

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number:

**0 387 445
A2**

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: **89311450.4**

(51) Int. Cl.⁵: **H01Q 9/38**

(22) Date of filing: **06.11.89**

(30) Priority: **16.03.89 US 324431**

(43) Date of publication of application:
19.09.90 Bulletin 90/38

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI NL SE

(71) Applicant: **CHU ASSOCIATES INC**
P O Box 2387 Witcomb Avenue
Littleton Massachusetts(US)

(72) Inventor: **Faigen, Ivan**
19 Highgate Road
Wayland MA(US)
Inventor: **Creaser, Charles**
South Merrimack Road
Hollis New Hampshire(US)

(74) Representative: **Allsop, John Rowland**
Rowland Allsop & Co. Black Boy Yard 15
High Street
West Wycombe High Wycombe, Bucks. HP14
3AE(GB)

(54) **Monopole antenna.**

(57) An azimuthal omnidirectional communications mast-mounted antenna in which the monopole antenna is encased in a dielectric cylinder which is received in a conductive base cylinder, having a plurality of metallic conductive guy wires of appropriate length, in turn extended by rope guy wires for support of the mast structure, and disposed about and radially depending at an acute angle from the outer surface of the base cylinder to form not only guying functions, but simultaneously to serve as an elevated radial ground plane for the antenna.

EP 0 387 445 A2

MONOPOLE ANTENNA

The present invention relates to communication antennas of the azimuthal omnidirectional type, being more particularly directed to such antennas adapted for mast-mounting and relatively broad banded to operate over a range of communication frequencies, such as, for example, in the 30 to 88 megahertz range.

There are a myriad of various types of omnidirectional communications and related antennas that have been successfully used in the art including, for example, those described in U.S. Letters Patent Nos. 3,324,476; 3,534,378; 4,218,687; and 4,598,296 of common assignee herewith. These antennas have operated as monopoles and dipoles with various types of matching networks and ground counterpoises and the like, heretofore relatively independent of the mast-mounting or supporting structure upon which they have been employed. It has now been discovered, however, that a very efficient type of guy wire support for the mast and antenna can be formed into a simultaneously operative effective radial antenna ground plane antenna, leading to relatively low cost and highly efficient and improved support systems of this character.

It is accordingly an object of the present invention to provide a new and improved mast-mounted omnidirectional communications antenna of the monopole type in which supporting guy wires are also simultaneously used effectively as elevated ground plane elements for the advantages above stated, and others.

Other and further objects will be explained hereinafter and are more particularly delineated in the appended claims.

In summary, however, from one of its viewpoints, the invention embraces an azimuthal omnidirectional communications mast-mounted antenna having, in combination, a monopole antenna encased in a dielectric cylinder, a conductive base cylinder securable to a mast and into which the dielectric cylinder is inserted and secured, a plurality of conductive wires symmetrically disposed about and radially depending at an acute angle from the outer surface of the base cylinder in the form of guy wires conically distributed about the base cylinder and mast and connected at their free ends to guy rope extensions for anchoring the antenna and mast, means for establishing electrical connection of the inner ends of the guy wires to the base cylinder, and coaxial conductor means, the inner conductor of which connects to the monopole antenna near the base of the dielectric cylinder and the outer conductor of which connects to the base cylinder, the length of the guy wires being

adjusted to about one quarter of the wavelength of the communication frequency(ies) so that the guy wires serve also simultaneously as an elevated radial ground plane or counterpoise for the antenna. Preferred details and best mode construction are hereinafter presented.

The invention will now be described in connection with the accompanying drawings,

Fig. 1 of which is a side elevation of the antenna and support system in preferred form;

Fig. 2 is a top elevation with one type of combined guy wire-ground plane structure;

Fig. 3 is a view similar to Fig. 2 of a modification; and

Fig. 4 is a view similar to Fig. 1 of a further modification.

Referring to Fig. 1, an antenna A as of the monopole type, is shown encased within a fiberglass or other dielectric cylindrical housing H, the lower end of which is inserted within a conductive base cylinder or casting B, as of aluminum, for example, to the inner walls of which the lower part of the housing H is secured as at S, such as by glue.

As before stated, conducting metal guy wires G are provided symmetrically disposed about and radially depending at an acute angle from the outer surface of the base cylinder B in the form of a conically distributed arrangement that envelops about the base cylinder B and the mast M, to which the same may be secured as by a latch clamp L. The guy wires are shown having inner end loops 1 for structurally connecting into apertures in conductive ears 3 at symmetrically spaced points about the conductive base cylinder B, shown as at 90-degree positions in Fig. 2. In accordance with the invention, however, the metallic radial guy wires G do not just serve as guy supports for the antenna-base-mast structure, but also as electrical ground plane or counterpoise elements which is made possible by electrically conductive connectors 5 making good electrical connection between the metallic guys G and the conductive ears 3 of the conductive base B, as more particularly shown in Fig. 1.

