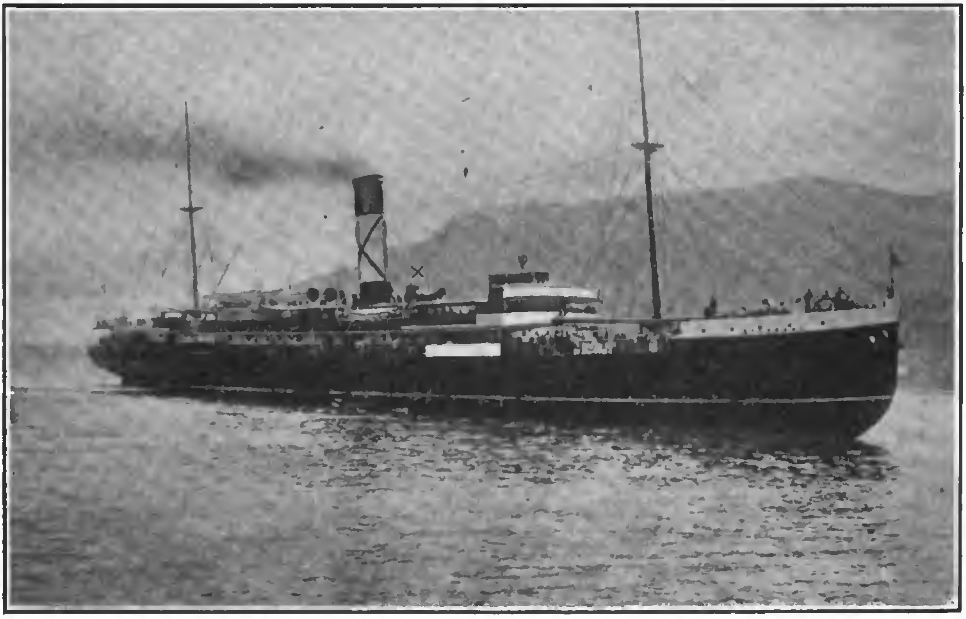
Hurrying from the saloon, I started for the bridge, where I found Captain Smith. He ordered me to tell the U-boat commander that there were forty-seven Americans aboard the Stephano. I did so, but received no reply. Then I called the destroyers. The Balch, which was at that time visible on the horizon, responded, asking "Who and where."

"Stephano being torpedoed off NLA" (Nantucket Shoals), I flashed.

Almost immediately he answered

"Am coming to your aid full speed."

Fifteen minutes afterward she was alongside.



The Stephano as she appeared when photographed off the Newfoundland coast

Meanwhile the Stephano's eight lifeboats had been successfully launched and the passengers found places in them. The boats were picked up by the Balch and the Ericson. A motor boat from the Balch took off the greater part of the ship's company of the Stephano.

With the completion of the rescue work came darkness, and the fleet of destroyers began to operate their searchlights. In the spectacular display which resulted could be distinguished the lights of the submarine. The latter inquired if all were off the Stephano and then steamed toward the vessel. Whether the Germans boarded her or not, I do not know. At any rate they did not sink her until about ten o'clock.

At this time the submarine opened fire, sending thirty high explosive shells into the doomed ship. But they did not take effect and her lights remained burning as brightly as when we abandoned her. One shell started the electric fog horn blower and another hit the Morse lamp on the bridge. It was a torpedo which accomplished the final destruction of the Stephano and she went to the bottom flying the British ensign which Mr. James, the second officer, had hoisted before leaving the ship.

When the last light of the Stephano had disappeared beneath the waters the Balch turned her prow toward Newport and steamed away. And as she passed close to the U-boat the latter threw the rays of her Morse lamp toward the destroyer while she seemingly waited like some voracious creature of the deep for other victims.

Following the attacks of the U-53, various vessels on the Atlantic were warned by wireless of the presence of the submarine. As a result all of these craft took measures to elude the raider, some racing toward their ports of destination at full speed, with lights out, and others hugging the safety zone.

When the French liner Lafayette steamed away from Bordeaux no one on board knew that the U-53 had been raiding off New England. After the liner had been several hours out of port, however, her commander received a wireless saying that the submarine had crossed the Atlantic. In mid-ocean he received another wireless, this message warning him to be on the lookout for submarines off Nantucket. Then he received a marconigram containing news of a ship being chased by a submarine, and the course of the Lafayette was changed. The ship arrived in New York harbor without mishap, however.

The Cunarder Orduna left Liverpool on the afternoon the U-53 was in Newport Harbor. After she had passed out of the Mersey word came of the submarine raids. Following the message, a lookout was posted in each crow's nest and the commander of the vessel remained on the bridge every night throughout the voyage.

From Captain J. L. Jones, of the freighter Bovic, came a story to the effect that when the vessel, bound for New York from Liverpool, was twenty-eight miles southeast of Nantucket lightship, the lookout man in the upper crow's nest had reported that he could see the periscope of a submarine. The submarine had suddenly changed her course and followed in the wake of a vessel which those on the Bovic believed to be the Scandinavian liner Hellig Olav. Messages were sent to the Hellig Olav from New York, asking for details of the chase and the following reply was received from the liner's captain "Have not seen any submarine."

A submarine, believed to have been the U-53, was sighted on October 10th about 100 miles off Nantucket lightship, by a neutral vessel. The submarine wirelessed the latter, asking her name and nationality. The information was transmitted and then, "Who are you?" was the message flashed to the undersea craft.

"German submarine from Newport. Goodby," was the answer.

That the news of the raid had come by means of wireless gave added importance to the art in newspaper offices. This is the way the news reached the office of a New York afternoon newspaper on Sunday, October 8:

When the steamship Kansan was stopped off Nantucket by a submarine, the liner's commander sent a wireless message to the Nantucket Shoals Lightship telling of the incident, and the facts were telegraphed to New York.

Then came wireless messages relating that other steamships had been stopped by the submarine, and when the last edition went to press all the details of the occurrence available were in type.

Thus did wireless share in a journalistic triumph.

Illustrating two visual and one electrical means of signaling; heliograph and wigwag at left, wireless on right

Paul Reveres of Our Own Time

How The Message is Sent From Command to Command In Modern Day Warfare

Felix J. Koche

HAD the great Napoleon only been possessed of the first stage of it, Grouchy could not have possibly failed him!

Had Marconi been born, say, a hundred and fifty years ago—in season to give New England colonists a chance at the wireless—Paul Revere would never have made his famous ride!

If Caesar, in Gaul, had only had the telephone, or if the great Hannibal could have sent marconigrams—fancy, if you can, how all world history might have changed!

Someone has said, and with undoubted truth, that *if* is, after all, the most important word in the language; and if any modern army should venture forth into battle not prepared, as its enemy, to get word from command to command, said army would fail in the end, no matter how well equipped otherwise.

To the laymen this wonderful system for "getting across" the message is almost wholly unknown.

In a ramble through the great muster camp, where such things concentrate, what appears as the Signal Corps, means but little to untrained lay eyes.

Thus, not so long since, at Camp Willis, on the outskirts of Columbus, where the Ohio National Guard was encamped, those who paid the Signal Corps a visit were greeted by three great wagons, drawn up alongside the tents, with trappings and harness nearby; horses were to be supplied when they came to the scene of action. But beyond volunteering this much information, the soldiers left you to make your own estimate of the equipment. At one place a squad of men was devoted, evidently, to wireless service; at the other the wiremen held their own. Given proper guide, and at either one of these places the visitor can remain long and profitably.

A two-horse cart is shown the favored caller. The cart is equipped with an outfit of wire, on a spool beneath the box proper of the wagon; each of these spools is wound with five miles of wire. Arrangements are such that this wire can be strung, even though the horses dash along at gallop; so that communication may be established, though the corps travel at top speed. Such wire will be attached to the ground, to fences and so on, where need be. Two linemen mounted on horses ride behind the fast-flying cart, and, by expert use of the pike and other tools, are able to properly lay the unreeling line, without quitting their steeds. Daring riders, too, keep up with the other cart, in a mad and seemingly impossible gallop. Both telephone and telegraph wires are laid in this way.

The hand generator which supplies current to the pack wireless set of the Signal Corps.

In the enemy's country, however, and among mountains and difficult terrain, it's not always feasible to resort to such means as this, and so the wireless comes in handy.

Wireless for such work is carried on mule back and the entire outfit is modelled to insure transportation flexibility.

There is a generator, mounted on a metal frame, fitting the pack saddle exactly. This generator is worked by hand; two men do the grinding, one relieving the other, but working continuously. This media generates all the current they may need, for the average sending radius is hardly over 35 miles.

The mast, a forty-foot affair, is also transported on mule back. En route, it is taken apart in compact sections which occupy a position beneath the special carrying device on the mule; or, circumstances permitting, it is carried on the wagon given over to the wireless transmitting instruments. This latter, as now carried by the Signal Corps of the Ohio militia, represents the perfection of practical compactness. A single case has been designed to contain both the sending and receiving apparatus.

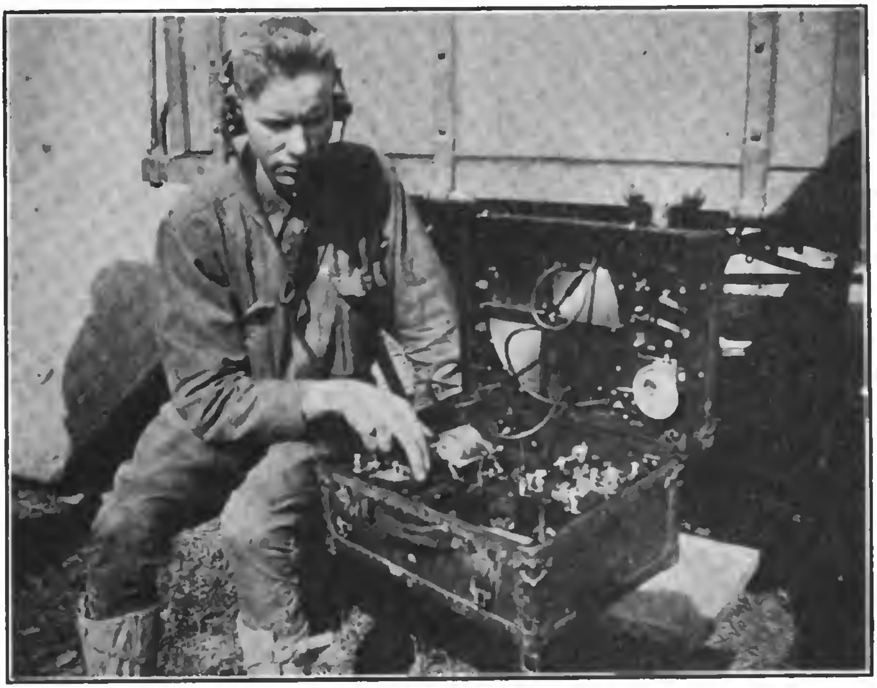
When the lid to this is open it is found that one-half of the space is occupied by the oscillation transformer; next this, in a corner, is the aerial-switch, and below it a clock-like device is indicated as the hot wire ammeter. In the body of the case are the primary and secondary coils, the loose coupler, and the complete detector, all so compact that a single operator can easily take charge of the station at all times.

These Paul Reveres of to-day, to whom is entrusted the sending of most vital messages, accomplish their task seated on the ground, wherever they happen to be. The generator is removed from the mule's back and put on the earth also; current sufficient to put the set in running order is manufactured inside three minutes. Meanwhile other men bring the mast from the mule—seven sections there are in all—and set it to rights. Wonderful system prevails here; superb discipline. Each man has his especial duties, and no time is lost.

You appreciate this more as you watch the new corps arrive. Two men unpack the generator, one man unships the pack set. Two more have taken charge of the bag containing the antennae and the counterpoise. Every one of these men is numbered. Nos. 1, 2, 3 and 4 run their lengths in as many different directions, each with his prescribed material. No. 9, assigned to such an end, raises the mast hand over hand. Man No. 7, ready on the instant, quickly assembles the sections. Meanwhile 5 and 6 connect up the generator and run out the counterpoise, while No. 8 acts as horse holder. It's all done in less time than it takes here for the telling!

