343-754

SEARCH ROOM

Sept. 11, 1962 E. G. PARKER ET AL 3,054,106

DIRECTIONAL BEACON ANTENNA

Filed Jan. 2, 1959

Fig. 1

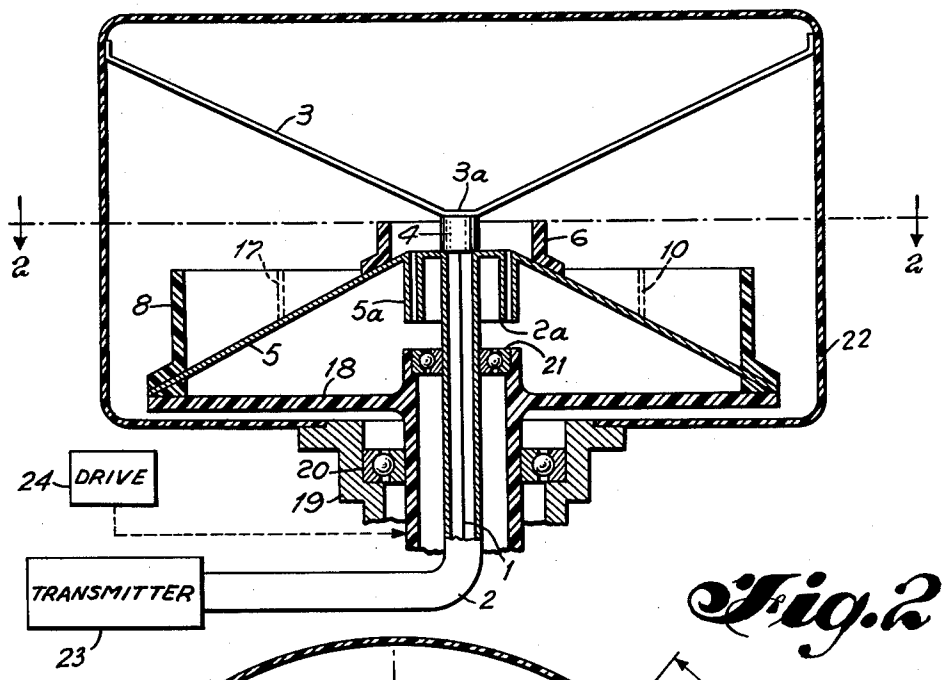
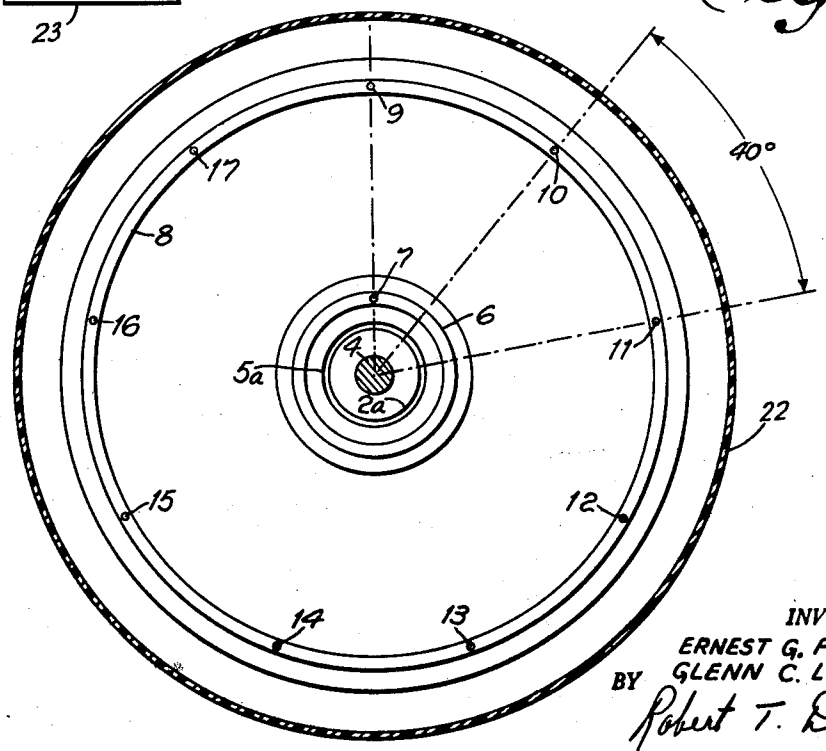


Fig. 2



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United States Patent Office 3,054,106 Patented Sept. 11, 1962

3,054,106

DIRECTIONAL BEACON ANTENNA

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Filed Jan. 2, 1959, Ser. No. 784,697
4 Claims. (Cl. 343—754)

This invention relates to directional antennas and more particularly to a small diameter directional antenna producing a rotating multilobed pattern of radiation having extended vertical coverage of modulations produced by said rotation.

