June 12, 1951 S. J. MASON 2,556,969

ANTENNA REFLECTOR

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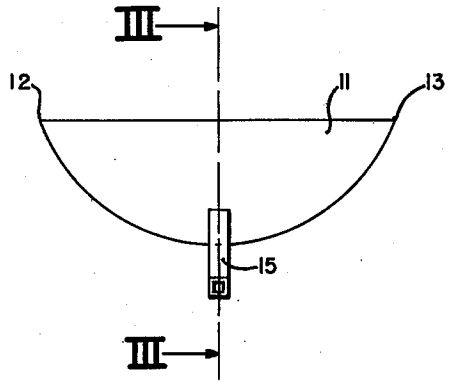

FIG. 2

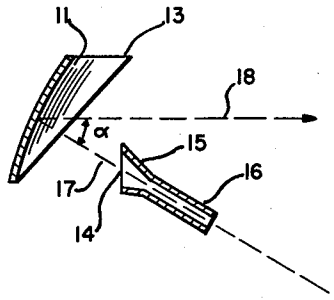

FIG. 3

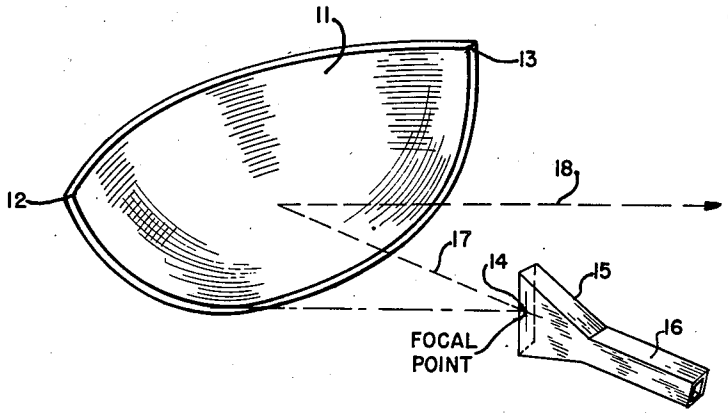

FIG. 1

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ANTENNA REFLECTOR

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This invention relates to reflectors for reflecting electromagnetic radiation and more particularly to sectional paraboloidal reflectors with specially shaped peripheries for use with surface search radar antennas.

For surface search radar it is desirable to concentrate the radiation from the antenna into as small a sector of azimuth as possible in order to secure good definition of targets and for high resolving power to distinguish between closely spaced targets. Any appreciable radiation in other than the selected azimuth is undesirable since it introduces false target indications on the radar. These undesirable secondary radiations occur with ordinary paraboloidal reflectors and they are referred to as side lobes. For surface search radars, these side lobes are troublesome only when they occur in the azimuth radiation pattern. Azimuth side lobes may be caused by diffraction of waves reflected from the paraboloidal reflector, or dish; by diffraction of waves emerging from the dish by a horn or other feed obstructing them; or by direct radiation from the feed.

The general object of the present invention is to provide a novel sectional paraboloidal antenna reflector which will reduce undesired side lobe radiation to a minimum.

Another object of the present invention is to provide a sectional paraboloidal reflector with a specially shaped periphery to secure low side lobe radiation in the azimuth pattern.

A further object of the present invention is to provide a novel sectional paraboloidal reflector with asymmetric feed to secure low side lobe radiation in the azimuth pattern.

These and other objects will be apparent from the following specification when taken with the accompanying drawings in which:

Fig. 1 is a perspective view of one embodiment of the invention as applied to a surface search radar antenna.

Fig. 2 is a front view of the embodiment shown in Fig. 1.

Fig. 3 is a side view in partial section along the line III—III of the embodiment shown in Fig. 1.

Referring to Figs. 1, 2, and 3, a reflector, or dish 11, has its periphery shaped as shown, the lateral extremities 12 and 13 of said dish being pointed.

A reflector as contemplated by this invention may be produced by passing a first plane through a paraboloid parallel to the axis of generation of the paraboloid and by passing a second plane through the paraboloid at an acute angle to the

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first plane. That is to say, such a paraboloidal section may be formed by cutting a paraboloid along planes as heretofore stated. A reflector formed in the above manner will have the upper and lower longitudinal edges thereof intersecting each other in a point at the opposite extremities thereof. The lateral distance from extremity 12 to extremity 13 is substantially twenty (20) wavelengths of the radiation with which the antenna is used. The internal reflecting surface of dish 11 is curved to form a paraboloid whose focus is at point 14 which also coincides with the opening of an electromagnetic horn 15. Horn 15 is attached to a wave guide 16 which serves to guide the radar energy between the radar set and the antenna dish 11. The purpose of horn 15 on the end of wave guide 16 is to match the impedance of said wave guide 16 to the impedance of space thereby providing for efficient transfer of energy, and its construction follows conventional wave guide design. Horn 15 has its axis 17 inclined to the horizontal at an angle α but the plane of the openinng 14 of said horn 15 is vertical. Radiation follows axis 17 and is reflected by the dish 11 along a path 18 above the horn 15.

