

Jan. 7, 1964

W. L. JONES

3,117,318

RADAR REFLECTOR

Filed April 29, 1960

2 Sheets-Sheet 1

Fig. 1

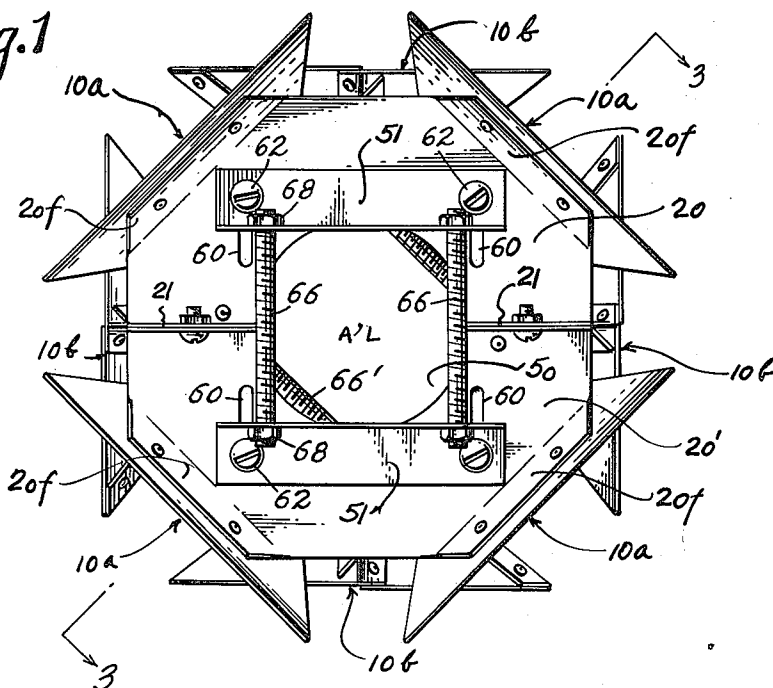
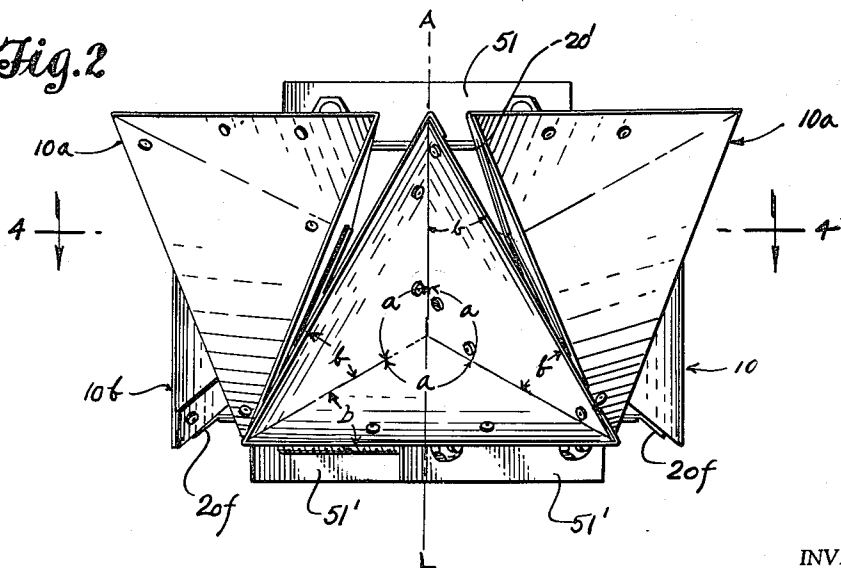


