Progress in Foreign Countries.

Germany.

Germany.

Great progress has been made and rivalry between different systems has ceased, as practically all interests are amalgamated into one concern, "Gesellschaft für drahtlose Telegraphie" (*i.e.*, Telefunken Company). This Company asserts that they have installed as many, if not more, working stations than all other systems put together. They have fitted up altogether about 450 installations, including some 80 ships and about a dozen shore stations for the Navy. The U.S.A. Navy is also making extensive use of this system for ship and shore stations. The navies of Russia, Austria Hungary, Spain, Portugal, Holland, and Denmark are now employing this system.

The Telefunken portable station is used in the German Army, and many other armies, including our own, have purchased some sets for trial.

The Telefunken Company offer to erect *and guarantee* communication.

They are now erecting a 360-mile station at New Orleans to communicate with 23 of their stations along the coast.

United States.

United States.

The systems now working in the U.S.A. include the Marconi Company, Telefunken Company, De Forest Company, Fessenden Company.

There are a great many stations fixed and many more contemplated, but the whole question of wireless telegraphy has now been placed, as with us, under the control of a Government department:—

(1) All coast stations to be built, equipped, and manned by the Navy.

(2) All such stations are open to the free and unrestricted use by vessels of all nationalities.

(3) Arrangements have been made for a "time signal."

(4) Under certain conditions of co-operative assistance storm warnings are transmitted free of charge from all Government stations to ships within their range.

(5) It is pointed out that by adopting a uniform wave length (320 metres recommended) different systems are intercommunicable.

(6) Signalling speed not greater than 12 words a minute has been fixed for the present.

(7) Erection of private stations is allowed provided that they do not interfere with the Naval stations.

Evidently the policy of the United States Government is to acquire the strategic control of wireless telegraphy in war time and in national emergencies, whilst at the same time encouraging invention and safeguarding against any attempt to create a monopoly of this method of signalling.

Many of the ships of the U.S.A. Navy are fitted with the Slaby-Arco system, but all the principal systems have been and are still being tried by the Navy Department, and two sets, at a low figure, have lately been ordered from the Shoemaker Company.

Italy.

Italy.

The Navy uses the Marconi system extensively and many shore stations have been fitted. A high-power station is being equipped at Coltano, near Pisa, whence it is hoped to communicate with Argentina. Commercial communication has been established between Bari and Antivari, across the Adriatic. The Sicilian railways have a communication across the Straits of Messina.

France.

France.

No great development has taken place, but the Navy is fully supplied. Several shore stations have been erected, including one at Dieppe and another at Newhaven in connection with the cross-channel steamer service. It is understood that Ducretet, Mors, Brauly, Rochefort, and others have been actively engaged in experimenting, but no striking developments have yet been announced.

India.

India.

Successful communication has now been obtained by the Lodge-Muirhead system between the Andaman Islands and Burmah, across about 300 miles of sea.

Transmitting arrangements :—

FIG. 4.

