LODGE MUIRHEAD PORTABLE WIRELESS SET.

A portable wireless set has been purchased from the Lodge Muirhead Syndicate. It is intended for use where a temporary wireless installation is required, and is designed to be independent of the earth connection.

The Syndicate claims a range of 20 to 30 miles over land, and about 100 miles over sea.

The set consists of—

(a) A portable telescopic mast, fitted with stays, upper and lower capacities. Weight about 90 lbs.

(b) A box containing the transmitting apparatus. Weight about 60 lbs.

(c) A dynamo, mounted on a bicycle frame and driven by means of pedals.

Mast.

The mast is of galvanised steel, and is 60 feet in length. It is made up in 10 sections, each of which telescopes into that immediately below it.

The mast is raised or lowered by means of a vertical derrick hinged at the head of the lowest section, and standing about 8 feet above it; a tackle from the head of this derrick raises each section in turn to its full height, when it is secured to the section below by means of a steel pin.

Similarly, each section can be lowered in turn by the same tackle. The mast is stayed on the lower section by hinged steel supports, on the fourth and eighth sections by wire stays, and at the masthead by the upper capacity area.

Capacity areas.

In place of the usual aerial and earth connection, two capacity areas are fitted. The upper area is of copper wire in four triangular parts, spaced umbrella fashion round the mast, and is spread by lengths of hemp taken to four small winches fitted on steel stakes driven into the ground about 50 yards from the mast.

The lower area consists of four triangles similar to the upper area, but secured to the mast about 8 feet from the ground, being spread by four other winches on the stakes. It is considered important that the lower capacity area should not touch the ground, and it is usually necessary to raise it by means of small poles. Both capacity areas are fitted with suitable insulators.

Transmitting gear.

The transmitting gear consists of a small induction coil, Morse key, two patent electric valves, spark gap, and variable inductance. The two capacity areas are joined up across the spark gap, the variable inductance being inserted in the lead to the lower area when a longer wave-length than the fundamental is required.

Electric valves.

The two electric valves in series are inserted in one of the leads from the secondary of the coil to the spark gap, and possesses the property of allowing current to pass through them in one direction. Thus, at each break of the hammer on the coil the capacity areas receive a certain charge, which, if insufficient to break down the gap, cannot escape back through the valves: the next break of the hammer sends a further charge into the capacity areas, and so on until the potential rises sufficiently to cause a spark. Thus by the use of the valves it is possible to work with high potentials while only using very small power. The induction coil is so designed that the hammer will only work when the current is sent through the primary in one direction. This prevents any attempt at working the installation in such a way that the electric valves are incorrectly joined up.

Dynamo.

The dynamo is of the direct-current type, and is totally enclosed. Working voltage, 15; and current taken, about 7 ampères. One man is sufficient to work the dynamo, but it is necessary to arrange for frequent reliefs for continuous signalling, the pedalling being very laborious.

Result of trials.

The trials carried out with the set have fairly well substantiated the claims of the Syndicate as regards range, but various defects in the general design have been noticed, of which the following are the more important:—

(1) The electric valves are easily damaged, and are unreliable.

(2) The system of transmission possesses to a great extent the faults common to all "plain" systems.

(3) The use of high potentials causes considerable leakage, especially in damp weather, and the insulation of the high-tension circuit is insufficient.

(4) The transmission box is not in any way water or even damp-proof.

(5) Some automatic means is considered desirable for driving the dynamo.

DE FOREST TELEPHONE.

Dr. De Forest's Report on his Visit to Europe in the Spring of 1908, forwarded by his Agents, Messrs. Firth and Sons.

Under the auspices of the French Ministry of Marine and of War, the De Forest radio-telephone apparatus was installed last March at the radio-telegraph station at the foot of the Eiffel Tower. The high antenna of the tower was not employed, but a special one, 250 feet in length, three wires in parallel, the top being about 100 feet above the ground.

Preliminary demonstrations were made to the station in the fort at Mont Valerien, about six miles distant. The receiving station was then removed to the "Post and Telegraph Department" at Villejuif, nine miles distant, where exhaustive tests were carried out before the officials of the three departments. Both French and English, talking, reading, and music were transmitted under varying conditions as to wave-length, loudness, &c.

The clearness of the speech transmission left nothing to be desired. This feature and the simplicity of the transmitting apparatus were specially remarked on by the French officials.

These tests brought out to a striking degree the relative efficiencies of the three forms of detectors used at Villejuif, viz., the Audion, the Perikon, and the Ferrie-Electrolytic detectors, whose sensitiveness stood in the order named.

The Perikon was admitted by the officials to be considerably more sensitive than the Ferrie-Electrolytic, while the speech reception on the De Forest Audion was far clearer and louder than either of the others.

