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**Hutchison et al.**

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[54] **WINDSHIELDING STRUCTURE FOR AN ANTENNA**


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[52] **U.S. Cl.** ..... **343/872**; 343/704

[51] **Int. Cl.**[2] ..... **H01b 1/42**

[58] **Field of Search** ..... 343/872, 840, 704



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[57] **ABSTRACT**

A windshielding structure for a large-diameter high-frequency dish-type antenna includes a flexible membrane extending from the edge of the antenna dish to a fixed rigid member mounted on a base plane. The membrane permits controlled movement of the antenna dish in azimuth and elevation, but minimizes the effect of wind approaching the dish from the front direction (head-on wind) by preventing the wind from interacting with the antenna dish edge to cause Von Karman vortices and associated mechanical oscillations of the antenna. The enclosure formed behind the antenna dish by the membrane, the antenna dish, the fixed rigid member and the base plane can be used for protection of equipment and personnel. The fixed rigid member may have a lip protruding from its surface to divert from the dish and membrane, wind approaching the antenna dish from other directions.


**9 Claims, 3 Drawing Figures**

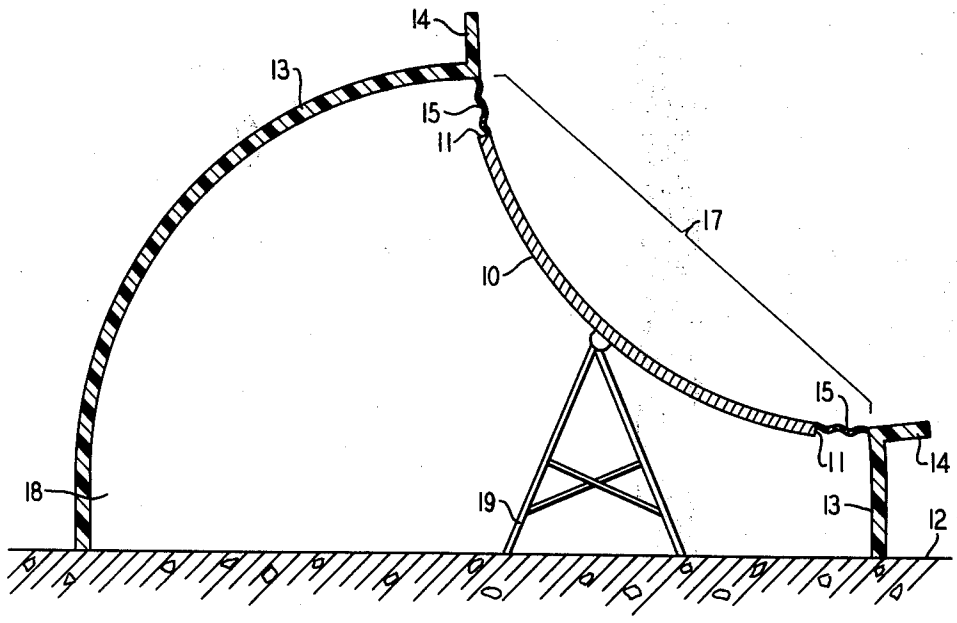


FIG. 1

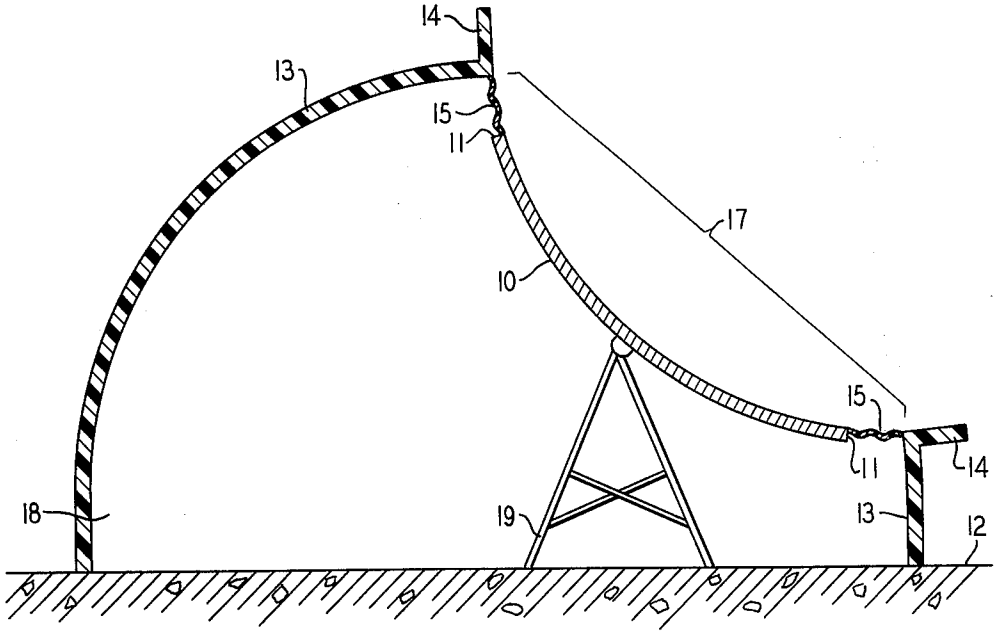
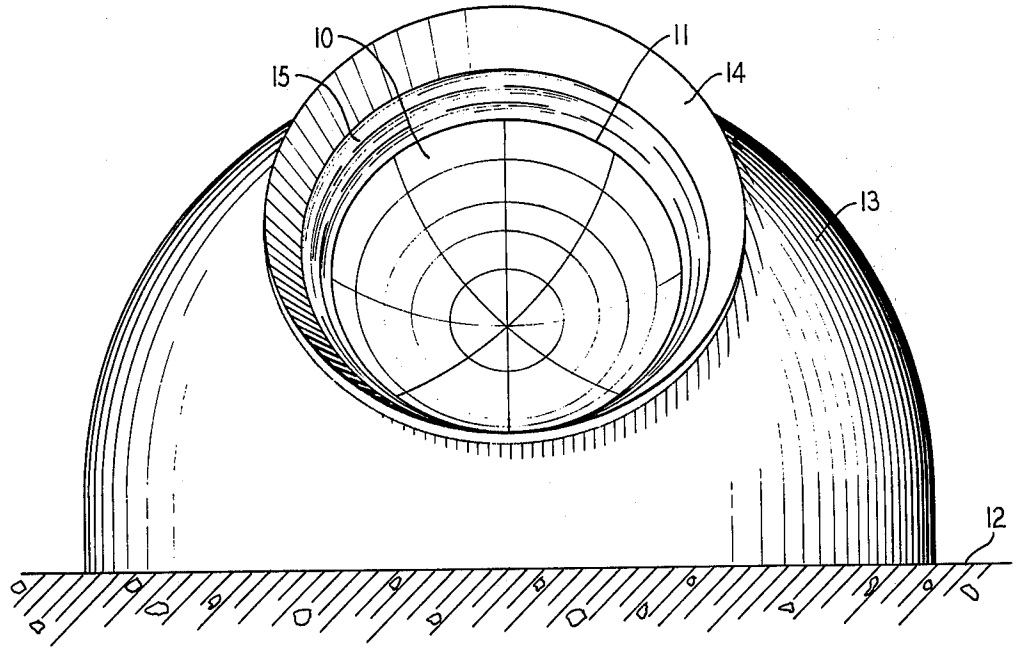



