[Second Edition.]

PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in Wireless Telegraph and Telephone Aerials.

I, CHARLES SAMUEL FRANKLIN, British subject, of St. Michaels, Westbury Lane, Buckhurst Hill, in the County of Essex, do hereby declare the nature of this invention to be as follows:—

This invention relates to wireless telegraph and telephone aerials which are high in proportion to the wave length used and are excited from one end.

It is known that if any aerial, half a wave length long is excited electrostatically from the bottom, there is produced in the aerial a standing wave which has maximum value at the centre. Such an aerial radiates best at right angles to the direction of the wire, the polar curve in the plane of the wire being a figure of 8. If the aerial is one wave length long, then the standing wave has current maxima $^{1}/_{4}$ wave and $^{3}/_{4}$ wave along the wire. As the wave in the bottom half of the wire is opposite in phase to the wave in the top half, such an aerial does not radiate in the direction at right angles to the wire but radiates in two directions approximately 45° on each side of this right angle direction, the polar curve in the plane of the wire being four loops with zeros at right angles to the wire and in the direction of the wire. If the wire is one and a half wave lengths long, then the standing wave has three maxima of current at $^{1}/_{4}$, $^{3}/_{4}$ and $1^{1}/_{4}$ wave lengths from the end, the phase of the currents at the $^{1}/_{4}$ and $1^{1}/_{4}$ points being the same and opposite to that at the $^{3}/_{4}$ point, and the polar curve in the plane of the wire has six loops.

In general, if the length of the wire is n half wave lengths, then the polar curve in the plane of the wire will have $2n$ loops.

According to this invention I suppress radiation from every alternate half wave length and so obtain a polar curve in the plane of the wire, having substantially only two loops which are in the direction at right angles to the wire, and the sharpness of which is a function of the length (or height) of the wire employed. I obtain this result by concentrating alternate half wave length portions of the wire within a small space, by winding such portions as inductance coils or by doubling such portions back on themselves so that there is practically no radiation from these portions.

The phases of the currents in the remaining portions are then all substantially the same and add their effects in the direction at right angles to the wire.

The same methods can be applied to an extended plane aerial of the type described in my Specification No. 226,246.

Dated this 5th day of August, 1924.

CARPMAELS & RANSFORD,
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W.C. 2.

COMPLETE SPECIFICATION.

Improvements in Wireless Telegraph and Telephone Aerials.

I, CHARLES SAMUEL FRANKLIN, British subject, late of St. Michaels, Westbury Lane, Buckhurst Hill, in the County of Essex, now of "The Clough", 39, Palmerston Road, Buckhurst Hill, in the County of Essex, 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 telegraph and telephone aerials, which are long in proportion to the wave length used.

It is known that if any aerial, half a wave length long, is excited electrostatically from one end, there is produced in the aerial a standing wave which has a maximum current value at the middle. Such an aerial radiates best at right angles to the direction of the wire, the polar curve in the plane of the wire being a figure of 8. If the aerial is one wave length long, then the standing wave has current maxima $^1/_4$ wave and $^3/_4$ wave along the wire. As the current in one half of the wire is opposite in phase to the current in the other half, such an aerial does not radiate in the direction at right angles to the wire, but radiates in two directions approximately 45° on each side of this right angle direction, the polar curve in the plane of the wire being four loops with zeros at right angles to the wire and in the direction of the wire. If the wire is one and a half wave lengths long, then the standing wave has three maxima of current at $^1/_4$, $^3/_4$ and $1^1/_4$ wave lengths from the end, the phase of the currents at the $^1/_4$ and $1^1/_4$ points being the same and opposite to that at the $^3/_4$ point, and the polar curve in the plane of the wire has six loops.

In general, if the length of the wire is n half wave lengths, then the polar curve in a plane of the wire will have $2n$ loops.

According to this invention, I annul or suppress radiation from every alternate half wave length, and so obtain a polar curve in a plane of the wire, having substantially only two loops which are in the direction at right angles to the wire, and the sharpness of which is dependent on the length of the wire employed. I obtain this result by concentrating alternate half wave length portions of the wire within a small space, by winding such portions as inductance coils or by doubling such portions back on themselves so that there is practically no radiation from these portions.

The phases of the currents in the remaining portions are then all substantially the same and add their effects in the direction at right angles to the wire.

An aerial constructed in this manner may also be advantageously employed for receiving.

The same methods can be applied to an extended plane aerial of the type described in my Specification No. 226,246.

The invention is illustrated in the accompanying drawing, Figure 1 of which shows the current distribution in and polar diagram of a normal aerial one half wave length long, Figure 2 shows the current distribution in and polar diagram of a normal aerial one and a half wave lengths long, and Figure 3 shows an aerial according to the present invention substantially one and a half wave lengths long.

In these figures, A represents the aerial, B the standing current distribution curve, and C the polar diagram.

In Figure 1 the aerial is half a wave length long.