During these tests from Eiffel Tower to Villejuif, the Government station at Melun, 60-K.M. distant, having been placed in tune with the tower transmitter, heard the conversations very clearly. The receiving antenna at Villejuif was 30 metres in height, that at Melun 60 metres.

The Italian Navy having ordered four sets of De Forest radio-telephone apparatus, Dr. De Forest next visited Spezia and directed the installation there upon three vessels for official test and instruction of Italian officers. These trials began during the first week in May, and extended over three weeks.

One complete set of radio-telephone apparatus was installed on board the training ship "Eridinio" at the San Vito dock; a second on board the "Castel Fidardo"; and a third upon the scout ship "Partenope." Between this latter vessel and the "Eridinio" the distance tests were carried out.

The mast at the shore station was 50 metres in height, and the antenna consisted of two wires, 8 feet apart. On the scout the foremast was only 7 metres high, but the antenna here consisted of two wires 4 feet apart, running up from the operating room below deck to a short after-mast, and thence nearly horizontally for 30 metres to the top of the foremast. Earth connection was made in the usual manner to the hull of the ship.

Satisfactory voice transmission was maintained both ways between the two vessels up to 15 miles, at which distance the voice from the ship at anchor became faint. However, the words from the scout ship were still heard clear and distinct, and a greater distance could have been covered.

The scout first sailed straight out to sea, but on its return voyage made a detour to bring the high rocky summits of the isle of Palmyra and those of the mainland (1,500 feet high) in the direct line of communication. The scout sailed close up under this mountainous coast, yet the transmission was every bit as good as when clear sea-way separated the vessels.

During the speaking on the scout at a distance of 9 miles from the shore, a 3-pr. gun was fired repeatedly. This gun was placed on the deck directly above the telephone apparatus.

The listeners detected absolutely no interruption or disturbance in the transmission from this cause, and the apparatus on the "Partenope" was not injured in the slightest. In a subsequent test successful transmission was maintained between the same two vessels as above up to a distance of 18 miles.

Throughout the Navy trials at Spezia a lieutenant of the "Brigota Specialisti" (Army Engineers) was present and participated. His report, we are informed, was highly approbative.

During the last week of May Mr. De Forest made a brief demonstration of the radio-telephone at the Exposition of Electricity, at Marseilles, during which tests the speaker's voice was heard at the French Government station at St. Marie de-la-Mer, 78 kilometres distant, using a Ferrie-Electrolytic detector. The transmitting antenna at Marseilles was 33 metres in height; that at the receiving station 60 metres.

In all these tests the style of apparatus was the same, viz., "Type C" of 1-K.W. capacity.

Extracts from "Vernon's" Report on De Forest Wireless Telephone. Dated 2nd October 1908.

The transmitting apparatus was set up on board "Furious," and was worked by Dr. Lee De Forest; the receiving apparatus was set up in "Vernon," and was worked by Mrs. De Forest. Opportunity was taken of trying other forms of receiving instruments on board "Niger" and "Velox." The results obtained with the "Niger" and "Velox" instruments are considered of great importance and interest, and should be kept confidential.

The Service tuned shunts were found to cut out interference which could not be stopped by any arrangement of the De Forest receiving instruments. During the experiments speech was usually distinct, but was found to interfere with Wireless Telegraphy communication, and *vice versâ*. This has previously been mentioned by the Naval Attaché at Washington, when reporting on experiments carried out by the American Navy with the De Forest Telephone system.

The disadvantages of the system at present appear to be :—

(1) That speech can only be transmitted in one direction at a time, that is to say, the receiving station must keep its instruments to "receive" until the message is completed. This, of course, is the same as in Wireless Telegraphy, but in the case of telephony it is particularly difficult to regulate the rate of talking to suit the receiver, and it requires considerable practice to put sufficient expression into the words to enable the receiver to readily follow the sentences. For this reason, if the words were not familiar ones, the difficulty would be greatly increased. It is, however, only fair to remark that numbers are easily distinguishable.

(2) That when receiving by Wireless Telegraphy on the Service instruments, speech transmitted by the De Forest telephone on the same wave-length interferes with the reception of the Wireless Telegraphy messages, and *vice versâ*.

(3) That for a reliable range of 30 (thirty) miles, aerial wires of sufficient size to send wireless messages to a distance of 500 miles by day have to be used.

(4) That the instruments are not suitable for sending short waves, *i.e.*, waves below 2,500 feet, in view of the fact that when transmitting on a shorter wave-length than this the arc does not oscillate properly.

(5) That a direct-current voltage of 500 volts is required to work the apparatus efficiently.

(6) That a skilled operator with some electrical knowledge is considered necessary to work the apparatus.