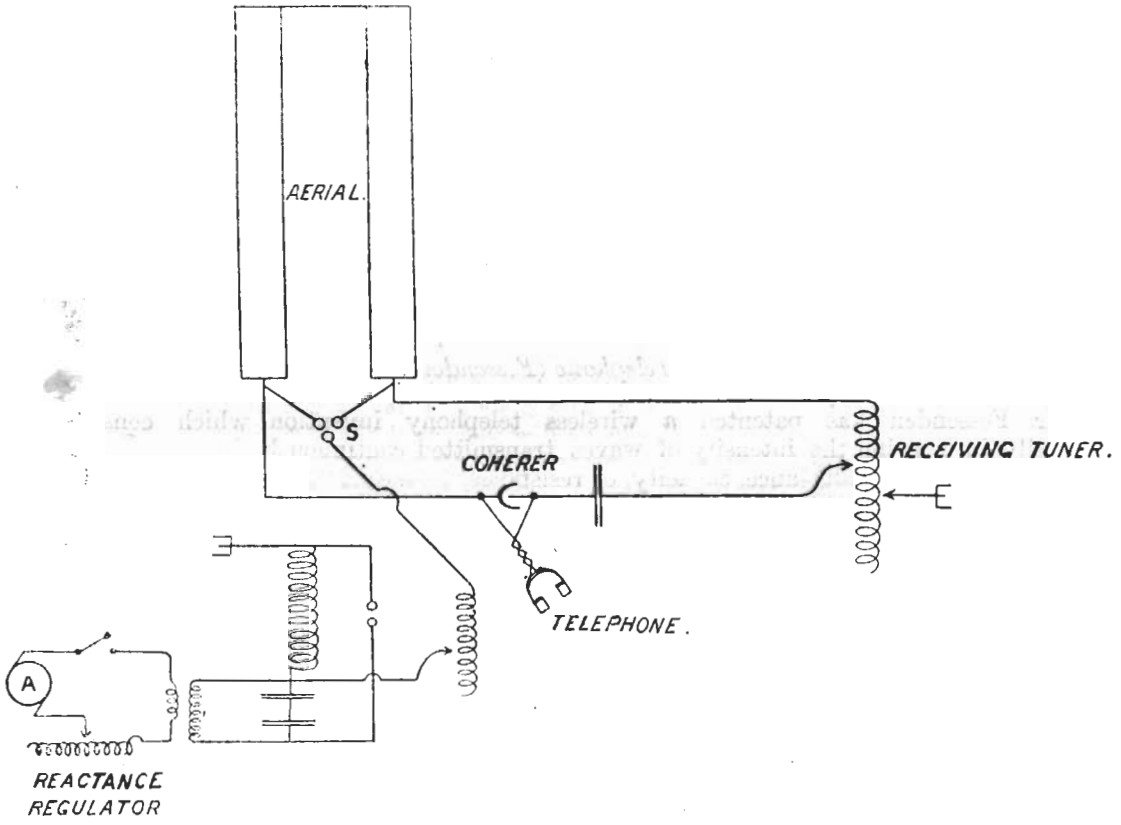


Fig. 4 shows diagrammatically the sending and receiving arrangements. There is, of course, a switch (not shown) for disconnecting the receiving gear when sending.

The aerial, of 7/21, is arranged as shown, all parts joined at the top, and its length is as nearly as possible a quarter the wave length used. The aerial is lead horizontally at the top if sufficient height cannot be obtained.

The "Anchor Spark Gap" S is an arrangement for sending on the fourfold aerial, by bridging across with the sending potential, and for cutting off the transmitter when receiving and utilising the closed aerial receiving circuit.

The "re-actance regulator" is simply a choking coil, with iron core, used for the usual purposes.

The oscillator is a closely coupled auto-oscillator, and additional inductance of ¼-inch copper tubing is placed as shown in the bottom of the aerial outside the oscillator. The capacity in the oscillator circuit is made up of tubular glass condensers, 18 inches long and 2 inches diameter, probably similar to those used in the Telefunken system.

A spark gap silencer is used.

Receiving Arrangements.

Fig. 4 shows the receiving arrangements, the transmitter being cut off at S.

The receiving circuit is a closed one, and consists of the aerial, adjustable tuning inductance, fixed capacity and electrolytic detector, all in series. The tuner is varied for strongest signals and is earthed as shown to cut out interference. It will be noticed that no cell is used with this electrolytic.

The United States Navy is at present experimenting with this system, and has a **250-mile set installed in the battleship "Maryland." Two receiving sets are now under trial in "Vernon."**

Fessenden's Patents.

Fessenden, U.S.A.

Liquid Barreter.—This is a receiver consisting of a glass tube containing two electrodes and a solution of nitric acid or caustic soda. The barreter is used with cells, potentiometer, and telephone receivers in the usual way, and the oscillatory currents passing through the barreter affect it in such a way as to alter the strength of the current through the telephone receiver. The inventor states that a pressure on the liquid above that of atmospheric pressure greatly increases the sound in the telephones, and that very good results have been obtained with pressures as high as 40 to 50 lbs. per square inch.

