The De Forest Wireless Telephone Set mentioned on page 38 of W.T. Appendix to Annual Report of 1908 has been purchased, and further trials have been carried out with this apparatus in "Vernon." De Forest telephone.

Extract from "Vernon's" Report on further Trials carried out with the De Forest Wireless Telephone.

Further experience with this apparatus has given confirmation of the general disadvantages as specified on page 38 of Annual Report of 1908. Results of experiments.

With a view to communicating over short distances with a wave which shall not interfere with communication on service wave lengths, experiments were carried out using waves of greater length than any Service waves. It was found that the radiation from the aerial was very weak indeed in these circumstances. Even when using the main aerial, speech could not be reliably transmitted on a 20,000 feet wave to ships in the harbour, and it is quite impracticable to use a special small aerial, as was at first intended. Use of long waves.

Further experiments were carried out with H.M.S. "Furious," using the main aerial, and a wave length approximately that of "T" tune. Speech was loud at close ranges, up to 10 miles or more, but never clear and reliable. This was due to the noise made by the arc itself, which interferes with the speech, and also to the microphone transmitter not giving clear articulation.

Speech was heard faintly at Portland and once or twice moderately loudly, but the words were not distinguishable.

The following technical points were noticed during these experiments:—

(1) Although it is fairly easy to get the arc to oscillate it is difficult to keep it oscillating *silently*. The arc tends to hiss and to splutter in a way which interferes very much with the reception of speech.

(2) Irregularity in the burning of the arc renders frequent adjustment of the variable primary condenser necessary, so as to keep the primary circuit in tune with the aerial.

(3) The arc vessel requires periodical cleaning out, as a sooty deposit forms inside and short circuits the arc. Owing to these difficulties with the arc, the apparatus requires the close and constant attention of a skilled operator with considerable electrical knowledge. Even with such attention the apparatus is not reliable.

The general conclusions arrived at are— Conclusions.

(*a*) That the transmission of speech by this system cannot be considered as reliable even at short ranges.

(*b*) That the apparatus cannot be used with waves of such lengths as to be clear of interference with and from wireless telegraphy signals made on the Service wave lengths.

(*c*) That although with an improved microphone transmitter giving clearer articulation, reliable communication might be obtained by skilled operators over ranges up to 50 miles, on the Service wave lengths, the general disadvantages mentioned on page 38 of Annual Report, 1908, would still exist.

That the system is therefore unreliable at present and unlikely to be of use in H.M. Service.

Poulsen Telephone.

Poulsen telephone.

The company working the Poulsen system have abandoned the use of the arc for wireless telephony as impracticable, *see* page 54.

Wireless Telephone System used in H.M.S. "Good Hope."

A wireless telephone set was made in H.M.S. "Good Hope" from Service gear. The system was practically the De Forest system adapted to Service gear.

The main aerial was used and the gear adjusted to "S" tune.

The reception of signals sent by this set was at times perfectly clear at short ranges.

Atmospherics, if at all strong, entirely upset the reception of speech even when the red plug was used.

The electrolytic detector appeared to be more suitable than the magnetic detector for the reception of signals.

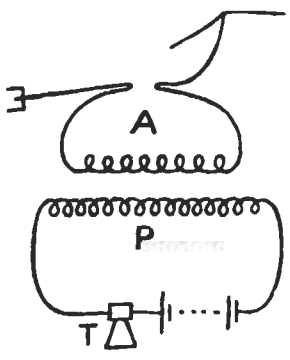
A transmitter as used for search light control was used.

The direction in which improvement is required appears to be in silencing the arc and in finding a better transmitter than the one employed.

Report by British Naval Attaché at Washington on an American System of Wireless Telephony invented by a Mr. McCarthy.

While at San Francisco, the Consul-General introduced me to a Mr. Holden, a broker, who is running the financial part of a system of Wireless Telephony, the invention of a Francis Joseph McCarthy. The original inventor died before completing his experiments, and it is now being carried on by his brothers, the chief one being Henry A. McCarthy. Just before the original inventor's death, the shares of the Company were quoted at 5 dollars for 1 dollar shares, at present they are about at par. An electrical engineer, Mr. McMeon, is now associated with the McCarthys. He is very highly spoken of in San Francisco, and is the Electrical Engineer of the Home Telephone Company, and is just completing their automatic exchange, which will do away with telephone girls.

The apparatus, as I saw it, consisted of 5 dry cells, 1½-inch coil, telephone transmitter and aerial.



A. Secondary and aerial.
P. Primary circuit.
T. Telephone transmitter.

I used it myself both ways for a distance of 1,200 yards. The aerial consisted at one end of three vertical wires 100 feet long, at the other four horizontal wires 80 feet long. It was very distinct both ways.