FIG. 2



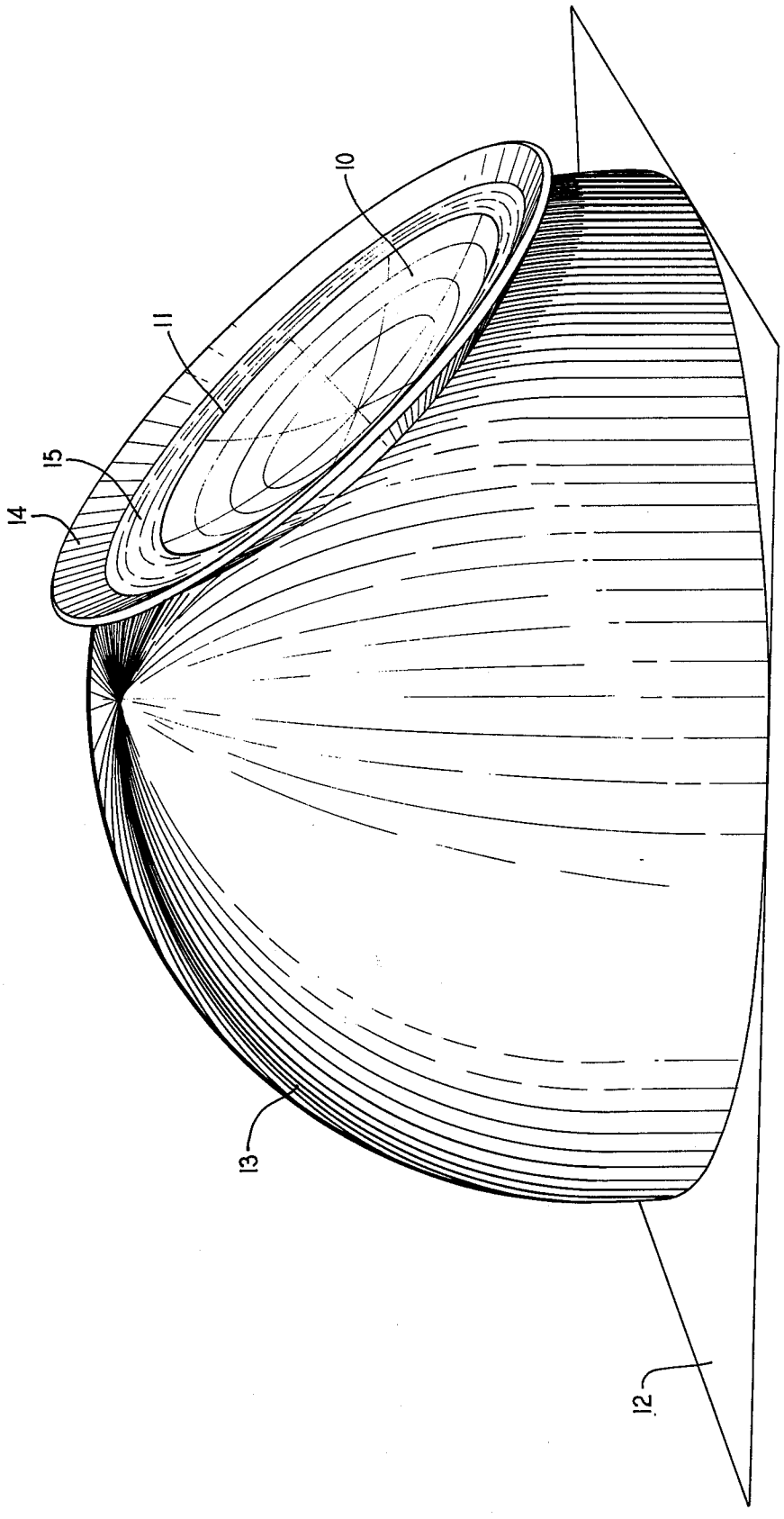



FIG. 3

# WINDSHIELDING STRUCTURE FOR AN ANTENNA

## BACKGROUND OF THE INVENTION

This invention relates to windshielding structures for large parabolic dish-type antennas and more particularly to a shielding structure capable of protecting the dish from undesired mechanical oscillations caused by wind.

As is well known, large-diameter parabolic-dish antennas used, for example, in high-frequency satellite systems are difficult to stabilize mechanically in the presence of wind. This difficulty is in part due to their large size and in part due to the requirement of dish movement in azimuth and elevation to properly track a satellite.

Attempts have been made to shield such antenna dishes with well-known radome type structures. Such radomes completely surround the antenna dish at all times, thereby protecting the dish from wind. However, any rainfall on the radome can cause unacceptable attenuation of both transmitted and received high-frequency signals. Other dome structures are designed with a window which is opened only when the antenna is being used. However, while such an open-window dome structure shields the antenna from winds approaching the antenna dish from the rear, it provides minimal protection from winds approaching the dish from the front (head-on winds). Thus, an antenna dish so protected may not be effectively used for tracking when head-on winds occur.

## SUMMARY OF THE INVENTION

In accordance with the present invention, a rigid windshielding member surrounds an antenna dish but has an opening corresponding to, and slightly larger than the antenna dish. The antenna and shielding structure is mounted on the ground or a base plane. A flexible membrane extends from the entire edge of the dish to the rigid member. This rigid member may, for example, be of the space frame or geodesic type, but it may alternatively be made of flexible material and maintained in a relatively rigid position by controlling the air pressure within an enclosure bounded by the antenna dish, the flexible membrane, the relatively rigid member and base plane.