(7) That the messages can be easily read by anyone having a Wireless Telegraphy receiving installation at ranges depending upon the type of receiving instrument used.

As a result of the experiments it appears desirable to purchase the apparatus with a view to trying experiments with waves of sufficient lengths not to interfere with Naval Wireless Telegraphy communication, and to use a small aerial, separated from the main Wireless Telegraphy aerial, with the special object of short-distance, say 5 miles, communication between ships.

It is recommended that legal advice should be obtained as regards the patent rights of the system in England.

EXTRACT FROM "VERNON'S" REPORT ON THE EXPERIMENTS CARRIED OUT WITH THE POULSEN ARC SYSTEM OF WIRELESS TELEGRAPHY AND TELEPHONY. DATED 2nd SEPTEMBER 1908.

Fitting up the installation.

In April 1908, the instruments for "Vernon" arrived from the Amalgamated Radio-Telegraphic Company. One set was installed in "Vernon" and the other on board "Furious."

Preliminary experiments.

Early in May, experiments were arranged between "Vernon" and Cullercoats, the Company's experts working the instruments at each place. Signals appeared to be received by Cullercoats from "Vernon," but "Vernon" was unable to receive anything from Cullercoats. The reason for this was attributed to defects in the receiving circuit, and some days were spent in trying to rectify them. After testing and re-calibrating the receiving and transmitting circuits, further experiments were carried out between "Vernon" and Cullercoats, but at no time was communication reliable. The sound in the telephone at best was easily interfered with by external noises. The Company's representative then left, as the second set had not yet arrived, and "Vernon" had sufficient experience to set up the installation without assistance.

Fitting up the set in "Furious."

The second set, loaned by the Company, arrived in May, and was set up by "Vernon" on board "Furious." The A.R.T. Co. then sent one of their electrical engineers to carry out trials with Cullercoats. The results of experiments in arc telegraphy between "Furious" and Cullercoats were similar to those between "Vernon" and Cullercoats, that is to say, at no time was the communication reliable.

A diagram of the non-interference curves, obtained from "Vernon" "Furious" experiments is shown in Fig. 1 below.

FIG. 1.

NON-INTERFERENCE CURVES BETWEEN COMMERCIAL WAVES.

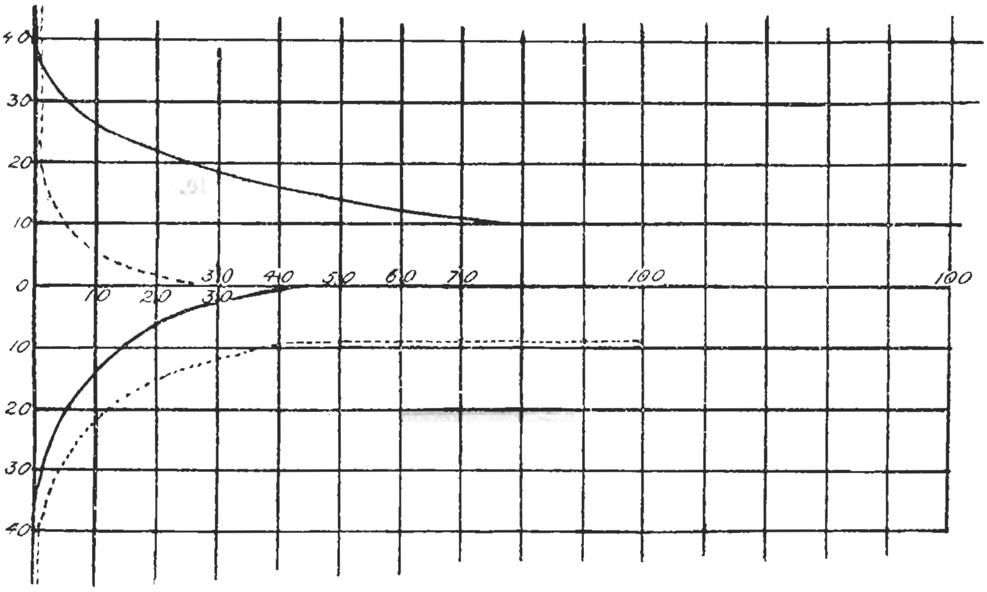
Two 1-K.W. stations, fitted with modern commercial instruments, are assumed to be in communication at a distance of 150 miles.

In the curves, the ordinates show the percentage difference between the wave-lengths necessary to ensure *complete* non-interference from a similar station at the various distances from the receiving station, which are shown as abscissæ.

The upper curves are for spark stations. The reliable range for 1-K.W. stations is 150 miles.

The full-line curve is for interference from a 1-K.W. spark station, a spark station receiving.

The dotted line curve is for interference from a 1-K.W. arc station, a spark station receiving.