The great trouble is the transmitter, the ordinary one sticking owing to the heat of the current. It is calculated that to obtain a distance of 5 miles, the transmitter should be able to stand a current of 4 amps. Mr. McMeon has no doubt that he can produce one, and when he has finished his work in connection with the automatic exchange (probably by now) he will take the matter in hand. The possibilities of this invention would seem to be great, owing to its simplicity and portability, and there appears to be no reason why, with proper fittings, transmitter, &c., &c.,

a considerable distance should not be obtained ; all the fittings were very extempore, as, with the exception of the coil, transmitter and cells, they had been made by the McCarthys in their own small workshop. Mr. McMeon was very confident as to the future of this invention, and told me that he had spent the previous Sunday with the McCarthys at Pale Alto, and that he was quite satisfied with the progress they were making. The numbers of the patents already taken out in England are 8,324 of 1906 and 5,532 of 1907.

An experiment of probably some interest was shown me by Mr. Henry McCarthy with a double primary coil. First primary 220 volts alternating current, second primary five dry cells and telephone transmitter and secondary sparking gap. On speaking into the transmitter sparking immediately took place and was entirely under the control of the voice.

Judging by the sketch shown, the system used appears to be very similar to one suggested by Lieut. Crauford, which was not very successful, but it is considered from the last paragraph, and from other information supplied to "Vernon," that the McCarthy System included a double primary winding and a resonator, and that it was on this that the success of the system depended.

LEPEL'S W.T. SYSTEM.

Report on Visit of Officers from Admiralty (A.D.T. Department) and H.M.S. "Vernon," to W.T. Station fitted with Baron von Lepel's Apparatus, at Slough, on 26th May 1909.

General description.

The station is situated in an open field about a quarter of a mile from Slough Railway Station. It consists of a wooden mast, about 200 feet high, near the centre of the field, and a single storey 4-roomed building near the foot of the mast.

The apparatus is fitted up in one small room in the building; the other rooms are apparently used as experimental workshops, &c.

Power to work the installation is obtained from the local electrical supply station, which is situated in an adjacent field. The supply is brought to the wireless station by overhead wires.

Baron von Lepel, the originator of the system, and Captain Simpson, representing the Directors of the Company, were present during the visit.

The staff at the station appeared to consist of four or five other members, or employees, of the Company.

The working of the apparatus was fully described ; all questions were answered and technical details explained apparently without any reservation.

Signals were received from Twickenham, distant about 12 miles. The station at Twickenham was stated to be similar to that at Slough, but with a mast of only 60 feet in height and with no apparatus for producing a musical note.

Technical Details.

(a) *Aerial &c.*

Aerial.

Three aerials are fitted at the station, only one of which was used during the visit. This aerial consisted of five or six parts of wire, supported nearly vertically between two spreaders, each, apparently, about 15 feet long.

The height of the upper spreader was stated to be about 150 feet. The wires from the lower spreader are brought together to a porcelain insulator, through which they enter the building. The earth wire leaves through the floor of the building and is connected to a buried earth.

The instruments, both sending and receiving, are installed on and below a wooden bench, about 8 feet by 3 feet, but only a small part of the available space is utilised.

(b) *Transmitting Apparatus.*

The transmitting circuit is shown diagrammatically in Fig. 1.

Power.

The power from the local power station is supplied at from 440 to 500 volts, the variation of voltage between these values depending on the town demand for current ; about $1\frac{1}{2}$ Kw. is required. To equalise the current taken, special resistances and chokers, R and K_1 and K_2 are employed.

Generator.

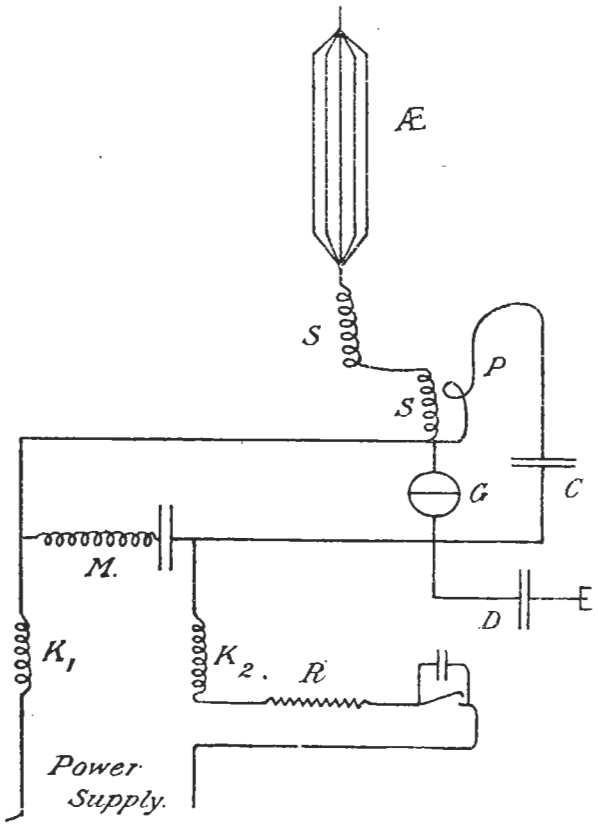
The generator consists of two hollow copper electrodes, about $2\frac{1}{2}$ inches in diameter, which are water cooled.

Between these electrodes are placed one or two thicknesses of thin paper, cut in discs of about $2\frac{1}{2}$ inches diameter, and having a hole about $\frac{1}{2}$ inch diameter cut in the centre.