Just so soon as the mast is up, they connect the instrument case with the generator and the aerial and are ready to commence work. The seemingly intricate process may be completed within three minutes from moment they strike camp—should such haste be desired.

The signal corps men concern themselves only with the matter of communication. Special cavalry is provided for their protection, keeping the communication intact under all adverse conditions. Use is also made of a secret key-word, against the enemy making use of such orders as it might intercept; and this is changed each day.



The Ohio militia's suitcase set, a light equipment designed for communication at 35 miles or less

The communication as it stands extends not only over land and water, but to things above. A master signal electrician devised apparatus for communicating to and from war balloons, wireless being, of course, involved. A service buzzer is employed here; the ground being woven into the anchor cable and other devices being so applied that they can communicate with a balloon at a height of 2,000 feet!

Buzzers employed to such ends resemble, to lay eyes, nothing quite so much as a camera case, but of a yellow leather. Open this and you find, inside, the battery and condenser, the phone, receiver, and the sending key. The entire outfit weighs less than five pounds and the man operating it rests himself, conveniently, upon the ground. In times of emergency, should no wire be near, he can attach the buzzer to any barbed wire fencing nearby. More commonly, however, the instrument is used with a wire. This line is unreeled by hand, generally running, from the tent of the commander to tne various unit headquarters and to the firing-line.

But, should wireless and telephone and telegraph fail, the Signal Corps relies on the semaphore and wigwag and the time-honored heliograph. Its operation of the latter is near perfection. Using it properly, tripods are set up, and the shutter employed to close off the light flashed from the mirror. Simple it all is; the mirror flashes as before it the shutter revolves and is lowered to produce the dots and dashes, effective at surprisingly long ranges. And, what's more, the men get from their instruments the very best that's in them.

At the camp it's a round of drill, with all present. Now they set up the heliograph and send a message. Now they raise an aerial, striving to break their own record time. Now there's a drill at the unreeling, now at packing or at breaking camp. Whatever else may be said of military unpreparedness, Uncle Sam's signal-men stand well equipped for duty.

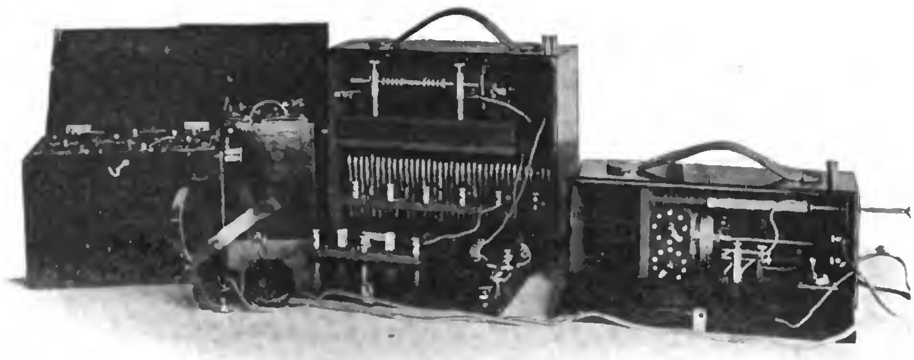
MAKING WIRELESS SETS

(Continued from page 163)

work and the opportunities. Boys, mechanics, testers and engineers were all of one mind in considering their employment as a special privilege. "They know how to treat a fellow in this plant," observed a veteran lathe-hand, in response to my inquiry. "Not only do we get the best working conditions, but special provisions are made for us all the time. Why, only recently, the company notified every man who'd been in its employ a year or more that his life had been insured. It doesn't cost us a cent; the company pays all the premiums and we get the money—that is, our wives or mothers do, if anything happens to us. After five years' service the amount doubles up. Now that's pretty fine treatment. Every man of any account feels it his duty to provide for loved ones in case they should suddenly be deprived of his wage-earning powers. But lots of us would find it mighty hard to keep up paying premiums on a life insurance policy. It's a fine thing to know that this is taken care of without a cent of expense to us. Maybe the boys don't appreciate it, too! You should see the pull-together spirit in this plant; every fellow's the other's friend, and we're there for the company forty ways all the time."

I saw an illustration of this pull together spirit during my visit, and incidentally caught a sidelight on the attention given to safety first details for these men. It so happens that I arrived on the day designated for the regular fire-drill. The factory has two organized fire brigades working under the supervision of a chief fireman. In exactly one minute and six seconds after the alarm sounded the Marconi boys had two streams of water playing on the building. Less than a minute later, the engine-driven apparatus of the Borough of Roselle Park had arrived and two more streams of water were in action. I was told that this was a feature of the drills, the local firemen respond regularly to the alarms for the Marconi factory drill and work in conjunction with them, the Borough Chief taking command as soon as he arrives on the scene and giving practical instruction in fire fighting.

Before I left, I spent a wonderful hour in the laboratory. Some day soon I shal! set down my impressions of this branch of the work; for here, too, were countless first-hand evidence that the manufacture of wireless apparatus is one of the smoothest working highly specialized and thoroughly enjoyable vocations in the commercial industry of today.



The Ideal Signal Corps Set

Description of the Portable Transmitting and Receiving Equipment Made by the Marconi Company from Designs Approved by the Military Committee of the N. A. W. A.

PORTABLE wireless equipment of special interest to all amateurs and invaluable to military signal corps, has recently been manufactured by the Marconi Wireless Telegraph Company of America. This set is the first Marconi apparatus to be made specially for amateur wireless workers and follows closely the design details given in the instruction book. "How to Conduct a Radio Club."

In making this set it was considered that portable apparatus having a sending range of five miles is ordinarily sufficient for all cadet military maneuvers. The Military Committee of the National Amateur Wireless Association has officially approved this equipment as one that is entirely practical for short distance work and well within the funds usually available in signal corps organizations.

This proceeding followed a series of field tests which proved notably successful. Excellent results were obtained and it was definitely determined that during field communication a receiving aerial is not required as a part of the equipment to receive signals from the headquarters or control station.

If the maneuvers are conducted in a locality where access can be had to a barbed wire or other wire fence (attached to wooden posts), direct connection can be made from the upper wire to the aerial post of the receiving cabinet and signals received with surprising clearness. In recent tests conducted on Long Island, N. Y., the upper wire of a fence was employed as the aerial and the lower wire as a "capacity" earth and, although the natural period of this system was excessive, remarkable results were obtained in receiving from transmitting stations operating at the wave-length of 600 meters. Experimenters duplicating this feat should, if possible, connect a condenser in series with the antenna lead to reduce the natural wave-length to a value suitable for the shorter range of wave-lengths.

These tests proved conclusively that the signal corps of a military organization can receive direct orders from its headquarters by using any available elevated insulated capacity as the aerial system.

The complete transmitting and receiving instruments are well illustrated in the accompanying photographs. The transmitting apparatus comprises mainly a 3-

inch spark coil energized by 12 dry cells. The receiving apparatus, although primarily designed for the wave-length of 200 meters, will respond to wave-lengths between 600 and 1,000 meters, but it is more efficient on the amateur wave-length.

The entire equipment is assembled in four containing cabinets as follows:

CABINET NO. 1—
- 1—3-inch spark coil with special high speed interrupter.
- 1—Aerial tuning inductance with several binding posts for connection.
- 1—Special zinc spark gap with cooling flanges.
- 1—Aerial changeover switch.
- 1—Transmitting key.

CABINET NO. 2—
- 1—200-meter receiving tuner of the inductively coupled type with 2 multipoint switches on the primary winding and a single multipoint switch on the secondary winding.
- 1—Sliding tube variable condenser.
- 1—Crystal holder with a cat whisker adjustment.
- 1—Fixed condenser.
- 1—Pair of special head telephones.

CABINET NO. 3—
- 6—Red Seal dry cells.

CABINET NO. 4—
- 6—Red Seal dry cells.

Convenient connecting leads are supplied for connecting together the various cabinets.

The induction coil of the transmitting set is fitted with a special high speed interrupter giving a current output of unusual volume, in fact the set connected to an amateur aerial of .0003 microfarads indicated a current flow of 1¼ amperes—all that can be expected of a small transmitting set.

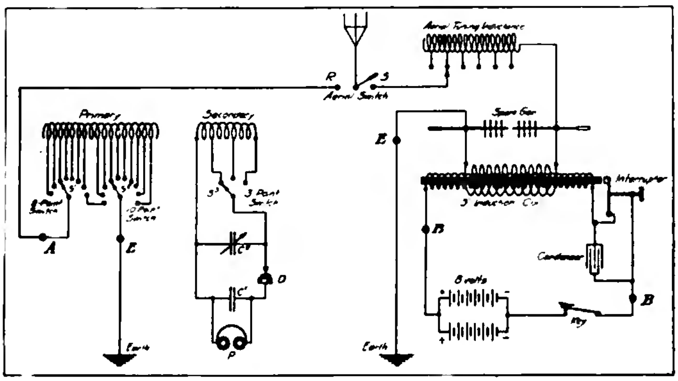
The amateur experimenter accustomed to receiving tuners ordinarily supplied to the amateur field for 200 meter use may be surprised at the diminutive proportions of the coupler furnished with this equipment, but it should be borne in mind that a winding for 200 meters requires but a few turns of wire.

The receiving cabinet has a compartment for the head telephones, thus making the entire receiving set one of desirable compactness. Provision has also been made in this apparatus whereby the coupling between the primary and secondary windings can be altered from the outside of the box by means of a sliding rod. The same method is applied to the variable condenser in shunt to the secondary windings, for, owing to the small size of the receiving cabinet, it is not convenient to do this by placing the hand inside the box.

To enable the experimenter to mount his own "pet' crystals, the crystal cup has been left empty. Crystals such as silicon, galena, molybdenite, cerusite, etc., are the ones that probably will be used.

Apparatus of this type is highly recommended for organizations desiring a small transmitting and receiving outfit, for it is the only type of apparatus that can be employed where there is no source of alternating current.

The range of this equipment varies widely, depending upon local conditions, such as the height and length of transmitting aerial, the nature of the ground connections and the topography of the surrounding country, but under favorable conditions, with an aerial having a fundamental period of 190 to 200 meters, 16 miles have been covered, which range



Wiring diagram for the portable equipment may be increased considerably by the addition of a sensitive vacuum valve detector. It should be kept in mind, however, that the set was designed for transmitting and receiving over a distance of five miles, and with the proper aerial and earth connections should easily make good.

At the military camp a spot may ordinarily be located where an aerial can be swung in the trees, but whatever the type of aerial support, it is recommended that an antenna of the flat top type be employed having 2 or 4 wires spaced about 2 feet apart. A T type of aerial, 100 feet in length, is excellent for the purpose.

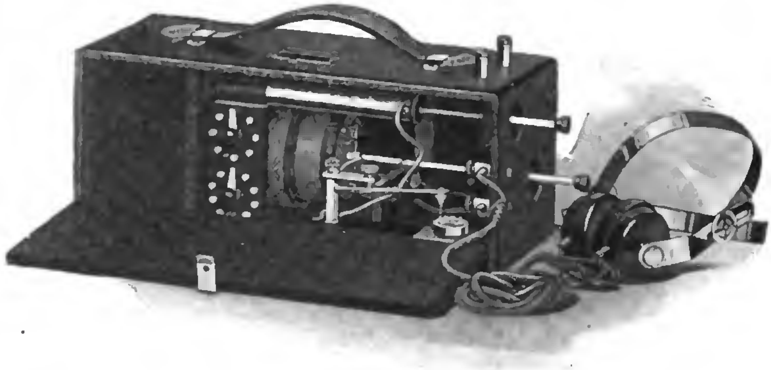
If possible, the station should be erected where contact can be made with damp earth, and the actual lead contacts from the portable sets to the earth should be short and of heavy copper wire. Two 5-foot sections of iron or brass pipe, driven to a considerable depth in the earth, should give sufficient contact surface. Experiment has proven, however, that a surface ground, consisting of galvanized iron wire netting, is the most effective, particularly if spread directly underneath the antenna wires.

