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SEARCH ROOM

March 21, 1950 R. B. BARNES 2,501,020

ANTENNA STRUCTURE

Filed Nov. 6, 1945

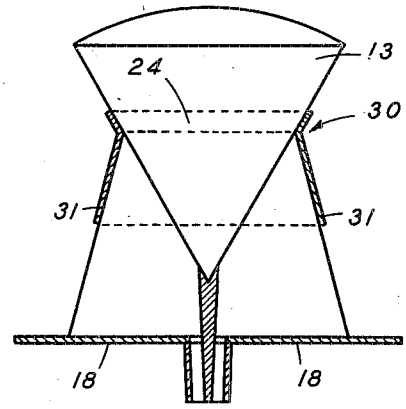

FIG. 2

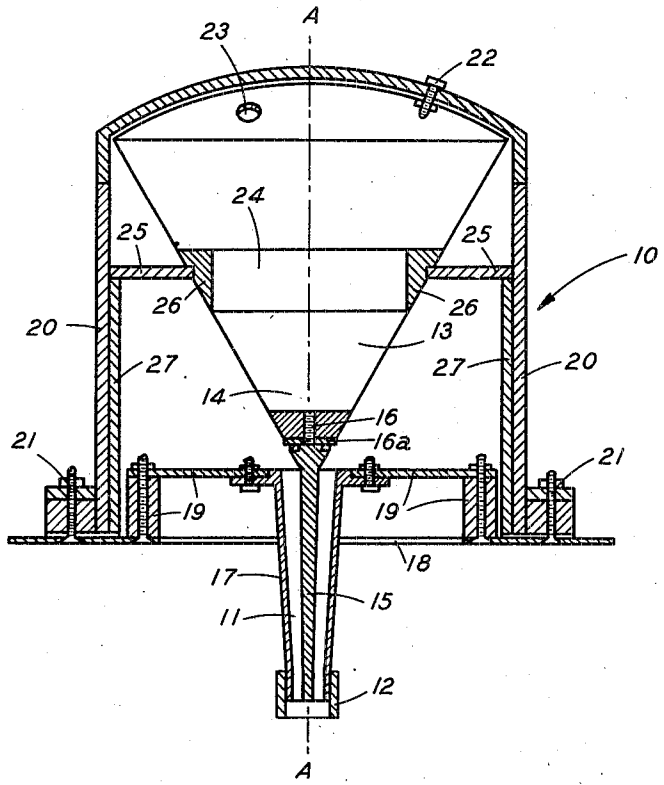

FIG. 1

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ANTENNA STRUCTURE

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2 Claims. (Cl. 250—33)

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This invention relates to antennas for transmission and reception of electrical energy at radio frequencies. More particularly it relates to means for supporting conical antennas to aircraft or other structures which adapt the antennas to operation over a wider range of frequencies than has been possible heretofore.

It has been the common practice of the prior art to have the coaxial transmission line which feeds electrical energy to a conical antenna serve also as a mechanical support for the antenna. This has been accomplished by filling the space between the inner and outer conductors of the transmission line at the apex of the cone with a solid dielectric material to lend rigidity and mechanical support to the antenna structure. Such a support requires that the antenna be fastened to the nacelle which shrouds it and which is attached to the fuselage of the aircraft or other structure because the single transmission line support at the bottom is not strong enough to securely position the antenna.

It is an object of the present invention to provide a conical antenna and support which operates over a wider frequency range than similar antennas in the prior art.

It is also an object of the present invention to provide a support for a conical antenna which is made of dielectric material and securely attached to the side or top of the antenna and which permits elimination of the use of dielectric material in the tapered section of the coaxial transmission line which conveys electrical energy to or from the antenna.

It is a further object of the present invention to provide a mechanical support for a conical antenna which is made of dielectric material and which is external to the conical antenna and not associated with the transmission line which conveys electrical energy to or from the antenna.

Generally, this invention comprises the affixing of a ring of dielectric material to the sides of a conical antenna and supporting that ring by a cylindrical dielectric support attached to the dielectric ring and enclosed by a protective nacelle made of dielectric material. This permits elimination of the dielectric supporting material in the tapered section of the coaxial transmission line connected to the antenna. The antenna may alternately be supported by a single skirt or a series of skirts made of insulating material attached to the sides or top of the conical antenna. This arrangement sacrifices none of the advantages of the dielectric ring and supporting cylinder.