In the past, beacon antennas producing a rotating multilobed pattern have been employed to radiate signals to receiving equipment, said signals being modulated by said rotation. One such antenna, commonly known as a TACAN antenna is described in volume 33, March 1956 of "Electrical Communication," Technical Journal of the International Telephone and Telegraph Corporation and associate companies and in Patent No. 2,803,821 issued to S. Pickles et al., filed August 10, 1954. The TACAN antenna described in the references employs a vertically disposed rotating element with one vertical parasitic element a given distance from said radiating element and nine other parasitic elements equally spaced about said radiating element and all the same distance from said rotating element. All the parasitic elements are rotated about the radiating element, thus producing a rotating multilobed pattern of radiation. Receiving equipment responsive to the radiation from the beacon detects a fundamental modulation of the beacon signal due to the rotation of the one vertical parasitic element and a ninth harmonic modulation due to the rotation of the nine other parasitic elements.

It is an object of this invention to provide an improved beacon antenna having greater vertical coverage of modulations produced by rotation of parasitic elements associated therewith.

It is another object to provide a beacon antenna having improved vertical coverage of the fundamental and harmonic modulations produced by rotations of parasitic elements associated therewith in a small simple antenna design.

It is another object to provide a broadband beacon antenna having no resonant elements so that the pattern of radiation from said antenna in the vertical plane remains virtually unchanged up to a high vertical angle over the TACAN interrogation and transmission frequency bands.

It is a feature of this invention to couple a biconical horn antenna to a transmission line, the inner and outer conductors of said line being radiantly coupled to different ones of said cones and said cones being separated at their apex by approximately one-quarter wavelength of the frequency energizing said antenna.

Other and further features of this invention will be more apparent from the following specific description taken in conjunction with drawings in which:

FIG. 1 depicits a vertical cross-sectional view of the biconical TACAN beacon antenna; and

FIG. 2 depicts a horizontal cross-sectional view of the biconical TACAN beacon antenna.

Turning first to FIG. 1 there is shown a coaxial type transmission line comprising an inner conductor 1 and an outer conductor 2, said outer conductor being a rigid support member as well as conductive. Center conductor 1 and outer conductor 2 are open circuited at their upper end and are spaced from conical conductive surface 3 by cylindrical dielectric spacing member 4. Spacing member 4 has a length equivalent to one-quarter wavelength of

the frequency energizing the antenna, thus energy is coupled from the upper open end of the coaxial line to section 3*a* of conical member 3, thus providing one-quarter wavelength coupling between center conductor 1 and conical conductor 3. Outer conductor 2 is coupled to conical conductor 5 by virtue of the proximity of skirt 5*a* to skirt 2*a*. Each of these skirts are cylinders of different diameters and each has a length that is approximately one-quarter wavelength of the energizing frequency. The spacing between skirts 5*a* and 2*a* is preferably less than one-tenth of a wavelength of the energization frequency signal. Skirt 5*a* is fixed to conical conductor 5 and is preferably of the same material as conical conductor 5 while skirt 2*a* is fixed to outer coaxial conductor 2 and is preferably of the same material as conductor 2.

Ten vertically disposed parasitic elements, shown in FIG. 2, are supported by rings of dielectric material attached to conical conductor 5. Dielectric ring 6 serves to support the single vertical parasitic element 7, referred to as the fundamental parasitic element while dielectric ring 8 serves to support the nine parasitic elements 9 to 17, referred to as the ninth harmonic parasitic elements. Conical conductive surface 5 is supported by dielectric support member 18 and support member 18 is rotatably supported by fixed support member 19 by means of bearing 20. Bearing 21 is provided between support member 18 and the outer coaxial conductor 2 to add rigidity to the coaxial transmission line. Conical members 3 and 5 and the parasitic elements are encased in a cover of dielectric material 22, thus providing an enclosure for protection against weather and other undesirable influences.

In operation a transmitter 23 is coupled to the coaxial line formed by inner conductor 1 and outer conductor 2 for providing RF energy to the antenna and support member 18 is driven in rotation about inner conductor 1 by motor means 24. Motor means 24 and transmitter 23 are synchronized so that at predetermined positions of the drive special signals are generated by the transmitter. These special signals are referred to as the fundamental and auxiliary reference signals in the TACAN system.

While there is described above a specific embodiment of this invention, it is to be understood that this is given only by way of example and not as a limitation to the spirit and scope of the invention as set forth in the accompanying claims.