Head-on wind striking the vicinity of the edge of the dish is guided by the flexible membrane away from the dish edge to the rigid member over which the wind is shed. The flexible membrane prevents the interaction of wind with the antenna dish edge thereby minimizing mechanical oscillations of the dish. In addition, a lip may be added protruding from the rigid structure to further protect the membrane and dish.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a longitudinal side view of the windshielding structure in accordance with the invention;

FIG. 2 shows a head-on view of the structure of FIG. 1; and

FIG. 3 shows a perspective view of the embodiment of the invention of FIGS. 1 and 2.

## DETAILED DESCRIPTION

The invention is shown in FIG. 1 in a lonitudinal sectional side view, in FIG. 2 in a head-on view and in FIG. 3 in a perspective view. In all figures, identical reference numbers indicate identical structures. A dish antenna **10** is supported by mounting structure **19** which rests on base plane **12.** Feeding and transmission structures are not shown. A curved member **13** extends upward from the base plane **12** to surround the antenna except for an opening **17** dimensioned and positioned so that the transmission to and from the dish **10** passes through the opening. Lip **14** surrounding the opening **17** and protruding from member **13** may be added to further protect the antenna dish **10** from wind approaching the antenna from the rear, side and top. This curved member **13** and its lip **14** may be made of any material. It is not, however, necessary for member **13** to be curved as shown. This rigid member may, for example, be of the space frame or geodesic type and is generally fixed in shape. It may, however, be flexible and maintained in position by controlling the air pressure from within. An annular flexible membrane **15** is attached to the entire edge **11** of the dish antenna and to the curved structure **13** at the edge of the opening **17** (the base of lip **14** if the lip is present). This flexible membrane may, for example, be made of elastomeric material such as neoprene and may typically be one-eighth to one-fourth inch thick. The dish and membrane together occupy the opening **17** in the curved member **13.** Thus, an enclosure **18** is formed by the dish antenna **10,** the membrane **15,** curved structure **13** and base plane **12.**

