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2,545,472

RADIO SYSTEM

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FIG. 1.

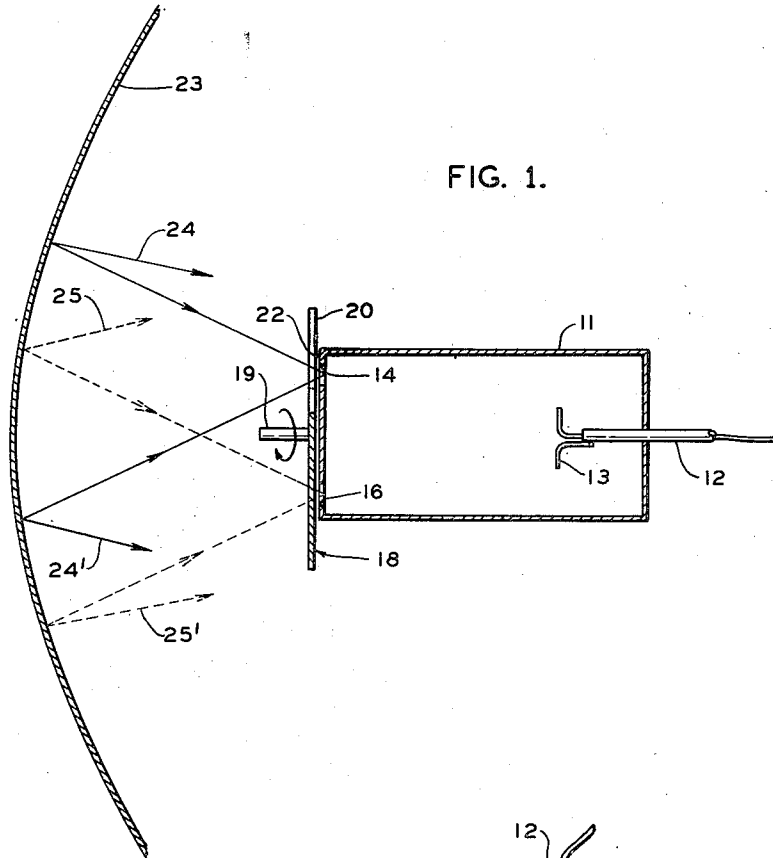
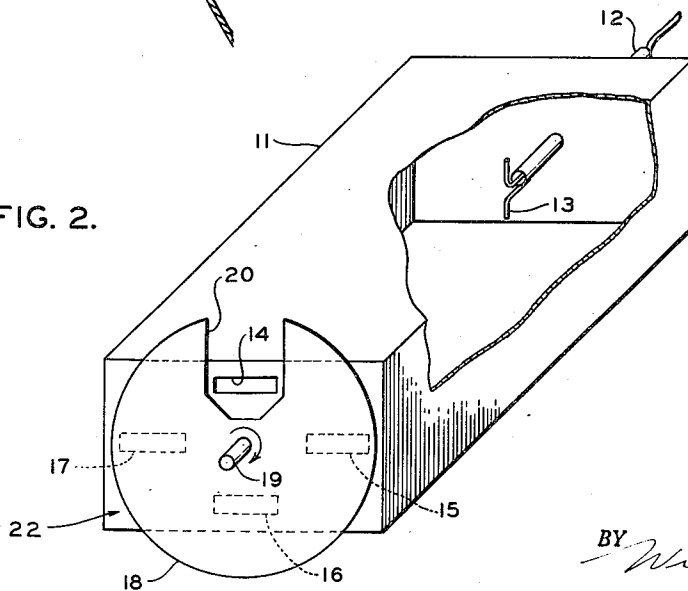


FIG. 2.



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RADIO SYSTEM

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6 Claims. (Cl. 250—33.65)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to directional antennas, particularly of the type useful for directional systems operating in the UHF region, or higher.

In accordance with one well known type of direction finding system, known as the "double tracking system," the antenna lobe pattern is abruptly shifted back and forth in azimuth and/or elevation to provide angularly-displaced, partially-overlapping response lobes. It is a principal object of this invention to provide an improved directional antenna for this purpose, which is electrically and mechanically simple.

