[Second Edition.]

N° 14,788 A.D. 1905

Date of Application, 18th July, 1905

Complete Specification Left, 23rd Jan., 1906—Accepted, 10th May, 1906

PROVISIONAL SPECIFICATION.

"Improvements in or relating to Wireless Telegraphy.

We, GUGLIELMO MARCONI, Electrician, and MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED, both of 18 Finch Lane, in the City of London, do hereby declare the nature of this invention to be as follows :—

The object of this invention is to provide improved apparatus for use in wireless telegraphy whereby direction can be given to the oscillations or waves so enabling one station to signal to another without affecting neighbouring stations and whereby a receiving station can ascertain the direction in which the transmitter is situated.

According to this invention we employ in place of the usual vertical "aerial" or "antenna" an insulated or partially insulated conductor lying in a horizontal or substantially horizontal straight line upon or at a short distance above the surface of the ground (or water), its forward end, that is the end nearer to the station with which it is desired to communicate, being connected to one side of a spark gap or oscillation producer the other side of which is earthed. It is found that the oscillations due to such an antenna are practically confined to a straight path which is a prolongation of the line of the antenna from its forward end, a receiver at a distance being operated so long as it is practically in the direct line of the antenna while receivers out of this direct line are not so operated. Oscillations are also produced in the rearward continuation of the line of the antenna but only to a smaller extent. The nearer to the ground that the antenna lies, the more confined is the path of the oscillations but the antenna may be supported above the ground at a distance small compared to its length in which case the oscillations are somewhat more powerful but not so restricted in direction and the more the antenna is raised the more do the oscillations tend to spread out.

By swivelling the antenna in a horizontal plane about its forward end signals may be emitted in any desired direction: in other words to signal any desired station it is only necessary to turn the antenna so that its free or rear end is pointing directly away from that station.

With such a transmitter any ordinary receiver may be used but we prefer to use a receiver made on the same principle, that is, consisting of a long horizontal or substantially horizontal conductor lying upon or near to the surface of the ground (or water) in the straight line joining the two stations, its forward end that is the end nearer to the transmitting station being earthed through a magnetic or other detector. Preferably the transmitting and receiving antennae are of substantially equal length or their lengths may be in the ratios of the odd numbers and either may be formed of several conductors laid side by side. Such a receiver is practically only operated by oscillations produced at a station situated in the continuation of the straight line of the length of the antenna through its forward end and at a much smaller distance by stations in the continuation of the same straight line through the rear end.

If therefore such an antenna be swivelled about its forward end in a horizontal plane and signals be received with the antenna in a certain position, the operator will know that the transmitting station is in the line of the

[*Price 8d.*]

antenna; in other words that its rear end is pointing directly away from the transmitting station.

This receiver may be used with great advantage to determine the direction of a transmitter say for instance on a ship at sea whether the transmitter be of the kind above described or any ordinary transmitter. By bisecting the angle between the limiting positions of the antenna in which signals can be detected, the direction of the transmitter can be ascertained with great accuracy.

Preferably the transmitting and receiving antennae above described are completely insulated except for the connections at their forward ends but they may be connected to earth at their rear ends or at other points and inductances and condensers may be inserted in these earth connections. The antennae may also be connected to the spark gap or detector as the case may be through condensers, in fact any of the usual adjuncts to the simple vertical aerial or antenna may be used with these horizontal antennae.

Dated this 14 day of July 1905.

G. MARCONI.
Carpmael & Co.
Agents for the Applicants

COMPLETE SPECIFICATION.

"Improvements in or relating to Wireless Telegraphy."

We, GUGLIELMO MARCONI, LL.D., D.Sc. and MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED, both of 18 Finch Lane, in the City of London, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

The object of this invention is to provide improved apparatus for use in wireless telegraphy whereby direction can be given to the oscillations or waves so enabling one station to signal to another without affecting neighbouring stations located substantially out of the vertical plane passing through the two stations and whereby a receiving station can ascertain the direction in which the transmitter is situated.

According to this invention we employ in place of the usual vertical "aerial" or "antenna" an insulated or partially insulated conductor lying in a horizontal or substantially horizontal straight line upon or at a short distance above the surface of the ground (or water) the end nearer to the station with which it is desired to communicate, being connected to one side of a spark gap or oscillation producer, the other side of which is earthed. That end of the transmitting antenna to which the oscillation producer is connected will be hereinafter referred to as the "generator" end and the end of the receiving antenna to which the oscillation or wave detector is connected will be referred to as the "detector" end. The other end of either antenna will be referred to as the "tail" end. It is found that the electric waves due to such a transmitting antenna reach a maximum in the vertical plane of the antenna and proceed principally from its generator end, a receiver at a distance being operated so long as it is practically in that plane while receivers out of such plane are not so operated. Electric waves are also produced in the rearward continuation of the line of the antenna but only to a smaller extent. The nearer to the ground that the antenna lies, the more confined is the path of

the waves but the antenna may be supported above the ground at a distance small compared to its length say not exceeding one tenth thereof in which case the waves are somewhat more powerful but not so restricted in direction and the more the antenna is raised the more do the waves tend to spread out.