The length of the elements G for the electrical purposes they serve, as distinguished from the structural guying purposes, are made approximately one quarter of the wavelength of the communication frequency or frequencies to be used, as is the vertical length of the antenna A. As more particularly shown in Fig. 1, the inner conductor of a coaxial feed line connects with the antenna A at a bottom edge thereof as at I, and the outer conductor connects with the ground base cylinder B.

In the system of Fig. 1, the antenna A may be a planar monopole sheet and it may be curved into cylindrical C-shape form within the outer fiberglass housing A (and about an inner fiberglass tube, if desired).

If, on the other hand, a linear type of monopole antenna is desired, as shown at A' in Fig. 4, the inner conductor of the coaxial line I will again connect with the bottom end of the antenna A' through a matching network N shown disposed within the base cylinder B, again with the outer cylinder capacitively coupled to the antenna and feedline and connected to the outer conductor O of the coaxial line.

In this manner, the metallic guy wires G serve not only for guying support of the structure, but simultaneously as an elevated radial ground plane or surface or counterpoise for the antenna, provided the remainder of the guying elements are non-conductive guy ropes anchoring the structure to the ground or other surface as shown at R. The free ends of the metallic guy elements G are therefore provided with further loops 1' that loop with rope guys R that extend to the ground, permitting the guy wires G to serve a guying function only for their length as a segment of the total guying structure, and having appropriate electrical length, as before stated, simultaneously to serve as an effective ground plane or surface for the antenna.

It has been found that a variation in the acute angle of the symmetrically disposed guy segments G with respect to the vertical mast can play a desirable role in tilting the elevational radiation pattern of the omnidirectional antenna. For example, with an antenna constructed as shown in the embodiment of Fig. 1 and operating at 30 megahertz, with an acute angle of the guy wire G of 30 degrees to the vertical mast, a symmetrical doughnut shaped radiation pattern has been achieved, with the horizon being the symmetrical axis thereof in the vertical plane. At 52 megahertz, the predetermined length of the elements G caused a ten degree downward tilt in the elevational pattern; and at 88 megahertz, about a ten degree upward tilt. At a 45 degree acute angle of the elements G, on the other hand, again at 30 megahertz, symmetry of the elevational pattern with the horizon was attained. At 41 megahertz, however, a 15 degree upward tilt was observed, as was the same achieved at 88 megahertz.

While the plurality of combined guy wire-ground plane elements G of Fig. 2 is illustrated in the form of four radial spokes, further variations are possible and useful, including the four-sided star of Fig. 3, which, though made of wire elements, in view of the wavelengths involved, has been found to act as if they were solid sheets in terms of

broad-banding and affecting the radiation pattern and impedance matches of the system.

Further modifications will occur to those skilled in this art, and such are considered to fall within the spirit and scope of the invention as defined in the appended claims.

Claims

1. An azimuthal omnidirectional communications mast-mounted antenna having, in combination, a monopole antenna encased in a dielectric cylinder; a conductive base cylinder securable to a mast and into which the dielectric cylinder is inserted and secured; a plurality of conductive wires symmetrically disposed about and radially depending at an acute angle from the outer surface of the base cylinder in the form of guy wires conically distributed about the base cylinder and mast and connected at their free ends to guy rope extensions for anchoring the antenna and mast; means for establishing electrical connection of the inner ends of the guy wires to the base cylinder; and coaxial conductor means the inner conductor of which connects to the monopole antenna at the base of the dielectric cylinder and the outer conductor of which connects to the base cylinder, the length of the guy wires being adjusted to about a quarter of the wavelength of the communication frequency(ies) so that the guy wires serve also simultaneously as an elevated radial ground plane for the antenna.

2. An antenna as claimed in claim 1 and in which the plurality of guy wires comprises four wires connected at 90° points about the base cylinder.

3. An antenna as claimed in claim 1 and in which the plurality of guy wires comprises a four-sided star.

4. An antenna as claimed in claim 1 and in which the monopole antenna is substantially a quarter-wavelength cylindrical sheet within the dielectric cylinder and to a bottom edge of which the said inner conductor is connected.

5. An antenna as claimed in claim 1 and in which the antenna within the dielectric cylinder is connected within the base cylinder through matching network means to the inner conductor of the coaxial line.

6. An antenna as claimed in claim 1 and in which means is provided for varying the angle of the guy wires to vary the tilt of the elevational radiation pattern of the antenna for various frequencies.

FIG. 1.