Of unquestioned utility is a buzzer tester in determining the requisite degree of sensibility of the receiving detector. For these sets two alternatives are offered. There is sufficient space in the receiving cabinet to mount a small buzzer, a terminal of which can be connected to one of the leads of the local detector circuit (a connection, of course, must be made from an external battery), or, at a slight additional cost, the buyer may purchase a small buzzer testing outfit complete, mounted in a box, with binding posts for immediate use.

In adjusting the transmitting apparatus of these sets, the amateur should adjust to secure a high pitched note rather than a long spark discharge of irregular pitch. With the average aerial it is of no value to lengthen the gap beyond one-quarter inch. It is of course understood that the barbed wire fence has insufficient insulation to be employed as a transmitting aerial, but that it functions extremely well as a receiving aerial.

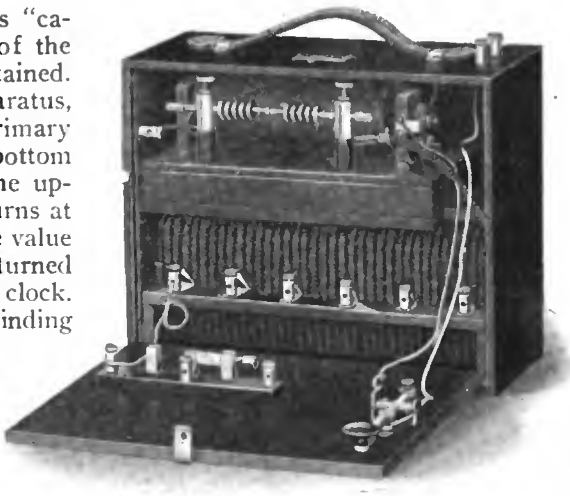
When the batteries furnished with these sets are fresh, a good spark can be obtained with a single set of dry cells connected to the primary terminals of the induction coil, but when they indicate signs of exhaustion another set can be connected in parallel. After both sets of batteries have become fairly well exhausted, they can be connected in series and the entire apparatus will function at its normal rate over a considerable period.

In making use of the transmitting equipment considerable attention is given to the earth connection. A single piece of gas pipe, five or six feet in length, driven in moist earth, cannot be considered having sufficient conductivity to allow the transmission of signals to any distance. Several pipes should be driven in the earth to a considerable depth and connected in parallel. As a substitute four or five copper wires can be spread over the surface of the earth directly under the flat top portion



The receiving cabinet weighs only five pounds, yet has an effective range of 500 miles of the transmitting aerial. If this "capacity" earth has the dimensions of the flat top portion good results are obtained.

Considering the receiving apparatus, the single turn switch for the primary winding is the one located at the bottom of the small switchboard, while the upper switch cuts in groups of ten turns at a time. To increase the inductance value of this circuit both switches are turned in the direction of the hands of a clock. The inductance of the secondary winding is also increased by turning this switch clockwise.



The tronsmitter is less than a foot square in size, but sends a message 16 miles

The experimenter should keep clearly in mind that these sets have a maximum adjustment of 600 meters and were primarily designed for operation at wave-lengths between 150 and 450 meters.

A portable mast for the pack set can easily be constructed of six or seven 6-foot sections of spruce, the bottom one being about 2½ inches in diameter, and the top one tapering to 1½ inches in diameter. The joints should be lapped by about 18 inches, being fitted with iron sockets permanently bolted to the top of one section, into which the base of the next section above fits snugly. This mast may be supported by two sets of guy wires, of four wires each, one set being attached to the center of the mast and the second set about 1 foot from the top. Iron or wooden anchors may be driven about 30 feet from the base of the mast and equi-distantly spaced. No. 12 iron wire will do for the guys.

It is recommended that each field station be fitted with two of these masts separated by about 100 feet and that there be suspended between them a two, three or four wire aerial of aluminum wire with the lead-ins attached to the center. The spreaders should be made of a bamboo pole which can be purchased from any supply house dealing in fishing rods.

During field maneuvers it is customary to have a powerful station at headquarters by means of which instructions can be transmitted to the various divisions in the open field. However, if care is not taken in the design of this station it will not be able to receive from the field equipment. The receiving aerial of the permanent station must be small enough so that it can be placed in resonance with the shorter wave-length used by the field station. Hence care should be taken to have an aerial of about the same dimensions as that employed for the portable set.

A powerful portable field set for headquarters may be made up by the following pieces: 10-inch induction coil (now on sale by the Marconi Company) the type D storage cell unit of 30 volts and a type A transmitting key. The spark gap should be connected directly in series with the antenna system, no condensers or tuning coils being required. If, however, the phenomenon of resonance is to be taken into account and it is desired to emit a sharp wave, then an oscillation transformer should be purchased or constructed. It will be found by experiment that with a flat top aerial erected in the trees and having a length of at least 150 feet, this apparatus will transmit to a distance of 15 to 30 miles, depending upon the receiving apparatus at the receiving station and the dimensions of the receiving aerial. Care should be taken not to have the emitted wave of the permanent station in excess of the possible adjustment at the receiving tuner of the field station.

A considerably more powerful field set could be requisitioned if one of the members of the military organization possesses a motorcycle with a side car. The basket of the side car should be removed from the chassis and a floor of 1¼ inch planking substituted. A complete transmitting set of ½ k.w. capacity should then be mounted on this base adn set into position for immediate operation. Possibly the alternating current generator could be mounted on the base and by means of a short chain drive, driven by the motor-cycle engine. Owing to the vibration of the engine it is not desirable to mount the receiving apparatus on the same base, but it can be carried there during transportation and then mounted on a small portable table or camp stool. The side car should be fitted with clamps for strapping on the portable mast. With an equipment of this type the entire apparatus can be moved from point to point with considerable dispatch and, owing to the power available, it should prove more efficient than with dry cell sets.

The receiving station at the headquarters should be fitted with some form of the vacuum valve amplifier to insure against loss of signals from the field station. The field receiving set, however, should be simple, free from all complicated adjustments and yet sufficiently sensitive to receive signals from headquarters. In this manner two-way communication is easily possible because, even though the receiving equipment at the field station is not sensitive, the increased power available at the permanent station makes up for the lack of sensitiveness.

For ordinary maneuvering, tuned transmitting circuits should be avoided. With the spark gap of the transmitting system connected directly in series with the aerial wires, it is not necessary to tune two circuits to resonance, to radiate energy. The value of this arrangement will be immediately understood by those who have had previous experience with radio telegraph equipment.

The Military Committee of the National Amateur Wireless Association has arranged to supply to the amateur field with military portable sets entirely practical for short distance work. A number of experiments will be made to determine the range of these sets and information accordingly supplied.

RELAY LINES IN THE MIDDLE WEST

It may be of interest to your readers to know that a 5-kw. spark set was installed at NAJ (Naval Station, Lake Bluff, Ill.), and it has been in operation since June 16. Under the supervision of the Navy Department six relay lines or routes, as they are designated, are radiating in as many directions from NAJ, having been made up through the medium of amateur stations throughout the Middle West.

A system of drills has been inaugurated as follows:

At 6:30 P. M. of each Tuesday and Friday, test messages are sent out by NAJ, which are copied and relayed by the stations of the several routes and the results obtained at each station reported back to headquarters. Every Sunday morning the stations of each route transmit their own call letters for a period of five minutes, the schedule being so arranged that no two stations on a single route send at one time. Since it has been ordered that all other stations on a single route are to listen in during these tests, calls are made followed by a complete report of the strength of signals, which gives a fairly accurate estimate of the efficiency of each station. During these tests stations failing to respond, either through negligence of their owners or inefficiency, are to be eliminated from the service. All reports are made to the A station of each route. Reports are submitted the first day of each week.

At eleven o'clock each night NAJ sends out the weather report for the benefit of amateur stations on the several routes in Illinois, Michigan, Wisconsin, Minnesota, the Dakotas, Nebraska, Kansas and Missouri. The work has progressed to such an extent that the United States Weather Bureau is furnishing the operators of those stations getting the weather reports with the necessary blanks, cards, etc., including card holders, for the purpose of posting each day the weather reports as they are received from NAJ. LEE HENRY, *Kansas.*

Detroit is now the headquarters of the United States radio inspection service for the eighth federal district.

With the Amateurs

The Amateur Marconi Radio Association, of Troy, N. Y., is planning to provide its members with pennants bearing the Association's initials. The pennants will be flown from the aerials of all members.

The members of the Association are also planning to erect a temporary aerial on the Y. M. C. A. roof. A course in instruction has been inaugurated and every member is to be supplied with a textbook, written by E. E. Bucher, instructing engineer of the Marconi Wireless Telegraph Company of America.

Charles Everingham, of Troy, has been appointed to send out weekly bulletins. Stations in Albany and Schenectady have been designated for the same purpose.

The Wireless Association of Atlantic City held a meeting recently at its office, 314 Guarantee Trust Building. Activities for the coming winter radio session were outlined, among which will be press service sent from the club station, "3if," St. Charles place, in the evening from seven o'clock to fifteen minutes after seven. "QST" will be sent at a speed of about ten words a minute. The regular business meeting will be held the first Wednesday of each month at the Association's office, while the "general" meetings will be held at the club station.

Kansas farmers will soon receive the weather forecast by wireless at the station nearest their postoffices in time to go out on the early morning rural route.

J. O. Hamilton, professor of physics, at the Kansas State Agricultural College, has installed a service which will be extended to all towns asking for it. He receives a special Government service, in connection with the college work. There are several hundred amateur wireless outfits in the state.

The Government forecast is telegraphed from Chicago to stations in all parts of the Middle West every morning at nine o'clock. From the central stations it is mailed or telephoned to some three or four hundred smaller distributing points. By using wireless no delay will result, as the operator of the radio station can transmit the forecast instantly to all parts of the state.

Two towns have already placed their names on Professor Hamilton's calling list. They are Logan, Phillips county, and Bennington, in Ottawa county. There are amateur stations in nearly every town with a high school. The operators transmit the forecast to the central office of the telephone company, and the farmers receive it almost as soon as the station in Topeka, the section center for Kansas.

Meetings for the winter season of the Washington Radio Club, Trenton, N. J., an affiliated organization of the National Amateur Association, were resumed recently in the headquarters in the Washington Market Building.

It was decided, upon motion of Martin K. Pillsbury, the president, that the club should participate in the electrical exhibit which will be held in Trenton during the week of December 9. Arrangements are now being made to have a display by the club during that time.

Weekly meetings will be held each Thursday evening. A complete Marconi receiving set and a high-power transmitter are now in use at the club, besides a smaller receiving set which is used for work among amateurs and boats.

At the last meeting several of the members spoke on the various phases of wireless telegraphy, which proved most interesting. A social hour followed the business and practice period.

The physical science department of the Wayne (Neb.) Normal College has undertaken the sending of wireless messages twice each day. The purpose is to give students practice in handling wireless stations and to give schools and those interested in science an opportunity for practice in receiving.

A wireless station over the ocean was opened successfully Friday evening, October 27th, by the Crescent Bay Radio Association of Santa Monica, Cal., by an exchange of messages with the U. S. S. South Dakota, which was anchored in Santa Monica Bay. The new home of the Association is at the end of the Looff amusement pier and was donated by the owner of the pier, C. I. D. Looff.

The wires are suspended from a flag pole at the highest point on a scenic railway to the roof of the station. This feature gives it a considerable advantage in exchanging messages with coastwise ships and for other long distance work.

The first message sent after the instruments had been installed was a greeting to the battleship's crew from the people of Santa Monica, through the secretary of the Chamber of Commerce. The first one received was a reply of thanks from Arthur McArthur, commander of the ship, and an invitation to the wireless men to visit it next day.

There are now twenty-four members in the Association, which has only recently been organized. The apparatus used is owned by members, but it is planned soon to purchase instruments for the Association. The president is T. J. P. Shannon, motorcycle sergeant of the Santa Monica police department, who sent and received the first messages.