The lower electrode is insulated by porcelain and ebonite from the body of the generator. By revolving the generator cover the length of the gap between the electrodes can be adjusted. The

usual distance between the electrodes for working is about 1/100th part of an inch, or less at the place where the spark takes place. Inspection covers are fitted for viewing the spark (or arc?), &c., without parting the generator.

FIG. 1.



S. Secondary coil.
G. Generator.
R. Steadying resistance.
D. Earth condenser.
P. Primary coil.
K_1 and K_2. Chokers.
M. Musical note arrangement.
C. Transmitting condenser.

Primary. Secondary. The primary inductance consists of one to two turns of copper wire (about ·25 inch diameter), it is laid inside the secondary coil, which is wound on a former of about 2 feet diameter, and consists of several turns of stout wire.

Condensers. The transmitting condensers, since they are only charged to a low potential, can be made very small. They consist of copper foil, with mica as a dielectric, built solid. The size of the primary condenser is about 3 inches by $2\frac{1}{2}$ inches by $\frac{3}{4}$ inch.

Musical note. The musical note arrangement is a device which has not yet been protected by patent. It consists of a large inductance and large condenser, of such values that they will be in resonance with the frequency of the musical note required; they are placed in shunt across the generator. In the set at Slough this condenser is subdivided into several parts, the connections for which are brought up to a small keyboard similar to that of a piano. By pressing different keys a considerable variation of note can be obtained; in fact, the air of "God save the King" was played with considerable effect on this apparatus.

Signalling key. The signalling key is placed in series with the power supply, with a condenser across it.

Earth lead condenser. "D" is a large condenser placed in the earth lead to avoid earthing the power supply system.

Coupling. The primary and secondary are very tightly coupled, in addition to being directly coupled together through the generator. This arrangement was stated to produce only one wave, whereas two waves usually appear with a coupled system. This point was checked, a wavemeter being worked near the system, and after a rough trial only one wave was found.

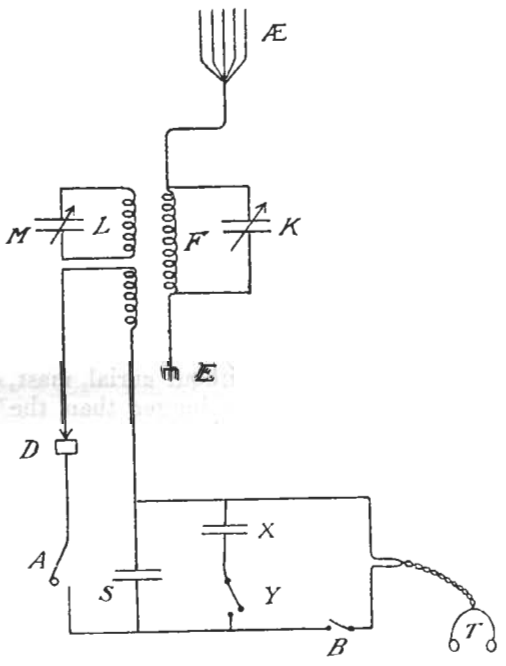
With this method of coupling, the wave-length is quite independent of the arc, and is not affected by any variation of length or resistance in the spark gap. In fact, any alteration in the primary circuit has very little effect on the wave-length given out.

The transmitting apparatus appeared to work well and steadily; the note was clear and steady. The tension in the aerial is very low, and it can be touched without appreciable shock, though an arc can be drawn out from it.

(c) *Receiving Apparatus.*

The receiving circuit is shown diagrammatically in Fig. 2.

FIG. 2.



In this circuit the aerial is connected to earth through an inductance F, which is shunted with a variable condenser K as shown in the figure.

This inductance is coupled with two other inductances. One of these, L, is connected across a variable condenser M, and is used for cutting out interference; the other is in the detector circuit.

The three inductances are wound in the form of flat coils; they are supported on hinges, and can be turned round through an angle and the coupling between them thus varied. Very loose couplings can be used. Coupling.

Connections are made to intermediate turns on these inductances, thus enabling any number of the four different sections of each to be employed.

The detector "D" consists of a carbon point (lead from a kohi-noor pencil is used) pressed by a spring on to a piece of gallena. Detector.

This detector is very cheap and appeared to work satisfactorily. Its action was stated to be that of a thermo junction, and the circuit in which it is placed aperiodic.

A is a switch that is opened while sending.

S is a small condenser placed across the telephones T which are of low resistance, about 10 ohms.

B is an interrupter, similar in construction to a Poulsen "ticker." When receiving from a spark station or from a Lepel station fitted with a musical note, it is not used, but kept closed. When receiving from a Lepel station without a musical note, for instance, the station at Twickenham, this interrupter and the large condenser X, which is put into the circuit by the switch Y, are used. Interrupter.

X was stated to be of about 5 micro-farads; it is contained in a small glass tube and consists of two platinum strips in dilute acid. It becomes a conductor at about 2 volts.

The signals from Twickenham were strong and clear when the interrupter was used, without the interrupter they were heard as a hiss in the telephones.

Further information gathered in Course of Conversation.