Fig. 2



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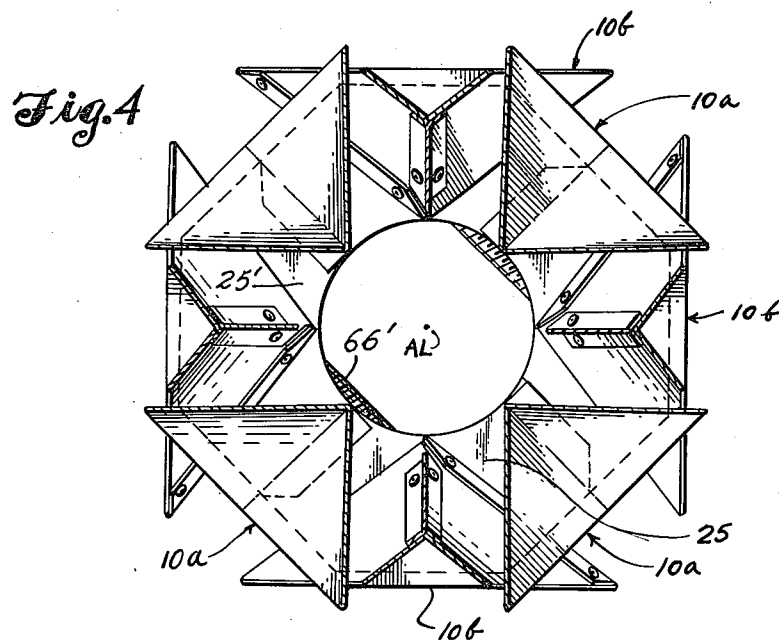
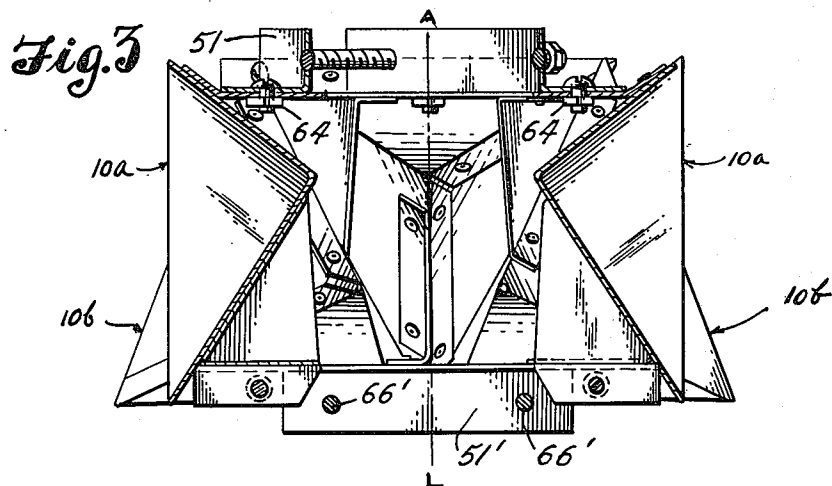
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RADAR REFLECTOR

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1 Claim. (Cl. 343—18)

This invention relates to improvements in radar reflectors. More particularly it has reference to reflectors of the character of that disclosed in a United States Patent Number 2,763,000 issued on September 11, 1956 to Edward K. P. Graham, described as comprising eight pyramidal reflecting bodies combined into a unit to provide reflecting power in all directions in a single plane.

The present invention resides in certain improvements in radar reflectors of the general character of the disclosure of the above identified Graham patent which provides, by reason of a certain change in relationship of the reflecting bodies, a unit of greater efficiency, which improves the target brightness on the viewing screen; which is more compact in its construction; which provides that all reflected rays will be reflected parallel to the incident rays, and which provides that the reflector unit can be rotated 45° in elevation or 360° azimuth with substantially constant performance.

More specifically stated, the present invention resides in the specific arrangement and relationship of the eight trihedral reflectors assembled in a circle to form a composite reflector that is especially useful on small boats and which will perform well through 360° of rotation regardless of roll or pitch of the reflector support.

The present invention is based upon that principle of radar operation that a pulse of high frequency energy transmitted in the form of a narrow beam will be reflected, at least in part, by a target object, back toward the pulse transmitter for reception and presentation as a "pip" on the viewing screen of the radar set. The brightness of the target, as it appears on the screen is a function of the amount of energy reflected to the radar set by the target.