T. J. P. Shannon, president of the Crescent Bay Radio Association of Santa Monica, Cal., sending the first message from the Association's station

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The Hoosier Radio Club of Philadelphia, a new organization, is a consolidation of the Hoosier Radio Club and the

Boy Scout Radio Club. F. E. Hamilton will be in charge and F. O. Belzer, scout executive, will represent the Boy Scouts. An efficient receiving station has been installed in the Chamber of Commerce Building.

At a meeting of the San Francisco Radio Club, held at its home, 50 Frederick street, on the evening of October 13th, E. W. Stone, United States Radio Inspector, made an address on "Decrement." He explained the tuning of sets to resonance to comply with the radio law and declared that amateurs should use only a short aerial without the aid of a series condenser on 200-meter work.

H. D. Dickow, president of the club, has arranged for a series of lectures to be delivered to its members. The membership of the organization now numbers fifty-six, twenty having been admitted to the club recently. A fifty-page magazine, containing the proceedings of the organization will be issued quarterly.

The Nassau Radio League was organized at a meeting of the amateurs of Freeport and Merrick, L. I., held recently at the headquarters of the League, 8 North Main street, Freeport. The following officers were elected to serve until September 1, 1917.

President, Thomas F. O'Brien; vice-president, Stephen Carpenter; secretary, Holmes Swezey; treasurer, John McCord. An executive committee, consisting of the officers and Clifton Weindeck, Stanley Terry and Wilbur Verity was named.

Business meeting of the club will be held the first Friday in each month and code practice and lectures the second, third and fourth Fridays in each month. Correspondence is requested. Communications should be addressed to the secretary, 8 North Main street, Freeport.

The amateurs of Essex, Mass., met recently at the station of Carl G. Ricks and formed the North Shore Radio Association. The following officers were elected:

President, Carl G. Ricks; secretary and treasurer, John F. Hardy; chief operator, David L. Haskell, Jr.; radio policeman, Walter W. Hammond. A committee to take charge of the general promotion of the affairs of the Association has been formed. Meetings will be held on Friday evenings when topics relating to wireless will be discussed, and lectures by the members delivered. The Association is installing a ½ k. w. transmitter. Amateurs in Essex and the vicinity are invited to join the Association. Correspondence should be addressed to the secretary.

The Wireless Club, of Chatham, N. J., is carrying on a campaign for new members. It offered a receiving condenser to persons joining the club before November 10th.

The Nyack (N. Y.) Y. M. C. A. Radio Club, which was organized about a year ago, held its regular Tuesday evening meeting in the Y. M. C. A. on October 17th. The following officers were elected for the coming year:

President, M. V. Bryant; vice-president, W. A. Robertson, Jr.; secretary, M. E. Robertson; treasurer, E. Hoffstatter.

A receiving set has been installed and the purchase of a ¼ k. w. sending set is now being considered. M. V. Bryant and M. E. Robertson are the chief operators. Correspondence with other clubs is invited. It should be sent to the secretary, at 98 Piermont avenue, Nyack.

The Wireless Club, of Worcester, Mass., met on October 18th and elected Warren B. Burgess, of Hyde Park, chief operator in charge of the maintenance of the Tech station. Twelve new members were voted in and plans were discussed for a series of talks to be given by Instructor Carleton D. Haigis, of the physics department on the theory of electric waves and other subjects interesting to wireless students. The president was empowered to appoint a committee to draw up plans of a new antenna to be erected this year.

The Wireless Association of Atlantic City has called its members together for the winter session with the following as officers: President, Charles Seymour; secretary, Clarence Cramer; treasurer, N. J. Jeffries; business manager, Earle Godfrey.

Business meetings are held the first Wednesday of each month at the Association's office, 314 Guarantee Trust Building. General meetings for experimenting and theoretical discussion are held on the remaining Wednesdays of the month at the Association's station (3if), St. Charles place. The Association will be pleased to hear from any of the radio clubs on wireless topics for exchange of ideas and general discussion. Correspondence should be addressed to the secretary of the Association's office.

The Radio Club of the Young Men's Christian Association of Nyack, held its annual meeting on October 10th, and plans for the winter work were discussed The following officers were elected:

President, Marquis Bryant; vice-president, William Robertson; secretary, Merle Robertson; treasurer, Earle Hofstatter.

Members of the Topeka (Kan.) Radio Club showed their willingness to offer their services and the use of their radio instruments to the Government in case of need, following the distribution of applications to join the volunteer radio operators' reserve. F. G. Howell, head of the Topeka naval recruiting station, addressed the club members at a recent meeting.

The Wireless Club has been formed at the Scotia High School, Schenectady, N. Y.. The officers are:

President, Erick Green; vice-president, Leonard Reid; secretary-treasurer, Morrison Mulhall; first operator, Roy Peugh; second operator, C. Dougall.

A club has been organized at the University Settlement, New York City, to study the non-technical aspects of various scientific subjects. The problems of wireless telegraphy, engineering, surveying and allied subjects will be taken up. The club will afford to those interested in these subjects an opportunity for informal discussion. It will further serve the purpose of giving an insight into the possibilities of engineering and similar professions. The club will be equipped with a wireless outfit for experimental purposes. It will meet at the University Settlement, 184 Eldridge street, on Sunday afternoons at five o'clock. The organization will be under the direction of Jacob C. Holzman, Esq., C. E. Detailed information can be obtained at the Settlement.

The Western High School Radio Club of Bay City, Mich., was organized in October, 1915, a wireless set being installed under the supervision of the physics instructor in the physics laboratory. Only High School pupils are eligible for membership. Last year the club gave a "Wireless Carnival," at which experiments in static electricity, a Tesla transformer made by members of the club, and miniature wireless and telegraph sets were among the features. The club is planning to repeat the carnival on a larger scale this year.

In a letter to the editor of The Wireless Age, Wendell F. Holst, a member of the National Amateur Wireless Association, who went to the Mexican border with Co. A, Illinois Signal Corps, says:

"During our stay down here we have done some very good radio work considering the equipment we have to work with. The sets we use are the 1912 1/8 k. w., 500-cycle type. They produce a very pleasing tone which is also a good carrying one in interference and static. Our aerial is of the 60-foot high four-wire umbrella type. We have transmitted thirty-five miles under the poorest conditions I have known."

The members of the Hudson City Radio Association have secured rooms at 541 Central Avenue, Jersey City, N. J., where they have erected a large aerial and a sensitive receiving outfit.

Code practice is given every night to those who desire it. Lectures on how to secure an operator's license and the use of the vacuum valve will be given shortly.

Election of permanent officers was held recently. The following were elected

President, Joseph F. Grece; vice-president, William Biedenkapp; financial secretary, Frank V. Bremer; recording secretary, Clarence Maves; treasurer, William S. Davidson.

All amateurs in Hudson Country are invited to join the Association. Address Clarence Maves, 90 Ferry street, Jersey City, for an application blank.

A San Antonio (Tex.) amateur writes: "There is mighty little going on in wireless in San Antonio among the amateurs, as there has been too much interference with the federal station. The Secret Service, the police and even the mail carriers are looking for antennae. Those who persist on operating their sets are arrested."

The first number of The Suburban Radio Journal, published monthly under the auspices of the Suburban Radio Club of Washington, D. C., has made its appearance. It announces that amateurs both in and out of Washington can obtain copies of the Journal by addressing Charles W. Longfellow, 5515 Potomac avenue, N. W., Washington.

The Suburban Radio Club, which is affiliated with the National Amateur Wireless Association, was formed in the autumn of 1912, the first meeting being held at the home of Howard Fellows. Five persons were present and a constitution, which contained many of the main features of the present one, was drafted. In 1914 it had a membership of fifteen. At this time it was believed advisable to buy a wavemeter capable of measuring wavelengths up to 700 meters. This instrument was so popular among the members that it was decided to obtain a hot wire ammeter. About this time it was found that if one member had an important message for another, he must trust to luck to find in his station the person for whom the message was intended. As a result the delivery of messages was sometimes delayed several days. So a scheme was devised whereby each member was allotted ten minutes in the evening, when he was sure to be "on." These ten-minute periods were printed on a "schedule card" after the names of the respective members, one card being posted in each club station. In this way by referring to the card one could readily find the time at which any member would be "listening in."

Statement of the Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, of THE WIRELESS AGE, published monthly at New York, N. Y., for Oct. 1, 1916.

State of New York, County of New York, } ss.:

Before me, a Commissioner of Deeds in and for the State and county aforesaid, personally appeared John Curtiss, who, having been duly sworn according to law, deposes and says that he is the business manager of the WIRELESS AGE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit.:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, John Curtiss, 450 Fourth Avenue, New York; Editor, J. Andrew White, 233 Broadway, New York; Managing Editor, J. Andrew White, 233 Broadway, New York; Business Manager, John Curtiss, 450 Fourth Avenue, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) John Bottomley, 233 Broadway, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner: and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN CURTISS.

Sworn to and subscribed before me this 3d day of October, 1916.

[SEAL] B. M. SWIFT.

Commissioner of Deeds, City of New York. Residing in New York County. Certificate filed New York County No. 1202. New York Register No. 17071.

(My commission expires April 20, 1917.)

Random Thoughts of an Old Timer

By Lloyd Manuel

WE have in our town a man with brains and ability. We call him, when not featuring his decisions in superlative terms, the Superintendent of Wiring. More than twelve years ago, when I asked him if I might run a telegraph line across a trolley's right of way, he turned me down. That proved his wisdom. If he hadn't turned me down, I probably would be on the shelf now as far as wireless is concerned. And the art thereby might have suffered. Perhaps it has suffered anyhow; but that isn't the story.

You see, it's this way. With the aid, counsel and support of a chum, I had decided to get a telegraph line across that trolley, but when we were refused permission to cross, we swore by all that is good and holy that we would establish communication in some way. We started to do it by wireless.

I began by getting together a lot of hay wire. This was easy; my brother at the time ran a livery stable. It was finally all patched together, after many trials and tribulations. Then I nailed a broom handle on one end of my woodshed. This was the mast. Two clothes pins served for spreaders and the completed cage was about a foot long, each wire separated by about an inch. Such is the ignorance of youth.

For a station, I commandeered my brother's hen-house, after evicting the hens. This of course made my brother peeved, but to his credit be it said that he did not block the progress of science. As a matter of fact, he remarked that my experimenting might lead to great things, and proceeded to sell the hens. As may well be imagined, this good word and action nearly overwhelmed me; since then, however, there has come the disturbing conclusion that his magnanimity had some relation to his needing money about that time.

I bored an inch hole in the roof of the house for an antenna lead-in, and inserted the neck of a soda-water bottle, after punching a hole through the bottom of the bottle. One of my mother's saucers ornamented the top of this dignified and formidable arrangement, and my insulator was complete. It looked quite like a commercial product. Even though it wasn't the most efficient insulator ever constructed, it was the joy of my heart for some little time.

After getting the lead-in through, I commenced to realize that a real outfit should have instruments. I had no more idea what the instruments were like than I had knowledge of Chinese script.

So, I hied myself to the public library and procured a book which gave a layman's account of the Marconi apparatus. I didn't understand the whole write up, but dimly realized that I must have a coherer and a relay.

I swapped my air rifle for a relay. The coherer—embryo inventors please note—I made as follows:

First I took a bottle and filed the neck off; this was the glass tube. For plugs I took two small corks and covered them with tinfoil. Then I went junking!

After raising rags, bones and bottles worth fifteen cents, I sold out. I filed enough silver off the dime to partly fill the space between the plugs and mixed 'em with a few nickel shavings from the five cent piece. This was my mixture, and the end of my finances. After mounting this "Busy Bertha" on a base, my coherer was complete.

To decohere, I quietly removed the electric bell from the house, leaving as a substitute my little dollar motor with a fan attached. Over this fan I placed a bell so that when the fan revolved it would hit the tongue of the bell and cause it to ring.

I connected the "instruments" and tried for about a week to get signals. Sometimes I thought that there was something doing, but more often. . . .

