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(54) An antenna, particularly for the reception of satellite communications.

(57) A groundstation antenna comprises a body 1 of a foamed plastics material having on a rear parabolic surface a metallised coating (3) providing a main reflecting surface. A front surface of the body (1) has on a hyperbolic surface a metallised coating (2) providing a sub-reflector. A feed horn is received within a rear recess (4) in the body 1. The main reflector and the subreflector are thus accurately located with respect to one another and protected from the weather. In an alternative embodiment (Figure 7), two casing members are joined at their outer peripheries to form an antenna of enclosed, hollow shell-like form.

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Croydon Printing Company Ltd.

Title: An antenna, particularly for the reception of satellite communications.

DESCRIPTION

Field of invention

This invention relates to an antenna, particularly a groundstation antenna for the reception of satellite broadcast television, business satellite communications or marine satellite communications.

New television (TV) services based upon the direct broadcast of signals from geostationary satellites are planned. These will become available in several countries in the next few years. Such services will be received, in a domestic context, either by a satellite groundstation devoted to a single home or, alternatively, by a community groundstation and then relayed to a number of homes. The patent application describes the design of a microwave antenna which is suitable for incorporation in a domestic groundstation system.

Background to the invention

Hitherto, the size of ground-based antennae for the reception of satellite transmissions has not been a primary constraint. The specialised nature of their use has also meant that performance has often taken a higher priority than cost. However, direct TV broadcast implies the proliferation of microwave antennae for the first time and, for this to be feasible on the anticipated scale, antenna size and cost considerations become paramount.

Antennae suitable for satellite broadcast reception fall into two categories, namely reflector antennae and planar array antennae. The constructional simplicity of the former has made them attractive for low cost applications. Reflector antennae are designed either with or without subreflectors, ie Cassegrain or front-fed respectively. The feed and/or sub-reflector(s) may be either along the principal axis of the main reflector (symmetrical) or offset.

The simplest reflector antenna configuration, a focal front-fed arrangement, generally requires a waveguide or coaxial cable to be routed from the microwave feed to a receiver. This implies a high radio frequency signal loss which is highly undesirable for satellite broadcast reception. Designs have been proposed where the receiver is suspended at the reflector focus; however the additional volume at the focus causes increased antenna aperture blockage (leading to lower efficiency, high sidelobes and depolarisation) and mechanical problems.

The Cassegrain configuration overcomes the signal loss problem but requires an extra reflecting surface(s) (sub-reflector(s)) and possesses a greater number of degrees of mechanical freedom, which makes alignment problematical.

Low cost offset systems are generally not possible on the grounds of manufacturing and alignment difficulties. Investigations into other antenna types, such as pseudo-reflector antennae and planar arrays, for satellite direct broadcast indicate that they will probably not match the efficiency of front-fed and Cassegrain reflector systems.

It is clear that the symmetrical Cassegrain configuration has advantages in satellite direct broadcast application. An aim in this invention is to eliminate or reduce the features of this type of antennae which prevent it from being a low cost option. Hitherto, the sub-reflectors in Cassegrain systems have been supported by struts, requiring adjustment and final positioning of the sub-reflectors and exposing the reflecting surfaces to the weather.

Summary of the invention

According to the invention an antenna comprises a main reflector having a parabolic reflecting surface, a sub-reflector having a hyperbolic reflecting surface and a microwave feed system aligned along the axis of the main reflector, wherein the two reflecting surfaces are accurately, permanently and non-adjustably located one with respect to the other and the two reflecting surfaces are protected from the environment surrounding the antenna.

In one preferred embodiment to be described, the main reflector and the sub-reflector are formed by an integral body which is conveniently of a foamed synthetic plastics material. The body may be moulded or cast in the desired shape, and have metal coatings over the parabolic and hyperbolic surfaces. The metal coatings may be deposited on the foamed body by spraying. A mounting flange is preferably attached to the parabolic surface by a suitable adhesive.

In another preferred embodiment to be described, the sub-reflector is integral with its radome support. The latter consists of a conical tube of a microwave transparent material, such as a plastics material, that extends from its base at the perimeter of the main reflector to the sub-reflector. The cone is truncated in the vicinity of the main reflector's primary focus and the truncating section formed by a hyperbolic surface. The inner surface of the hyperbola is coated with conducting material to form the sub-reflector. A simple bayonet or snap fastener arrangement may join the main reflector to the sub-reflector/radome allowing simple assembly and servicing. The main reflector has a diameter of typically 0.5 to 1.0 metres for 12 GHz TV direct broadcast, while suitable dimensions for the sub-reflector diameter and the distance from the feed to the sub-reflector are given in texts on antenna practice and theory, respectively.