In the present instance, brightness of the "pip" is enhanced by the improved arrangement of the radar reflectors, as will later be explained.

In accomplishing the previously mentioned and other objects of the present invention, I have provided the improved details of construction and assembly, the preferred forms of which are illustrated in the accompanying drawings, wherein:

FIG. 1 is a top view of the present reflector showing eight pyramidal reflecting bodies, as assembled for normal use of the reflector.

FIG. 2 is a side view of the assembly of reflecting bodies shown in FIG. 1.

FIG. 3 is a vertical, cross-section of the reflector, taken on line 3—3 in FIG. 1.

FIG. 4 is a horizontal section, taken on line 4—4 in FIG. 2.

Referring more in detail to the drawings:

It has been well shown in FIG. 1 that the present eight reflector bodies are symmetrically arranged about a central vertical axial line AL equally spaced therefrom at 45° intervals. The unit provided by the arrangement of reflector bodies will herein be described as comprising an upper assembly of four bodies, each of which bodies is designated, in its entirety, by reference numeral 10a, and a lower assembly of four bodies, each of which is designated, in its entirety, by reference numeral 10b. The four bodies 10a comprising the upper assembly are mounted at the same horizontal level, outwardly faced relative to the common axial line AL and equally spaced

2

therefrom with the outer bounding edges of their three sides coinciding with the four vertical sides of a square.

The four bodies 10b of the lower assembly, likewise, are mounted at the same horizontal level; are faced outwardly and are evenly spaced from the central axial line AL of the unit, at 90° intervals thereabout with their bounding edges at the open side of the trihedral reflectors, likewise coinciding with the four sides of a square but which square has been rotatably advanced 45° relative to the square first mentioned in connection with the description of the upper assembly.

Each reflector body comprises three equally dimensioned sidewalls of isosceles triangular form, each with a 90° vertex angle and 45° base angles; these three angles being designated, in FIG. 2, at a, b and b, respectively. The base edges of the triangular top walls of the upper trihedral bodies coincide with the same horizontal plane. It has been shown in FIG. 1 that the top walls of two adjacent reflector bodies are riveted or otherwise fixedly secured to angularly directed flanges 20f at opposite ends of upper horizontal supporting plates 20—20'. The two upper horizontal plates 20—20' are fixedly joined at their inside edges, as shown at 21 in FIG. 1, to rigidly secure the four reflecting bodies of the upper assembly in that 90° angular relationship in which they are shown in FIGS. 1 and 3.

The four reflector bodies 10b of the lower assembly have the bottom walls thereof similarly fixed to the lower horizontal supporting plates 25—25' and are held thereby in a 90° angular relationship to each other, but in the illustrated 45° angular relationship to the bodies of the upper set that has been shown particularly in FIGS. 1 and 4 of the drawings.

It is to be observed by reference to FIGS. 1 and 2 that the four reflector bodies that constitute each assembly are horizontally spaced. It is further to be observed that the base edges of the sidewalls of each of the reflector bodies of the lower assembly converge upwardly and are disposed between the downwardly diverging sidewalls of adjacent reflector bodies of the upper set. The reversed position of bodies of the upper and lower assemblies permits the four bodies of each assembly to be alternately received between bodies of the other assembly, as has been well shown in FIGS. 2 and 4. It will further be understood that, by reason of the isosceles triangular form of the wall forming members of the eight reflector bodies, the disposition of bodies of one group between bodies of the other group provides for the crossing or overlapping of the upper corner portions of the upper assembly of bodies with the lower corner portions of the lower assembly of bodies, as has been illustrated both in FIGS. 1 and 4.

