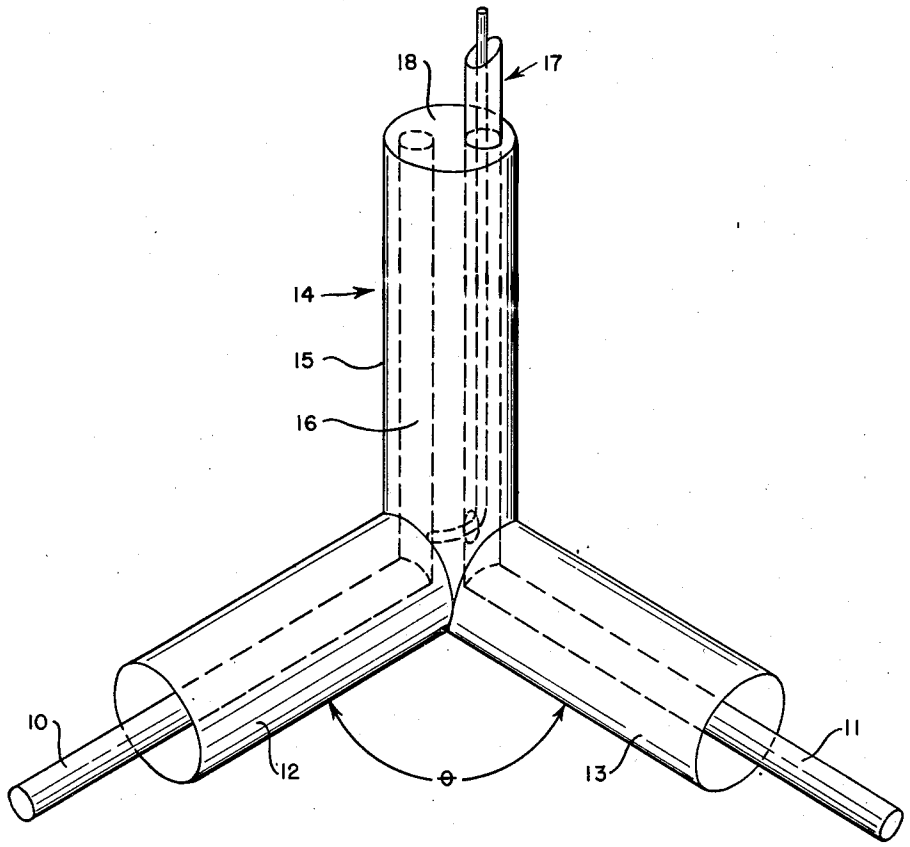
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BROAD BAND BIDIRECTIONAL ANTENNA

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BROAD BAND BIDIRECTIONAL ANTENNA

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This invention relates generally to electrical apparatus and more particularly to antennas.

The conventional dipole radiator, which is one of the most simple forms of antennas, has a bidirectional free space pattern generally resembling the figure eight. The front and rear lobes are equal in shape and response, and complete nulls exist at both sides.

In certain applications it is frequently desirable to use an antenna whose pattern is generally unidirectional but whose side nulls do not drop to a value of zero. That is, it may be required that the principal lobes be forward and to the rear but with some response from the sides.

It is well known that an antenna array can be designed which will have any pattern desired, within reason. However such arrays usually become complex in proportion to the requirements of the antenna pattern and such an array is not acceptable for use in many applications, such as in aircraft for example.

It is an object of the present invention to provide a dipole antenna capable of some response from the sides.

It is another object to provide a generally bidirectional antenna capable of operation over a wide range of frequencies.

It is also an object to provide a generally bidirectional, broad band antenna particularly adapted for use on aircraft.

An antenna which will accomplish the above objects, consists of a bent, sleeved, plane polarized, dipole with an impedance balancing device generally known as a "balun." A conventional dipole radiator is bent so that the longitudinal axes of the radiating elements no longer are common but intersect to form a V. An inner portion of the dipole is enclosed in a sleeve and a "balun" device is connected between the two dipole elements and a coaxial feed line. The "balun" is so called because it provides a means for connecting a system which is balanced with respect to ground to a system which is unbalanced with respect to ground.

Other objects, features and advantages of this invention will suggest themselves to those skilled in the art and will become apparent from the following description of the invention taken in connection with the accompanying drawing which is an isometric view of an antenna embodying the principles of this invention.

Referring now to the single figure of the drawing, two conductor elements 10 and 11 with their respective sleeves, 12 and 13 are bent to

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form a V. The included angle θ of the V, as shown in the drawing, is about 100 degrees. Perpendicular to the plane formed by the radiating elements, a balun 14 is connected to conductor elements 10 and 11 and sleeves 12 and 13.

