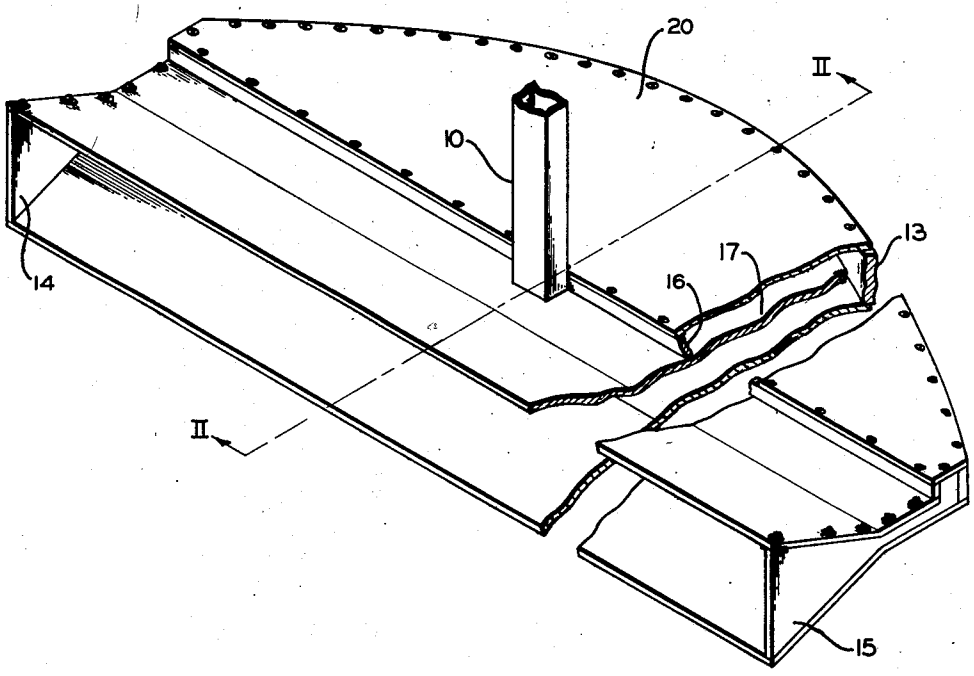
May 12, 1953 LAN JEN CHU ET AL 2,638,546

PILLBOX ANTENNA

Filed March 14, 1946

FIG. 1



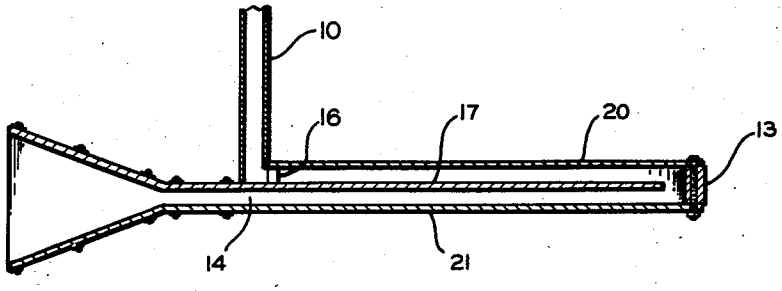


FIG. 2

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PILLBOX ANTENNA

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This invention relates to an antenna, and more particularly to a pillbox antenna having two layers so arranged that the feed and radiating apertures do not obstruct each other.

Line sources of electromagnetic energy combined with cylindrical reflectors have found considerable use in microwave antenna design. The pillbox, a short length of parabolic cylinder connecting two parallel plates, is one type of line source which has been used extensively, despite some serious disadvantages.

There are two major disadvantages in the use of a conventional pillbox in an antenna system. First, the pillbox feed, by obstructing the aperture, lowers the power gain and increases the intensity of secondary lobes in the radiation pattern of the antenna. Second, energy reflected into the feed from the parabolic back plate of the pillbox makes broad-banding, or impedance matching over a broad frequency band, impossible without the incorporation of a compensating device, which causes further degeneration of the pattern.

It is an object of this invention to provide an improved pillbox antenna.

It is another object of this invention to provide a pillbox antenna having an aperture free from obstructions.

It is a further object of this invention to provide a pillbox antenna which is properly matched in impedance to a feed over a broad frequency band.

It is still another object to provide a pillbox antenna having two separated sections, one above the other coupled by a toroidal bend, with the feed in one section and the aperture in the other.

These and other objects will be more apparent upon consideration of the following description, together with the accompanying drawings, in which:

Fig. 1 is a cutaway perspective view of an embodiment of this invention; and,

Fig. 2 is a sectional view along line II—II of Fig. 1.

Referring to the drawings, a conducting parabolic reflector 13, comprising a short section of parabolic cylinder, is closed at its ends by conducting top and bottom plates 20 and 21, respectively. An intermediate conducting plate 17, having a parabolic edge conforming to the curvature of parabolic reflector 13, is fixed midway between plates 20 and 21, forming a septum, with a uniform separation being maintained between the parabolic edge of plate 17 and parabolic reflector 13.

Plates 17 and 21 are extended beyond the focus of parabolic reflector 13 and are flared to form an aperture. Top and bottom plates 20 and 21 and septum plate 17 are fastened to end plates 14 and 15, which form the end boundaries of the aperture.

A feed, comprising the open end of a waveguide transmission line 10, is positioned at the focus of reflector 13 and is terminated between plates 17 and 20. The aperture formed by plates 17 and 20 is closed by conducting strip 16 except at the center, where the feed is introduced.