By swivelling the antenna in a horizontal plane about its generator end signals may be emitted in any desired direction ; in other words to signal to any desired station it is only necessary to turn the antenna so that its tail end is pointing directly away from that station.

With such a transmitter any ordinary receiver may be used but we prefer to use a receiver made on the same principle, that is, consisting of a long horizontal or substantially horizontal conductor lying upon or near to the surface of the ground (or water) in the vertical plane passing through the two stations, its detector end being nearer to the transmitting station. Preferably the transmitting and receiving antennae are made of the same wire and are of substantially equal length or their lengths may be in the ratios of the odd numbers and they may be formed of several conductors laid side by side. To obtain the best results, this antennae should be in resonance. Such a receiver is operated best by waves produced at a station situated in the vertical plane of the receiving antenna and in a direction such that the detector end is nearer to it than is the tail end and at a smaller distance by stations in the same vertical plane but in the contrary direction.

If therefore such an antenna be swivelled about its detector end in a horizontal plane and signals be received with the antenna in a certain position, the operator will know that the transmitting station is in the line of the antenna; in other words that its tail end is pointing directly away from the transmitting station.

This receiver may be used with great advantage to determine the direction of a transmitter, say for instance on a ship at sea, whether the transmitter be of the kind above described or any ordinary transmitter. By bisecting the angle between the limiting positions of the antenna in which signals can be detected, the direction of the transmitter can be ascertained with great accuracy.

Preferably the transmitting and receiving antennae above described are completely insulated except for the connections at their generator and detector ends but they may be connected to earth at their tail ends or at other points and inductances and condensers may be inserted in these earth connections. The antenna may also be connected to the spark gap or detector as the case may be through a condenser in fact any of the usual adjuncts to the simple vertical aerial or antenna may be used with these horizontal antennae.

Figures 1 and 2 are a diagrammatic elevation and plan respectively of transmitting and receiving stations at a considerable distance apart and equipped with horizontal transmitting and receiving antennae as above described. In these figures the transmitting station is on the left, *a* being the horizontal antenna which is connected to the earth *e* at its generator end, a pair of spark balls *b* being inserted in the earth connection and these are shown as usual connected directly to an induction coil *c*, but in place of the spark balls an inductance may be inserted or the coil of an oscillation transformer so as to create in the antenna *a* electric oscillations by inductive action in the usual manner.

In correspondence with this transmitting station is the receiving station on the right in which *d* is the horizontal receiving antenna connected to the earth *e* through any oscillation detecting device *f* which may be a magnetic detector or coherer or any other receiving arrangement used in connection with electric wave telegraphy. The antennae *a* and *d* are so situated that their tail ends point away from each other and their earthed ends are in opposition to each other.

Figures 3 and 4 show in elevation and plan respectively a transmitting station on the left and a receiving station on the right a horizontal transmitting antenna *a* being employed associated with an ordinary vertical receiving aerial *g* situated in the vertical plane of *a* and nearer to its generator end,

Figures 5 and 6 show in like manner in elevation and plan respectively a pair of stations comprising a vertical transmitting aerial *h* of the ordinary type and a horizontal receiving antenna *d* in a vertical plane passing through the transmitting station and with its detector end nearer to that station.

The following is an example of a satisfactory installation for communicating over a distance of about 150 kilometres. At the transmitting station an antenna consisting of four parallel copper wires was employed each wire being about 2 mm. diameter and 150 metres long, spaced 1·5 metres apart, all in the same horizontal plane, and supported by means of poles and insulators at a height of 14 metres above the ground.

At the ends nearer to the receiving station these wires were connected to a slanting conductor which was brought down into a building and joined to one sphere of the spark gap of an induction coil or transformer, the other sphere of which was connected to earth in the usual manner.

When transmitting by means of a telegraphic key placed in the primary circuit of the coil a spark 2 cm. long between the spheres was employed.

At the receiving station also an antenna similar to that above described was employed, but in place of being connected to a transmitting apparatus it was connected to a magnetic receiver.

The receiving antenna was directed away from the sending station, that is, the detector end was nearer to and the tail end further from that station.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is ;—

1. In a system of wireless telegraphy arranging the transmitting antenna substantially horizontal and in a vertical plane passing through the receiving station substantially as described.