The lower curves are for arc stations. The reliable range for 1-K.W. stations is 100 miles.

The full-line curve is for interference from a 1-K.W. spark station, an arc station receiving.

The dotted curve is for interference from a 1-K.W. arc station, an arc station receiving.

NOTE.—Interference from a 1-K.W. arc station will stop all wireless signalling within a radius of one mile.

Wireless Telephone.

Attention was then given entirely to the Wireless Telephone. A complete set was fitted up by the Company's engineer on board both "Furious" and "Vernon," and attempts were made to communicate between the ships at a distance of three cables. Great difficulty was experienced in keeping the arc burning regularly, and although a few words could now and again be received, all efforts at getting a complete sentence through were ineffectual. After spending a considerable time—about a fortnight—trying various arrangements with no further success, the Company's representative left Portsmouth.

Further attempts were made to carry out experiments, but as only a few words could be got through during all the hours set apart, the experiments in this direction were considered a complete failure.

It is considered undesirable at present to spend more time on these experiments, as the results are not promising.

POULSEN ARC TELEGRAPHY.

Extracts from Report by Lieutenant Loring on Observations at Cullercoats, and Demonstration of High-Speed Reception by Photographic Methods.

Printer.

It was said that naval ships in the Tyne sometimes prevent the reception of signals by sound at Cullercoats. But with the printer, when receiving by *hand*, from Lyngby or Esjberg in Denmark, either signals could often be made out from the tape owing to the different form of the spark signals. This is possible, but requires confirmation.

Mast.

The biggest mast at the station is buckling about 70 feet up. Two extra sets of stays have already been fitted, but Mr. Sorensen cannot get money to fit another set. The mast is likely to come down unless something is done.

Christiansen detector.

The Christiansen detector is an improved Bronk cell. It is well designed, very sensitive, and apparently very constant. The elements are :—

(1) Hardmuth's "Koh-i-noor" pencil (H.B.).
(2) Gallena or Bleiglance—a crystal of this is chipped off from the natural quartz.

The resistance is stated to be about 300 ohms.

Wave-lengths.

The wave-length of Esjberg is 1,200 metres; that of Cullercoats, 1,600 metres.

High-speed reception.

Signals were sent automatically from Lynberg (560 miles distant) by means of a disc which revolved at speeds of 30, 40, 50, 60, 70, and 80 revolutions a minute, representing 37, 50, 62, 74, 86, and 99 words per minute.

The signals were readable, but the method does not appear to be suitable for ships, as the receiving gear is very sensitive to vibration, inequalities appearing on the tape when people walked about the room.

Also, though the signals are recorded at these high speeds, account has to be taken of the time necessary to decipher them, and this may be considerable.

Wave-lengths radiated from the arc system.

Instead of only one wave being radiated from the arc system, as is generally supposed, several waves are radiated. At Cullercoats, in addition to the working wave of 5,280 feet, and the spacing wave of 4,940 feet, other less powerful waves of 955 feet, 1,395 feet, 1,838 feet, and 2,720 feet were measured. No means were available at the time for measuring waves longer than 6,000 feet.

ARTICLES UNDER TRIAL.

The following notes on various articles which have been under trial in "Vernon" may be of interest :—

Walter's Tantallum detector.

Walter's Tantallum Detector.—Unreliable in action, and failed to detect signals altogether after a few hours' use. Was again tried after a month's rest, but failed immediately.

Perikon detector.

Perikon Detector.—Consists of two special stones or crystals in contact with one another, the point of contact acting as a thermo-junction. As only one of the crystals has any tendency to become insensitive, nine of one kind and one of the other are provided, the latter being mounted so as to make contact with any one of the former at will. An adjustable spring regulates the pressure between the crystals.

The Perikon has had several trials (one being on the occasion of the "Indomitable's" passage to Quebec), and has usually been found more sensitive than the magnetic detector and occasionally than the electrolytic.

The great disadvantage of this detector is that, for no apparent reason, it varies greatly in sensitiveness, and although it may be possible to correct this, when discovered, by either altering the tension of the spring or trying one of the auxiliary crystals, it is obviously undesirable to adopt such an instrument for watch-keeping duties in the Service.

Recent experiments in "Vernon" have shown that by placing the Perikon in oil its reliability is greatly increased.

Further experiments are in progress with a view to issuing some of these detectors to seagoing ships for trial.

Fleming's glow lamp.

Fleming's Glow-Lamp Detector.—Has given fairly satisfactory results, but introduces undesirable complications into the receiving circuits, and the necessary use of secondary cells for working it is considered a drawback to its use for seagoing purposes.

EXPERIMENTS CARRIED OUT IN "VERNON" TO ASCERTAIN THE BEST METHOD OF SENDING OUT A SHORT WAVE, 700 FEET, FROM A LARGE AERIAL.

