March 18, 1952 H. J. RIBLET 2,589,433

WAVE GUIDE FEED FOR CYLINDRICAL PARABOLOID

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FIG. 1

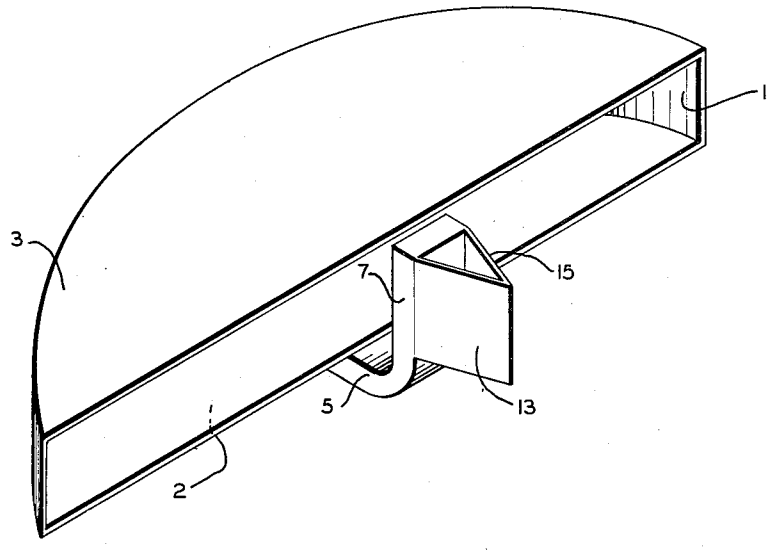

FIG. 2

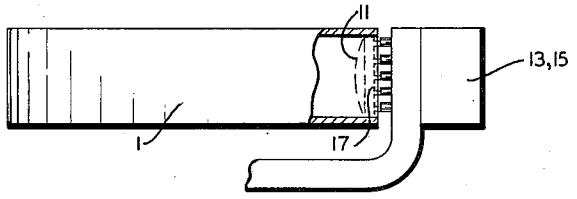

FIG. 3

FIG. 4

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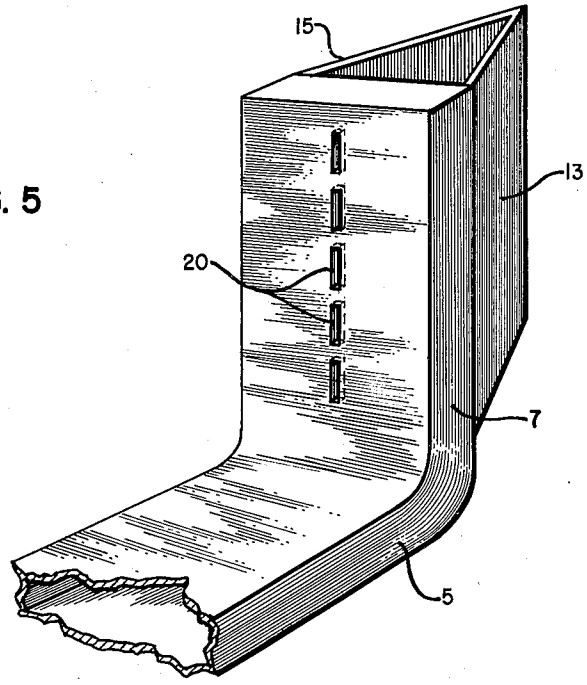
FIG. 5



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WAVE GUIDE FEED FOR CYLINDRICAL PARABOLOID

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9 Claims. (Cl. 250—33.65)

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This invention relates to directional microwave antennas, and in particular to an improvement in the feed for antennas using a principal concave reflector in the form of a portion of a parabolic cylinder. One widely used form had a reflector comprising a portion of a parabolic cylinder lying between two parallel end plates each perpendicular to the elements of the cylinder, and the feed for this consisted of a series of radiating elements along the focus, and energized from a rectangular wave guide so that the energy distribution to the elements was sinusoidal across the aperture of the reflector with maximum at center and minimum at the top and bottom of the aperture. The radiating elements were either radiating slots or dipoles. This apparatus produced a relatively narrow directional radiation beam, however, because of the fact that the wave guide which energized these elements was necessarily located within the reflected field and presented an obstruction to it there resulted seriously large secondary lobes of radiated energy on each side of the main lobe.

It is an object of this invention to provide apparatus to decrease the relative size of the secondary lobes of such an antenna system. Other objects and uses will appear from the following description and explanation.

Fig. 1 is a perspective view of an antenna which includes a parabolic cylindrical reflector and a portion of a rectangular wave guide feed to the same and also shows two conducting plates positioned like a prow on the wave guide pointed in the direction of reflected radiation. It is these two plates which embody the principle of the invention to produce the desired object;

Fig. 2 is a side view of the embodiment shown in Fig. 1; and

Figs. 3 and 4 are diagrams illustrating the radiation beam patterns produced by the earlier device and by the improved feed having the conducting plates of this invention, and shows clearly the considerable reduction in the side lobes.

Fig. 5 is a perspective view of a rectangular wave guide feed that may be equivalently substituted for the wave guide feed shown in the embodiment of Figs. 1 and 2.

Referring now to Fig. 1 there is shown a conductive reflector 1 having the shape of a portion of parabolic cylinder, the elements thereof being depicted as vertical in the drawing. The reflector 1 is partially enclosed by plane conductive sheets 2 and 3 extending forward from the upper and lower edges respectively of the reflector 1

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perpendicularly to the elements thereof, and extending out as far as the aperture of said reflector which aperture includes the focus of said reflector. Since the reflector is cylindrical and not paraboloidal the focus is not a point but a line parallel to the elements which may be referred to as the focal line.