Baron von Lepel stated that the company was now constructing a generator to work with alternating current in lieu of the 400-volt direct current supply. He considered that this would be an improvement, since the use of alternating current would facilitate the use of larger power. It was pointed out that with direct current, at 440 volts, the power which could be used depended on the capacity of the condenser employed. It is not possible to use a large transmitting condenser with short wave-lengths satisfactorily, hence the power on the shorter wave-lengths is limited with the present system unless higher voltages are used; the higher voltage is not generally available, Alternating current to be introduced.

nor is it desirable with a direct current system. With an alternating current system a transformer can be used, and the key, &c. kept at a low potential, while using higher voltage at the generator. With the higher voltage it would not be necessary to arrange for so small a clearance between the discs of the generator, or to have them so exactly parallel to one another.

The firm propose to sell two sets :—

Small set. (*a*) A small set, the range of which they give as from 80 to 140 miles. The set comprises all transmitting and receiving gear except mast, aerial, and dynamo.

Large set. (*b*) A larger set, the range of which they state to be 800 miles. The set comprises all transmitting and receiving apparatus, except mast, aerial, and alternator. It is understood that an alternating current machine would be required with this set.

Manufacture. The company's apparatus is at present constructed in Germany, but arrangements are being made to start manufacture in England as soon as the sets have been standardised, which should be within the course of a few weeks. The standardisation of the small set is already practically completed.

Price. It was stated that the price of a small set would be about 150*l*. This does not include aerial, mast, or dynamo.

Delivery could be made in about six weeks.

The price of the large set is about 300*l*. (without aerial, mast, or alternator). The time for delivery of this set was not given, but would be longer than the six weeks required for the small sets.

It is understood that orders have been received by the company from the Argentine Republic and, for one of the larger sets, from a cable company in Jamaica.

Ranges obtained. It was stated that clear signals have been received at a distance of 200 miles from the station at Slough, and that weak signals were obtained at longer ranges from similar stations in Germany.

Endurance test. An endurance test had been carried out from Slough, 100 words having been sent without pause at a rate of 20 words a minute. These signals were received at Hunstanton, and the strength of signals fell steadily throughout the message, starting at about strength 8 and dropping to about strength 5.

It is understood that the company hope to avoid this falling off by means of improvements in the new generator.

Other applications of system. Apart from the wireless application of this invention, it was stated that the principle used in the generator could be employed for surgical purposes, the curious combination of spark and arc being a convenient means of cauterisation. The patent rights for the surgical application have been sold to a separate company in Germany.

General Remarks.

The apparatus as a whole appears to be reliable, and it is considered that the system is well worth a trial, since the lightness and compactness of the installation and the low voltage used render it especially useful for certain purposes. The small set, for instance, might be useful for portable sets, and the large set may very possibly prove the best system for airships, especially as it appears likely that the weight and size of the apparatus can be still further reduced.

Before a final opinion can be given on the reliability and general utility of the system, it is necessary that experiments be carried out with both sets, and it is suggested that sets be acquired for this purpose for trial in "Vernon."

Two small sets and one large set were ordered from the Lepel Company for trial.

One small set was installed in "Vernon" and one in "Furious," and experiments were carried out between the two ships.

Extracts from "Vernon's"

REPORT ON TRIAL WITH LEPEL INSTALLATION.

A series of experiments with the Lepel system were carried out between "Vernon" and "Furious" (the latter ship being at Portland), between the 28th September and the 5th October.

Results of trials. As a result of the experiments the following information has been obtained :—

(1) Direct current gives a very good musical note. The note obtained with alternating current is not good. For the same power the strength of signals is about the same for direct current and alternating current.

(2)—(*a*) The D.C. musical note is better than the Mark I*. The alternating current musical note is not so good as the Mark I*.

(*b*) The D.C. musical note is higher than Mark II., and, if loud, is better for reading through atmospherics. The A.C. musical note is not as good as Mark II.

(3) Service wave lengths from "R" to "W" can be used with the Lepel sets, but the range seems to decrease with the length of wave used.
Wave lengths shorter than "R" cannot be radiated efficiently from the installation as supplied.
(4) Whether using alternating or direct current, the Lepel set appears to take more power than the Mark I*. set.
(5) It appears that the maximum reliable range with the small Lepel sets employed is about 60 miles on "S" tune and less on longer waves.

General conclusions.

As a result of these experiments the following general conclusions are arrived at.
The Lepel set in its present form is not suitable for Service requirements. The idea that the small set might be suitable for harbour defence and portable sets, and the large set for the airship, is now proved impracticable. It is proposed, however, to continue the experiments when the large set is received, in order to ascertain whether there is any possibility of being able to make use of the system, which, in spite of its failure with regard to range, has the following advantages :—
(1) A very good note with direct current.
(2) Silent working of transmitting apparatus.
(3) Low tension in the aerial.

A report of trials with the large Lepel set will be found on page 57.

REPORT ON VISIT TO CLIFDEN.

The following is a report on the Marconi High Power Station at Clifden, which was visited on the 24th May 1909, by officers from the "Vernon" and from the D.N.O. Department of the Admiralty :—

Improvements made in the Present Working Arrangements of the Station.

(a) *Buildings, Aerials, &c.*

Buildings.

