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PATENT



SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in Means for Determining the Direction of a Distant Source of Electro-magnetic Radiation.

(A communication from Lt. FRANK ADCOCK, R.E., No. 3, Army Wireless Observation Group, Third Army, B.E.F., France.)

I, REGINALD EATON ELLIS, of the Firm of Mewburn, Ellis, & Pryor, of 70 & 72, Chancery Lane, London, W.C. 2, Chartered Patent Agents, do hereby declare the nature of this invention to be as follows:—

This invention relates to wireless telegraphy and telephony and has for its object to provide improved means for determining the direction of a distant source of electromagnetic radiation from any given receiving station.

In ascertaining the direction of the location of such a distant source of electromagnetic radiation it has heretofore been customary to employ aerials which are wholly or partly inclined to the vertical and in such cases the aerial is generally influenced by the horizontal electrostatic component of the electromagnetic radiation which, I have ascertained, causes a considerable error in the action of the indicating device employed for this purpose.

In order to get over the difficulty, I provide, according to this invention, aerials so constructed that the receiving device is not affected, or is only slightly affected, by the horizontal electrostatic component of the electromagnetic waves, the direction of the source of which is to be determined.

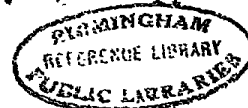
In carrying out the invention various arrangements of aerials may be employed but the feature common to all such arrangements, and which constitutes the special feature of the invention, consists in the fact that the aerials, which have identically the same dimensions, are so mounted and connected that only the vertical parts are effectively influenced by the electromagnetic radiation, the horizontal parts or those parts having a horizontal component, being so arranged that the effect on them is eliminated or reduced to a minimum.

In one method of carrying out the invention the aerials are disposed in planes at right angles to one another, each aerial having two members directed vertically upwards and connected by leading in wires placed near the surface of the ground; with this arrangement the radiogoniometer or the like indicating device employed is disposed in a central position relatively to the vertical aerials.

In some cases however each vertical member of each aerial may be formed in two parts, the upper part of one of the said vertical members being electrically connected to the lower part of the other vertical member of the same aerial.

It is also to be understood that the aerials may be either earthed or unearthed. In case the aerials are earthed the leading in wires are arranged near the surface of the ground, but when unearthed aerials are employed, the upper and

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lower parts of the vertical members of the pair of aerials are made of approximately equal length.

In the operation of the invention the aerials at the receiving station may or may not be syntonised with the transmitting apparatus the direction of the location of which it is desired to determine.

For obtaining the desired indication of the direction of the said location any suitable form of radiogoniometer and indicating device may be employed and may be connected up to the aerials in the usual manner.

Dated this 25th day of October, 1918.

MEWBURN, ELLIS & PRYOR,
70 & 72, Chancery Lane, London, W.C. 2,
Chartered Patent Agents.

COMPLETE SPECIFICATION.

Improvements in Means for Determining the Direction of a Distant Source of Electro-magnetic Radiation.

I, REGINALD EATON ELLIS, of the Firm of Mewburn, Ellis, & Pryor, of 70 & 72, Chancery Lane, London, W.C. 2, Chartered Patent Agents, 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:—

This invention relates to wireless telegraphy and telephony and has for its object to provide improved means for determining, from any given receiving station, the direction of a distant source of electromagnetic radiation.

In ascertaining the direction of the location of such a distant source of electromagnetic radiation it has heretofore been customary to employ aerials which are wholly or partly inclined to the vertical and in some cases the aerial is influenced by the horizontal electrostatic component of the electromagnetic radiation which, I have ascertained, causes a considerable error in the action of the indicating device employed for this purpose.

In order to get over the difficulty, I provide, according to this invention, aerials so constructed that the receiving device is not affected, or is only slightly affected, by the horizontal electrostatic component of the electromagnetic waves, the direction of the source of which is to be determined.