To functionally support the unit from a vertical mast or pole, not shown, the horizontal supporting plates 20—20' and 25—25' that mount the assemblies of units are recessed at their inside edges to provide central vertical passages designated by numeral 50 in FIG. 1. The mast is adapted to extend vertically through the passages 50. A pair of elongated angle members or clamping bars 51 are mounted in parallel relationship on the upper surface of plates 20—20'. The ends of each clamping bar extend over a pair of elongated apertures 60 provided in the plates 20—20', and as shown in FIGURE 1, the apertures 60 extend perpendicular to the longitudinal axis of the clamping bars 51. Screws 62 extend vertically downwardly through bores formed in the ends of the clamping bars 51 and through the apertures 60. A nut 64 is threaded on the lower end of each screw 62 so that when the nuts are tightened, the clamping bars 51 are secured to the plates 20—20'. Each angle member or clamping bar 51 includes a vertically extending leg which has bores provided in each end thereof. Threaded

studs 66 extend through these bores and each stud 66 has a nut 68 threaded on each of its outer ends as shown in FIGURE 1. The studs 66 also extend across diametrically opposite sides of the passages 50 and in perpendicular relationship to the clamping bars 51. The plates 25—25' also have a pair of clamping bars 51' secured to their lower surfaces in the same manner and by the same means as the bars 51 are secured to the plates 20—20'. The clamping bars 51' also adjustably connected together by threaded studs 66' as shown in FIGURE 3. To secure the antenna unit to a mast extending through the passages 50, it is only necessary to loosen the nuts 64 and then urge the clamping bars into clamping engagement with the mast by rotating the nuts 68 onto the studs 66. This permits the screws 62 to slide within the apertures 60. The nuts 64 are then tightened on the screws 62 to secure the clamping bars to the mounting plates.

Assuming that the reflecting unit is so constructed and properly mounted by a vertical mast, a pulse transmitted from a radar set will be received thereby from any horizontal direction and will be reflected back along lines parallel to the lines of the transmitted pulse to give a bright target indication on the radar screen.

The angular and intermeshed arrangement of reflectors of the two assemblies places them at the same horizontal level, and in a compact circular arrangement, not disclosed in any similar device known to me.

There is a proven and decided advantage in that overlapping relationship of units of the upper and lower groups, shown in FIGS. 1 and 4, that is made possible by the spacing of the units in each group so that the vertex portions of their outwardly opening end areas can be brought within the base angle or corner portions of adjacent reflector bodies of the other group.

The details of construction provide a relatively simple and inexpensive unit to manufacture and the unit may be readily applied to or removed from a mast or the like.

What I claim as new is:

A radar reflector unit comprising eight substantially identical reflectors, each reflector comprising three plates of isosceles triangular form joined together at their edges so as to form a pyramid having three closed sides converging to an apex and an open triangular base having

three edges of equal length, a first group comprising four of said reflectors and a second group comprising four of said reflectors, the reflectors of each group fixedly arranged in equal angular spacing about a vertical axis, the bases of both groups of reflectors each lying in substantially vertical planes and the apexes of both groups of reflectors located between said bases and said axis, the bases of the first group having upper edges defining a first square and lying in an upper horizontal plane, the bases of the second group having lower edges defining a second square of the same size as said first square being angularly displaced 45° about said axis relative to said first square, the apexes and bases of all said reflectors being substantially equally spaced from said axis, each base of each group having a corner vertically spaced from its horizontal edge which lies substantially in the horizontal plane defined by the horizontal edges of bases of the other group, the bases of all said reflectors defining a polygon having eight equal sides, and securing means securing all said reflectors together and adapted to secure said reflector unit to a vertical mast coaxial with said axis, said securing means comprising spaced upper and lower horizontal plates each having canted edges secured to said reflectors and each having a central opening therethrough adapted to receive said mast therethrough, a pair of parallel clamping bars on opposite sides of each opening, means adjustably securing each pair of clamping bars to one of said horizontal plates and a pair of threaded members extending perpendicular to each pair of said clamping bars and adjustably connecting their ends together whereby the bars may be urged into gripping relationship with said mast.

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