Also shown is a rectangular wave guide 5 a portion of which marked 7 extends across the aperture of the reflector 1 substantially along the focal line. An array of dipoles (not shown in this view; see Fig. 2) positioned along said focal line within the aperture is energized from said guide, the respective dipoles being adapted to pick up and radiate an amount of energy so as to produce a distribution of energy along the focal line having the shape of a sinusoid across the aperture with the maximum at the center of the aperture as suggested diagrammatically in Fig. 2 by dotted line marked 11. The reflector and guide may be mounted in any suitable conventional fashion, for example, similar to that described in the application of Thomas Joseph Keary, Serial No. 599,162, filed June 13, 1945.

The preferred embodiment of the principle of this invention as applied to this reflecting antenna is constituted by two conducting plane plates 13 and 15 (or a single plate formed to the same shape). These plates 13 and 15 (or an equivalent single plate) are formed into the sides of a narrow wedge and are mounted with the base along the side of the wave guide 7 away from the reflector 1 extending across the aperture. The apex is pointed away from the reflector 1 and is parallel to the focal line. There results thus a prow shaped streamlining member of conductive material positioned as to the energy reflected from the reflector 1 behind the obstruction thereto presented by the section of wave guide 7 across the aperture. This shape has been found helpful in materially reducing the side lobes which are present in the pattern of radiation.

Fig. 3 illustrates the pattern of a similar antenna which does not have the "streamlining" wedge while Fig. 4 shows the beam pattern of the above described antenna having it. It will be noted that the secondary lobes are much smaller in proportion to the respective main lobe in the latter case.

Fig. 2 is a diagrammatic side view of the embodiment of Fig. 1 and shows in sketch the reflector 1, and near the focal line the wave guide 7 upon which are mounted an array of dipoles 17 of the side toward the reflector 1, and on the

side away from the reflector 1, the metallic wedge or streamlining prow 13 and 15 which has been described in detail above.

The radiating dipoles 17 of the rectangular wave guide feed, as shown in Fig. 2, may be replaced by equivalent radiating slots 20, as shown in Fig. 5, without changing the operation of the invention.

While a specific reflector has been described herein and a specific wave guide for illuminating the same, it must be understood that the principles of this invention may be applied to other forms of reflectors and guides. Indeed wherever collimated radiation or radiation with substantially a plane wave front must pass an obstruction certain undesired diffractive effects of the obstruction may be reduced by similarly "streamlining" the obstruction by the addition of conductive members to alter the external shape of the obstruction.

What is claimed is:

1. A directional microwave antenna, comprising a parabolic cylindrical reflector, a wave guide having a portion thereof extending across the aperture of said reflector substantially at the focus thereof, an array of radiating slots in the side of said guide adjacent to said reflector adapted for being energized from said guide with respective intensities proportioned to accomplish a sinusoidal distribution of radiation across the aperture of said reflector having a maximum value at the center, and a conductive prow-shaped member mounted along the side of said guide away from said reflector and extending across said aperture.

2. A directional microwave antenna comprising a parabolic cylindrical reflector, a wave guide having a portion thereof extending across the aperture of said reflector substantially at the focal line thereof, an array of radiating dipole elements located at the side of said guide adjacent to said reflector adapted to be energized from said guide with respective intensities proportioned to accomplish a sinusoidal distribution of radiation across the aperture of said reflector having a maximum value at the center, and a conductive prow-shaped member upon the side of said guide away from said reflector and extending across said aperture, the apex of said prow-shaped member being substantially parallel to said focal line.

3. A directional microwave antenna comprising a concave reflector formed with an aperture, means including a wave guide for illuminating said reflector, a section of said wave guide obstructing the aperture of said reflector, and a conductive prow-shaped member mounted upon said wave guide section upon the side thereof away from said reflector and extending across said aperture.

4. A device for reducing the side lobes of radiation from a directional microwave antenna having a concave reflector, said reflector being illuminated by a wave guide feed having a section extending across the aperture of said reflector,

said device comprising a conductive extension upon said section and on the side thereof away from said reflector, said conductive extension being tapered in the direction of radiation from said reflector.

5. A microwave antenna feed comprising a hollow wave guide, means for coupling energy to and from said wave guide and a conductive wedge-shaped structure disposed upon said wave guide oppositely of said coupling means.

6. A microwave antenna feed comprising a hollow rectangular wave guide, energy transferring means in a wall of said wave guide and a conductive wedge extending and tapering from the opposite wall of said wave guide.

7. A microwave antenna feed comprising a hollow rectangular wave guide, energy transferring means in a wall of said wave guide and extending parallel to the wave guide longitudinal axis, and a conductive wedge disposed upon the opposite wall of said wave guide in the region of said energy transferring means and tapering therefrom to an apex parallel to said wave guide axis.

8. A microwave reflector feed comprising a rectangular wave guide having broad and narrow walls, a linear array of energy transferring elements disposed within one of the broad walls of said wave guide parallel to the wave guide longitudinal axis, and a wedge-shaped conductive member formed of two conductive plates extending from the edges of the other of said broad walls to an apex parallel to said linear array and said wave guide longitudinal axis, said wedge-shaped member being disposed upon said wave guide in the region of said linear array.

9. A microwave antenna system comprising a reflector having a predetermined focal line, a rectangular wave guide having broad and narrow walls and extending into the region of said focal line, a linear array of radiating elements disposed upon a broad wall of said wave guide in substantial coincidence with said focal line and coupled into said wave guide for transferring energy between said reflector and wave guide, and a conductive wedge-shaped structure formed of two conductive sheets extending from the edges of the other of said broad walls to an apex parallel and substantially equal in length to said focal line, said wedge-shaped structure being disposed on said wave guide in the region of said radiating elements.

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