In carrying out the invention various arrangements of aerials may be employed but the feature common to all such arrangements, and which constitutes the special feature of the invention, consists in the fact that the aerials, which have identically the same dimensions, are so mounted and connected that only the vertical parts are effectively influenced by the electromagnetic radiation, the horizontal parts, or those parts having a horizontal component, being so arranged that the effect on them is eliminated or reduced to a minimum.

In order that the nature of the invention may be clearly understood, arrangements in accordance therewith will now be described with reference to the accompanying diagrammatic drawings, in which Fig. 1 explains the phenomena involved in arrangements according to this invention; Fig. 2 illustrates one arrangement, and Fig. 3 a second arrangement according to this invention.

Referring to Fig. 1, the problem involves the comparison of the instantaneous values of the electric currents set up by the electro-magnetic radiation in a number of equal vertical aerials placed in various positions.

Such a comparison is usually effected by a suitable apparatus placed generally in a central position with regard to the vertical aerials and a proportional amount of electrical energy is conveyed for this purpose from the vertical aerials

to the comparing device by a number of horizontal conductors (or conductors possessing a horizontal component in direction).

Unless suitable precautions are taken, these horizontal conductors (or conductors possessing a horizontal component in direction) are liable to be affected by the electro-magnetic radiation and the electric currents produced will also act upon the comparing apparatus and the comparison will be vitiated.

In order to overcome this source of error various arrangements may be adopted for the horizontal conductors (or conductors possessing a horizontal component in direction) but all these arrangements depend upon the principle indicated in the following example.

Let AB in Fig. 1 represent a vertical aerial and CD an inductively wound coil of the apparatus used in making comparisons.

The coil CD is placed at a distance from AB and is connected to it by a pair of horizontal conductors (or conductors possessing a horizontal component in direction) EF and GH which are placed as closely as possible to one another without actually being in contact.

If at any instant the electro-magnetic radiation should tend to cause an electric current to flow from the upper part of the vertical aerial AB to the lower part, then a portion of the electric current will flow from the upper part of AB, along the conductor EF, through the inductively wound coil CD and back along the conductor HG to the lower part of AB.

Thus, when the electro-magnetic radiation acts upon the vertical aerial AB, an electric current passes through the coil CD and the comparing apparatus is affected.

On the other hand, if the electro-magnetic radiation acts upon the horizontal conductor EF in such a manner as to tend to cause a current to flow in the direction E to F, then since conductor GH occupies practically the same position in space, an equal current will tend to flow in that conductor in the direction G to H.

These currents will tend to flow through the coil CD in opposite directions, consequently no inductive effect is produced in the vicinity of this coil.

In general it will readily be seen that the action of the electro-magnetic radiation upon the horizontal conductors (or conductors possessing a horizontal component in direction) will not affect the comparing apparatus.

In order to allow a greater proportion of the energy to reach the comparing device from the vertical aeriels the horizontal conductors, (or conductors possessing a horizontal component) such as EF and GH may be separated slightly and wound spirally upon a cylinder (preferably of non-conducting material) of small diameter.

This method ensures that each conductor is alternately above and below the other, and, further, that each conductor is alternately on the right hand and left hand of the other conductor of the pair.

The electro-magnetic radiation will then act upon each conductor of a pair of horizontal conductors (or conductors possessing a horizontal component in direction) to a very nearly equal extent.

Figs. 2 and 3 represent typical applications of this principle to direction finding stations; the horizontal conductors (or those possessing a horizontal component in direction) the function of which is to convey electrical energy from the vertical aeriels to the comparing apparatus are either placed close together in pairs or wound spirally in pairs as indicated above.

These pairs of conductors are shown separated in Figs. 2 and 3 for the sake of clearness.

It will be readily understood that a great number of methods (involving magnetic or condenser coupling) may be used to transfer electrical energy from the vertical aeriels to the horizontal conductors (or conductors possessing a horizontal component in direction) and to further transfer electrical energy from these conductors to the apparatus used in making comparisons, but in

every case each pair of horizontal conductors (or conductors possessing a horizontal component in direction) is arranged non-inductively according to one of the methods shown above. A more detailed description of the particular arrangements shown in Figs. 2 and 3 follows.