Liquid Aerial.—An aerial formed of a jet of water pumped up through a glass tube, inductance being put in the bottom of the aerial by having a spirally twisted tube.

Feeder for Roof Aerial.—A feeder consisting of a cylindrical structure, of suitable diameter, in sections, so that a great height may be obtained as well as access to the roof by an internal ladder.

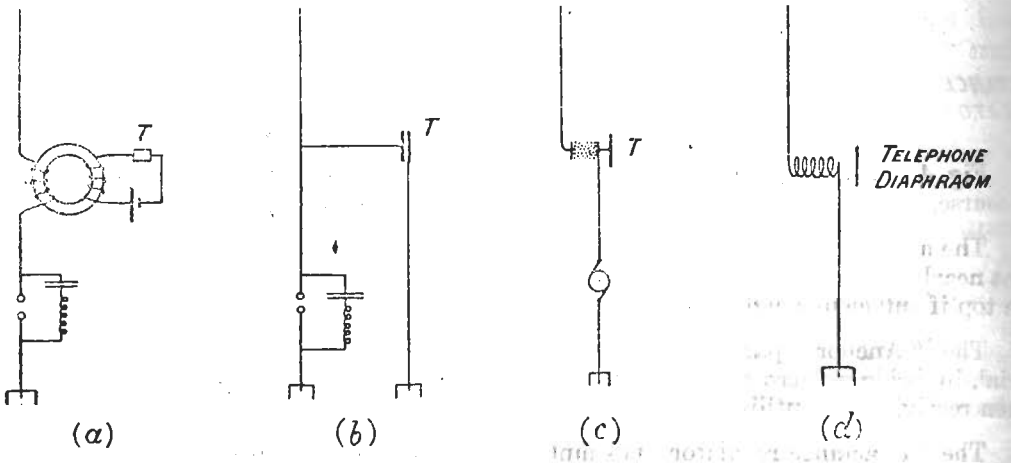
Condensers.—Compressed air condensers, which he claims are far more efficient than condensers with any other dielectric as regards hysteresis, loss, &c., and can be made at a reasonable cost.

Wireless Telephone (Fessenden).

Fessenden's wireless telephone.

Mr. Fessenden has patented a wireless telephony invention which consists essentially in varying the intensity of waves transmitted continuously from an aerial wire by altering its inductance, capacity, or resistance, by means of sound waves. The receiving aerial, which is in resonance with the transmitter, has a small coil of wire in series with it, so that a variation of current strength in the coil will act on a diaphram placed close to it, in the same way as a telephone receiver

FIG. 5.



In Fig. (*a*), the inductance of the aerial is varied by speaking into the microphonic transmitter T, which varies the current in the cell circuit, thus altering the permeability of the annular core of fine iron wire, which makes an alteration in the inductance of the turns of aerial round the core. The tune of the aerial is thus continually varied, and therefore the strength of the transmitted waves, which will be strongest when the aerial is in tune with the oscillator circuit.

In Fig. (*b*) the capacity of the aerial is varied by talking into the transmitter T, and in (*c*) the resistance in the aerial is varied by talking into the microphonic transmitter T.

Mr. Fessenden also states that a high-frequency alternator may be used, as shown in Fig. (*c*).

Fig. (*d*) shows the receiver, already described.

Abstract of Report by Lieut. Donaldson, H.M.S. "Ariadne" (dated 9th March 1905), giving a Copy of a Pamphlet on the De Forest System.

De Forest, U.S.A.

The signalling key is designed so that the break occurs in an oil bath; a condenser is also connected across the make and break.