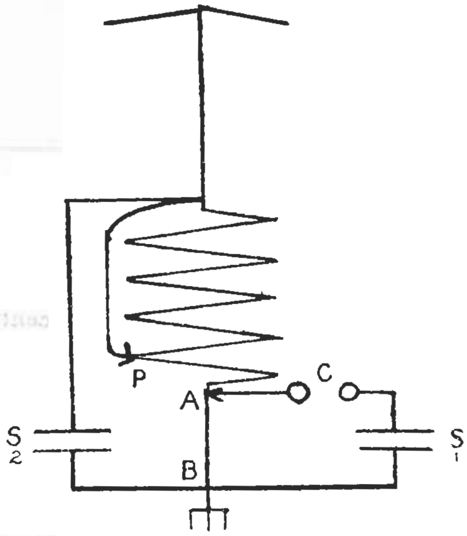
The following experiment was carried out to see if it was possible to send a 700-feet wave from the Service Mark I. set on "Vernon's" large aerial.

The first method tried was to shorten up the aerial, so that the 700-feet wave should be its fundamental wave. This gave rather unsatisfactory results owing to the difficulty of tuning the aerial itself.

The second method consisted in lengthening the aerial by inserting capacity between top of aerial coil and earth, so that its fundamental wave was a long one, and the wave required its harmonic; then by coupling a circuit with it, whose L.S. value was that of the harmonic, the fundamental was too weak to be found.

Fig. (1) shows the connections of the circuit.

FIG. (1).



The primary circuit, A B C is tuned to an L.S. of 11·5.

C is the spark gap. S_1, the capacity in the primary circuit, is 5 jars.

S_2, the capacity in the secondary circuit, was 1, 2, and 3 jars for different experiments.

The position of the point P was varied, and the resulting waves in the aerial were measured at each position, and curves plotted. From these curves the position of resonance is very approximately found.

Three curves were drawn, showing the waves formed in the aerial when different capacities were put in the secondary circuit, A B P.

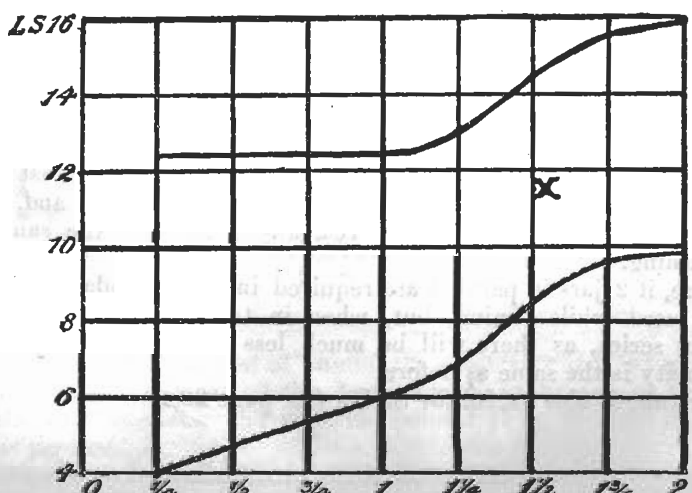
Point X between the curves, Figs. (2), (3), and (4), is the point where the aerial is in resonance with the primary circuit.

Fig. (2) shows curves when $S_2 = 3$ jars.

Here point P is at position $1\frac{1}{2}$ turns up "B" tuner.

Waves = 784 feet and 600 feet; coupling = 26·6 per cent.

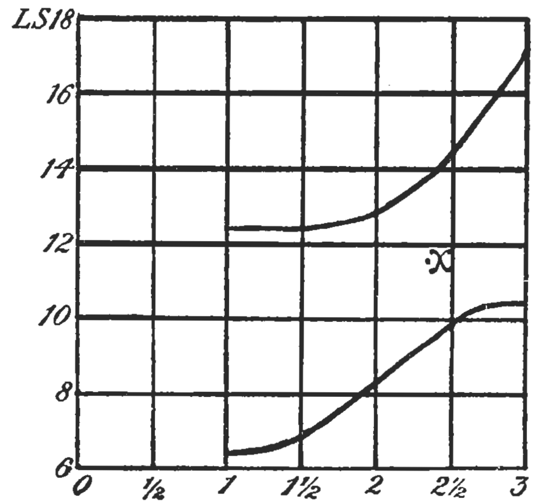
FIG. (2).



Number of turns from bottom of "B" tuner to point P.

Fig. (3) shows curves when S_2 = 2 jars.
Here point P is at position $2\frac{1}{2}$ turns, less 6 inches, up " B " tuner.
Waves = 764 feet and 635 feet; coupling = 18·5 per cent.