In Figure 2 it will be seen that the standing current distribution curve B comprises three sections, the phases of current represented by the two end sections being similar and in opposition to the phase in the centre section.

The polar diagram C comprises six loops, three on each side of the aerial A.

In Figure 3 which shows an aerial constructed according to the present invention, the centre portion of the aerial is doubled back on itself so that the radiation from this portion is annuled. The current distribution B in this aerial is similar to that shown in Figure 2, but, since radiation from the centre portion is annuled the radiation from the two end portions, add in a direction at right angles to the aerial, giving a polar diagram approximately as shown at C.

It will be seen that this polar diagram C is much sharper than in Figure 1, and that the aerial A is therefore much more directional.

If a longer aerial be employed, and radiation from alternate half wave lengths be annuled in a similar manner, the polar diagram is sharpened to a still higher degree, and a maximum radiation is maintained in a direction substantially at right angles to the aerial.

In a modification, in place of doubling back on themselves, those parts of the aerial from which it is desired to annul radiation, I may employ electrical equivalents, such as an inductance coil with a condenser in parallel, or an inductance coil having sufficient natural capacity. The equivalent inserted to replace the "doubling back" of the aerial should be substantially in tune with the frequency employed and should have small natural radiation compared with a straight wire aerial of half wave length.

In an aerial constructed according to my invention, large concentration of energy is obtained in a direction at right angles to the aerial, and in the plane of the wire. If my invention be applied to an extended plane aerial of the type described in my Specification No. 226,246, or to a plurality of aerials arranged in a line, any desired degree of concentration may be obtained in planes passing through the centre line of the aerial system and parallel to the aerials.

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 aerial for wireless transmission or reception, electrically long in comparison with the wave length employed, and so arranged that radiation from alternate half wave lengths is annuled or suppressed.

2. An aerial as claimed in Claim 1, in which the annulment is attained by doubling back upon itself a length of the aerial corresponding to a half wave length, substantially as described.

3. An aerial as claimed in Claim 2, in which there is employed the electrical equivalent of a length of the aerial (corresponding to a half wave length) doubled back on itself.

4. An aerial as claimed in Claim 1, in which the annulment is obtained by inductance and capacity, substantially as described.

5. The combination of a number of aerials, as claimed in any of the preceding claims, spaced in a line.

6. Improvements in wireless telegraph and telephone aerials, substantially as described with reference to the accompanying drawing.

Dated this 5th day of June, 1925.

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2nd Edition

Fig. 1.

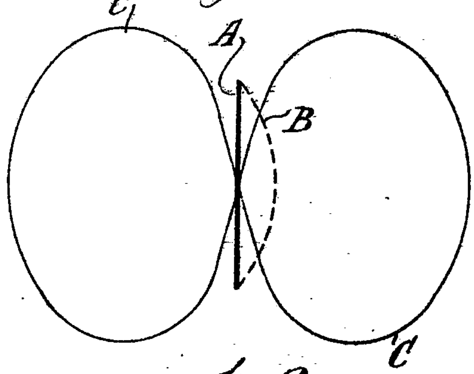


Fig. 2.

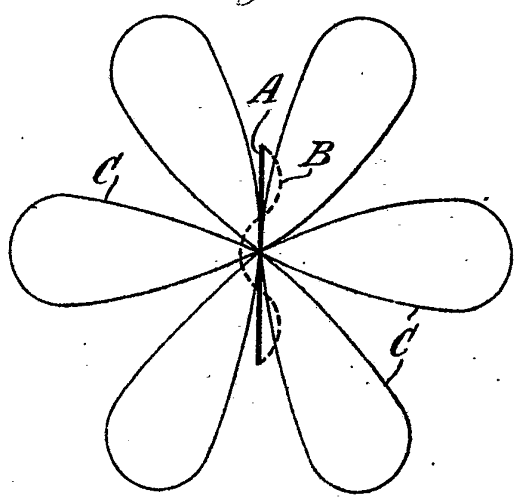
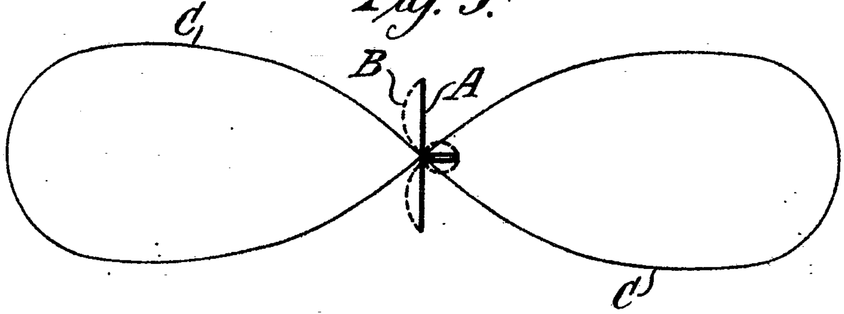


Fig. 3.



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

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