The electrolytic detector consists of a mixture of litharge, glycerine, and alcohol occupying the gap between the electrodes, and carrying very fine tin filings. The local battery normally causes minute particles of metal to be projected from the anode wire to the tin filings, and from the latter to the cathode wire, thus causing a metallic conducting bridge to be formed for the local circuit through the glycerine mixture. Upon the passage of electrical energy down the aerial and through this gap in a direction opposite to that of the local battery, this metallic conducting bridge is destroyed according to the laws of electrolysis, and therefore the local battery circuit is suddenly broken, which causes its static charge to operate the receiver and sound the signal. The detector is self-restoring.

Report from Naval Attaché to N.I.D. (dated 28th March 1905), on Systems adopted in U.S. Navy.

Slaby Arco.

The Slaby-Arco system of wireless telegraphy is used on all the U.S. war vessels except three, which carry the Fessenden system for trial. It is understood that the four armoured cruisers of the "West Virginia" class are to be fitted with the Shoemaker system for trial. Tenders called for by the Naval Department for fitting these four armoured cruisers were answered by all companies, and it is understood that Marconi's estimate for fitting four cruisers was 41,000 dollars, whereas the Shoemaker Company estimated 8,000 dollars for the same, with a guarantee that they would be able to work at a distance of 250 miles, with a mast of 135 feet. Marconi guaranteed 60 miles. The Navy Department say that wireless is still in the stage of experiment, and until they are satisfied which is the best they will adopt no particular system.

Only one tune is used at present.

It is impossible to find out exactly how many sets of Slaby-Arco are in use in the U.S. Navy.

German Systems.

Telefunken System.

Telefunken, Germany.

The Telefunken system arose out of an amalgamation, in the summer of 1903, of the Brau.-Siemens and Slaby-Arco systems of wireless telegraphy.

In this system the usual forms of net and roof aerials are used.

In shore stations where suitable low-resistance "earths" cannot be obtained, the "earth" consists of a large conducting surface made up of wire gauze stretched horizontally and insulated from the ground. This form of "earth" is usually called an electric counterpoise, and the Telefunken Company state that an inductance is required in the aerial in front of the counterpoise; this inductance is used as a part of the secondary of the oscillator.

It is claimed that an "earth" of this form not only gets over the difficulty of long earth leads and ohmic resistance, but also considerably reduces the strength of atmospheric disturbances. The spark gap consists of some four or five small spark gaps in series, which are said to greatly reduce damping when using long sparks.

The oscillator used is of the auto-oscillator type, loosely coupled, shown on page 24, A.R. 1904, and the whole aerial is joined to the oscillator by a small spark gap which is bridged over by the high potential when sending, so that a large aerial may be used for sending and only a part of it for receiving. By this means the interference of atmospherics, &c., is greatly reduced.

An alternator or rotary converter is used, as in other systems, and the coupling of the transformer is adjustable and is usually regulated so as to obtain about 25 sparks per second. The coupling is loose and should adverse atmospheric conditions entail an increase of energy per spark, the coupling is varied so as to reduce the number of sparks per second.

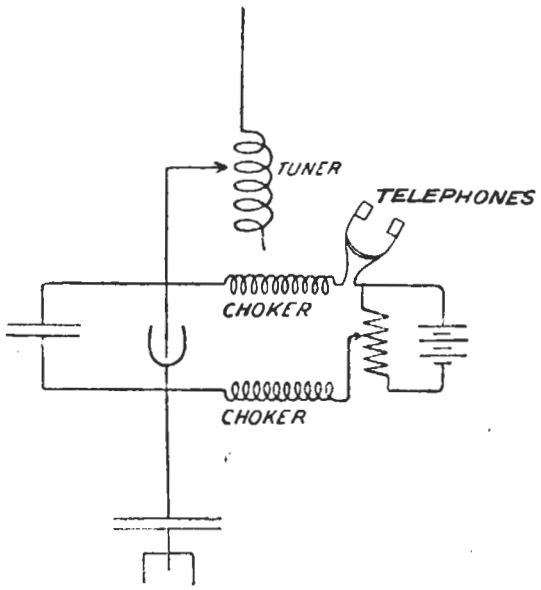
The ohmic resistance of the oscillator circuit is reduced to a minimum by using a copper conductor consisting of very thin insulated wires.

