

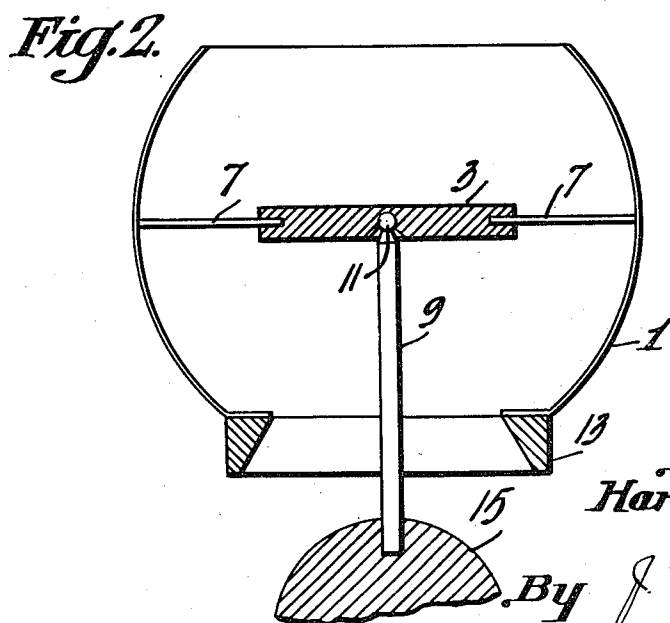
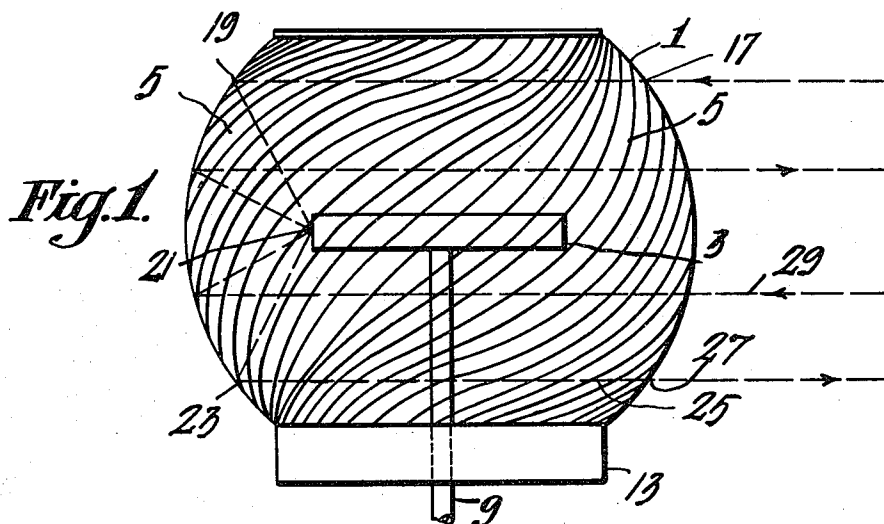
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H. IAMS

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REFLECTOR FOR RADAR NAVIGATION

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Inventor.
Harley Iams

By *J. L. Whittaker*
ATTORNEY

UNITED STATES PATENT OFFICE

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REFLECTOR FOR RADAR NAVIGATION

Harley Iams, Venice, Calif., assignor to Radio Corporation of America, a corporation of Delaware

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7 Claims. (Cl. 343—18)

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This invention relates to reflectors for radiant energy such as one type of said reflector, comprising a spherical lens surrounded by an equatorial band of reflecting material as described in copending application Serial No. 777,355 filed October 1, 1947 by Harley Iams and entitled "Radio reflectors." Said reflectors have the disadvantage of excessive weight for some applications, owing to the fact that the sphere is completely filled with dielectric material.

It is the principal object of the present invention to provide an improved type of omnidirectional reflector wherein dielectric material is not required. The invention will be described with reference to the accompanying drawing, wherein Figure 1 is a view in elevation of a reflector in accordance with the present invention and Figure 2 is a vertical section of the structure shown in Figure 1. Similar reference characters are applied to similar elements throughout the drawing.

The device in Figure 1 comprises generally two parts: a spherical shell 1 and a cylindrical or disc-shaped reflector member 3 disposed concentrically within said shell. Shell 1 is made up of a large number of wire or rod like conductors 5 lying in a somewhat spiral formation and tilted substantially 45 degrees from the vertical at the equator to the sphere. Thus as viewed by an observer from the axis, the conductors 5 would all appear inclined in the same sense at 45 degrees with the vertical. The conductors 5 are separated by a maximum distance of not more and preferably considerably less than $\frac{1}{2}$ wave length of the energy to be reflected. The vertical dimension of the reflector member 3 is not substantially less than $\frac{1}{2}$ wave length.