The fastening between the main reflector and combined radome/sub-reflector should be as waterproof as practically possible to reduce deterioration of the metallic surfaces by exposure to moisture.

Conveniently, the surface of either the main reflector or the sub-reflector, or both, can be modified to correct for any error caused by the presence of the radome material.

Two embodiments of the invention will now to be described, by way of example, with reference to the accompanying drawings in which

Figure 1 is a side view of the first embodiment of antenna,

Figure 2 is a front view of the antenna of Figure 1

Figure 3 is a rear view of the main reflector structure of the second embodiment of antenna,

Figure 4 is a side view of the main reflector structure of Figure 3,

Figure 5 is a front view of the sub-reflector structure of the second embodiment of antenna,

Figure 6 is a side view of the sub-reflector structure of Figure 5, and

Figure 7 is a sectional side view of the assembled antenna of the second embodiment, showing a feed horn in position.

The antenna of Figures 1 and 2 comprises a body 1 of foamed plastics material having a metallised hyperbolic surface 2 (forming a main reflector) and a metallised parabolic surface 3. The body 1 has a circular outer periphery marking the transition between the rear parabolic surface 3 and the front frusto-conical surface, in the centre of which is the hyperbolic surface 2. The metallised surfaces 2 and 3 are formed by deposition of metal on appropriate regions of the external surface of the body 1. The body 1 is moulded with a recess 4 to receive a feed horn carried by a mounting flange 5 which is attached to the body 1 by a suitable adhesive.

The foamed body 1 is simple and cheap to mould or cast in the desired shape and is light yet robust. It will be appreciated that the body 1 may be made of any shape which presents the required parabolic and hyperbolic surfaces. In particular the external surface of the body surrounding the hyperbolic surface 2 may be shaped differently from the frusto-conical configuration shown.

The metallised surfaces 2 and 3 are, where they reflect an incoming signal (e.g. along the single ray path A), covered by the foam meterial and therefore protected from the environment. Also, the surfaces 2 and 3 are maintained in their relative positions by virtue of being deposited on the common body 1 of foamed material.

Referring to Figures 3 and 4, the antenna of the second embodiment has a main reflector 10 which is of metal and plastics with a parabolic reflecting surface 12 having at its centre an orifice 13 surrounded by an antenna mounting flange 14. The sub-reflector 15 (Figures 5 and 6) has a central hyperbolic reflecting surface 17 integral with and surrounded by a radome 16. The reflecting surfaces 12 and 17 are suitably formed by coating the concave side of the main reflector 10 and the convex side of the sub-reflector 15.

Figure 7 shows the main reflector 10 and the sub-reflector 15 assembled together by means of a bayonet attachment around their peripheries, projections on the periphery of the sub-reflector engaging within slots in the periphery of the main reflector. The main reflector 10 and the sub-reflector 15 are in the nature of dished casing members so that the assembled antenna is a hollow shell-like structure which encloses the reflecting surfaces 12 and 17. The orifice 13 accommodates a feed horn 19 which has a feed output flange 20 and which is clamped in position by a detachable split feed clamp 21.

In both embodiments the sub-reflector is in effect rigidly positioned and located with respect to the main reflector which is shaped to provide a convenient means of aligning a feed horn. The antenna of each embodiment is designed so that the reflecting surfaces are well protected, and so that the antenna is adaptable to accept future commercially available microwave feeds.

CLAIMS

1. An antenna comprising a main reflector having a parabolic reflecting surface, a sub-reflector having a hyperbolic reflecting surface and a microwave feed system aligned along the axis of the main reflector, wherein the two reflecting surfaces are accurately, permanently and non-adjustably located one with respect to the other and the two reflecting surfaces are protected from the environment surrounding the antenna.

2. An antenna according to claim 1, wherein the main reflector and the sub-reflector are constituted by a single body of material coated to provide the reflecting surfaces.

3. An antenna according to claim 2, wherein the single body of material is a foamed synthetics plastics material.

4. An antenna according to claim 2 or 3, wherein the reflecting surfaces are applied to the body of material by spraying.