The condenser in the transmitting circuit consists of a number of long tubular glass condensers of a form which would appear to be eminently suitable for obtaining a large high-tension capacity in a small space. There will shortly be under test in "Vernon" a high-tension condenser of a similar form.

For receiving, a coherer (with tapper, inker, &c.) and an electrolytic detector (with telephone receivers) are generally used together. Both circuits are very loosely coupled

to the aerial, and are adjusted to the incoming wave. Fig. 6 shows diagrammatically the Company's connections for receiving on the electrolytic. The coherer connections are shown on page 24, A R. 1904.

Fig. 6.



A report of trials by "Vernon" with this instrument will be found on page 32.

Intercepted German Naval Messages.

Intercepted German Naval messages.

Conclusions by "Vernon," from tapes forwarded by H.M.S. "Venerable" at Corfu (dated 13th April 1905) :—

(1) There is very little system among the operators.

(2) A B calls up C D thus :—

VE VE VE C D C D C D . . . . . V A B D D D.

C D answers a call :—

A A A Hier C D D D D.

A B sends message :—

VE VE VE A B message D D D.

C D acknowledges either by

VE VE VE VE VE C D D D

or by

A A A VE VE VE C D D D.

(3) 2 2 is sometimes substituted for D D D, but a call followed by 2 2 is frequently prior to a message ending by D D D.

It is possible that D D D is their usual tune, but also does duty as their "finish" sign. Thus a call followed by 2 2 may be a call on some other tune, and the message following would naturally be in that tune.

(4) The German repeat sign is N V N V N V.

(5) The erase sign is a succession of shorts.

(6) — — — — signifies C H.

(7) The sign . — . . . is of the same significance as our sign M Q.

(8) Bitte V V V H W may mean "Please send V's on Harbour Wave" (*see* A.R. 1904, page 27), as "Hafen" means Harbour, and "Wellen" means Wave.

(9) One message ends P R O P P and one P P O R P. No conclusion can be drawn as to the meaning of these signs, but the letters are in the reverse order.

(10) No particular routine seems to be followed. VE is used as an introductory sign and as R D. Sometimes a call or message is acknowledged one way and sometimes another.

Dutch Systems.

Abstract of a Report by Lieut. Edwards, R.N., H.M.S. "Exmouth," dated 24th September 1905, on information gathered by the Fleet during the Baltic Cruise.

Dutch systems.

A station was observed at Marhelsdorf Point fitted with a "roof" aerial, also one at Kronsborg (the Sound Denmark). The wave length of the station at Scheveninger, near the Hague, was found by experiment to be 7,000 feet.

The cruiser "Evertsen" was apparently fitted with a short wave, similar to "A" tune and was in constant communication with a station at Amsterdam which used a wave length similar to "B" tune. The method of signalling was practically that of the International Book, the same calls and signs being used.

Following call signs used:—

E V Evertsen.
A S D Amsterdam.
S C H Scheveningen.
J A Jansden (near Dordrech), uncertain.
S L Sliedrecht, uncertain.
H D R Helder.
S R, S T, S F, Z D (S.S. "Zealand"), H B (S.S. "Hamburg"), S G.

The following signs, which are not confidential, were used by German ships:—

S denotes Government message.
S S denotes free.
A denotes urgent.
D denotes urgent private.
K used after an answer to a call means "I am ready to receive."

The sign • ▬ • • • means "wait," and is followed by the number of minutes probable delay.

The latest German battleships were fitted with two light topgallant masts, and the aerial, which is double for the greater part of its length, is led from the fore topgallant mast to the main, and then down to the office which is before the funnels. The aerial is thus clear of flag signalling from the after bridge. Great attention is paid to insulation, and where long wire stays are used they are insulated at frequent intervals in order to prevent loss of range due to induction effects. Triatic stays are not fitted in the latest ships.