It can be seen easily that the electromagnetic energy introduced into the pillbox by the feed will be propagated through the space between plates 17 and 20 and will be coupled to the space between plates 17 and 21 through the opening between parabolic reflector 13 and the parabolic edge of plate 17. The energy reflected by parabolic reflector 13 will be propagated through the space between plates 17 and 21, arriving at the flared aperture with a uniform phase front. It will be noted that the radiating aperture is free from obstruction by the feed as is the case in the conventional pillbox. By reciprocity, the pillbox will produce equally satisfactory results when used for either transmitting or receiving electromagnetic energy.

Since certain changes may be made in the above described antenna and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A pillbox antenna comprising, a short, conductive, parabolic reflecting cylinder axially terminated in first and second substantially parallel flat conductive plates, an intermediate substantially flat conductive plate centrally disposed between said first and second plates, said intermediate plate having a substantially parabolic edge within said pillbox and conforming to the curvature of said parabolic reflector, said parabolic edge being uniformly separated from said parabolic reflector, a conductive strip lying in a plane through the focal line of said parabolic cylinder separating said first and said intermediate conductive plates, and a transmission line coupled through said conductive strip to said parabolic reflector between said first and said intermediate conductive plates, said second and said intermediate plates being flared outwardly.

2. A pillbox antenna comprising, a short parabolic reflecting cylinder axially terminated in first

and second flat conductive plates, and an intermediate conductive plate centrally disposed between said first and second plates, said intermediate plate having a shape substantially similar to that of said first and second plates and being so disposed adjacent the parabolic surface of said cylinder as to form an opening for transferring energy between the sections of said parabolic cylinder.

3. A pillbox antenna comprising, a short parabolic reflecting cylinder axially terminated in first and second flat conductive plates, and an intermediate conductive plate centrally disposed between said first and second plates and lying in a plane substantially parallel to the planes of said first and second plates, said intermediate plate having a substantially parabolic edge conforming to the curvature of said parabolic reflecting cylinder, said parabolic edge being uniformly separated from said parabolic cylinder.

4. A pillbox antenna comprising, a short parabolic reflecting cylinder axially terminated in first and second parallel conductive plates, an intermediate conductive plate being centrally disposed between said first and second plates, and lying in a plane substantially parallel to said first and second plates, said intermediate plate having a substantially parbolic edge conforming to the curvature of said parabolic cylinder, said parabolic edge being uniformly separated from said parabolic reflector, and transmission means coupled to said reflector between said first and said intermediate plates, said intermediate plate and said second plate being outwardly flared at the edges opposite said parabolic edge.

5. A pillbox antenna comprising a parabolic reflecting cylinder axially terminated in first and second conductive plates, a third conductive plate disposed perpendicular to and bisecting the focal line of said reflecting cylinder, said third conducting plate dividing said reflecting cylinder into two substantially similar reflecting cylinders and being so disposed adjacent the parabolic surface of said cylinder as to form an opening for permitting the reflection of energy from one to the other of said two reflectors, and separate energy transfer means coupled to each of said reflectors, said energy transfer means being substantially completely isolated one from the other.

6. A pillbox antenna comprising a parabolic reflecting cylinder axially terminated in first and second conductive plates, a third conductive plate disposed perpendicular to and bisecting the focal line of said reflecting cylinder, said third conducting plate dividing said reflecting cylinder into two substantially similar reflecting cylinders and being so disposed relative to the reflecting cylinder as to form an opening for permitting transfer of energy between said two reflectors, a wave guide connected to one of said reflectors substantially at the focal line thereof and a flared horn formed at the extremities of the other of said two reflectors.

7. A pillbox antenna comprising a parabolic reflecting cylinder axially terminated in first and second flat conductive plates, an intermediate plate parallel to said first and second plates and equally spaced therefrom by an amount less than a half wave length at the frequency of operation

of said antenna, said intermediate plate dividing said cylinder into two sections and being so disposed adjacent the parabolic surface of said cylinder as to form an opening between the sections of said parabolic cylinder.

8. A pillbox antenna for providing an unobstructed line source of energy comprising, a parabolic reflecting cylinder axially terminated in first and second plates, an intermediate plate parallel to said first and second plates and dividing said reflecting cylinder into two substantially similar reflectors, said intermediate plate being uniformly spaced from said reflecting cylinder, transmission means coupled to one of said reflectors, and energy interchange means at the mouth of the other of said reflectors for providing said unobstructed line source of energy.

9. A pillbox antenna comprising a parabolic reflecting cylinder axially terminated in first and second substantially parallel, flat conductive plates, an intermediate conductive plate perpendicular to and bisecting the focal line of said reflecting cylinder, said intermediate plate having a substantially parabolic edge within said reflecting cylinder and conforming to the curvature thereof, said parabolic edge being uniformly spaced from said reflecting cylinder, a conductive strip lying in a plane through the focal line of said reflecting cylinder, and transmission means coupled through said conductive strip to the portion of said reflecting cylinder lying between said first and intermediate plates.

10. A pillbox antenna comprising a parabolic reflecting cylinder axially terminated in first and second substantially parallel conductive plates, an intermediate conductive plate perpendicular to and bisecting the focal line of said reflecting cylinder, said intermediate plate having a substantially parabolic edge within said reflecting cylinder and conforming to the curvature thereof, said parabolic edge being uniformly spaced from said parabolic reflecting cylinder, a conductive strip disposed in a plane including that portion of the focal line of said parabolic reflector included between said first and said intermediate conductive plates, said conductive strip having an opening formed therein, a wave guide terminated by said intermediate plate and having a lateral opening in register with said opening in said conductive strip, said registered openings being centered on the focal line of said reflector, said second and intermediate plates extending outwardly beyond said first conductive plate and being flared at the extremities thereof to form an electromagnetic horn.

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