5. An antenna according to any of claims 2 to 4, wherein the body of material has a recess which receives a feed horn of the microwave feed system.

6. An antenna according to claim 5, wherein a mounting flange is secured to the body of material around the recess, the mounting flange serving to mount the antenna.

7. An antenna according to claim 1, wherein the main reflector and the sub-reflector are provided by respective

casing members which are permanently joined together around their external edges to form a shell-like structure enclosing the reflecting surfaces.

8. An antenna according to claim 7, wherein the casing member providing the main reflector has an orifice in the centre thereof, the microwave feed system being located in the orifice.

9. An antenna according to claim 8, wherein a mounting flange for the antenna surrounds the orifice and supports the feed horn in alignment along the axis of the main reflector.

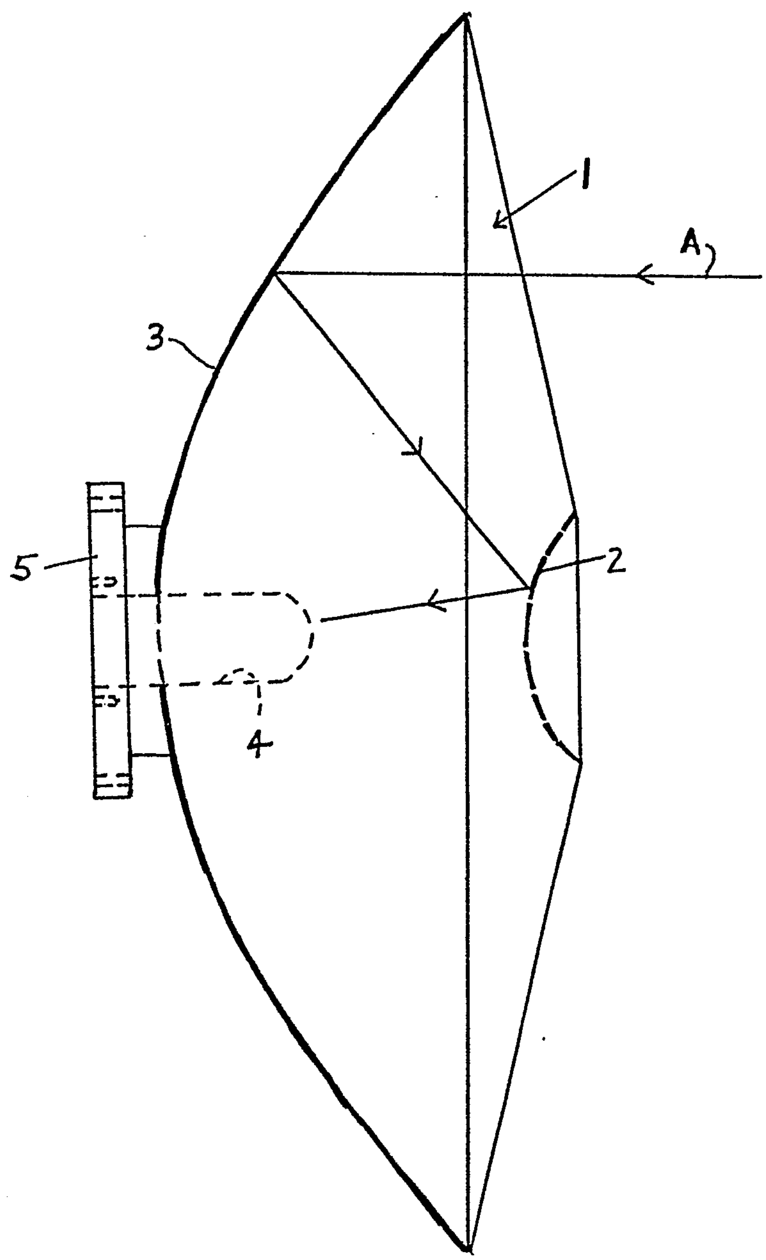