Some German destroyers are fitted, but, apparently, signals can only be exchanged up to about 5 miles.

French Systems.

Wireless Telegraphy in the French Navy.

French Navy.

The French Naval Wireless Telegraphy Handbook for 1904 calls for few remarks, as it only describes a Plain System which was the Rochefort Plain System adapted to naval requirements.

For receiving, a filings coherer was employed, joined straight in the aerial. No jigger was used. The sensitiveness of the coherer was varied by the addition or subtraction of filings. The relay was of the moving coil type. The usual shunts and choking coils were employed in the receiver. The tapper and inker were of the usual pattern.

For transmitting, a multiple aerial was used. The power for a transformer using a mercury break was supplied from accummulators or the mains, with a series resistance, through a signalling key with an oil-bath break.

The system has since been expanded, and the following information on the subject is abstracted from reports by Lieutenant Moore, R.N., H.M.S. "Vernon"; Captain Salkeld, R.M.A., H.M.S. "Russell"; and Lieutenant Malden, R.M.L.I., H.M.S. "Triumph," all dated August 1905.

Aerial.—Fourfold, not split, of insulated wire led through an ebonite and glass insulator into the office.

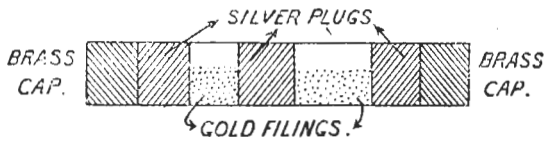
Transmitter.—A large transformer with spark gap fed by a direct current passing through a mechanical dipper interrupter driven by a small motor. A flat condenser was used for absorbing the spark at the make and break. Plain aerial was used, and one of the operators stated that an 18-cm. spark could be obtained with the aerial and earth joined up. As this seems improbable, it is possible that the question was misunderstood.

Receiver.—Several jiggers were seen, apparently wound by the operator himself and apparently used at random. They were not in boxes, but the six wires from the jigger were brought to six spring clips which fitted six contacts on the table. These contacts were connected to the aerial, earth, jigger condenser, and coherer.

The shunts consisted of lamps across the usual terminals.

The coherers were of two sorts, silver plugs and gold or silver filings.

FIG. 7.



The other receiving instruments were as described above.

When the Fleet was at Cowes, all routine work except urgent signals was promulgated by wireless telegraphy. Signals were sometimes repeated six times before being satisfactorily received. There seemed to be no method of calling up several ships at a time. At short distances they seem to prefer using big sparks and coarsely adjusted receivers to using delicate adjustments and small sparks. The wave length as measured in "Vernon" varied between 970 feet and 1,030 feet. While signalling it was noticed that the sign • • • ▬ • ▬ is equivalent to our R D, and the sign for é (mentioned in our N.I.D. List of Signs, No. 691) • • ▬ • • is also used for ê, the ordinary sign • being used for e and è.

Newhaven Wireless Telegraph Station.

Rochefort system.

Early in the year the stations at Newhaven and Dieppe, using the Rochefort system, in connection with the London, Brighton, and South Coast cross-channel service, started experiments which effectually jammed all "B" tune work in the "Vernon." An arrangement was come to in June by which an officer from the "Vernon," using our own gear, might, at Newhaven, discover what fraction of the power ordinarily used at Dieppe was necessary for the transmission of signals. The "Vernon" also stood by to receive, and received as much from Dieppe as the Rochefort receiver did at Newhaven. The "Vernon's" officer at Newhaven received readable messages when Dieppe was using $\frac{1}{6}$th of her usual power, and signs at $\frac{1}{25}$th the usual power.

A report to this effect was forwarded, and the jamming from Newhaven has ceased.

Abstract of a Report on French Wireless Telegraph Station at Brest by Lieut. Riley, R.N., H.M.S. "Prince George," dated 19th September 1905.