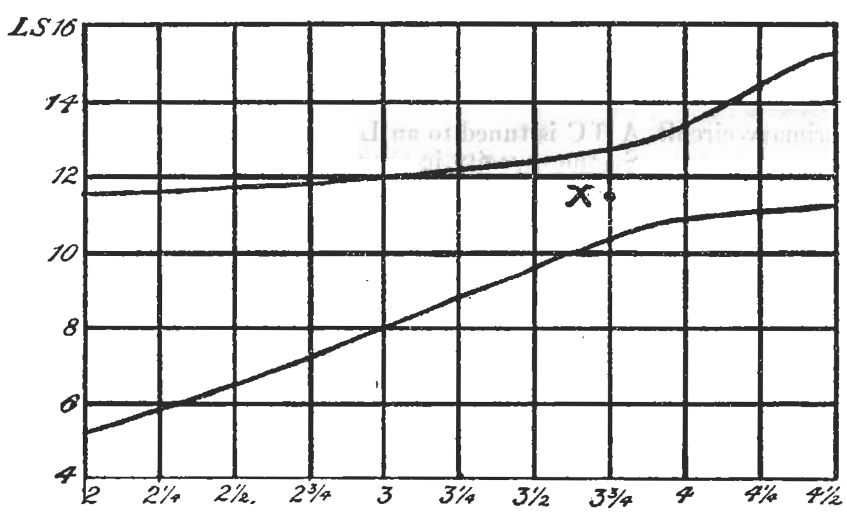
FIG. (3).



Number of turns from bottom of " B " tuner to point P.

Fig. (4) shows curves when S = 1 jar.
Here point P is at position $3\frac{3}{4}$ turns on " B " tuner.
Waves = 725 feet and 693 feet ; coupling = 9·1 per. cent.

FIG. (4).



Number of turns from bottom of " B " tuner to point P.

These curves show the effect of coupling on the resulting waves, and also how the waves in an aerial altered as the aerial was gradually brought into tune with the influencing circuit.

A quick way of seeing when the system is in resonance is by observing the brushing of the jars in the secondary circuit. The brushing will be a maximum when the system is in resonance.

While this brushing effect is useful for tuning purposes, it must be remembered that, when sending, brushing means considerable loss of energy ; and, therefore, after the system is in tune, the jars should be rearranged to have the same capacity but without the brushing.

For instance, if 2 jars in parallel are required in the secondary circuit, the 2 jars only would be used while tuning, but, when in tune, 8 jars should be used, 4 in parallel and 2 in series, as there will be much less brushing with this arrangement, though the capacity is the same as before.

A Geissler tube is also useful for tuning (*see* page 20).

TUNING TO "D" AND "P" TUNES IN SHIPS OTHER THAN TORPEDO BOAT DESTROYERS.

The following extracts are taken from Memorandum No. 113 D. of 19th September 1908, issued by Commander-in-Chief to the Home Fleet.

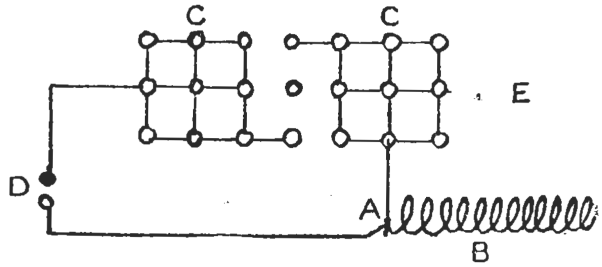
Arrangements for the primary of "D" and "P" tunes in ships fitted with Mark I. apparatus :—

Primary of "D."

Use 20 jars, 10 in parallel and 2 in series. Join as in Fig. (1), moving point A **until the exact wave-length** is obtained.

The jars must be raised from the table on glass strips.

FIG. (1). PRIMARY OF "D."

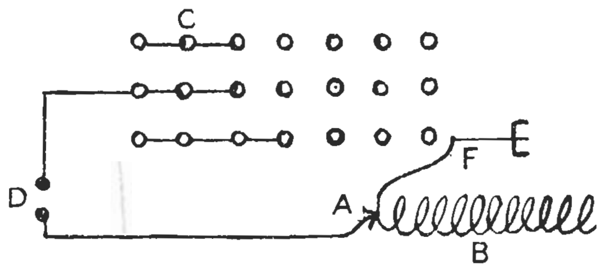


B. "B" tuner. C. Top of jars. D. Spark gap.

Primary of "P."

It will be found that the same primary leads can be used, but with 10 jars in parallel, joined as in Fig. (2).

FIG. (2). PRIMARY OF "P."



B. "B" tuner. C. Top of jars. D. Spark gap. F. Bottom of jars.

For small sparks, the best method of generating power for "D" tune is to use the rotatory. The primary of one coil and the secondary of two in series, will be found to give a good spark of 5 mm. or more.