To this end, there is provided a cavity resonator positioned along the axis of a curved reflector, preferably having a parabolic cross section. Situated within said cavity is a wave transducer in the form of a dipole. The front face of said cavity lies substantially in the focal plane of the reflector, and has slots thereon which are symmetrically displaced from the focal axis. By means of a rotating shutter, the slots are sequentially exposed so that only one slot at a time is effective. Because said slots are off focus, the directional characteristic of the antenna system will vary with the variation in direction of displacement of the sequentially exposed slots from said focus.

For a better understanding of the invention, together with other and further objects thereof, reference is made to the following description, taken in connection with the accompanying drawing; wherein like parts are indicated by like reference numerals and wherein:

Fig. 1 is a sectional view of the invention, showing the cavity resonator and reflector; and

Fig. 2 is an isometric view of the cavity resonator, with a portion broken away to show the dipole situated therein.

Referring to the drawing, there is shown a rectangular cavity resonator 11, in which there is supported a transducer, which may be in the form of a dipole 13 or any equivalent thereof. Said dipole is coupled, by means of a transmission line 12 extending through the rear wall of the cavity, to a receiver and/or transmitter. The design is such that the resonator operates in accordance with the $TE_{0,1,1}$ mode (electric lines vertical) and provides a vertically polarized wave; although other modes can be utilized.

The front face 22 of the cavity is positioned in the focal plane of a reflector 23, which is pref-

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erably paraboloidal in shape, and has cut therein rectangular slots 14, 15, 16, and 17, symmetrically displaced from the axis of said reflector. Slots 14 and 16 are directly above and below said axis, while slots 15 and 17 are on either side of said axis and parallel to the other slots. The longer dimension of said slots is about one-half wave length long; while the shorter dimension is not critical and can be adjusted to provide maximum signal strength. It will be noted that the polarization is always perpendicular to the longer edge of the slot. Each slot is the equivalent of a dipole; and since said slots are offset from the focus of the reflector, maximum energy transfer through each slot will occur along a direction which is at an angle to the axis of the reflector. Thus solid lines 24 and 24' indicate the direction of reflected energy emerging from upper slot 14, while dotted lines 25 and 25' indicate the direction of reflected energy from lower slot 16.

A disc 18, coaxial with the axis of the reflector and mounted on a rotating shaft 19, has a section 20 cut out so that it will expose only one slot at a time as it is rotated. Said disc may be mounted for rotation adjacent the front face of the cavity, either on the outside of said cavity, as shown, or on the inside thereof. As a result, energy transfer will take place only through one slot at a time, and the effective direction of said transfer will be continuously shifted so that four lobe shifts will be obtained successively; two lobe shifts being in azimuth and two in elevation. If lobe shifting along one dimension is desired, i. e., only in elevation or azimuth, a reflector in the form of a cylindrical parabola and two slots on opposite sides of the focal axis will be sufficient. Spherical reflectors may be used, with the slots displaced from the effective focal point.

From the above description, it will be seen that the invention provides an efficient antenna system in which lobe shifting can be accomplished without any switching of circuit elements and with a minimum of moving parts.

While there has been described what is at present considered a 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; and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A directional antenna system comprising a paraboloidal reflector, a rectangular resonant

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cavity having a wave transducer coupled thereto, one side of said cavity facing said reflector, and being situated in the focal plane thereof, said side having four slots symmetrically displaced from the focal axis of said reflector, and a rotating shutter for closing all but one of said slots.

2. A directional antenna system comprising a curved reflector, a resonant cavity having a wave transducer coupled thereto, one side of said cavity being situated in the vicinity of the effective focal plane of said reflector, said side having at least four apertures therein displaced from an axis of symmetry of said reflector, and rotating shutter means for closing all but one of said apertures.

3. The system of claim 2, wherein said apertures have the form of rectangles whose respective sides are parallel to one another and wherein the longer dimension of each of said rectangular apertures is substantially one-half wave length long.

4. The system of claim 2, wherein said wave transducer is in the form of a dipole.

5. The system of claim 2, wherein each of said apertures forms a dipole off focus with respect to said reflector.

6. A directional antenna system including: a paraboloid reflector; a cavity resonator having a

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wave energy transducer coupled thereto, one side of said resonator facing said reflector, said side being substantially disposed in the focal plane of said reflector and having a plurality of apertures therein arranged along a circle about the axis of said reflector; and a shutter rotatable about said axis and having a form to uncover in single succession each one of said apertures, said shutter comprising a disc having a radially disposed portion cut out therefrom.

MORRIS KLINE.

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