Since the last visit to the station a separate receiving house has been erected at a distance of about a quarter of a mile from the main building, which contains the transmitting apparatus.
The receiving house is divided into three parts, the centre room being for use in connection with the land lines, and the other two for transmission and reception respectively, the two rooms being required in connection with the duplex working referred to on page 48.
The building is of wood and is completely shielded with sheet metal.
It was considered necessary to have a separate building in order to place the operator well clear of any disturbing noises from the transmitting gear in the main building. The transmitting key in the main building will be worked from a small Morse key in the receiving house.

Additional alternator.

A second engine and 500 Kw. alternator, similar to that seen during the last visit, has been **installed in the power house.**

Transmitting aerial.

The aerial has been considerably enlarged. It is now supported by 12 large masts, and will **consist, when complete, of 18** wires, each approximately 2,500 feet long.
The aerial is supported by three jackstays of $1\frac{1}{2}$-inch steel wire, each jackstay being supported **by four of the main masts.** The jackstays are insulated at the mast heads, and each aerial wire is **rove through an insulator** which hangs from the jackstay.
The reason given for increasing the size of the transmitting aerial was that the brushing **from** the aerial, which entailed a serious loss of power, was thus reduced.

Receiving aerial.

There is a special receiving aerial, consisting of four wires, supported above the transmitting **aerial** and extending beyond it. Each wire is about 4,500 feet long. One end of this aerial is **carried** over to the receiving house, the other extends 200 or 300 feet beyond the other end of the **transmitting** aerial.
The general arrangement of the aerials is shown in Plate IX.

(b) *Transmitting Apparatus.*

Tight coupling.

The old apparatus, as previously seen, is still employed for the general working of the station, **but in** order to obtain the two waves, a considerable distance apart, a very tight coupling is used **in lieu** of the two separate oscillators previously seen.

Long and short waves.

It was stated that, sometimes the long wave and sometimes the short wave was found to be **the best,** the suitability of either wave depending, apparently, on the atmospheric conditions at **the time.**

Improvements in transmitting gear.

The new transmitting gear is of the same type, but is being improved in various details. **All the modifications aim** at reducing the losses in the transmitting circuit.

Primary.

The primary is built up on a wooden ring, of about 4 feet diameter ; and having a cross section of about 6 inches diameter.

A large number of parts of fine, cotton insulated, copper wire is wound on the surface of the wooden ring; these wires are of equal length, and are so arranged that each wire takes its fair share of current.

The terminals of this primary consist of two large sheets of copper placed close together at the bottom of the ring.

Primary connections.

The primary connections from these terminals to the condenser, and from the condenser to the spark gap, are built of wide sheet copper instead of zinc as formerly used, and all connections are carefully soldered instead of being simply bolted together as in the old arrangement.

Aerial circuit.

The aerial current passes through a coil, which is fitted on a sliding bar by means of which the coupling can be altered and, if necessary, made very small. The winding of this coil and all the connections in the aerial circuit are made of stranded wire.

The condensers, transformer, magnetic key, &c., remain as before.

Revolving spark gap disc.

The new revolving spark gap disc is similar to that seen during the last visit, but is larger, and is considered to be a great advance on the older one. It consists of a heavy steel disc about 4 feet diameter; it is rotated by a direct current motor of 50 h.p., and can be run up to 3,000 revs. per minute.

The disc is fitted with six copper studs of a large section, 4 inches by 1 inch; these studs pass between two smaller copper discs which are kept slowly rotating; a large number of copper brushes with flexible connections, about 40 per disc, carry the primary current to the two smaller discs. The clearance between the small discs and the studs on the large disc is kept as small as possible, not more than a millimetre.

The high speed and large diameter of the main disc, and the fact that it has studs projecting from it, introduces a powerful fan action: this has made it necessary to enclose the disc in a stationary metal cover, and even with the addition of this cover the 50-h.p. motor is overloaded when the disc is running at 3,000 revolutions. A flexible insulated coupling is fitted between the disc and the motor, and the foundations of the motor stand on ebonite pillars. Two such discs are being fitted. The number of studs and speed of revolution can be varied to give any required musical note.

(c) *Receiving Apparatus.*

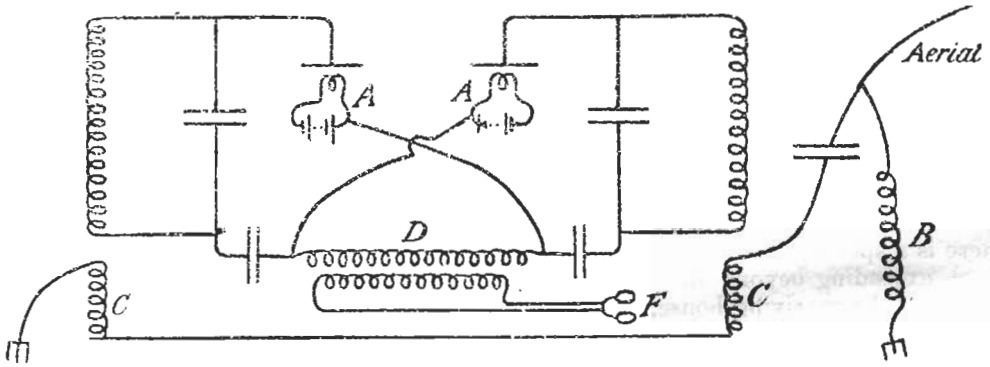
Oscillation valve.

