June 2, 1953 A. G. KANDOIAN 2,640,928

CIRCULARLY POLARIZED BROAD BAND ANTENNA

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Fig. 1.

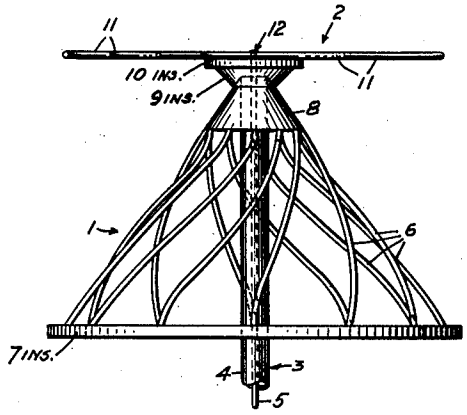
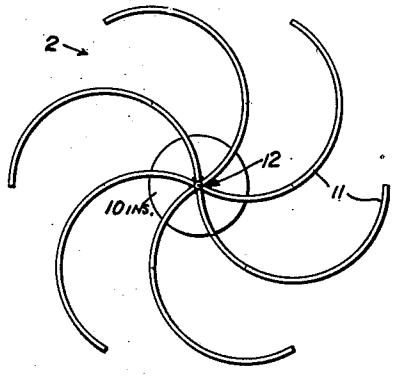


Fig. 2.



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CIRCULARLY POLARIZED BROAD BAND ANTENNA

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8 Claims. (Cl. 250—33)

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This invention relates to broad band antennas and more particularly to broad band antennas adapted for operation with circularly or elliptically polarized radio energy.

Broad band antennas have been proposed in which the antenna comprises a conical portion at the apex of which is mounted a plate or disc. The antenna is generally fed by a two conductor line, for example the coaxial type, with one conductor coupled at the apex of the conical portion and the other at a point on the disc, preferably near the center thereof. In this type of antenna the radiation is polarized in the direction of lines perpendicular to the planes of the disc and the cone base, generally vertical, as this construction is most often used.

For many purposes it is desirable to have energy circularly polarized. For example in direction determining antenna arrays the received energy more often than not has substantial polarization components in both the vertical and horizontal planes.

It is an object of this invention to provide an antenna of the disc and cone type in which either the disc element, the conical element or both are modified to introduce a polarization component at right angles to the normal polarization of the assembly.

According to a feature of this invention, the antenna comprises an assembly of a substantially conical shaped element with a generally disc shaped element mounted at its apex, with one or both of said elements comprised of a plurality of individual conductors deviating from a normally rectilinear relation along the surface of the element to introduce a component of polarization at right angles to the plane of polarization of an antenna composed of rectilinear elements. The conductors are preferably deviated in the conical element by introducing a twist so that the conductors form at least a partial turn of a spiral along the surface of the cone. In the disc element, the deviation comprises a curvature of the conductors from the rectilinear radial form. The amount of deviation is made sufficient to introduce the desired amount of horizontally polarized component into the normally vertically polarized field. By adjustment of the deviations in either or both elements, the antenna may be made to have the desired degree of elliptical polarization, the vertical or horizontal component predominating, or circular polarization.

To produce elliptical polarization it is required that the currents producing the horizontal and

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vertical radiation components be in phase when the center of radiation of the two components is the same. Thus if a horizontal loop (magnetic dipole) and a vertical dipole radiation are used the currents in the loop and vertical dipole must be in phase. This makes the horizontal and vertical radiated field in phase quadrature. In the antenna according to this invention both the horizontal component and the vertical component are cophasal since they are produced by the same current traversing the deviated conductors. The conductors are all fed in parallel from a common point and the outer ends of the conductors are insulated one from another. To achieve circular polarization the powers radiated as the vertical and horizontal components must be equal. This can be achieved according to this invention by adjusting the degree of deviation. By proper choice of the adjustment polarization may be made elliptical with either horizontal or vertical components predominating, or may be made circular.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood, by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

Fig. 1 shows a vertical elevation of an antenna incorporating the features of this invention; and

Fig. 2 shows a top plan view of the disc element of Fig. 1.

In Figs. 1 and 2 the antenna is shown to comprise a substantially conical element 1 and a substantially disc shaped element 2. Energy coupling may be effected by means of a line 3 having an outer conductor 4 connected to conical element 1 and an inner conductor 5 connected to disc element 2. Conical element 1 may comprise a plurality of individual conductor wires 6 each fastened at one end to a base supporting ring 7 of insulating material and at its other end to a short section of conductor sheet 8, providing a terminal to interconnect the individual conductors for cophasal energization. It is clear that if conductors 6 are sufficiently rigid the ring 7 may be dispensed with. Wires 6 are deviated from the rectilinear dimension of the cone from base to apex to provide a twisting or spiral about the conical surface. The degree of deviation, that is the angle of twist, controls the amount of horizontal polarization effect introduced in the antenna. At the top of portion 8 is provided a supporting insulator 9, to which is fastened an

insulating disc 10 carrying the disc-shaped element 2. Element 2 is composed of a plurality of conductors 11, connected together at a common terminal point 12. Conductors 11 are deviated from the rectilinear radial dimension of the disc shaped element 2, as shown. Here again the amount of deviation may be adjusted to control the degree of horizontal polarization introduced into the antenna. While sufficient effect might be introduced by either element 1 or element 2 alone, a more satisfactory solution generally can be obtained by adjusting the curvature of the conductor wires of both elements to secure the desired horizontal polarization effect.

It will be clear to those skilled in the art that the illustration given here is merely by way of example, and that departures from the particular construction may be made as desired.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

What is claimed is:

1. In a wide band antenna including a generally conical element and a generally disc-shaped element mounted adjacent to but spaced from the apex of said conical element having a normal single polarization effect, a construction to provide circular or elliptical polarization effects, comprising a plurality of individual conductors to outline the surface of one of said elements, said conductors being curved to follow a non-rectilinear path from the center of the surface of said one element to the outer edge of the element to introduce a polarization component at right angles to the normal polarization effect.

2. An antenna according to claim 1, further comprising a terminal for interconnecting the individual conductors of said one element at one end.

3. An antenna according to claim 1, wherein both said elements are constructed of individual conductor elements following a non-rectilinear path on the surface of said elements.

4. An antenna according to claim 3, further comprising terminals for interconnecting the individual conductors of each of said elements at one end thereof.

5. An antenna according to claim 1, wherein said one element is said substantially conical element.

6. An antenna according to claim 1, wherein said one element is said disc shaped element.

7. In a wide band antenna including a generally conical element and a generally disc-shaped element mounted immediately adjacent but spaced from the apex of said conical element, a construction to provide circular or elliptical polarization effect, comprising a plurality of conductors arranged to provide said generally conical element, said conductors each being twisted to follow a non-rectilinear path on the surface of said conical structure between the base and apex, a second plurality of conductors arranged to provide said generally disc-shaped element, each conductor of said second plurality extending in a curved path from the center to the periphery of said disc-shaped element, and terminals for electrically interconnecting the conductors of each plurality of conductors at one end thereof.

8. An antenna according to claim 7, further comprising a coaxial transmission line, the outer and inner conductors of said transmission line being connected respectively to said terminals of the conical and disc-shaped elements.

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