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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 drawings in which:

Fig. 1 is a cross-sectional view of a conical antenna with a supporting structure constructed in accordance with the present invention; and

Fig. 2 is a diagrammatic sketch showing another embodiment of a supporting structure, in accordance with the present invention.

Referring more particularly to Fig. 1, the conical antenna and its associated structure are generally designated by 10. The configuration of structure 10 may be more fully appreciated by visualizing it as a figure of revolution about axis A—A. The tapered coaxial section 11 is connected to a coaxial transmission line by connector 12 and electrical energy is conveyed to or from the conical antenna 13 through its apex 14. The tapered section 11 is constructed so that its characteristic impedance at its juncture with connector 12 is equal to the characteristic impedance of the transmission line used and its characteristic impedance at juncture 14 with the antenna 13 is equal to the radiation resistance of antenna 13. This is to insure minimum electrical discontinuity and loss of energy by the coaxial connections to the transmission line at 12 and to the antenna 13. The inner conductor 15 of tapered section 11 is secured to the apex 14 of the conical antenna 13 by the screw connector 16. The washer 16A is used to position and adjust the position of antenna 13 and inner conductor 15 to the correct length for mechanical snugness. The number of such washers used varies in accordance with their thickness. The outer conductor 17 of tapered section 11 is secured to the antenna supporting structure 18, often the fuselage of an aircraft, by the structure 19 which is constructed to position antenna 13 above any metallic parts of the structure such as screws 21, 21. This prevents distortion of the antenna radiation pattern.

The nacelle 20 made of dielectric material, completely surrounds the conical antenna 13 and is attached to the supporting structure 18 such as the wall of an aircraft fuselage by means of screw connectors 21, 21. The conical antenna 13 is fastened to the nacelle 20 at its top by screws 22 and 23.

The metallic ring 24 fits around the side of antenna 13. Dielectric disc 25 fits around ring 24 as shown at 26 and rests upon the cylindrical

dielectric support 27. The dielectric support 27 is supported by the supporting structure 18 and snugly fits inside the nacelle 20.

Referring to Fig. 2, the conical antenna 13, is held in position by mechanical support 30 which is secured to the supporting structure 18. A single dielectric supporting skirt or series of dielectric supporting skirts 31 are attached to the ring 24 at one end and to the structure 18 at their other end thereby giving rigid and permanent support to antenna 13. Supporting skirts 31 may be attached directly to antenna 13 without the use of ring 24.

It has been found that in the use of antennas of this type where sections of solid dielectric material have been used in tapered section 11, the efficient range of operating frequencies has been limited by the electrical discontinuities introduced by the dielectric material. The elimination of the dielectric supporting material in tapered section 11 and the use of a supporting structure embodying the principles of this invention has allowed operation of this type of antenna over a much wider frequency range than any antenna of the prior art.

While there has been shown two particular embodiments of the supporting structure of this invention, it is readily seen that the principles of this invention embrace all methods of mechanically supporting within its nacelle a conical antenna at its top or its side.

While there has been here described what is at present considered to be 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 scope of the invention.

What is claimed is:

1. An antenna system comprising a conical antenna, means for supporting said antenna relative to a mounting surface, said means comprising a dielectric ring disposed about the outside surface of said antenna between its base and apex, said ring being narrow relative to the length of said antenna, a dielectric disc-like member attached at its inner periphery to said dielectric ring and supported on said mounting surface by a tubular dielectric structure fixed to the outer periphery of said disc-like member, a dielectric nacelle enclosing said aforementioned elements, means to fix said tubular dielectric structure and said nacelle to said mounting surface, means to fix the base of said antenna to the top of said nacelle, and adjustable means to fix a conductor within the apex of said antenna, said last named means including an axial channel formed in the apex of said antenna and complementary in diameter to said conductor.

2. The device according to claim 1, wherein said conductor is provided with a shoulder and comprises the inner conductor of a coaxial line, the outer conductor of which is fixed to said mounting surface, and wherein said adjustable means further includes a plurality of spacing washers removably positioned about said inner conductor between said shoulder and said apex whereby the depth of penetration of said inner conductor into said channel may be regulated.

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