Then a friend, a real electrician, who had seen the aerial harzarded a guess that I was using a microphonic detector. Not having the least idea in the world what that was, I denied the allegation. He then told me of the Massey microphone. I scouted around under the electric light pole on the corner, found several carbons and fixed up a microphone. Then I was stuck. I had to have a telephone receiver. Nothing could be done without a 'phone.

I went junking again. With the money procured by three days' work, I bought a long receiver, second-hand.

I possessed, at this time, a little box of tools, presented to me by that genial and mythical old gentleman, Saint Nicholas. I dumped all the tools out of the box and mounted the carbons on the top. I had an eye for the esthetical, so in order that things might look quite orthodox and beautiful, I bummed some twisted pair and wired this wonderful instrument up as per instructions received from the before-mentioned electrician friend.

I hadn't listened for more than five minutes, when—wonder of wonders!—the contraption began to buzz! My chest swelled with pride. I ran out of the place with more agility than ever an occupant (hens included), had left it before.

Into the house I dashed and breathlessly informed my parents that I was some boy; that I was designed for a more useful place than the reformatory. To better impress the achievement upon my five brothers and two sisters, I announced that I was headed for the scientific class. Verily, I believe in all truth that I felt that day greater than Sir Oliver Lodge.

With what I considered becoming modesty, I permitted them all to listen-in, gravely informing them that the signals which they heard emanated from a station about five hundred miles away. I afterwards got to know that spark very well, and had I told them five hundred feet, my chances of getting to heaven would now be brighter.

But allowing the family to listen helped some, for they all clubbed in and bought me a dinky little quarter-inch Rhumkorf coil, which I hooked up.

I now started to learn the code. In those days Morse was used more extensively than the Continental. I took the bell which I had used on the coherer set, hitched it up in series with a battery and a strap key made from a piece of barrel hoop and a round headed screw. I then started in to practice.

At night I took this outfit in upon the kitchen table and sat up sending to myself until some unspeakable hour, when my father would appear with fire in his eye and a slipper in his hand, and make me sashay. My code practice would then be finished on my brother's shins—he slept with me, poor soul—until I fell asleep. After a while I was able to handle about five words a minute.

I will never forget the day when the government station answered my signals. They reduced their speed to such an extent that I could read them. My sign was GR. "GR GR GR," they said, "if you don't stop operating that coil, you will find yourself in the jug shortly." I answered by sitting on the key. I was such a nice boy!

My first receiving tuning coil was made from a portiere pole wound with No. 18 annunciator wire. This was inserted in the aerial circuit, in series. Meanwhile, the house bell had been shorn of its wire and discontinued. Such trifles as annunciators for callers could not be allowed to stand in the way of scientific research; the coil added materially to my range.

The next thing that comes to mind is the fact that a friend of mine had seen a silicon detector. He informed me that he had seen a detector that worked without battery. I promptly told him that the operator had been stringing him. But I set out to find out about it, and soon got hep to a piece of a fused silicon. What an improvement! Immediately I threw the microphone into the junk-heap; it was a thing of the past.

Then I left school and got a job driving a grocery wagon, at the fabulous sum of five dollars per week. As a promulgator of the quardruped, I was not what is called a success, my mind being constantly on the wireless. If a customer ordered a pound of coffee, I was sure to bring a barrel of flour. Anyway, at the end of nine weeks, the inevitable happened; I got fired. Not, however, until I had saved enough money to buy myself a good head set and a decent aerial.

Immediately, I erected a fifteen-foot mast on my house and a thirty-footer on my woodhouse, a large edifice of its kind with a chimney. Since the erection of that mast, the chimney has never been seen. I may say in confidence that the chimney was used as a fulcrum to raise the mast. How myself and my brother ever managed to raise that pole is beyond me. But raise it we did, amidst the slangy protestations heaped upon my, so to speak, innocent head by a battered and torn brother.

One neighbor asked me if I had erected a pigeon trap; and I now see the justification of the question. Marconi himself never used more wire in a single aerial.

There is nothing like a decent aerial to make a boy proud, I reflected.

Dilapidated though the station be,
Antenna you're a joy to me.

With the advent of these improvements, my range was immediately increased to about a hundred miles. So satisfied was I then, that for want of something better to do, I went to work as a carpenter's helper. On this job, I received nine bones a week, and between the fact that I was a real scientific explorer and a youth of means, I acquired a swelled cranium. So I started to stick signs up in my station, making patent the fact that I was not running an information bureau and that I was controlling 3,500 volts in my transmitter. Soon I had little kids, in short trousers, and big kids who should have been dressed in pinafores, on my trail.

They all wanted a set, and I was invited in all manner of ways to aid them. Feeling, in my egotism, that I could uphold the reputation of a consulting engineer, I elected to assist anyone who would pass over the formidable sum of ten cents. I had one customer on this basis. I was an information bureau, after all.

Finding that the cash proposition didn't go, I opened my heart and became a king to the kids. But, O my, when I think of some of the answers that I handed out, I feel that shooting is too good for me.

The electrolytic detector, the carborundum, the magnetic, the perikon, the galena and many others were tried in their turn. I had good success with all the different types.

Now, so far as the personal reminiscence thing is concerned, it is time for me to cease firing.

My experience has been that the youthful enthusiast is not willing to start simply, and let his instruments grow with his knowledge. Yet this is unquestionably the best way to get a good fundamental knowledge of the subject, and will make for success every time.

At the present time I use the vacuum valve. Combined with this I have a good loose coupler, doughnut type, a 2,000-ohm pair of phones, two variables and a loading coil. I reside in Rhode Island and get Guantanamo, Cuba in good shape. Figure that out on your sliding scale. I have received Pensacola when using a crystal, and a single straightaway wire, 200 feet long and forty feet high.

My radio set has kept me in many nights, when I probably would have otherwise been out wasting my time on the street corner. So seriously, it is a real thing to be interested in. How better can a fellow spend his loose change than by becoming acquainted with this, a most interesting field of study that has been opened by Marconi and the great men who have contributed to the art.

So boys, men, aye and girls, go to it.

It has been announced that a new wireless station will be erected at Ooresäter, Norway. The station, which is designed for communication with connecting links in other parts of Europe, will have masts 300 feet in height.

A wireless call for help from R. R. Buck, navy radio operator at Diamond Shoals Lightship, who had been taken suddenly ill, caused the dispatch of the destroyer Cushing from the Norfolk navy yard to the ship on the night of November 8 with a physician and a substitute operator.

The wireless truck of the New York Police Department's Military Signal Corps passing down Fifth avenue in the recent parade

Police Preparedness in New York

What the Police Department Has Accomplished in Military Preparation for Home Defense and the Participation of the Signal Corps in the Recent Parade

NEW YORK had a chance on October 17 to see its police soldiers. They marched down Fifth avenue, khaki clad, 2,500 strong, with all their accoutrements of war. From the reviewing stand in front of the library at Forty-second street the Mayor, Police Commissioner Woods, and many others watched them swing past. Every man in the line had attended the military training camps of the Police Department at Fort Wadsworth last summer, and the purpose of the parade was to demonstrate to the public the result of that training.

The olive drab khaki-clad columns marched out of the Seventh Regiment Armory in command of Chief Inspector Max Schmittberger, shortly after 1 o'clock. The men were formed into two regiments of three battalions each. The Police Department band headed the first regiment.

Next came the Signal Corps, commanded by Acting Captain McKenzie, of the Telegraph Bureau. The operators were transported in a police motor patrol wagon. A wireless mast reached toward the sky, while signal flags fluttered at the front and rear of the patrol. The wireless transmitter was working continually, keeping up a buzzing that could be plainly heard fifty feet away.

Back of the Signal Corps came two glittering rapid fire guns from the police boat Patrol. The rapid fire battery was commanded by Lieutenant Edward B. Mulronney, with half a dozen stalwart men dragging a gun along each curbstone. Following came the machine gun company under Lieutenant H. A. Taylor. It looked about as businesslike a unit as was in the parade. There were eight machine guns in as many small automobiles. Each gun was mounted on a tripod and stood in the tonneau, with two men in the rear seat and two men in the front seat.

The men presented a soldierly appearance as they passed the reviewing stand with "eyes right," the officers with their right hands at the brims of their hats. They marched with a springly step and nearly every rookie looked in fit condition.

There were old men leading companies who a few years ago would have been doubtful whether military training could have been carried out in the Police Department. There were others in the line who had received their first military training in the Spanish-American War. Indeed, the parade seemed to emphasize the passing of the old style policeman, who grew stout on the job, and as a class furnished a subject for the cartoonist and joke writer.

The military camp has become a permanent part of police training. The men carried guns, and the only evidence that they were members of the department were the badges pinned to each drab shirt.

Among those in the reviewing stand were Mayor and Mrs. Mitchel, Commissioner and Mrs. Woods, Magistrate Barlow, Major General Daniel Appleton, Ambassador James D. Gerard, Senator M. M. Coronado of Cuba, Secretary to the Mayor Theodore Rousseau, Secretary to the Police Commissioner Henry J. Case and the following officers from the Artillery Corps at Fort Wadsworth, Colonel Bartlett, Major Kilbourne, Major Martindale, Captains Eddy, Gilmore and Campbell and Lieutenants Easterday and Waddell.

The automobile wireless equipment of the Signal Corps excited comment all along the line of march. It carried a 20-foot mast set in the frame of the machine and grounded on the chassis; an 8-wire aerial with 5-foot spreaders extended to a short mast 12 inches above the roof, giving an antenna 14 feet long. The transmitter consisted of a Marconi 10-inch coil operated by three 24-volt storage batteries and included the standard equipment of the Marconi auxiliary sets, oscillation transformer, stationary gap and accessories. The receiving tuner was of crystal detector type equipped with three sets for phones for the operators carried. The wave-length tuning was 300 meters.

A representative of The Wireless Age was invited to "listen in" as the truck stood in front of the armory before the parade. The Marconi station at Wanamaker's could be heard very plainly and signals from Sea Gate, just outside New York harbor, were easily read. This reception clearly indicated the practicability of using the motor truck apparatus at any place within the 60-square-mile area of Manhattan and the Bronx. With a counterpoise under the truck frame, as is now proposed, the transmission range could be brought up to 25 miles, enabling communication to be established with any point in the five boroughs of the city.

Sergeant Charles E. Pearce, instructor in wireless to the police, explained the proposed uses of the automobile station. "It is equally valuable as a civic asset as it is obviously an indispensible military equipment," he said. "While the truck as it stands today represents a mobile means of quick communication should New York be invaded and its police instantly become soldiers, the Department expects to demonstrate that automobiles equipped with wireless are of great value in emergencies, such as riots or serious fires when the telephone might be put temporarily out of commission. The motor truck can always be kept in readiness and be sent direct to any locality that felt its need. Of course, the wireless equipped automobile is merely an auxiliary station, but so, for that matter, is the entire system of police wireless which the Department is planning. Radio telegraphy to us means insurance of communication with any point in the city, should the hour come when all the wires are down. As there is no telegraph, we are now considering establishing a wireless station at Fire Headquarters to serve as an auxiliary to the telephone.

"The New York Police Department will thus soon be ready to cope with any emergency that may arise to threaten the safety of New York."

How ably the problem of safeguarding the interests of its citizens is being studied was demonstrated by a visit to Police Headquarters. By a comprehensive system of laying out the city in zones and establishing innumerable points of contact with all quarters, sections and sub-sections, it is believed that 10,000 policemen could be mobilized in any threatened district within three or four hours. The headquarters staff has prepared data for dealing with every contingency and wireless plays a prominent part in the various schemes for protection.

The practical usage of the headquarters set was illustrated during the writer's visit to that station. Chief Inspector Schmittberger came in person to the operating room to inquire the weather conditions prevailing off the coast just outside New York harbor, which would influence the movements for the day of the harbor police boat Patrol. Communication with the Marconi station at Sea Gate returned the weather observations before the Chief had left for his desk.