Transmitting Arrangements.

Brest station.

Aerial consisted of six parts of insulated wire 50 metres long joined together at the bottom and led into the office through a thick glass plate.

A tuned system, consisting of an oscillator and a capacity of six jars in parallel, as well as a Plain aerial system, is fitted. The power is supplied from accumulators working a large induction coil.

Receiving Arrangements.

A coherer consisting of filings of an alloy of gold and silver between electrodes of brass and steel. These coherers were said to be sensitive, working with a very small potential and requiring a hand tap.

A rough form of M.D., worked by hand, was being tried, and M. Tissot stated that with it they had heard Poldhu sending.

The maximum signalling distance was given as 200 miles, and the average distance was 50 to 100 miles.

RUSSIAN SYSTEMS.

Abstract of a Pamphlet on Wireless Telegraphy in Russia, forwarded by Captain Calthorpe, R.N., dated November 1904.

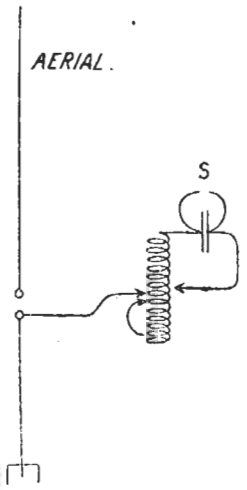
Tuning the Transmitter.

Russia.

The spark to be used during the operation is decided on; the aerial is connected as in "Plain" with an ammeter in the earth lead, and the make and break is varied for a maximum reading on the ammeter. This rate of interruption will probably give the steadiest and most oscillatory spark. A mercury turbine interrupter is used.

The $\lambda\sigma$ of the aerial is then measured as follows —

FIG. 8.

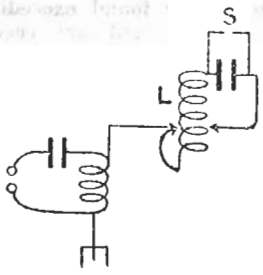


The aerial is connected up as Plain aerial, and a lead from the earth connection is taken to a closed oscillatory circuit consisting of a variable inductance L, and a capacity with a spark gap S across it. L is varied for a maximum spark at S, which will occur when $\lambda\sigma$ = LS of closed circuit.

It will be noticed that the free end of the tuning inductance is short-circuited to the resonance point on the inductance, as, if the capacity in the closed circuit is small, the lower turns of L, if close to earthed bodies, would affect the frequency of the circuit.

The closed resonance circuit is now used for tuning the oscillator.

FIG. 9.



The oscillator is attached to the resonance circuit as shown, and the number of turns in the oscillator is varied for a maximum spark at S.

Then LS of oscillator = LS of resonance circuit.
= $\lambda\sigma$ of aerial.

The capacity in the resonance circuit is taken as twelve times that of the aerial, probably to suit the coherer, which has a capacity about 40 times that of our Service coherer.

The oscillator is then connected to the aerial as shown in Fig. 10.

FIG. 10.

The aerial and oscillator circuits are now very nearly in tune, as the addition of the oscillator inductance to the aerial is almost negligible, being about $\frac{1}{12}$th that of the aerial.

The wave length of the station can then be measured as explained for the measurement of $\lambda\sigma$ of aerial, by connecting the resonance circuit to the E lead of oscillator.

Tuning the Receiver.

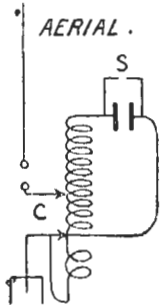


FIG. 11.

The same resonance circuit is taken to the receiving station and connected as shown in Fig. 11. The contact C is varied for a maximum spark at S, that is, the number of turns required in series with the aerial to bring it into resonance with the sending station is thus found. The coherer is then substituted for the condenser in the resonance circuit, and as it is approximately of the same capacity, the tune of the receiver remains as before.