Von Karman vortices, as is well known, are alternate whirlpools of fluid, such as air, which are shed from a surface when the fluid interacts with the surface edge. The interaction of wind with antenna dish edges produces Von Karman vortices. These vortices are shed alternately from opposite regions on the edges of the antenna dish and induce mechanical oscillations which, in turn, produce pointing and tracking errors.

It is the object of the invention to minimize oscillations due to these Von Karman vortices by preventing the wind from interacting with the antenna dish edge. Membrane **15** serves to divert head-on wind away from the antenna dish edge to the curved member **13** and over lip **14** if present. Lip **14** further serves to divert winds, approaching the antenna dish from all other directions, away from the antenna dish edge. The curved member **13** and lip **14** need not be completely rigid because any mechanical oscillations induced in these structures by the diverted wind or other force can not be transmitted back to the antenna dish since the flexibility of membrane **15** damps such oscillations. Communications satellites normally move slightly relative to the earth's surface. Because the width of the received high frequency signal beam is small, motion of the satellite relative to the earth may cause an interruption in communications. It is therefore necessary that the antenna dish not be fixed in position but be subject to controlled movement to track the satellite. Because the membrane is flexible, desired movement in elevation and azimuth is permitted to properly track a communication satellite and avoid interruption in communications.

The dish is not physically covered but rain falling directly onto the antenna dish does not cause serious attenuation of the signal transmitted or received because the total electric field at the surface of the reflecting metal is almost zero. This field at the surface is nearly null because the incident wave on the surface and the reflected wave from the surface are almost equal in

magnitude and 180° out of phase at the surface.

The invention thus reduces difficulties associated with both attenuation of signal due to presence of a radome and head-on winds thereby enabling the antenna dish to be used in severe weather conditions.

In all cases it is to be understood that the above described arrangements are merely illustrative of a small number of the many possible applications of the principles of the invention. Numerous and varied other arrangements in accordance with these principles may readily be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

**1.** A windshielding antenna structure comprising a parabolic section dish antenna mounted on a base plane, a structure surrounding the antenna dish but having an opening corresponding to and slightly larger than the antenna dish, said structure being positioned so that electric waves reflected from the dish pass through the opening of said structure, a flexible membrane extending from the entire edge of said antenna dish to the opening of said structure whereby head-on wind is diverted from the edge of said antenna dish to said structure thereby preventing mechanical oscillations of said antenna dish due to wind, said dish being capable of controlled movement relative to said structure surrounding said antenna dish.

**2.** A structure as described in claim **1** wherein a lip protrudes from the surrounding structure so that wind is diverted by the lip away from the membrane and the dish edge.

**3.** A structure as described in claim **1** wherein an enclosure is formed bounded by the antenna dish, the surrounding structure, the membrane and the base plane.

**4.** A windshielded antenna structure comprising a parabolic section dish antenna mounted on a base plane, a fixed member mounted on the base plane extending behind and above said antenna, a flexible membrane extending from the entire edge of said antenna dish to said fixed member whereby head-on wind is diverted from the edge of said antenna dish to said fixed member thereby minimizing mechanical oscillations of said antenna dish said dish being capable of controlled movement relative to said structure surrounding the antenna dish.

**5.** A structure as described in claim **1** wherein a lip protrudes from the fixed member so that wind is diverted by the lip away from the membrane and the dish edge.

**6.** A structure as described in claim **4** wherein an enclosure is formed by said antenna dish, said fixed member, said membrane and the base plane.

**7.** An improved parabolic section dish antenna windshield mounted on a base plane and having a fixed structure extending behind and above an antenna whereby the antenna is shielded from winds behind and above the antenna wherein the improvement comprises a flexible membrane connected from the entire edge of said antenna to said fixed structure whereby head-on wind is diverted from the edge of said antenna to said fixed structure and prevented from interacting with the antenna edge to cause mechanical oscillations of said antenna said dish being capable of controlled movement relative to said structure surrounding the antenna dish.

**8.** A windshield as described in claim **7** wherein a lip protrudes from the fixed member so that wind is diverted by the lip away from the membrane and the dish edge.

**9.** A windshield as described in claim **7** wherein an enclosure is formed by said antenna dish, said fixed member, said membrane and the base plane.

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