The class in instruction which was inaugurated with eight members has now grown to thirty-five and the school will continue all winter without interruption. Those who have passed the examination and secured government licenses are: Lieutenants George H. Quackenbos, John A. Altenbach and William H. Van Keuren, Sergeant Charles E. Pearce and Patrolmen Michael C. Moroney, George T. Valentine, George Wolf, Emil Kepko and John F. Murphy. Others in the class are: Sergeants Charles P. Vosburg and Harry Kahl and the following patrolmen: John E. Hanley, Charles Gaul, Harry Upham, William R. Black, John Seymour, William Hughes, James J. Ward, John W. Ray, Frederick Schwartz, John F. Ward, Russell McKee, William J. Gaffney, William E. Northrop, William J. Ferrick, Robert C. Jewett, Francis X. Madden, John J. Mahoney, Patrick J. Driscoll and John A. Lovett.

RADIUM AND WIRELESS IN AN EXPERIMENT

The European war interrupted the experiments that a young man was conducting near Berlin, but in order that other scientists might take up his work and carry it to a conclusion, his experiments have been described in the Elektrotechnische Zeitschrift. He was endeavoring to carry out a theory that the presence of radium causes a definite and remarkable action upon a wireless station.

The first experiments were carried on indoors, with an antenna consisting of a small wooden rod, upon which wire was loosely wound. With the receiving instruments adjusted, he placed a tube containing 50,000 units of radium salts near the wooden rod. Immediately he could hear the buzzing of distant signals which the apparatus was unable to detect otherwise.

Encouraged by this success, he carried on his experiments, using a full-sized outdoor antenna, or aerial. With a delicate measuring instrument known as the galvanometer, he discovered that the presence of the radium tube near the aerial wires would cause an appreciable current of electricity to flow. But when the radium tube was attached to the wires at their mid-point, reception of signals was found impossible, even with the most sensitive of ear receivers. Technically speaking, it was found that the presence of radium under certain conditions shortened the wave length.

VESSELS RECENTLY EQUIPPED WITH MARCONI APPARATUS

Names	Owners	Call Letters
Lysefjord	Huddleston Marsh Mahogany Co.	LHL (provisional)
S/Y May	J. R. De Lamar.	KZI
Tug Wellington	Cook-Cummer Steamship Co.	KMR
Brynhilda	Brynhilda Shipping Corporation.	KIO
Epson	Furness, Withy & Co.	ERH
Tug Britannia	Bay Steamship Co., of America.	KXS
Tug J. W. Thompson	Bay Steamship Co., of America.	KXT
Niels Nielsen	B. Stolt Nielsen.	(Unassigned)
Hanna Nielsen	B. Stolt Nielsen.	(Unassigned)
Luise Nielsen	B. Stolt Nielsen.	(Unassigned)
Stolt Nielsen	B. Stolt Nielsen.	(Unassigned)
Washington	H. Waalmann.	(Unassigned)
Golaa	Fridtjof Siegwarth.	(Unassigned)

CHANGE IN NAVAL CENSORS

A meeting of bankers of New York City was held on October 30th, to protest against an order issued by Lieutenant Charles R. Clark, U. S. N., as naval censor of wireless messages stationed at the Sayville, L. I., station, directing them to send him their secret code key. Afterwards other bankers received from Commander David W. Todd, U. S. N., Director of Naval Communication, a ruling in answer to previous protests from them concerning the Clark order. He countermanded the order.

Almost simultaneously with the news of Commander Todd's action came despatches from Washington announcing that Lieutenant Charles R. Clark and Lieutenant Keep, the naval censor at Siasconsett, had been relieved from duty by order of Admiral Benson and that Lieutenant J. C. Clark had been ordered to Sayville. The reason for these changes was not stated.

Lieutenant Charles R. Clark some time ago asked bankers to send him their private cipher key before their messages could be transmitted. The bankers already had filed with the censor their private codes. But the "secret cipher" which this order required is used to "authentic" money messages. It is employed as a safeguard against fraud by anyone who might obtain a copy of the code and use it to transmit unauthorized messages by which transfers of money might be effected. It was explained to Commander Todd by bankers that these keys were held by them as sacred as signatures.

Commander Todd replied that he understood their position thoroughly. He proposed that the bankers give guarantees by signing affidavits to that effect when using secret key words and numbers in the future. To this the bankers agreed.

NEW DISTANCE RECORD

Marconi Operator A. J. Costigan, of the Floridian, reports a new long distance record.

The Floridian left San Francisco for Sydney, Australia, on July 13th; from that date, up to and including July 31st, the vessel's position was transmitted to San Francisco. With a single exception, these position reports were received directly at the Marconi Hillcrest Station, near San Francisco, up to a distance of 5,227 miles.

The Floridian is equipped with the standard Marconi 2 k. w., 500 cycle panel set. The current consumption at the transformer did not exceed 1,600 watts up to 2,600 miles and at 5,200 miles the power consumed was 2,600 watts. Costigan says the San Francisco signals were audible up to some 3,000 miles.

THE SHARE MARKET

NEW YORK, November 8.

Bid and asked quotations to-day:

American, 3⅛—3⅜; Canadian, 2—2¼; English, common, 15—19; English, preferred, 14—18.

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.

V. J. S., Allston, Mass., inquires:

Ques.—(1) Please tell me the greatest possible length of the flat top portion of a two-wire aerial that can be used for the wave-length of 200 meters where the vertical lead-ins are 50 feet and the height of the aerial from the ground is 60 feet?

Ans.—(1) The flat top cannot exceed 80 feet in length. With these dimensions the natural wave length will be about 175 meters, and with the secondary winding of the oscillation transformer in series the wave-length of 200 meters can be obtained.

Ques.—(2) Please give the number of plates, with dimensions 8 inches by 10 inches, for a condenser to be immersed in oil and to have a capacity of .008 microfarad. These plates are to be connected in parallel. With this connection will the glass be able to withstand the voltage of 13,200 volts?

Ans.—(2) If you cover the 8 by 10 plates with foil, 6 inches by 8 inches, each plate will have an approximate capacitance of .00066 microfarad. Twelve plates connected in parallel will give the required value of capacity. Unless a very good grade of glass is obtained, they will not withstand this potential; consequently you will require 48 plates, 24 connected in parallel in each bank and the two banks connected in series.

Ques.—(3) What is the best arrangement to use as a container for these plates and what is the best grade of oil that can be purchased for insulating purposes? Where can I obtain it?

Ans.—(3) A metal tank will do, providing the precaution is taken to thoroughly insulate the plates from the bank. If a local oil dealer can supply you with Swan & Finch's Special Atlas AA Oil, it is to be preferred.

* * *

E. W. B., Alta, Iowa, inquires:

Ques.—(1) What is the approximate wave-length of an aerial 400 feet in length, 65 feet in height, composed of a single wire having a 50-foot lead-in?

Ans.—(1) The wave-length of this system is approximately 700 meters.

Ques.—(2) How may this wave-length be reduced to receive signals from amateur stations?

Ans.—(2) The aerial is too long for the reception of amateur signals at the wave-length of 200 meters. The largest aerial that you can employ for this work is one of the T type, comprising one or two wires 110 feet in length, approximately 50 or 60 feet in height with the lead-in wires attached to the center.

Ques.—(3) What is the comparative sensitiveness of the crystaloi and the vacuum valve detector?

Ans.—(3) We have no exact quantitative data, but the vacuum valve detector is considered more sensitive than the crystaloi.

Ans.—(4) We cannot tell the possible wave-length adjustment of your loading coil without more complete data concerning the manner in which it is wound.

Your query concerning the running of a ground wire from the top of the 65-foot wooden pole to the earth, is not thoroughly understood and consequently no reply can be given.

* * *

G. S., Los Alto, Cal., inquires:

Ques.—(1) Is there 39.39 feet in one meter?

Ans.—(1) No. 39.37 inches are the equivalent of one meter.

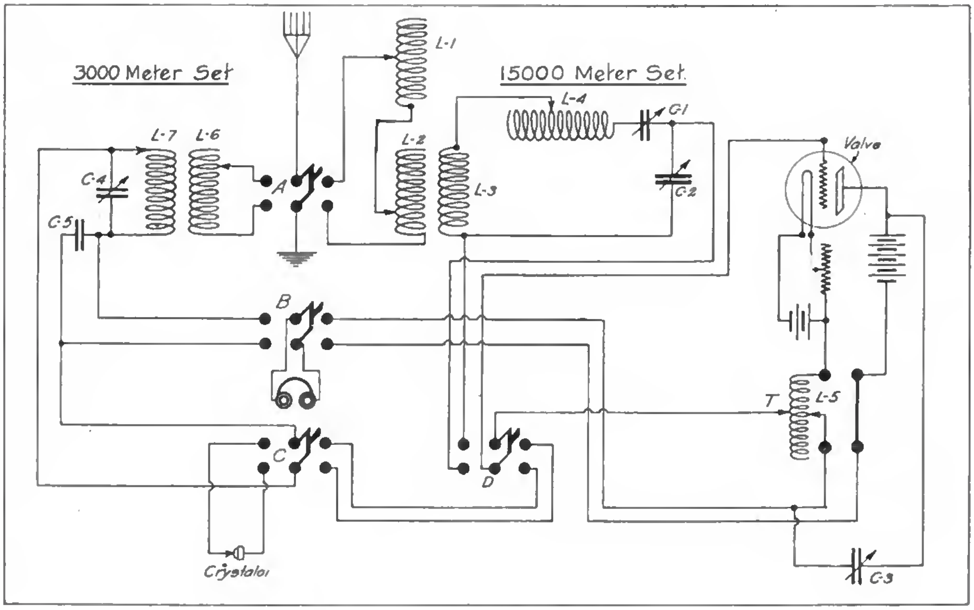
Ques.—(2) Should you obtain a shock if you place your finger on the secondary winding of an oscillation transformer during sending? I do not get a shock from mine.

Ans.—(2) It would seem from the statement further on in your queries, that you have employed your body as a radiation indicator and while it has not proved fatal in your particular case, we would not advise a repetition of the test with all types of apparatus. You may find that the capacity of your body is not sufficient to carry the current. Of course if you stand on an insulating material you will not receive a severe shock from the secondary winding of any oscillation transformer, but should you by chance be standing upon earth or upon a conductor connected to the earth you would probably soon be aware of the fact.

Ques.—(3) How can I determine where to place the primary and secondary clips on my oscillation transformer in order to obtain the best results?

Ans.—(3) Lacking a hot-wire ammeter connected in the antenna circuit, you had better place these clips on different positions and have a nearby receiving station listen in until the signals come the loudest. For example: Set the clip for the antenna circuit at a definite point on the helix and then shift the clip from the closed circuit until the distant station obtains the loudest signals. With the hot-wire ammeter connected in series with the antenna circuit or a small glow lamp, you can adjust the position of these clips until you get the greatest value of antenna current as indicated by a brilliant glow of the lamp.

Ques.—(4) How can I measure the secondary amperage of a spark coil and the voltage?



Ans.—(4) The amperage can be measured by connecting a small milli-ammeter in series with the winding. The voltage is best measured by the jump spark method, a table for which is given in the "Naval Manual of Wireless Telegraphy" for 1915. Two sharp needle points can be mounted on a base and separated by a certain distance. They are then connected in shunt to the secondary winding and the gap widened out until all sparking ceases. By observing the length of the gap, reference can be made to the table and the secondary voltage approximately determined.

* * *

S. W. H., Williamsport, Pa., inquires:

Ques.—(1) Please publish a diagram of connections for a damped and undamped wave receiver, employing a 15,000-meter and a 3,000-meter inductively-coupled receiving tuner, the former for undamped waves, the latter for damped waves. Please include in this circuit a vacuum valve and arrange it so that it can be switched to either tuner. The circuit is also to contain a crystaloi detector as an auxiliary to be arranged by means of switches so that they can be connected to either circuit.