This has been shifted to the new receiving house described in clause (*a*). The magnetic detector and oscillation valve are still both in use, the latter being more generally employed. A Tungstein filament is now in use in the oscillation valve instead of the carbon filament previously employed, and the dimensions of the valve have been reduced. The improved valve is said to take less current and have a longer life.

Atmospheric stopper.

An arrangement of the receiving circuit for cutting out atmospherics was seen in use. Fig. 1 shows the circuit.

FIG. 1.



A. Oscillation valve.
B. Large inductance with iron core.
C. Aerial primary.
D. Telephone transformer.
F. Telephone receivers.

It consists of a balanced circuit, each half of which consists of a separate receiver placed in an oscillating circuit, the wave length of which can be adjusted. Each of these circuits is acted upon by the primary aerial circuit through an adjustable coupling.

The rectified current from either valve is taken to the telephone transformer, the two currents working in opposition. The low tension winding of the induction coil is taken to the telephones in the usual manner.

Either the couplings of the two circuits are different, or one of the circuits is placed slightly out of tune, to allow of the reception of signals. The relative effects of an atmospheric and a signal, on a circuit out of tune, are different, and so the circuit can be adjusted to weaken the atmospheric more than the signals. The aerial is also earthed, above the receiving instruments, through a large inductance with an iron core, in order to allow a path to earth for atmospherics. A condenser is placed in the aerial in series with the receiving gear.

The circuit did not seem particularly efficient, and the strength of signals was reduced almost as much as the atmospherics.

During the visit, although signals from Glace Bay were strong, it was very difficult to read them through the strong atmospherics experienced.

It was stated, however, that the atmospherics were unusually bad.

As explained last year, atmospherics of various wave lengths are experienced, one wave length at one time and another wave length at another time being received.

There was said to be no difference in the strength of signals during daylight and at night, except that generally speaking signals were best at 11 p.m.

Direct Current System.

The Company are developing their direct current system. The system would have been in working order but for a breakdown of the motor driving one of the direct current generators.

Machines.

The general arrangement is as follows :—

Power is obtained from four electrically-driven 50 Kw. direct current dynamos, each supplying 10 amps. at 5,000 volts.

A high tension insulating coupling is placed between the motor and dynamo. The bed-plate of each dynamo, its field regulator and all parts in connection with it, are supported on a highly insulated foundation, the insulation consisting of a special kind of asphalte which also forms an insulated flooring round the machine. The machines are of the ordinary Thury high-tension pattern, but manufactured in England.

All four machines are connected in series, giving an output of 20,000 volts.

High tension battery.

In conjunction with these dynamos a high-tension battery is used. This battery consists of 10,000 small lead accumulators, of approximately 7-ampère hours capacity each, joined in series. They are divided into a number of sections, and each section is supported in trays, hanging from porcelain insulators.

The total cost of the cells was about 500*l.*, the parts being bought separately and put together at the wireless station.

Impedance coil.

The cells are joined in parallel with the dynamos, and the joint supply is taken through impedance coils to the two terminals of the spark gap, *i.e.*, to the two smaller discs referred to in section 1, clause (*b*).

Sparking discs.

As a stud approaches the small discs a spark occurs. It is stated that the spark starts when the total air gap is about 1 c.m., and as the length of the air gap rapidly diminishes the resistance is lowered, thus decreasing the damping effect due to the spark.

Resonance effect.

The choking coil placed in series with the supply to the spark gap prevents a rush of direct current from the cells through the spark gap, and also steps up the voltage due to the resonance effect. A sparking voltage of about 28,000 volts is obtained by this means.

Magnetic key.

The same kind of magnetic key as described in last year's report is used, but it is found necessary to use two of these keys in series instead of one as required for alternating current.

During the visit one of the motors for driving the high tension dynamos was under repair, having burnt out, and it was only possible to see the system working from the cells at reduced power.

Musical note.

The system appeared to work well and gave a very pure note. The note was heard in a small receiving station, and was compared with the note from the ordinary alternating current set. The note from the direct current system was very much the better, being far more steady and pure than that from the alternating current set.

Advantages of the system.

The great advantage of this system is the clear, steady, bell-like note, which is perfectly regular and requires no adjustment, while it can be varied in a short time by altering the number of studs and the speed of rotation.

It was stated that various notes had been tried up to 600 sparks per second : 200 to 250 sparks a second was said to give the best note for reading.

This system also appears to be eminently suitable for the duplex working described on page 48.

It was claimed that better signals were received at Glace Bay from this system than from the alternating current system. The power taken, on the other hand, was apparently greater.

Disadvantages.

The disadvantages of the direct current system appear to be :—

(1) The use of accumulators taking up a great deal of space and rendering the system only applicable to shore stations.

It is understood that accumulators cannot be dispensed with as they absorb the inductive effects which would otherwise damage the dynamos.

(2) The fact that dynamos of a dangerously high voltage have to be used.

