

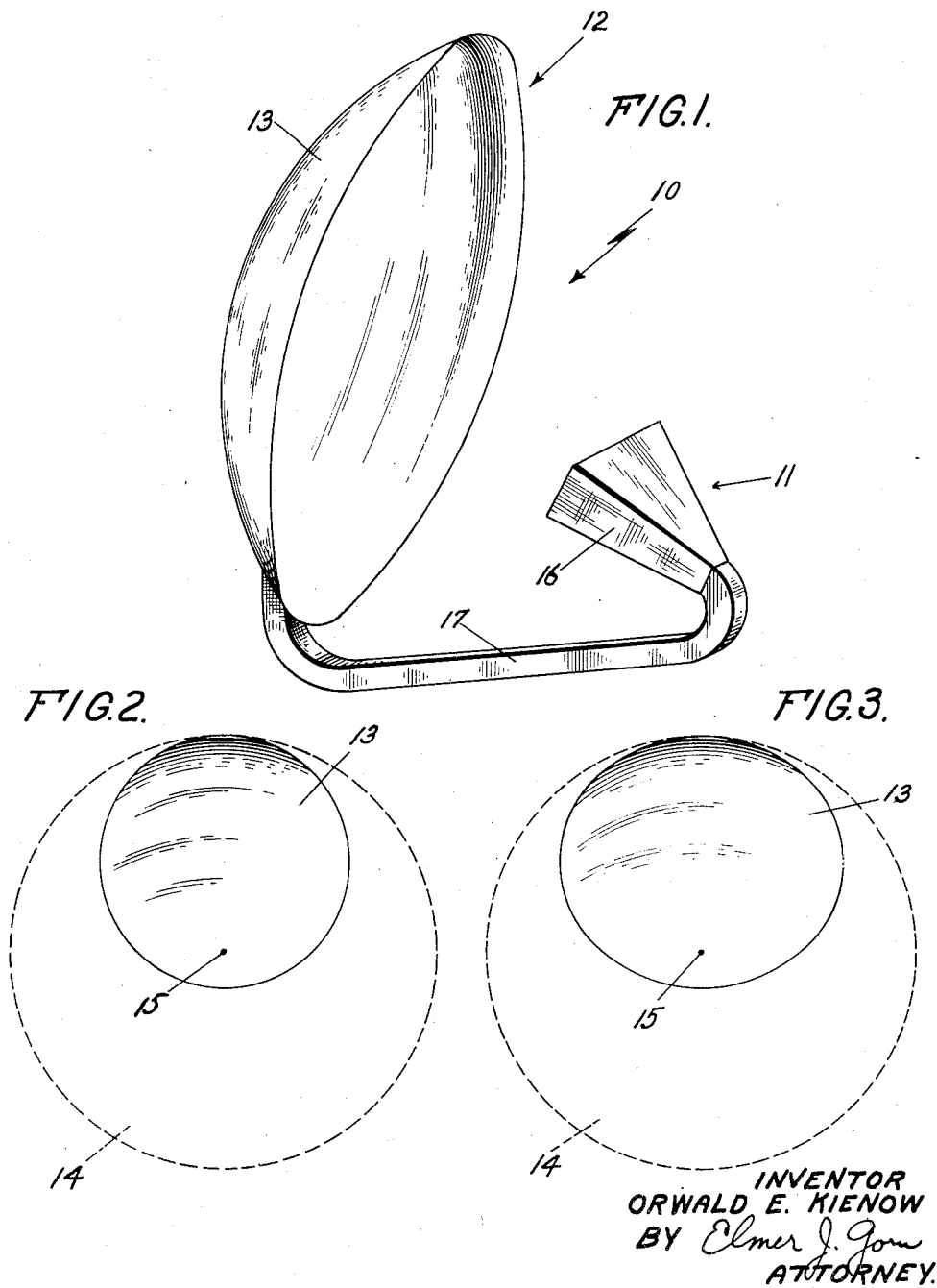
Dec. 19, 1950

O. E. KIENOW

2,534,271

ANTENNA SYSTEM

Filed Oct. 17, 1947



UNITED STATES PATENT OFFICE

2,534,271

ANTENNA SYSTEM

Orwald E. Kienow, South Acton, Mass., assignor
to Raytheon Manufacturing Company, Newton,
Mass., a corporation of Delaware

Application October 17, 1947, Serial No. 780,448

6 Claims. (Cl. 250—33.65)

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This invention relates to microwave antenna systems.

Such systems have heretofore comprised a reflecting element, generally in the form of a paraboloid, and a radiating element, such as an electromagnetic horn, disposed at the focal point of said paraboloid, with the line corresponding to the direction of maximum response of said radiating element intersecting the surface of said paraboloid substantially at the vertex thereof.

The objective of said systems is the projection into space of a highly directional, cylindrical, or other shaped beam of microwave energy. It has been found, however, that due to the location of the radiating element within the area of the projected beam, the desired pattern is not wholly attained, the resulting distortion causing an unwanted scattering of the energy of said beam whereby inaccuracies are introduced into calculations relying on the directive character of said beam. This is particularly disturbing where such systems are employed in precision radar installations and certain forms of communication equipment.

It is, therefore, the main object of the present invention to obviate the foregoing disadvantages and provide microwave antenna systems of increased directional accuracy.

It is a further object of the present invention to accomplish this purpose in a simple and expeditious manner.

These, and other objects of the present invention, which will become more apparent as the detailed description thereof progresses, are attained, briefly, in the following manner.