Ans.—(1) Your question is comprehensive, but by following closely the accompanying diagram you will obtain the desired result. The necessary connections from one tuner to the other can be effected by means of four double-pole double-throw knife blade switches. On the right hand side of the drawing we have indicated the complete circuit, comprising the necessary loading inductances for an oscillating vacuum valve, and call your attention particularly to the coil, L-5, through which the wing and grid circuits are coupled. This coil should be rather long, approximately 20 inches in length, 6 inches in diameter, and wound closely with No. 30 S. S. C. wire. The slider, T, should be arranged to include just a few turns of the circuit.

To make use of an oscillating vacuum valve for the longer wave-lengths, throw the switches, A and B, to the right and switch C to the left.

If it is desired to use a 3,000-meter tuner in connection with the crystaloi detector, throw switches A, B and C to the left. To use the vacuum valve in connection with a 3,000-meter tuner, the switches, A and B, remain in the left position, but the switches C and D are thrown to the right. With this connection the sliding contact on the coil, L-5, should be placed at the zero position. Complete dimensions for the various coils of this tuner have been published in previous issues of The Wireless Age and also in the book "How to Conduct a Radio Club."

* * *

F. C. S., Washington, D. C.:

An amateur residing in Washington, D. C., should have no difficulty in receiving sigreading your communication we believe that you do not fully understand the difference between an undamped wave receiving set and a damped set. The diagram of connections which you have attached to your query is quite correct and will give good results, but you had first better decide for yourself on the type of circuit best suited to your work. For example: a receiving set particularly suitable for the reception of signals from Nauen, Sayville, Hanover, Tuckerton, etc., will not be efficient on the shorter range of wave-lengths unless it is fitted with a special set of dead-end switches, thereby completely disconnecting the unused portions of the inductance. You had, therefore, better construct a receiving tuner for the reception of spark signals with a maximum adjustment of 3,000 meters and the second equipment for adjustment to waves inclusive of 10,000 meters. Complete circuits for both types are given in the book "How to Conduct a Radio Club" and if you will follow instructions carefully you should have a set that will respond uniformly. Note the September, 1916, issue of THE WIRELESS AGE, in the series "How to Conduct a Radio Club," which contains a number of diagrams applicable to long and short distance receiving apparatus.

The Arlington tuner described in the January, 1916, issue of the National Amateur Wireless Association Bulletin should give good results on wave-lengths between 600 and 3,000 meters and the fact that you do not even obtain fair signals seems to indicate there is an error in the circuit at some point.

* * *

E. B. J., Newark, N. J., inquires:

Ques.—(1) With a two-slide tuning coil primarily constructed for the reception of wave-lengths of 1,600 meters, I am able to hear the signals of the Arlington station. Do you think it is possible that this tuner is in reality adjustable to the wave-length of 2,500 meters?

Ans.—(1) It is quite likely that the upper range of this receiving tuner is much greater than you suppose and consequently it can be placed in resonance with Arlington; or again it may be that you employ a very close degree of coupling between the primary and secondary circuits and the apparatus responds by reason of forced oscillations.

Ques.—(2) Please give the fundamental wave-length of an antenna consisting of four No. 16 copper wires, 50 feet in length and 40 feet in height, with a lead-in of 70 feet.

Ans.—(2) The fundamental wave-length is approximately 165 meters.

Ques.—(3) Would you recommend a 1-inch or 2-inch induction coil with above described aerial?

Ans.—(3) Either size may be employed. A slightly greater range will be obtained with a 2-inch coil.

Ques.—(4) Please give the dimensions of a condenser suitable to a 1-inch coil or a 2-inch coil.

Ans.—(4) The dimensions of the condenser for induction coils vary widely, depending to a large extent upon the action of the vibrator, such as the speed of interruption, etc. Ordinarily one or two plates of glass, 5 inches by 7 inches, covered with tinfoil 4 inches by 6 inches, connected in parallel, will give the right capacity. The maximum allowable value is in the neighborhood of .0005 microfarad.

The correct value of capacity for a given coil is best determined by experiment, but you can rest assured that it will be less than .0005 microfarad.

* * *

J. C. L., Jr., Baltimore, Md., inquires:

Ques.—(1) Would an inductively-coupled receiving tuner of the following dimensions be efficient? The primary winding is 8 inches in diameter, 24 inches in length, wound with No. 24 D. C. C. wire. The secondary winding is 7 inches in diameter, 24 inches in length, wound with No. 26 D. C. C. wire. What is the possible wave-length adjustment?

Ans.—(1) This receiving tuner is easily responsive to the wave-length of 10,000 meters.

Ques.—(2) Are the coils of this tuner of the right dimensions for use with an oscillating vacuum valve?

Ans.—(2) Yes, but additional coils are required in the local telephone circuit for resonance. The correct dimensions for these coils are given in the book "How to Conduct a Radio Club."

Ques.—(3) How long should the coils of this receiving tuner be for a wave-length of 15,000 meters?

Ans.—(3) With a variable condenser connected in shunt to the secondary winding and a few turns of inductance added in the antenna circuit, the present tuner will respond to wave-lengths of 15,000 meters. The actual dimensions for the loading coil depend upon the dimensions of the antenna with which it is to be used.

Ques.—(4) How can I calculate the total area of the 2 plates in a condenser to have a capacity of .005 microfarad and another of .001 microfarad? I also require a third condenser to have a capacity of 1 microfarad.

Ans.—(4) To calculate the capacity for these condensers use the following formula, namely:

$$C = \frac{K\ A\ 2248}{T\ X\ 10^{\circ}}$$

Where C = the capacity of microfarads.
A = the area of the dielectric in use in square inches.
T = the thickness of the dielectric in inches.
K = the dielectric constant of the insulating medium.

For glass K varies from 6 to 9; for paraffine paper 2; for air 1 or unity.

This formula is only approximate owing to the wide variation in the dielectric constant of the different grades of insulating material.

You have not stated in your query whether you desire the dimensions for a variable condenser or for one of fixed capacity.

The condenser of 1 microfarad capacity usually consists of two long sheets of tinfoil, separated by a thin piece of paraffine paper, and you will find it as cheap to purchase one of these as to construct it.

Ques.—(5) What should be the wave-length of the small variometer described in the N. A. W. A. bulletin for January, 1916, if it is used as a receiving tuner? How can I change the dimensions to attain the wave-length of 600 meters?

Ans.—(5) We do not understand the query. How do you intend to employ this variometer as a receiving tuner? Do you expect to connect it in series with the antenna circuit and shunt across it a fixed stopping condenser and a crystalline detector? If so, the variometer will alter the wave-length of the antenna circuit about 300 meters, the actual variation of course depending upon the constants of the aerial. A larger range of inductance values would be obtained with a variometer wound with No. 32 S. S. C. wire.

* * *

C. L., North Adams, Mass., inquires:

Ques.—(1) I have an aerial composed of three strands of antenium wire, 57 feet in length and 50 feet in height, the wires being spaced 1½ feet apart. The lead-in is 20 feet in length. What is the approximate capacity of this aerial?

Ans.—(1) The natural wave-length is approximately 195 meters and the capacity about .00025 microfarad.

Ques.—(2) I have an E. I. Company, Jr., tuning coil which has metal bars for supporting the windings. Do these bars deduct from the efficiency of the set?

Ans.—(2) No.

* * *

W. J., Jr., Louisville, Ky., inquires:

Ques.—(1) What is the natural wave-length of a 2-wire aerial, 125 feet in length, 50 feet in height, with a lead-in of 35 feet?

Ans.—(1) The fundamental wave-length is approximately 330 meters.

Ques.—(2) Which is the more efficient, a 4-stranded antenium wire or a 1-strand copper wire, for receiving purposes?

Ans.—(2) We do not understand whether you refer to an antenna comprising 4 wires as compared with one containing a single wire or whether the antenna wire is made up of four twisted strands. Good results can be obtained on a single wire aerial in receiving, but most amateurs prefer a 2 or 4-wire equipment.

Ques.—(3) How can the aerial mentioned in my first query be reduced to the wave-length of 200 meters without decreasing the dimensions?

Ans.—(3)) A short wave condenser will not reduce the natural wave-length of this system to 200 meters and consequently you had better cut down the flat top portion to a length of 110 feet and afterward attach the lead-in wires to the center.

Ques.—(4) Please give the dimensions for a ¼ k.w. open core transformer.

Ans.—(4) The core should be 16 inches in length, 2 inches in diameter composed of a bundle of soft iron wires. The primary winding contains two layers of No. 14 double cotton covered B & S gauge magnet wire. The winding is 14 inches in length and is insulated from the secondary winding by Empire cloth of several thicknesses.

The secondary winding comprises ten sections, each of which is 5½ inches in diameter and 1¼ inches in thickness, and is wound with No. 30 or No. 32 single silk covered wire. The various sections should be separated by fibre or micanite washers to prevent sparking between them. This transformer is preferably immersed in oil.

Ques.—(5) Please give a description and the dimensions of a condenser for a ¼ k.w. transformer.

Ans.—(5) For the wave-length of 200 meters, the capacity cannot exceed .008 microfarad. Eight plates of glass 14 inches by 14 inches, covered with tinfoil, 12 inches by 12 inches, the glass being ⅛ of an inch in thickness, will give about the required value of capacity. Four plates should be connected in parallel in each bank and two banks finally connected in series.

* * *

J. F. D., New York City, inquires:

Ques.—(1) What is the approximate wave-length of an aerial composed of a single strand, of No. 14 phosphor bronze wire, 1,000 feet in length, 150 feet in height at one end and sloping down to 80 feet at the lower end, with a lead-in of 25 feet?

Ans.—(1) The wave-length is approximately 1,500 meters.

Ques.—(2) If this aerial were increased to two wires instead of one, what would be the change in wave-length?

Ans.—(2) It would have but a slight effect on the wave, probably increasing it by about 75 meters.

Ques.—(3) Approximately what is the possible wave-length adjustment with an inductively-coupled receiving tuner the primary winding of which is 6 inches in length and 5¼ inches in diameter, wound with No. 28 single silk covered wire. The secondary is 6 inches in length and 4½ inches in diameter, wound with No. 32 single silk covered wire.

Ans.—(3) Shunted by the proper values of capacity at the secondary winding, this tuner will easily respond to 5,000 meters.

Regarding the latter part of this query (not published): We cannot give any data on the possible wave-length adjustment without a more complete description of the loading coil referred to.

Ans.—(4) We cannot calculate the possible receiving range of a complicated set of the type you mention, but with it you should hear stations employing wave-lengths in excess of 1,000 meters on the Atlantic coast.

Ques.—(5) Would it be possible to receive Nauen, Germany, Sayville, and Tuckerton with a tikker detector in connection with a crystaloi type AA detector with the aerials and apparatus referred to?

Ans.—(5) It would be rather difficult to receive signals from foreign stations on a tikker; in fact, we know of no station which has performed this feat over a continuous period.

Ques.—(6) Is there such a device on the market as a ½ k.w. transformer coil operated by dry cells or storage batteries, and if so, where can one be purchased?

Ans.—(6) A ½ k.w. coil is manufactured by the E. I. Company, New York City, but it is made to function on 110 volts direct current. Induction coils consuming approximately 300 watts and giving a 10-inch spark discharge are on sale by the Marconi Wireless Telegraph Company of America, 233 Broadway, New York City.

The only stations we know of that employ long wave-lengths are the Marconi stations at Glace Bay, N. S., and Bolinas, Cal. You of course are aware that the Arlington station has a 100 k.w. spark set that operates at the wave-length of 2,500 meters.

The fundamental wave-length of your 85-foot flat top aerial approximates 260. When connected to the receiving apparatus you describe it should permit the reception of signals from stations located throughout the Atlantic Coast.

* * *

T. P., Brooklyn, N. Y.:

The Brown amplifying relay is fully described in the "Text Book of Wireless Telegraphy" by Rupert Stanley, a copy of which can be obtained from the Marconi Publishing Corporation, No. 450 Fourth Avenue, New York City.

Regarding your last query: Certain types of used apparatus can be purchased from the Marconi Wireless Telegraph Company of America and all inquiries concerning it should be directed to the Traffic Department of the company No. 233 Broadway, New York City.