It is impracticable to make small power machines with such high voltage.

(3) The excessive power required to drive the disc, in this case 50 h.p.

Proposed Future Experiments.

Duplex telegraphy

It was proposed to fit a commutator at the receiving house to be driven in synchronism with the disc of the spark gap. This commutator will keep the receiving aerial connected up at all times with the exception of the very small fraction of time during which a stud is passing the sparking discs; at these times the receiving aerial will be disconnected from the instruments. With a 6 studded disc working at 2,000 revolutions this means that the receiving circuit is made for about ·0047 seconds and broken for about ·0003 seconds alternately.

The receiving instruments are thus always disconnected while a spark is passing, and, as even a dot will consist of a large number of sparks, the small percentage of sparks missed by the receiving apparatus will not affect the efficiency of reception unless the discs at the sending and receiving stations happen to be in exact synchronism, which can easily be avoided.

By using an increased number of studs on the disc it may be possible to use this system when working at 100 words a minute, when receiving with the recording device mentioned below.

Foundations to take the commutators have been arranged in the receiving house.

As this system involves the use of large high speed discs and other complications it is not suitable for use at sea; and even to introduce it into shore stations would involve considerable changes.

Recording receiver.

Arrangements were also being made for a series of experiments with a recording receiver. The instrument was not in place, but it was described as consisting of a specially sensitive galvanometer of the Einthoven string pattern, with arrangements for a photographic record being taken of the received impulses. The movements of the galvanometer were expected to be sufficiently rapid to give a separate indication for each spark impulse received, and it is hoped that it will be possible to pick out the spark signals from among the atmospherics as the form of the spark signal should be perfectly regular.

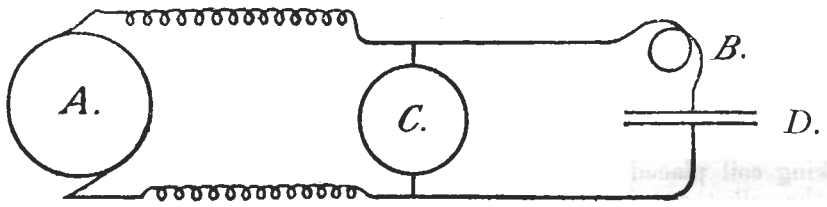
The galvanometer was due to arrive in about a fortnight; a special concrete foundation has been put in to carry it.

If the experiments are successful it is hoped that a working speed of 100 words a minute will be obtained.

Small power sparkless system.

Mr. Marconi described a small power direct current system which he proposed to experiment with, and which is shown in Figure 2.

Fig. 2.



A. 500 v. D.C. dynamo.
B. Primary.
C. Commutator.
D. Condenser.

A direct current dynamo, giving about 500 volts, is connected up through choking leads to a commutator. The commutator short circuits two brushes, for a short interval, any desired number of times during each revolution. When the brushes are open the condenser is charged up and it discharges through the primary and commutator when the brushes are short circuited. The system works practically without a spark.

Short wave receiver.

Mr. Marconi also stated that he had a small receiving set, in which the Tungstein valve is used, suitable for short waves; he offered to send one of these to the Admiralty for trial.

Switch for changing wave lengths.

It is proposed to arrange a switch to allow of changing quickly from one transmitting wave length to another. Some large wooden formers, about 10 feet in diameter, for winding the primary were seen.

Avoiding atmospheric interference by use of longer waves.

It was also proposed to use longer waves with the object of exceeding the general range of atmospheric wave lengths received.

Condensers.

It was stated that the air condenser had cost nothing for upkeep since the last visit, but, on account of the bulk of the air condenser, it is proposed to try oil condensers in future stations. Glass plate condensers are also being tried.

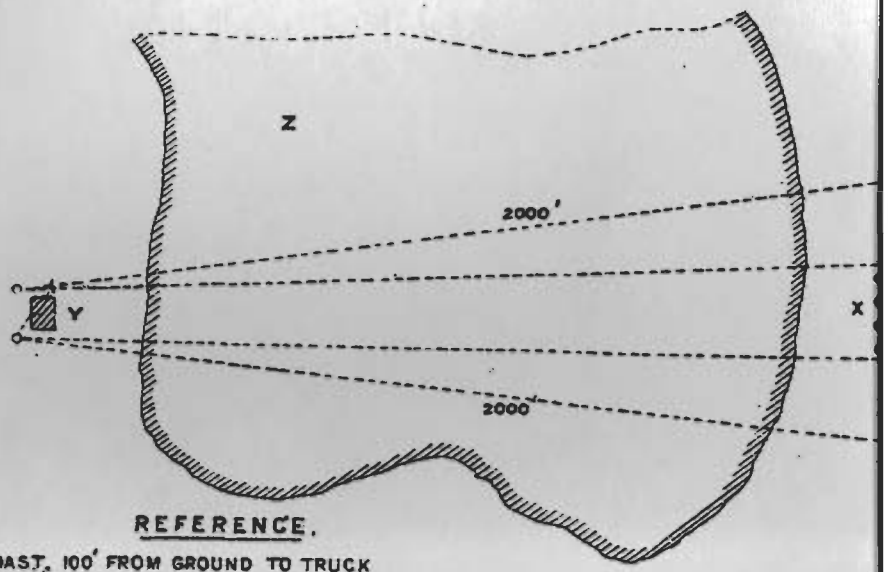
Commercial Working.