Bearing in mind the three previously mentioned causes of side lobe radiation, it can readily be understood that the special shape of the dish periphery operates to reduce side lobe radiation due to diffraction of waves reflected from the dish; placement of the horn opening 14 below the radiated beam 18 operates to limit side lobe radiation due to diffraction of waves emerging from the dish 11 by the horn feed 15; and the construction of the horn opening 14 so that its plane is not normal to the horn axis 17 operates to reduce side lobe radiation caused by direct radiation from the feed. Thus it can readily be understood since the present invention attacks all three of the causes of side lobe radiation from a paraboloidal reflector, a novel antenna system relatively free from troublesome side lobe radiation in the azimuth pattern results.

What is claimed is:

1. A reflector for reflecting radio microwave radiation comprising a paraboloidal section formed by passing a plane parallel to the axis of generation of a paraboloid intersecting the surface of said paraboloid and by passing a second plane at an acute angle to said first plane intersecting the surface of said paraboloid, the lines of intersection of said planes with the surface of said paraboloid defining the opposite longitudinal edges of said reflector.

2. A reflector for reflecting radio microwave

radiation comprising a paraboloidal section formed by passing a plane parallel to the axis of generation of a paraboloid intersecting the surface of said paraboloid and by passing a second plane at an acute angle to said first plane intersecting the surface of said paraboloid, the lines of intersection of said planes with the surface of said paraboloid defining the opposite longitudinal edges of said reflector, the open ends of said longitudinal edges each intersecting in a point.

3. A reflector comprising a paraboloidal section formed by passing a plane parallel to the axis of generation of a paraboloid intersecting the surface of said paraboloid and by passing a plane at an acute angle to said first plane intersecting the surface of said paraboloid, the upper and lower edges of said paraboloidal section intersecting each other in a point at the opposite extremities thereof.

4. An antenna for radio frequency radiation comprising a paraboloidal section reflector formed by passing a plane parallel to the axis of generation of a paraboloid intersecting the surface of said paraboloid and by passing a second plane at an acute angle to said first plane intersecting the surface of said paraboloid, the lines of intersection of said planes with the surface of said paraboloid defining the opposite longitudinal edges of said reflector; and an electromagnetic feed horn having its opening coinciding with the focus of said paraboloid, the axis of said horn being inclined to the axis of said paraboloid, said axis of said horn pointing substantially at the center of said paraboloidal section, and the plane of the opening of said horn being perpendicular to said axis of said paraboloid.

5. A reflector comprising a conductive, paraboloidal section formed by passing a plane parallel to the axis of generation of a paraboloid intersecting the surface of said paraboloid and by passing a second plane at an acute angle to said first plane intersecting the surface of said paraboloid, said planes being so positioned with respect to said axis of generation that the major portion of said section lies on one side of said axis of generation, the upper and lower edges of said paraboloidal section intersecting each other in a point at the opposite extremities thereof.

6. A reflector comprising a conductive paraboloidal section formed by passing a plane parallel to the axis of generation of a paraboloid and at a predetermined distance from said axis, intersecting the surface of said paraboloid, and by passing a second plane at an acute angle to said first plane intersecting the surface of said paraboloid, said planes being taken such that substantially all of said section lies on one side of said axis, the upper and lower edges of said paraboloidal section intersecting each other in a point at the opposite extremities thereof.

7. An antenna for radio frequency radiation comprising a conductive paraboloidal section formed by passing a plane parallel to the axis of generation of a paraboloid and at a predetermined distance from said axis intersecting the surface of said paraboloid, and by passing a second plane at an acute angle to said first plane intersecting the surface of said paraboloid, said planes being taken such that substantially all of said section lies on one side of said axis, the lines of intersection of said planes with the surface of said paraboloid defining the opposite longitudinal edges of said reflector, said edges meeting in a point at opposite extremities of said section and an electromagnetic feed horn having its opening coinciding with the focus of said paraboloid, the axis of said horn being inclined to the axis of said paraboloid and pointing substantially at the center of said paraboloidal section, the plane of the opening of said horn being perpendicular to said axis of said paraboloid, said horn lying in the plane perpendicular to said first mentioned plane that includes said axis, said horn being further positioned on the side of said axis opposite the major portion of said paraboloidal section.

8. An antenna for radio frequency radiation comprising a paraboloidal section reflector formed by passing a plane parallel to the axis of generation of a paraboloid, said plane intersecting the surface of said paraboloid, and by passing a second plane at an acute angle to said first plane, said second plane intersecting the surface of said paraboloid, the lines of intersection of said planes with the surface of said paraboloid defining the opposite longitudinal edges of said reflector; and an electromagnetic feed horn having its opening coinciding with the focus of said paraboloid, the axis of said horn ponting substantially at the center of said paraboloidal section.

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