* * *

G. G. G., Whiting. Ia.:

The only method by which you can get rid of the inductive noises from the telephone line lying parallel to your aerial is to change the position of the antenna and, if possible, place it at a right angle to the telephone line.

The apparatus you have described should permit the reception of signals from local amateur stations and from certain commercial stations located in the Great Lakes district during the night hours.

* * *

F. B. W., Elgin, Ills., writes:

Ques.—On page 608 of the June, 1916, issue of THE WIRELESS AGE it is stated: "A multi-layered loading coil, regardless of the radio frequency of the circuit in which it is to be used, is not practical. A high frequency current will not traverse turns of a multi-layered winding." We question the correctness of this statement in view of the fact that at present we are using multi-layered loading coils in both the primary and secondary circuits. Our primary and secondary transformer coils are also multi-layered and by the use of these coils in a vacuum valve circuit for the reception of undamped waves, we have obtaned very satisfactory results, having no difficulty in picking up OUI, KSS, NPL, NBA and other distant stations using undamped waves."

Ans.—The statement published in THE WIRELESS AGE holds good, for a multi-layered winding in which the adjacent layers are separated by the thickness of a piece of paper. Multi-layered windings are entirely practical when the adjacent layers are separated by about a half inch and will give practically the same results as a very long coil with a single layer.

* * *

E. W. E., Red Bluff, Cal., inquires:

Ques.—(1) I desire to erect the most efficient possible aerial to have a fundamental wave-length of 160 meters and would like to have you give the correct dimensions, including the height of the mast, the length of the flat top portion, the number of wires, spacing, etc.

Ans.—(1) The flat top portion should consist of 4 wires spaced 3 feet apart, and should be 40 feet in length and 50 feet in height. The lead-in wires should be attached to one end of the flat top portion. The fundamental wave-length of this aerial will be about 163 meters.

Ques.—(2) Is not a slanting aerial more efficient than one of a flat top type?

Ans.—(2) Not necessarily. We are inclined to believe that a flat top aerial of the usual construction will give the best results.

Ques.—(3) In which direction should this aerial point in order that the major portion of the energy may be sent in one direction?

Ans.—(3) Have the free end of the flat top portion point in the direction opposite to that of the distant receiving station.

Ques.—(4) Which is the better conductor for wireless work, a seven-strand bronze cable consisting of No. 22 wire, a No. 14 copper clad wire or a No. 14 solid copper wire?

Ans.—(4) We would have to know the specific resistance of each wire to answer the question intelligently, but if the aerial system comprises at least four wires, practically equal results will be obtained with either of the three types mentioned. Seven-strand bronze cable is used in commercial work with success.

Ques.—(5) How much aerial insulation is required to hold the potential of a 1 k.w. Thordarsen transformer?

Ans.—(5) The free end of the antenna system must have the better insulation. In commercial apparatus hard rubber insulators 2 feet in length are employed at this end of the antenna.

* * *

R. W. P., Caro, Mich.:

Ques.—(1) Please state the natural wave-length of a four-wire aerial 120 feet in length and 45 feet in height.

Ans.—(1) Approximately 300 meters. I

Ques.—(2) What should be the sending range of a ½ k.w. open core transformer when used in connection with this antenna?

Ans.—(2) From 40 to 100 miles in daylight and perhaps several hundred miles after dark.

Ques.—(3) I noted this spring that whenever I have been able to see the Northern lights from my station signals from the government station at Arlington seemed to come louder, but owing to the low grumbling noise I hear at this period I find that the signals from Arlington are very hard to read. I would like to know if other readers of your excellent magazine have observed this phenomenon.

Ans.—(3) We have received no reports from other sources concerning this phenomenon, but actual data would be of great interest to the radio field at large.

Ques.—(4) Now and then I hear a certain station making the test letter "V." This letter is usually made for two or three minutes with sometimes a pause for intervals of ten or fifteen minutes. Will you please advise if this is the call of the station or what the signal means?

Ans.—(4) It is simply a test letter for placing two stations in resonance and is probably used by radio inspectors in your district or possibly Canadian stations of the Great Lakes District.

Ques.—(5) Would two different aerials fastened to the same mast, but placed at right angles to each other, work as well as if they were placed further apart?

Ans.—(5) Yes, practically so.

* * *

A. L. B., Danvers, Mass., inquires:

Ques.—(1) What is the wave-length of a two-wire aerial 105 feet in length, spaced 10 feet apart, placed 35 feet above the earth?

Ans.—(1) Approximately 240 meters.

Ques.—(2) What is the wave-length of an aerial composed of a single wire of No. 16 composition, 225 feet in length, 40 feet in height at one end and 35 feet at the other?

Ans.—(2) The natural wave-length is close to 375 meters.

Ques.—(3) If these aerials are constructed of No. 14 copper wire instead of No. 16 composition wire, would there be much difference in the receiving range, and if so, how would it be affected?

Ans.—(3) The copper wire is undoubtedly a better conductor of high frequency current than the composition wire and should give better results, but just how much is difficult to state.

Ques.—(4) Will a receiving transformer having a primary winding 4 inches in diameter, 6 inches in length, wound with No. 22 S. C. C. and a secondary winding 5½ inches in length by 3½ inches in diameter, wound with No. 30 S. C. C. wire, be efficient for the reception of Arlington time signals? Is a loading coil required? If so, what should be the dimensions? The receiving detector is of silicon. The head telephones have a resistance of 2,000 ohms and are shunted by a small fixed condenser.

Ans.—(4) This tuner should respond to the time signals from Arlington if a small variable condenser is connected in shunt to the secondary winding. If the primary winding were made of No. 24 wire it would respond to the time signals of Arlington with the aerial having the longer natural period without the use of a loading coil. At the most, the loading coil need not be more than 4 inches in diameter by about 4 inches in length wound with a couple of hundred turns of No. 22 wire.

Ans.—(5) Since we do not know the composition of this wire or its relative tensile strength, we cannot compare it with hard or soft drawn copper. This is a matter that you should take up with the manufacturers of the wire.

Ans.—(6) You should hear stations throughout the Atlantic coast during the night hours.

* * *

W. S. M., Farmington, Ill.:

Your four-wire aerial, 50 feet in length, 45 feet in height at one end and 25 feet in height at the other, has a fundamental wave-length of approximately 170 meters, which is quite the correct value for communicating at the amateur wave-length of 200 meters, for the reception of signals from Lake Bluff, Ill., and Arlington; however, you should erect an aerial of increased dimensions, say 200 or 300 feet in length. The receiving tuner you describe has a probable wave-length adjustment of about 2,500 meters and hence is not satisfactory for the reception of signals from the Lake Bluff station which operates at the wave-length of 6,000 meters. The diagram of connections for the receiving apparatus which you enclosed is not correct. There is no fixed condenser in the secondary circuit of the receiving tuner. The variable condenser should be connected in shunt to the secondary winding. In your circuits the loading coil should be connected in series with the secondary winding in order to keep that circuit in resonance with the antenna system which already possesses a loading coil according to your diagram.

As we understand from the description, you support your aerial by means of an iron pipe mast which is fastened in a socket on the window-sill. And in order to protect it from lightning you have placed a copper wire through the pipe with about 1 foot extending above the upper end. The ground wire then continues to the earth without being insulated from the building or the pipe at the window-sill.

It is customary to insulate an earth connection, even a lightning rod, from the building which supports it; consequently you would do well to fasten this earth wire on large glass insulators such as are used for the better class of telephone work or for high tension transmission lines. We do not see any necessity for connecting the iron pipe mast to the copper wire, provided the copper wire is at least No. 4. The underwriters require that the earth wire be capable of carrying a current of about 100 amperes.

It will aid you in your problems to purchase a copy of the book "How to Conduct a Radio Club," which gives a complete set of diagrams for receiving apparatus; also note the article on Receiving Tuners for A Definite Range of Wave-Lengths in the May, 1916, of the series "How to Conduct a Radio Club."

* * *

O. N., Washington, D. C., inquires:

Ques.—(1) What is the range of wave-lengths of a receiving tuner having the following dimensions: The primary winding is 9¾ inches in length, 4¼ inches in diameter, wound full with No. 24 D. S. C. wire. The secondary winding is 9¾ inches in length, 3⅝ inches in diameter, wound full with No. 34 S. S. C. wire. A condenser of .0001 microfarad capacity is to be connected across the secondary winding, and the receiving tuner is to be employed in connection with a vacuum valve detector. Dead-end switches are also provided.

Ans.—(1) With a condenser of the value stated, in shunt to the secondary winding, the circuit is responsive to a wave-length of 3,600 meters. With a condenser of .001 microfarad this winding will respond to a wave-length close to 10,000 meters.

Ques.—(2) What is the wave-length of an aerial 175 feet in length, with an average height of 55 feet? It is composed of two wires of the inverted L type. The lead-in wire is 16 feet in length.

Ans.—(2) The capacitance of this aerial is about .006 microfarad, and the inductance approximately 80 000 centimeters. The natural wave-length is therefore about 415 meters, and if the primary winding described in your first query is connected in series therewith the antenna circuit will have a possible adjustment of about 3,800 meters.

Ques.—(3) With the receiving transformer described in your first query, fitted with a proper primary and secondary loading coil and a condenser of .001 microfarad connected across the secondary winding and a variable condenser of .0005 microfarad in series with the grid of the vacuum valve, how far should I be able to receive undamped wave stations, provided I use the Armstrong hook-up?

Ans.—(3) You should hear undamped wave stations at a distance of ?,000 miles.

Ques.—(4) How far could I receive spark stations cutting out the loading coil?

Ans.—(4) You should hear ship stations at a distance of 600 or 700 miles and the shore stations at perhaps a greater distance during the daylight hours.

Ques.—(5) I wish to receive arc stations using wave-lengths up to 10 000 meters. With the set described in the foregoing, what should be the dimensions for the primary and secondary loading coils and the size of wire?

Ans.—(5) We advise you to construct a primary and secondary loading coil, also the complete tuner, after the diagram given in the book "How to Conduct a Radio Club." The secondary loading coil may, if desired, be wound with No. 36 wire, but the primary loading coil should have No. 22 S. S. C. wire.

Ques.—(6) Could I receive Nauen, Germany, at night time with the set referred to by the use of a single wire aerial 252 feet in length with an average height of 40 feet in place of the aerial described in my second query? Or would it be advisable to use both aerials?

Ans.—(6) Provided your apparatus is in correct adjustment throughout and is thoroughly understood by the manipulator you should hear the signals from Nauen during the night hours by means of a single vacuum valve. The signals however, will be weak and can only be read at periods when the atmospheric electricity is at a minimum.

* * *

A. C. Y., Buffalo, N. Y., asks:

Ques.—(1) Which style rotary gap do you think the most efficient for long distance transmission on the 200-meter wave with a ¼ k.w. set?

Ans.—(1) A gap of ordinary construction, giving about 240 spark discharges per second, will give the best results. A disc 8 or 10 inches in diameter fitted with from ten to twelve electrodes and revolved at a speed varying from 1,800 to 2,400 revolutions per minute, will give a clear spark note and a fair value of current in the antenna circuit.

Ques.—(2) Does the Delaware, Lackawanna & Western Railroad still make use of the wireless system aboard trains?

Ans.—(2) All radio equipment of this company is still in use for auxiliary purposes.

Ques.—(3) Does increasing the height of an antenna raise the wave-length or increase the strength of signals and allow a further distance to be covered or does it affect both factors?

Ans.—(3) An increase of height will increase the wave-length and also the distance that can be covered, provided the wave-length desired is not exceeded in increasing the height.

Ques.—(4) In receiving over long distances from the spark station would better results be obtained by employing an "audiotson bulb" connected to a galena detector as an amplifier than by using the bulb singly?

Ans.—(4) Probably not, but the entire apparatus in connection with the crystalline detector, particularly if carborundum were used, might prove more stable during heavy static. Results of the experimental tests from these circuits seem to vary, some experimenters preferring the crystal-bulb combination, others desiring to record the signals directly on the single vacuum valve. You might do well.