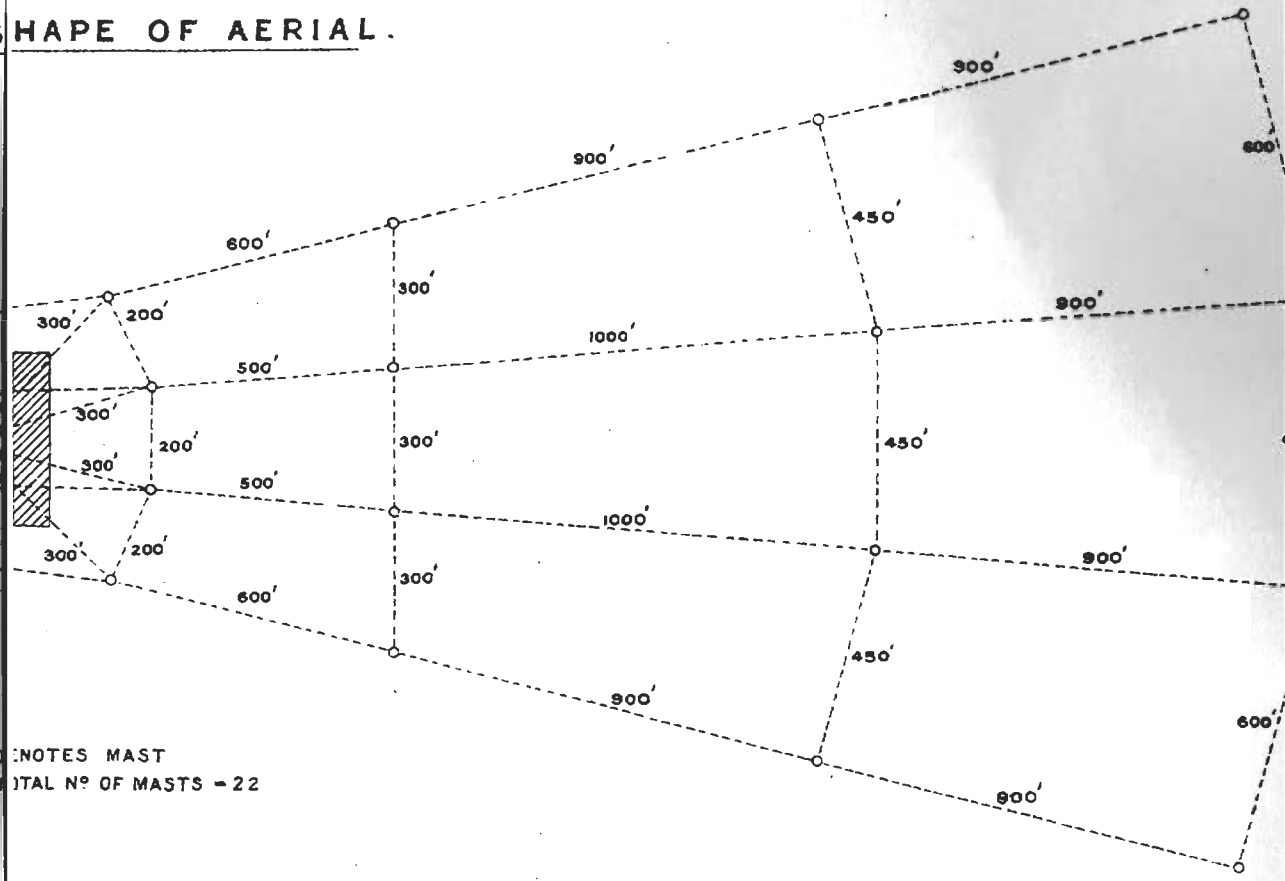
Commercial working.

The commercial work done by the station is made subsidiary to the experimental work at present, and the total amount of traffic is about 2,000 words a day. This approximately pays the working expenses. As a general rule, if a signal cannot be got through by wireless in three hours, it is sent by cable.

ARRANGEMENT OF AERIAL AT CLIFDEN.

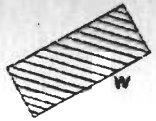
PLAN, SHOWING SHAPE OF AERIAL.





REFERENCE.

A. MAST, 100' FROM GROUND TO TRUCK
B.C.D. " 200/215' VARYING ACCORDING TO GROUND LEVEL
E. " 55'
F. " 200', (NOW BEING ERECTED, AND STANDS ON GROUND ABOUT 75' ABOVE THE LAKE.
W. POWER HOUSE.
X. TRANSMITTING HOUSE
Y. RECEIVING HOUSE
Z. LAKE



O D NOTES MAST
TOTAL Nº OF MASTS = 22

ELEVATION, SHOWING SIDE VIEW OF AERIAL.

AERIAL, TRANSMITTING, TOTAL LENGTH ABOUT 190(
" RECEIVING, " " " 450(