Fig. 2 shows an arrangement in which each vertical aerial of a pair of aeri- 5
als is formed in two parts and the upper part of one of the vertical aeri-
als is electrically connected to the lower part of the other vertical aerial of the same
pair. In the arrangement shown in Fig. 2 the aeri-als are unearthed and the
upper part 11 of one vertical aerial 1 for example, is of approximately the same
length as the lower part 12 of the same aerial, these parts being connected to 10
the opposite ends of the radiogoniometer coil 5 by means of leading in
wires 13, 14 of which wire 13 is also connected to the lower part 16 of the other
aerial 2 of the pair of aeri-als 1, 2 by means of a wire 17 while the leading in
wire 14 is also connected to the upper part 15 of the aerial 2 by means of a
wire 18. 15

In the arrangement shown in Fig. 3 the aeri-als are earthed and in this case
the leading in wires are arranged near the surface of the ground; consequently
the two parts 11 and 12 of aerial 1, and 15, 16 of aerial 2 are not required to be
of equal length as in Fig. 2; the connections to the radiogoniometer coils
shown in Fig. 3 are similar to those of Fig. 2. 20

In a known arrangement for determining the direction of a distant source of
electromagnetic radiation a revolving loop aerial has been employed. If
desired the arrangement of aeri-als according to this invention may also be
erected so as to be rotatable in order to eliminate and/or reduce errors in
direction due to the existence of the horizontal electrostatic component of the 25
electromagnetic radiation. For this purpose any suitable mechanical arrange-
ment adapted to be rotated at will may be adopted; no radiogoniometer is
necessary, and the direction of the distant station is found by noting the
variations in the strength of the signals as the aeri-als are rotated.

In the operation of the invention the aeri-als at the receiving station may or 30
may not be syntonised with the transmitting apparatus the direction of the
location of which it is desired to determine.

For obtaining the desired indication of the direction of the said location any
suitable form of radiogoniometer and indicating device, except as noted above
when the aeri-als are rotatable, may be employed and may be connected up to 35
the aeri-als in the usual manner.

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

1. An improved arrangement for determining the direction of a distant source 40
of electromagnetic radiation, in which the aeri-als, which have identically the
same dimensions, are so mounted and connected that only the vertical parts are
effectively influenced by the electromagnetic radiation, the horizontal parts, or
those parts having a horizontal component, being so arranged that the effect on
them is eliminated or reduced to a minimum. 45

2. Arrangement according to Claim 1, mounted so as to be rotatable about a
vertical axis, substantially as described.

3. Arrangements according to Claim 1, substantially as described and as
illustrated in the accompanying drawings.

Dated this 19th day of February, 1919. 50

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

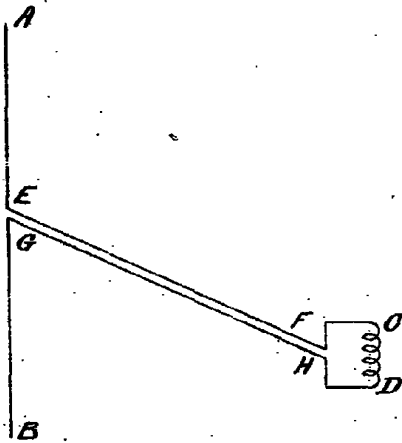


Fig. 2.

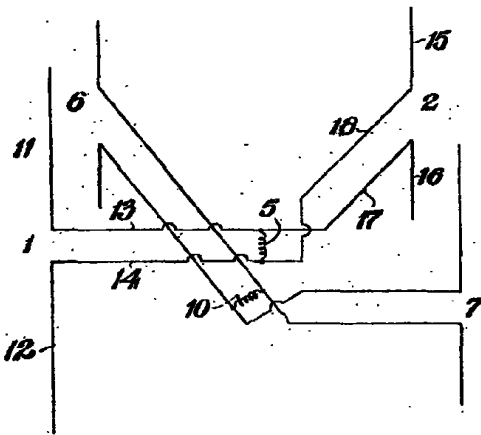


Fig. 3.