FIG.1

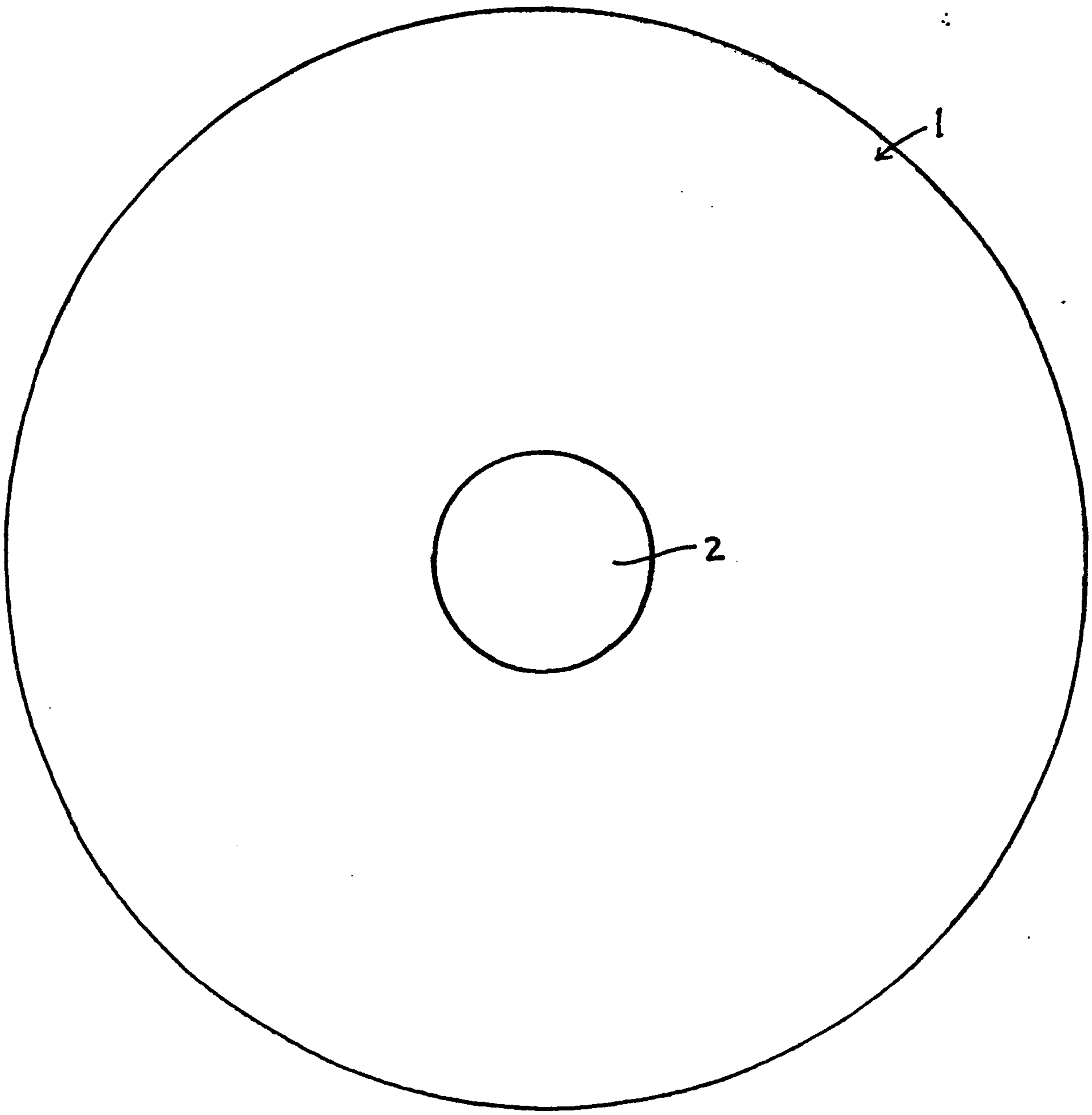

FIG. 2

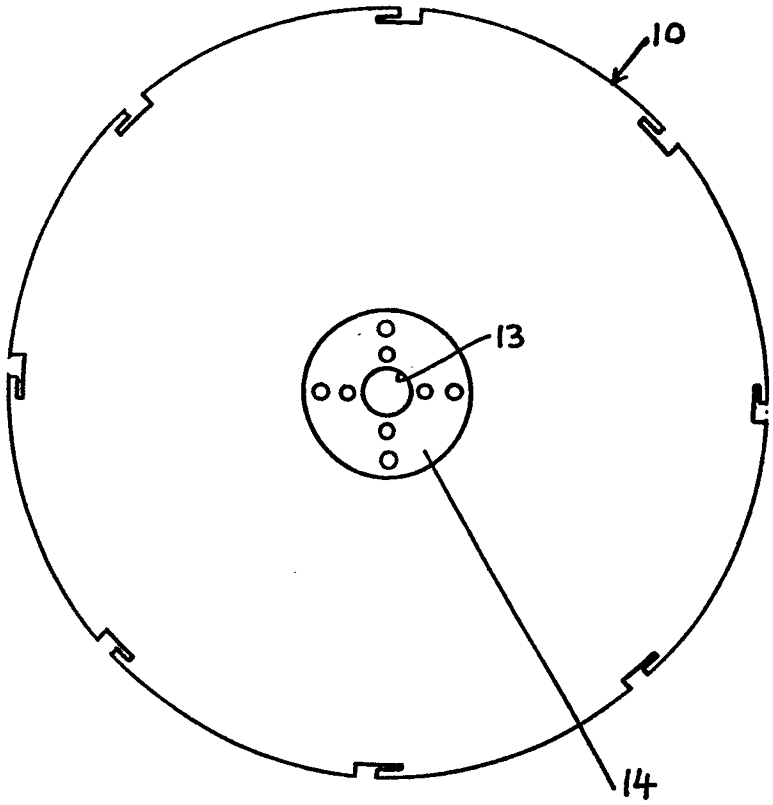

FIG.3

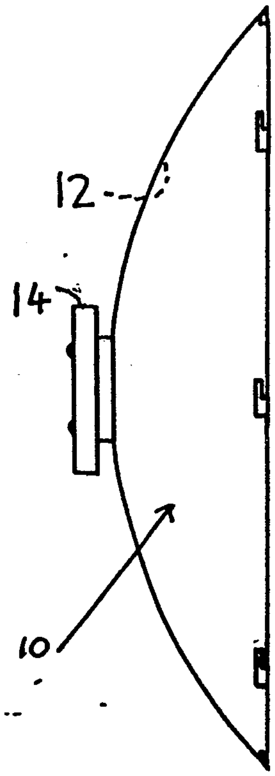

FIG.4

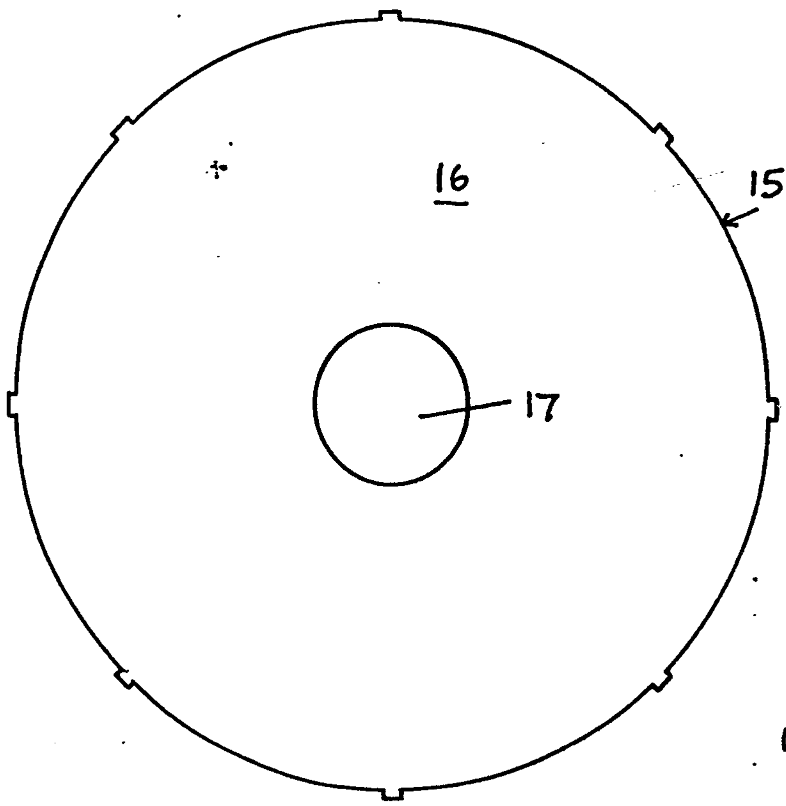

FIG.5

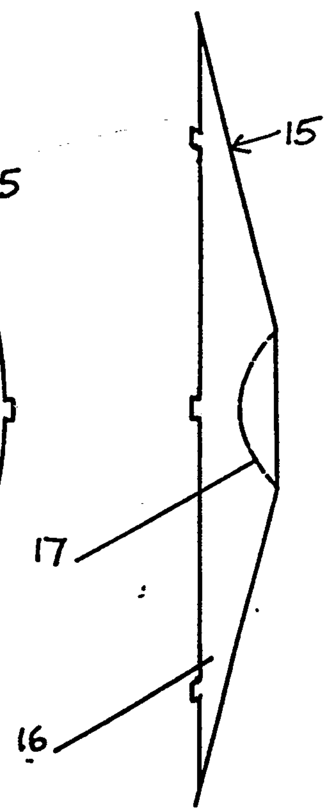

FIG.6

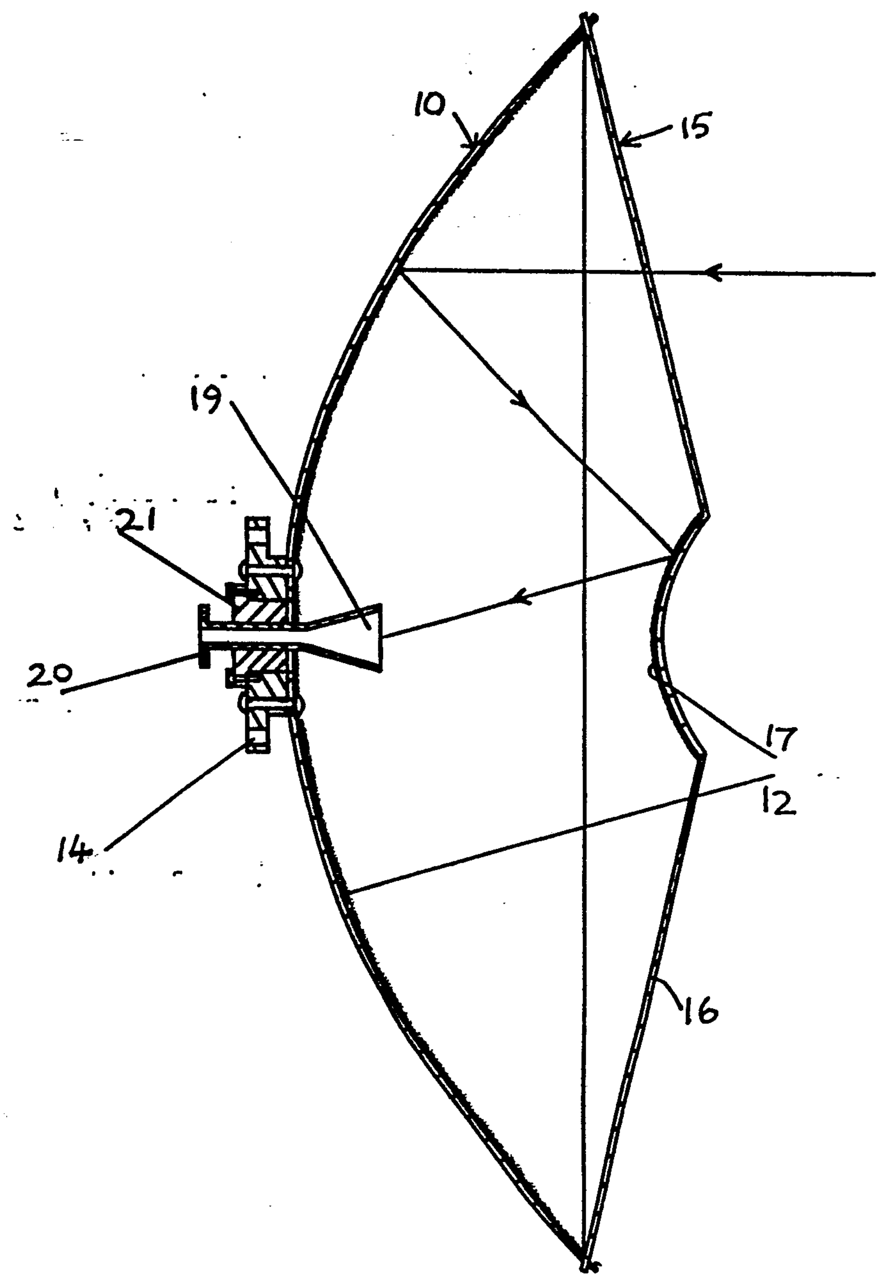

FIG. 7