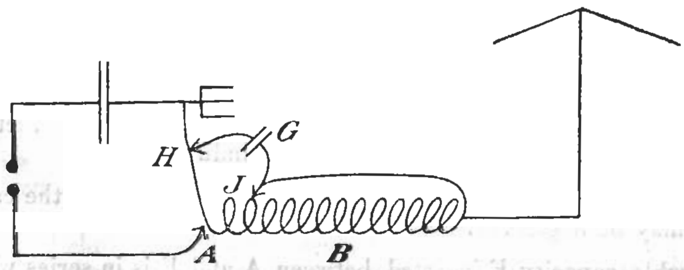
For "P" tune a small spark can be obtained with one coil only in use.

For maximum power, on either "P" or "D," the hammer make and break must be used.

Tuning the Secondary.

Battleships and 1st Class Cruisers require one jar in the auxiliary condenser. Scouts are better off with two jars in parallel (*see* Fig. (3)).

FIG. (3). FINAL CIRCUIT FOR "D" AND "P."



B. "B" tuner. G. Auxiliary condenser.

The quickest **and best method of tuning the secondary is to hang a Geissler tube, which can be obtained for 1s. 6d. at the Army and Navy Stores, on to the fork at the lower end of the deck insulator and shift the point J (Fig. 3) until it glows brightest when the key is pressed.**

If no Geissler tube is available, the method recommended in the Annual Report of the Torpedo School, 1907, page 49, paragraph 1, of Appendix X., Wireless Telegraphy, is the best.

For "D" tune the point J is generally three turns from the bottom of the "B" tuner in scouts, and rather more in battleships.

For "P" it is about five turns for scouts and eight or nine for battleships.

The Coupling is varied by bringing the point H nearer to or further from A; for loose couplings it should be close to A.

The length of wire between A and H should not be less than 12 inches or more than 36 inches.

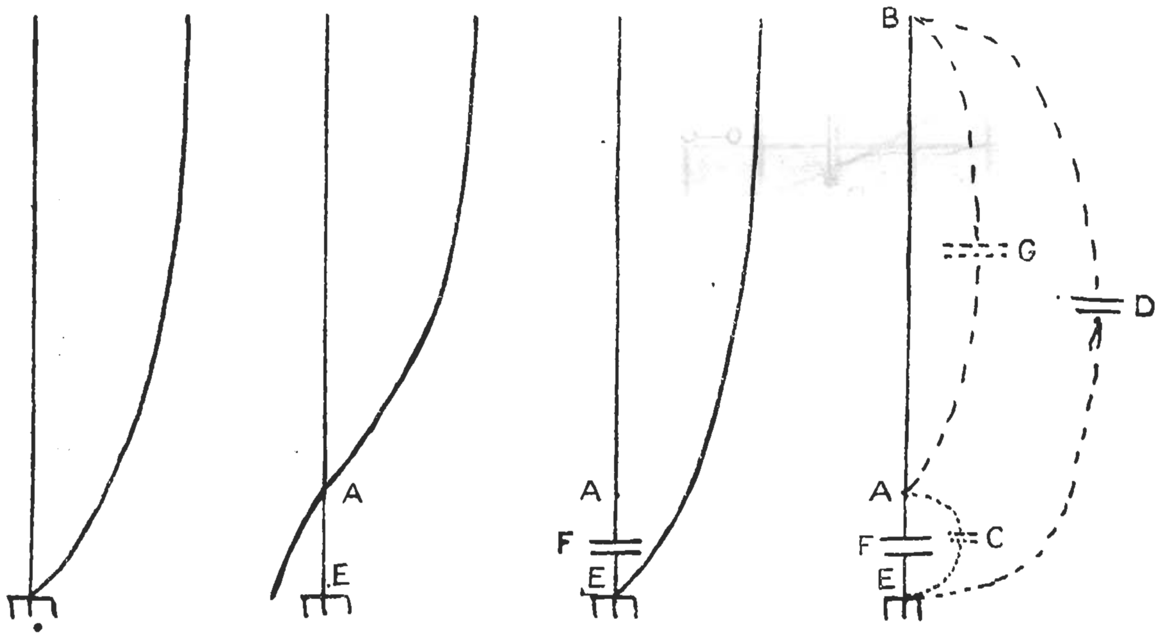
In order to simplify the gear as much as possible, the method of tuning "P," given herein, should be adhered to, provided the resultant wave-length does not exceed 1,000 feet. The eventual duty of "P" being communication with shore stations whose wave-length is 300 metres.

Receiving Short Waves.