From a body of conventional paraboloid form, there is cut an off-center section, said section being circular, elliptical, or of any other shape, depending, in a well known manner, upon the final cross-section desired of the radiated beam. Said section, preferably, but not necessarily, includes within its borders the vertex of the paraboloid from which it is cut, and where such section includes said vertex, the ratio of the distances between said vertex and the furthest and nearest points therefrom on the periphery of said section should be appreciable, for example, of the order of four or more to one.

Disposed in advance of said section, substantially at the focal point of the original paraboloid, is a radiating element, for example, an electromagnetic horn, the plane of the mouth of said horn being so angularly disposed, with respect to the line between the vertex and the focal point of said paraboloid, that said section is equally

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illuminated by the energy emanating from said radiating element.

With such a construction, interference between the projected beam and the radiating element is held to a minimum and, sometimes, wholly eliminated; in any event, reduced to a point which does not substantially distort the desired radiation pattern.

In the accompanying specification there shall be described, and in the annexed drawing shown, an illustrative embodiment of the microwave antenna system of the present invention. It is, however, to be clearly understood that the present invention is not to be limited to the details herein shown and described for purposes of illustration only, inasmuch as changes therein may be made without the exercise of invention, and within the true spirit and scope of the claims hereto appended.

In said drawing:

Fig. 1 is a perspective view of a microwave antenna system incorporating the principles of the present invention; and

Figs. 2 and 3 are plan views illustrating, respectively, the taking of circular and elliptical cuts from a body of conventional paraboloid form.

Referring now more in detail to the aforesaid illustrative embodiment of the present invention, with particular reference to the drawing illustrating the same, the numeral 10 generally designates a microwave antenna system including a radiating element 11 for emitting or collecting electromagnetic energy, depending upon whether the equipment with which the system is used is a transmitter or receiver, and a reflecting element 12 for projecting into space the energy illuminating the same from the radiating element 11 or concentrating the energy collected thereby from space towards said radiating element 11, again depending upon whether the equipment with which the system is associated is a transmitter or receiver.

The reflecting element 12 consists of a section 13 cut off-center from a paraboloid 14 and may be circular, as shown in Fig. 2, or elliptical, as shown in Fig. 3, or of any other peripheral contour depending, in a manner well known to those skilled in the art, upon the cross-section desired of the radiation pattern of the system. Preferably, but not necessarily, the section 13 includes within its boundaries the vertex 15 of the paraboloid 14, and the ratio of the straight-line distances between said vertex and the furthest and nearest points therefrom on the periphery of

the section should be appreciable, for example, of the order of four or more to one.

The radiating element 11 may consist of a conventional electromagnetic horn 16 mounted at the outer end of a wave guide 17, said wave guide being supported in any suitable manner, for example, from the reflecting section 13, and being appropriately coupled at its other end to a transmitter or receiver not shown. The horn 16 is disposed substantially at the focal point of the original paraboloid 14, with its mouth in a plane which is at such an angle, with respect to a line between the vertex and focal point of said paraboloid, that the section 13 is substantially equally illuminated by the energy emanating from said horn. In other words, the response pattern of the horn 16 has its direction of maximum response lying along a line which intersects the surface of the section 13 at such a point that the energy about the periphery of said section is of substantially equal amplitude at all points about said periphery. This may be determined by measuring the power in the side lobes projected into space by the reflecting section and adjusting the angle of said horn until the power in said side lobes is of substantially equal amplitude at a plurality of points along a path following the periphery of said section.

It will be noted that in constructing the system as aforesaid, the radiating element 11 is located at such a point that it has a minimum or zero distorting effect upon the radiation pattern of the beam projected or received by the reflecting element 12, thereby appreciably increasing the directional accuracy of the system over what has heretofore been the case. It will further be noted that an antenna system made in accordance with the present invention is simple in construction, easy to fabricate and assemble, and admirably adapted to perform its intended function.

Other advantages of the present invention will readily occur to those skilled in the art to which the same relates.

What is claimed is:

1. A microwave antenna system comprising: an off-center section of a paraboloid; and a directive radiating element disposed substantially at the focal point of said paraboloid; the line corresponding to the direction of maximum response of said radiating element intersecting the surface of said section at a point equally to illuminate the edges of said section.

2. A microwave antenna system comprising: an off-center section of a paraboloid; and an electromagnetic horn disposed substantially at the focal point of said paraboloid; the line cor-

responding to the direction of maximum response of said horn intersecting the surface of said section at a point equally to illuminate the edges of said section.

3. A microwave antenna system comprising: a circular, off-center section of a paraboloid; and an electromagnetic horn disposed substantially at the focal point of said paraboloid; the line corresponding to the direction of maximum response of said horn intersecting the surface of said section at a point equally to illuminate the edges of said section.

4. A microwave antenna system comprising: an elliptical, off-center section of a paraboloid; and an electromagnetic horn disposed substantially at the focal point of said paraboloid; the line corresponding to the direction of maximum response of said horn intersecting the surface of said section at a point equally to illuminate the edges of said section.

5. A microwave antenna system comprising: an off-center section of a paraboloid; the surface of said section including the vertex of said paraboloid; and an electromagnetic horn disposed substantially at the focal point of said paraboloid; the line corresponding to the direction of maximum response of said horn intersecting the surface of said section at a point equally to illuminate the edges of said section.

6. A microwave antenna system comprising: an off-center section of a paraboloid; the surface of said section including the vertex of said paraboloid, and the ratio of the distances between said vertex and the furthest and nearest points therefrom on the periphery of said section being not less than about 4 to 1; and a directive radiating element disposed substantially at the focal point of said paraboloid; the line corresponding to the direction of maximum response of said radiating element intersecting the surface of said section at a point equally to illuminate the edges of said section.

ORWALD E. KIENOW.

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