Referring to Figure 2 the spherical shell may be supported by arms 7 extending radially from the member 3 which is in turn supported on a vertical rod 9. In order to maintain an assembly in the proper position with reference to the horizontal plane, the connection between the rod 9 and the disc 3 includes a ball and socket joint 11, and a ring shaped weight 13 is secured to the bottom of the shell 1. The lower end of the rod 9 extends to a supporting member 15 which may be, for example the upper surface of a floating buoy. The radius of curvature of the cylindrical member 3 is approximately $\frac{1}{2}$ that of the sphere 1. Thus the cylindrical member is placed substantially at the conjugate focal surface of sphere 1 in the interior thereof.

The operation of the described device is as follows: Assume first that the incident radiation

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is vertically polarized. Energy striking the surface 1 at the point 17 is partly reflected and partly transmitted. The reflected energy goes out substantially in all directions and is not particularly directed toward the source. The transmitted energy is necessarily polarized in a plane perpendicular to the wires in the vicinity of the point 17 which are 45 degrees to the right. This energy strikes the inner surface of the sphere at the point 19, where the conductors 1 lie at an angle of 45 degrees to the left looking in the direction of energy flow. Thus the inner surface at the point 19 acts as a substantially perfect concave spherical reflector, and directs the ray to a point 21 on the cylindrical reflector 3. A second reflection occurs at the point 21, directing the ray to a point 23 on the inner surface of the sphere 1. Here a third reflection occurs, causing the energy to travel along a path 25 parallel to that of the incident ray. The polarization of the triply reflected energy is such that it passes through the spherical surface at the point 27 substantially without reflection and continues in the direction of the original source.

The above described sequence of reflections occurs with any other approximately horizontally incident rays such as the ray 29. Horizontally polarized energy is treated in substantially the same manner, approximately $\frac{1}{2}$ of the incident energy being lost by the initial reflection from the outside surface of the shell 1. It will be apparent that substantially all of the energy would be diffused if it were polarized in a plane parallel to the conductors 5 and thus completely reflected from the surface upon which it is initially incident and that the device would work with high efficiency if the polarization were perpendicular to the wires 5; however, it is usual in radio signalling and radar practice to employ either vertical or horizontally polarized energy.

I claim as my invention:

1. An omnidirectional reflector for returning incident radiant energy along a path comprising a plurality of conductive wires, each inclined at an angle of 45 degrees to the horizontal and disposed so as to define the surface of a sphere, a body of conductive material in the form of a right circular cylinder with its axis of revolution extending vertically through the center of curvature of said spherical surface, said cylindrical body having a height of at least $\frac{1}{2}$ wave length of the energy to be reflected.

2. In a reflector, a structure comprising a plurality of metallic members spaced by less than a half wavelength of the energy to be reflected,

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said members being disposed to define a surface of revolution for a complete revolution of the line generatrix thereof about an axis, said surface having at least one dimension greater than a half wavelength of the energy to be reflected, each said member being inclined in the same sense at an angle as viewed by an observer from said axis of 45 degrees with a line parallel to said axis.

3. A reflector comprising a plurality of metallic members spaced by less than a half wavelength of the energy to be reflected, said members being disposed to define a surface of revolution for a complete revolution of the line generatrix thereof about an axis, said surface having dimensions greater than a half wavelength of the energy to be reflected, each said member being inclined in the same sense at an angle as viewed by an observer from said axis of 45 degrees with a line parallel to said axis, and a metallic reflecting body within the defined surface and spaced from said members.

4. The reflector claimed in claim 3, said surface being a substantially closed surface.

5. The reflector claimed in claim 3, said surface being substantially a complete sphere.

6. The reflector claimed in claim 5, said metallic body having a reflecting surface in the shape

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of a right circular cylinder coaxial with said surface of revolution and completely encircling said axis.

7. The reflector claimed in claim 3, said surface being substantially a complete sphere, said metallic body having a reflecting surface substantially at the conjugate focal surface of said sphere in the interior thereof.

HARLEY IAMS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,625,946	Laird	Apr. 26, 1927
1,830,176	Schroter	Nov. 3, 1931
2,085,406	Zworykin	June 29, 1937
2,130,389	Gothe	Sept. 20, 1938
2,370,053	Lindenblad	Feb. 20, 1945
2,407,318	Mieher et al.	Sept. 10, 1946

FOREIGN PATENTS

Number	Country	Date
668,231	Germany	May 26, 1935
770,482	France	July 2, 1934