In all cases of receiving, the point aimed at is to obtain maximum current through the receiving instruments. These latter being placed at the foot of the aerial, the object aimed at is to obtain a node of potential at the bottom of the aerial. The bottom of the aerial is assumed to be at the point where the aerial circuit connects to the acceptor and rejector circuits. In the following description and diagrams the acceptor circuit has, for the sake of clearness, been omitted, because if it is in resonance with the short wave to be received it has no bearing on the question of how best to receive short waves on a long aerial. The bottom of the aerial has therefore been taken as being earthed.

When receiving the fundamental of an aerial the node of potential is naturally at the bottom, as shown in Fig. 1.

Fig. 1. Fig. 2. Fig. 3. Fig. 4.



When receiving a wave slightly shorter than the fundamental, as in Fig. 2, the L.S. value of the aerial can be reduced to the required wave-length by inserting a condenser in the aerial between A and E (*see* Fig. 3).

Fig. 4 shows the oscillating circuit diagrammatically. The inductance A B with its capacity G in parallel acts in this instance as an inductance.

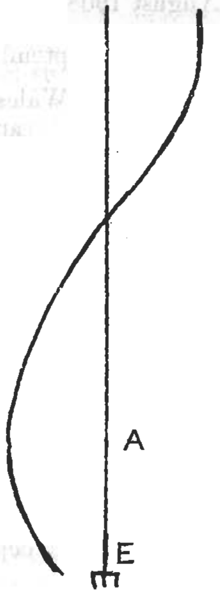
A and E are very nearly at the same potential, and therefore the capacity of C has little effect and may be neglected.

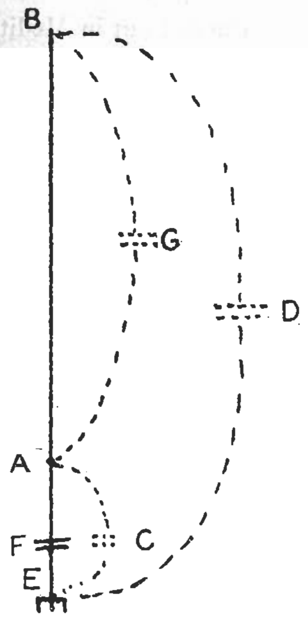
The adjustable capacity F inserted between A and E is in series with capacity D, and thus reduces the total capacity and so the L.S. value of the aerial till the fundamental of the aerial is the wave required and the potential curve is as shown in Fig. 3.

This is the most suitable method for receiving waves slightly shorter than the fundamental.

If the wave received is very much shorter than the fundamental, as in Fig. 5, there is very considerable difference of potential between A and E; and the capacity C has to be considered (*see* Fig. 6).

FIG. 5. FIG. 6.

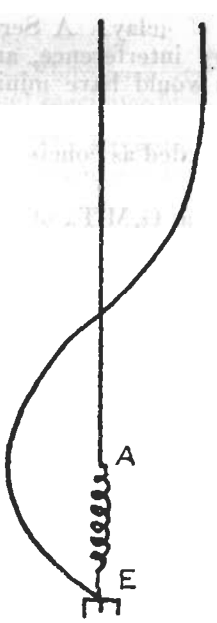


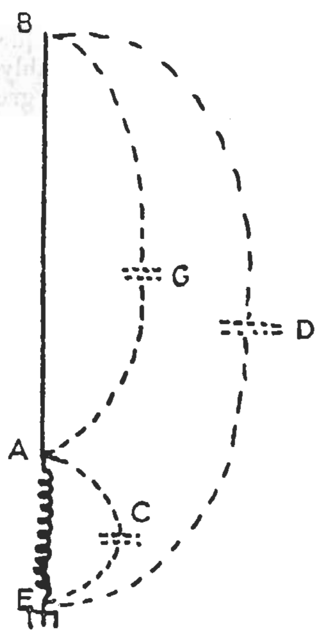


It is evident that since the capacity F, inserted between A and E, is in parallel with the capacity C, any reduction of F beyond a certain point will have but little result on the total capacity, and therefore it may be impossible to reduce the L.S. of the aerial to a sufficient extent. Under these circumstances the best method is to insert *inductance* between A and E by adding turns of the tuner, thus lengthening the aerial till a fundamental is obtained of which the wave to be received is an harmonic.

The state of affairs will then be that shown in Figs. 7 and 8.

FIG. 7. FIG. 8.





Therefore, for receiving waves considerably shorter than the fundamental, inductance is added in series with the aerial, thus lengthening its L.S. value to a wave-length of which the required wave is an harmonic.

An acceptor tuned to the short waves can then be added at the bottom of the aerial and the tuned shunts used in the usual manner.

NOTE.—No. 5 condenser, which has small capacity values, is intended to be used as the rejector capacity for short waves.