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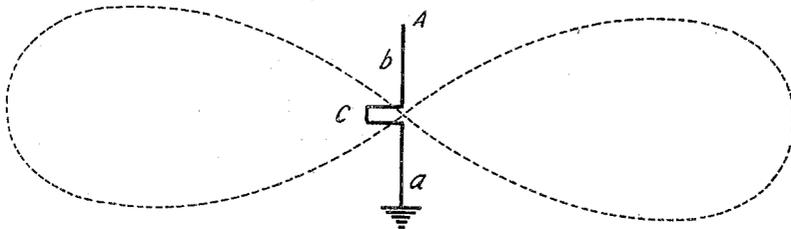
C. S. FRANKLIN

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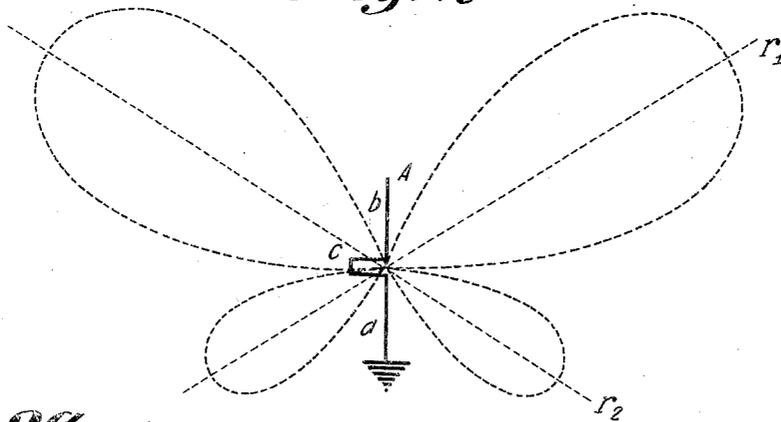
WIRELESS TELEGRAPHY AND TELEPHONY AND AERIAL SYSTEM THEREFOR

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*Fig. 1*



*Fig. 2*



*Fig. 2a*



Inventor  
CHARLES S. FRANKLIN

By his Attorney *Ira J. Adams*

# UNITED STATES PATENT OFFICE

CHARLES SAMUEL FRANKLIN, OF BUCKHURST HILL, ENGLAND, ASSIGNOR TO RADIO CORPORATION OF AMERICA, A CORPORATION OF DELAWARE

WIRELESS TELEGRAPHY AND TELEPHONY AND AERIAL SYSTEM THEREFOR

Application filed January 24, 1929, Serial No. 334,631, and in Great Britain January 26, 1928.

This invention relates to wireless telegraphy and telephony, and aerial arrangements therefor.

The invention, which is suitable for use in long distance short wave signalling (as between Europe and America), envisages the employment of aerials in which radiation is suppressed or substantially reduced from alternate fractional lengths of the aerial or aerials.

Aerials, in which the radiation from alternate half wave lengths is suppressed or greatly reduced, are already known.

This invention is defined with particularity in the appended claims. However, it may best be understood both as to its method of operation and structural organization by referring to the accompanying drawing in which

Figure 1 is an elevational view of a known type of antenna in which radiant action occurs mainly in a horizontal direction, and

Figure 2 is an elevational view of an antenna built according to this invention wherein radiant action is caused to occur at a predetermined angle with respect to the horizontal.

Figure 2A illustrates in perspective an antenna array employing antennæ embodying the principles of the present invention.

Figure 1 of the accompanying drawing shows a known aerial A, constructed as described in prior specifications and arranged substantially vertically. As shown, the aerial comprises three lengths,  $b$ ,  $c$ ,  $a$ .

If the parts  $b$ ,  $c$ ,  $a$ , are in accordance with known arrangements made to be each one half wave length long, the currents in the upper and lower radiating portions  $b$ ,  $a$  of the aerial will be in the same phase, and maximum signal strength will be obtained as shown, in a direction at right angles to the aerial.

The present invention has for its object to provide an aerial or aerial system comprising one or more aerials in which radiation is annulled or substantially reduced from alternate fractional lengths, and by means of which radiation, for example, in the form of a so-called beam, may be pro-

jected at a considerable angle above the horizontal, the said radiation being received by an aerial system arranged to receive from a similar angle.

According to this invention, aerial arrangements for wireless signalling comprise one or more substantially vertical aerials, in which radiation is suppressed or substantially reduced from alternate equal fractional lengths of said aerial or aerials, said fractional lengths being different from and preferably each longer than a half wave length.

Where there is a plurality of aerials, they are preferably spaced a fraction of a wave length apart and arranged along a line at right angles to the horizontal component of the desired direction of transmission or reception.

If desired, a reflecting system of any convenient known form may be arranged behind an aerial system in accordance with this invention.

In the case of a transmitting aerial system, each aerial is energized, preferably at the bottom, through a feeding system arranged so as to ensure that the currents in all the aerials are in correct phase.

With an aerial or aerial system arranged and excited in accordance with the present invention, the direction of maximum radiation and reception has been found to be considerably inclined above the horizontal, when the fractional lengths of the aerial or aerials are each longer than a half wave length.

Similarly, the direction of maximum radiation is downwardly inclined if the fractional lengths are each shorter than a half wave length.

It will be seen, therefore, that an aerial system in accordance with this invention may be employed to transmit or receive a beam concentrated to any desired degree in a horizontal plane, and with any desired upward or downward inclination.

The invention is illustrated in Figure 2 of the accompanying drawing, which shows an aerial A comprising three equal fractional lengths  $b$ ,  $c$ ,  $a$ , the radiation from the

part *c* being suppressed as shown by folding it back upon itself or in any other known way. The parts *b*, *c*, *a* are each longer than a half wave length, i. e. the distance between the centers of the portions *a* and *b*, as measured electrically along the wire, is slightly longer than a wave length. With this arrangement the currents in *b* will lag behind those in *a*, and there will be a direction of maximum radiation inclined towards *b*, i. e. if the aerial be vertical, the direction of maximum radiation will be inclined upward of the horizontal and along the line *r*1. There will also be a second and smaller radiation-loop (due to the reflected wave from the end of the aerial), whose principal directional chord is *r*2, the lines *r*1 and *r*2 making equal angles with the horizontal.

Figure 2 also illustrates an antenna system made up of a plurality of aerials A, the aerials being arranged in line and placed one behind the other. This figure, therefore, is a cross sectional view of the system and consequently radiant action is concentrated in a direction at right angles to the direction in which the system extends or, in the plane of the drawing.

By suitably proportioning a plurality of such aerials with respect to the energizing wave length, and combining them to form a so-called beam aerial, maximum radiation may be obtained in any desired upward or downward direction, and with any desired concentration in the horizontal plane.

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 comprising a plurality of equal fractional coaxial linear portions, each of length other than a half wave length and less than one wave length, and in which radiation from alternate portions is suppressed or substantially reduced, substantially as described whereby radiation occurs predominantly in a direction other than normal to said coaxial linear portions.

2. An aerial system comprising a plurality of equal, fractional, coaxial, vertical, linear portions, each portion being of a length slightly longer than a half wave length and less than one wave length, alternate portions of said aerial being so arranged that radiation therefrom is suppressed or substantially reduced whereby radiation from said aerial occurs predominantly above the horizontal.

3. An aerial system comprising a plurality of substantially vertical aerials as claimed in claim 1, spaced a fraction of a wave length apart and arranged along a line substantially at right angles to the horizontal component of the desired direction of transmission or reception, substantially as described.

CHARLES SAMUEL FRANKLIN.