Balun 14 consists of an outer sheath 15, impedance balancing conductor 16, a coaxial transmission line 17 and an end plate 18. Conductor 16 is contained in sheath 15. One end of conductor 16 is connected to end plate 18 and its other end is connected to an end of conductor 10. A portion of coaxial line 17 is also contained in sheath 15 and the outer conductor of line 17 is shorted to end plate 18 where it enters sheath 15. The outer conductor of line 17 terminates in contact with an end of conductor element 11. Near the termination of the outer conductor of line 17, the inner conductor of line 17 leaves the confinement of its outer conductor and terminates in contact with the juncture of conductor 16 and conductor 10. A portion of coaxial line 17 extends outside of sheath 15 for connection purposes.

All previously mentioned components of the antenna assembly are metallic conductors. Some nonconductive form of supporting material is required to maintain the inner and outer conductors of line 17 in their usual concentric orientation, however, such a support being conventional is not of importance in the disclosure of this invention and has been omitted in the drawing for clarity.

The antenna above described is a balanced system in that it consists of two symmetrical conductors 10 and 11, which are energized by equal and opposite voltages and conductors 10 and 11 are at an impedance balance with respect to ground. Conductor 10 is connected to the inner conductor of line 17 and conductor 11 is connected to the outer conductor of line 17, resulting in equal and opposite voltages being applied to the two radiators. Sheath 15 is at ground potential and each of conductors 10 and 11 is connected to end plate 18 of sheath 15 by a quarter-wave line. Sleeves 12 and 13 are at ground potential where they are joined to sheath 15.

Conductor 10 is connected to ground potential by conductor 16 and conductor 11 is connected to ground potential by the outer conductor of line 17. Thus, conductors 10 and 11 are at an impedance balance with respect to ground and the magnitudes of these impedances to ground are large and equal in value.

Sleeves 12 and 13 are used to modify the current distribution on the radiating surfaces to im-

prove the input impedance of the antenna and each has a length of approximately one-eighth of a wavelength. Conductors 10 and 11 each have a length of approximately one-fourth wavelength. Each of conductors 10 and 11 extends beyond their respective sleeves by an amount approximately equal to one-eighth of a wavelength.

Since this antenna will operate satisfactorily over a wide range of frequencies, all the aforementioned lengths relative to wavelengths, correspond to a wavelength whose frequency is approximately the midpoint of the operating frequency band.

An angle of 100 degrees between the two branches of the dipole has been used to increase the amount of side response. However, the antenna still maintains a generally bidirectional response pattern with the two major lobes forward and to the rear.

An antenna constructed in accordance with the teachings of this invention will operate over a two to one band of frequencies with a standing wave ratio of about two to one or better.

While there has been here described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention.

What is claimed is:

1. A broad band plane polarized generally bidirectional bent sleeved dipole antenna for producing two main lobes of radiation in opposite directions with some radiation to the sides including a first radiator having a cylindrical shape with a length substantially equal to one fourth of a wavelength corresponding to the midpoint of the operating frequency band, a second radiator physically similar to said first radiator oriented with respect to said first radiator so that the longitudinal axes of said first and second radiators intersect to form a V, the included angle of said V being substantially 100 degrees, a first tubular sleeve having a length substantially equal to one eighth of a wavelength corresponding to the midpoint of the operating frequency band enclosing a portion of and insulated from said first radiator, a second tubular sleeve physically similar to said first sleeve enclosing a portion of and insulated from said second radiator, an impedance balancing system oriented perpendicular to a plane formed by said radiators comprising a tubular metallic sheath having an end plate at one end with its open end electrically connected to said sleeves, an impedance balancing conductor enclosed by said sheath electrically connected to an end of said first radiator with its other end electrically connected to said end plate, said impedance balancing conductor having a length substantially equal to one quarter of a wavelength corresponding to the midpoint of the operating frequency band, a coaxial transmission line inserted in said sheath through a hole in said end plate with its outer conductor shorted to said end plate and terminated in contact with an end of said second radiator and with the inner conductor of said coaxial transmission line terminated in contact with the juncture of said impedance balancing conductor and said first radiator.

2. A broad band plane polarized generally unidirectional bent sleeved dipole antenna for producing two main lobes of radiation in opposite directions with some radiation to the sides including a first radiator having a cylindrical shape with a length substantially equal to one quarter of a wavelength corresponding to the midpoint of the operating frequency band, a second radiator physically similar to said first radiator and oriented with respect to said first radiator so that the longitudinal axes of said first and second radiators intersect to form a V, the included angle of said V being substantially 100 degrees, a first tubular sleeve enclosing a portion of and insulated from said first radiator and having a length substantially equal to one eighth of a wavelength corresponding to the midpoint of the operating frequency band, a second tubular sleeve physically similar to said first tubular sleeve enclosing a portion of and insulated from said second radiator, electrical means connecting said sleeves to a point of reference potential, and a coaxial line balanced to unbalanced system having a length substantially equal to one fourth of a wavelength corresponding to the midpoint of the operating frequency band and being connected to said radiators whereby the current distribution on said radiators is modified so that said antenna has a low input impedance and can be fed by an unbalanced transmission line.

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