We claim:

1. A biconical horn antenna for producing a rotating multilobed pattern of radiation comprising a biconical horn antenna having coaxially disposed first and second conductive conical surfaces, said second conical surface being stationary and having a radius larger than said first conical surface, means supporting said first conical surface for rotation about the common axis of said antenna, a coaxial transmission line having inner and outer conductors, the inner conductor of said transmission line being coupled to said second conical surface, the outer conductor of said transmission line being coupled to said first conical surface, a plurality of parasitic elements disposed on said first conical surface, all of said parasitic elements lying at radial distances from the common axis which are appreciably less than the radius of said second conical surface whereby said antenna produces a radiation pattern having a relatively constant ratio of modulation signal to carrier signal at high elevation angles.

2. An antenna system for producing a rotating antenna pattern having a carrier component and a rotating modulation component comprising a biconical horn antenna having first and second conical conductive surfaces disposed about a common axis of said antenna, a coaxial transmission line having an inner and an outer conductor, said first conical surface being supported by said trans-

mission line and coupled to said inner conductor of said transmission line, said second conical surface being coupled to the outer conductor of said transmission line, means for rotatably supporting said second conical surface for rotation about said common axis, said first conical surface having a radius appreciably larger than the radius of said second conical surface, a fundamental parasitic element disposed for rotation on said second conical surface, a plurality of harmonic parasitic elements disposed for rotation about said axis on said second conical surface, all of said parasitic elements disposed at radii appreciably smaller than the radius of both said first and second conical surfaces whereby said parasitic elements produce the modulation component of said antenna radiation pattern and said biconical horn in cooperation with said transmission line produces a carrier component of said antenna radiation pattern, the said relative dimensions and disposition of said parasitic elements and said conical surfaces providing decreasing strength of said carrier component at relatively higher elevation angles so that the ratio of said modulation component to said carrier component remains substantially constant over a relatively large range of elevation angles.

3. An omnirange beacon antenna for providing a rotating multilobed pattern of radiation having a carrier component and a modulation component comprising first and second oppositely directed conical conductive surfaces disposed as bodies of revolution about a common axis of said antenna to form a biconical horn antenna, said first conical surface having a radius larger than said second conical surface, a fundamental parasitic element located at a first radius and disposed on said second conical surface, a plurality of harmonic parasitic elements disposed upon said second conical surface at a second radius larger than the radius of said fundamental parasitic element, all of said parasitic elements being disposed on said second conical surface parallel to said common axis and having lengths shorter than the separation between said two conical surfaces at their respective radii, means supporting said second conical surface for rotation about said common axis, a coaxial transmission line having an inner and an outer conductor, said first conical surface being supported by said transmission line and coupled to the inner conductor of said transmission line, means coupling said outer conductor of said transmission line to said second conical surface, all of said parasitic elements being disposed between said conical surfaces at radii from said common axis smaller than the radius of either of said conical surfaces whereby said larger radius of said first conical surface serves to cause a relative decrease in the strength of said carrier component at higher elevation angles and the location and length of said parasitic elements allows the strength of said modulation component to remain relatively unaffected at higher elevation angles so that said antenna produces a radiation pattern wherein the radio of said modulation component to said carrier component remains substantially constant over a wide range of space elevation angles.

4. An omnirange beacon antenna for producing a rotating multilobed pattern of radiation comprising first and second oppositely directed conical conductive surfaces disposed as bodies of revolution about a common axis, a coaxial transmission line having an inner and an outer conductor, said second conical conductive surface having a radius larger than the radius of said first conical conductive surface, said second conical conductive surface being supported by said coaxial transmission line and coupled to said inner conductor of said transmission line, means supporting said first conical surface for rotation about said common axis, first, second, third and fourth cylinders coaxially disposed about said common axis, said first cylinder being conductive and fixedly attached to said outer conductor of said transmission line, said second cylinder being conductive and disposed upon said first conductive conical surface near the apex of said surface and spaced apart from said first cylinder by one-tenth wavelength of the frequency of operation of said antenna, said third and fourth cylinders being dielectric and disposed on the opposite side of said first conical surface from said second cylinder, said third and fourth cylinders lying in between said two conical surfaces, a fundamental parasitic element disposed on said third cylinder, a plurality of equally spaced parasitic elements disposed on said fourth cylinder, drive means coupled to said support means for rotating said second, third and fourth cylinders and said first conical surface as a unit about said common axis, said third cylinder having a radius smaller than said fourth cylinder, said fourth cylinder having a radius appreciably smaller than the radii of both said first and second conical surfaces whereby said antenna produces a rotating multilobed pattern of radiation having a relatively constant ratio of modulation signal strength to carrier signal strength over a wide range of space elevation angles.

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