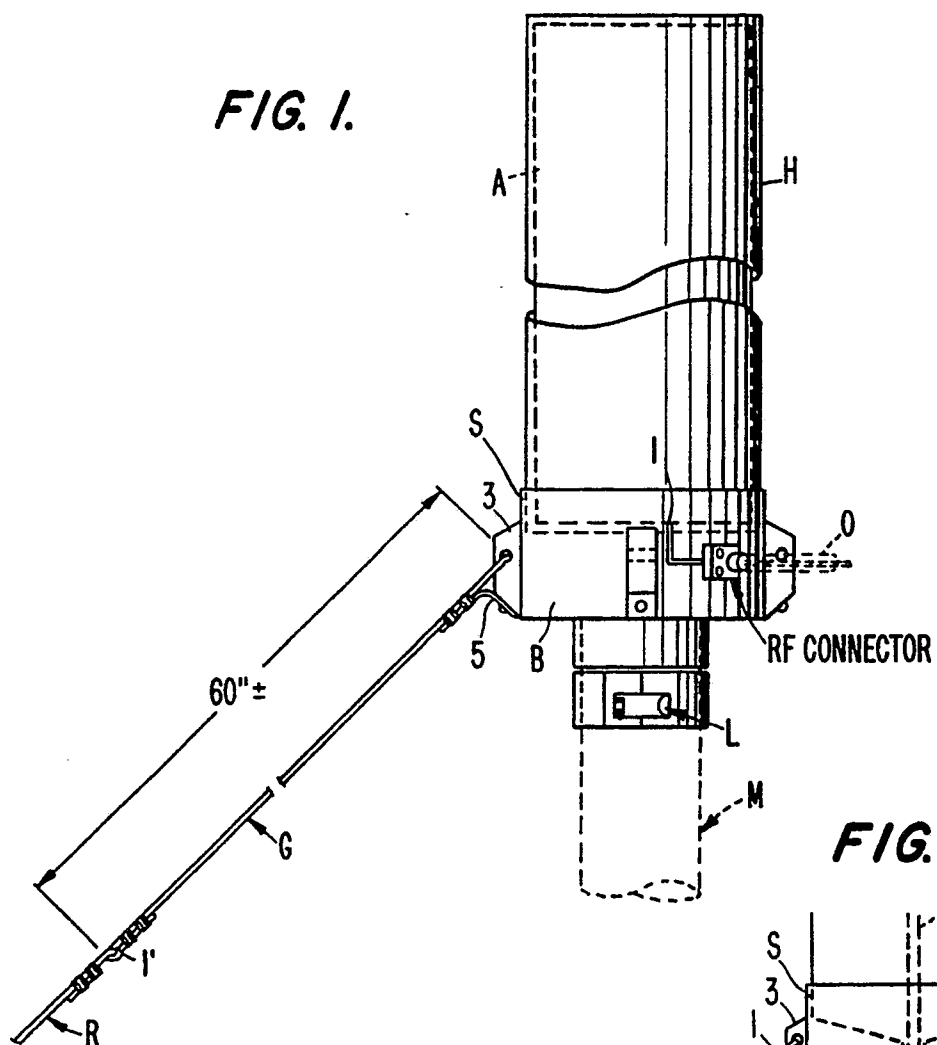


FIG. 4.

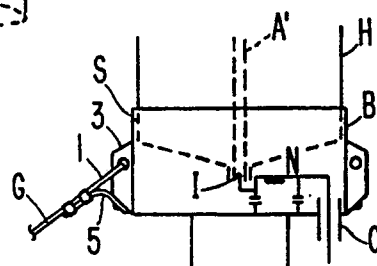


FIG. 2.

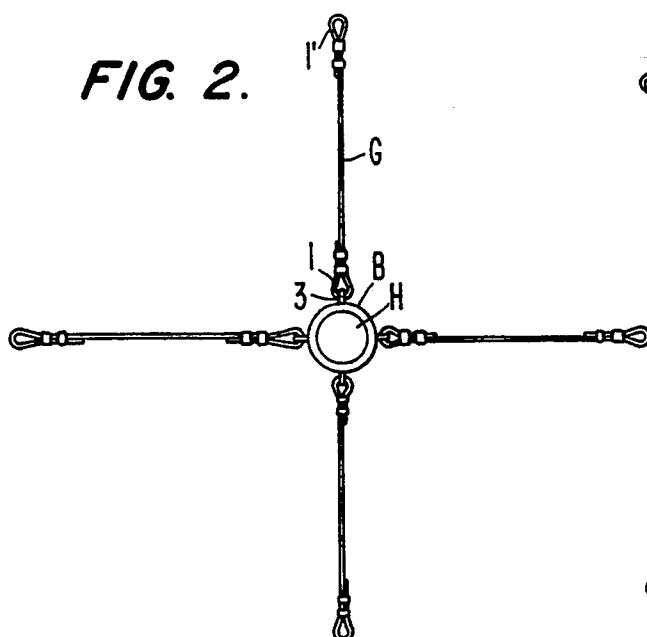


FIG. 3.