2. In a system of wireless telegraphy arranging the receiving antenna substantially horizontal and in a vertical plane passing through the transmitting station the detector end being nearer thereto substantially as described.

3. In a system of wireless telegraphy arranging the transmitting and receiving antennae substantially horizontal and in the same vertical plane substantially as described.

4. Apparatus for wireless telegraphy substantially as described and illustrated in the drawings.

Dated this 23rd day of January 1906.

G. MARCONI.
MARCONI'S WIRELESS TELEGRAPH CO. LTD.,
H. CUTHBERT HALL,
G. MARCONI
Directors.
HENRY W. ALLEN,
Secretary.

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MARCONI & *others'* COMPLETE SPECIFICATION.

(1 SHEET)

(2nd Edition)

Fig. 1.

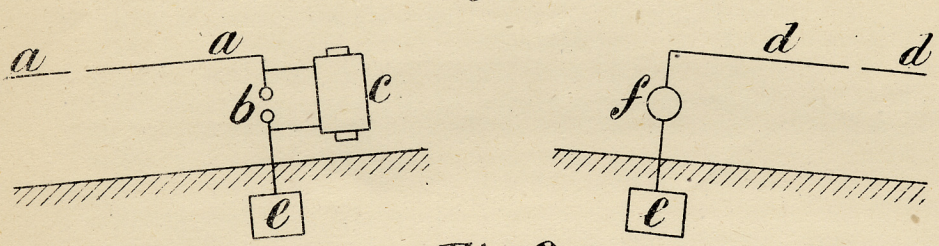


Fig. 2.

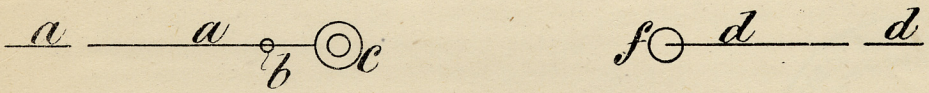


Fig. 3.

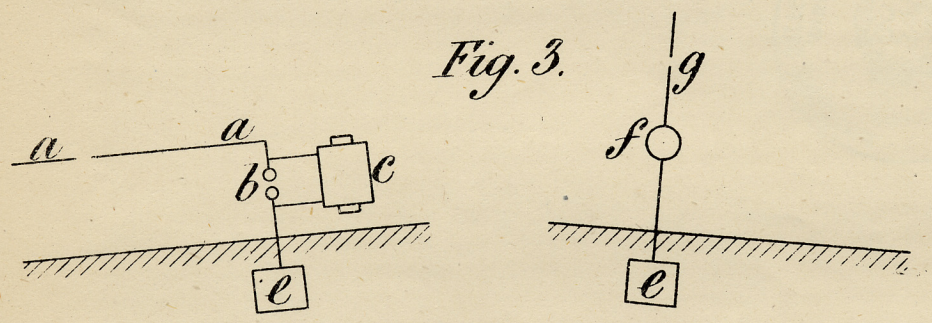


Fig. 4.

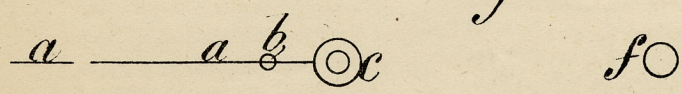


Fig. 5.

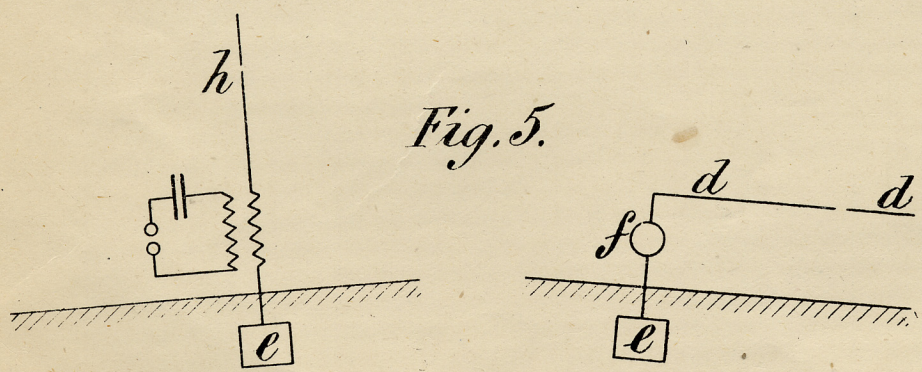
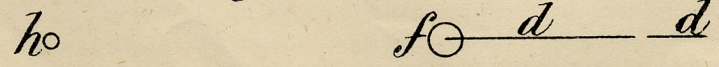


Fig. 6.



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