

United States Patent [19]**Fitzroy et al.**[11] **3,896,450**[45] **July 22, 1975**[54] **HARDENED ANTENNA ELEMENT COVER**

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[51] Int. Cl.² **H01Q 1/42**

[58] Field of Search **343/797, 872, 873**

[56] **References Cited****UNITED STATES PATENTS**

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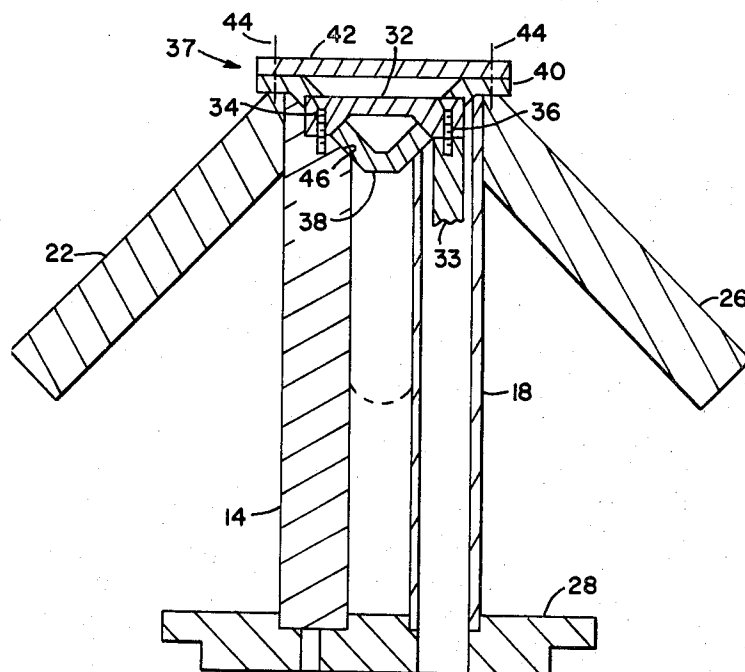
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[57]

ABSTRACT

A hardened cover to provide weather protection (rain and thermal radiation) to an antenna element of a radar system. The antenna element includes a pair of dipoles in normal relation. Each dipole assembly includes a solid and hollow post, a cross-over wire extends between the posts to connect to a dipole arm carried on each post. The hardened cover is comprised of polytetrafluoroethylene (Teflon) filled laminated fiberglass which can be classed as an ablative material.

2 Claims, 2 Drawing Figures

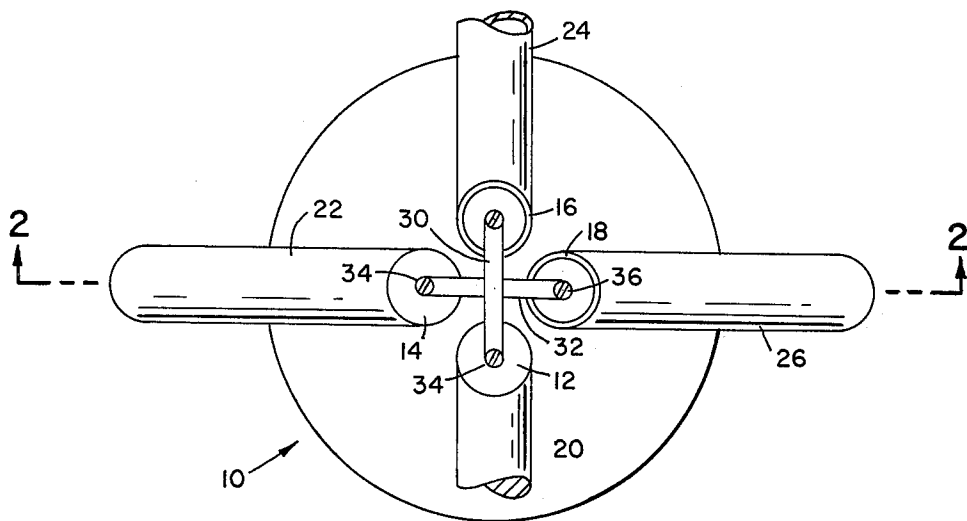


FIG. 1

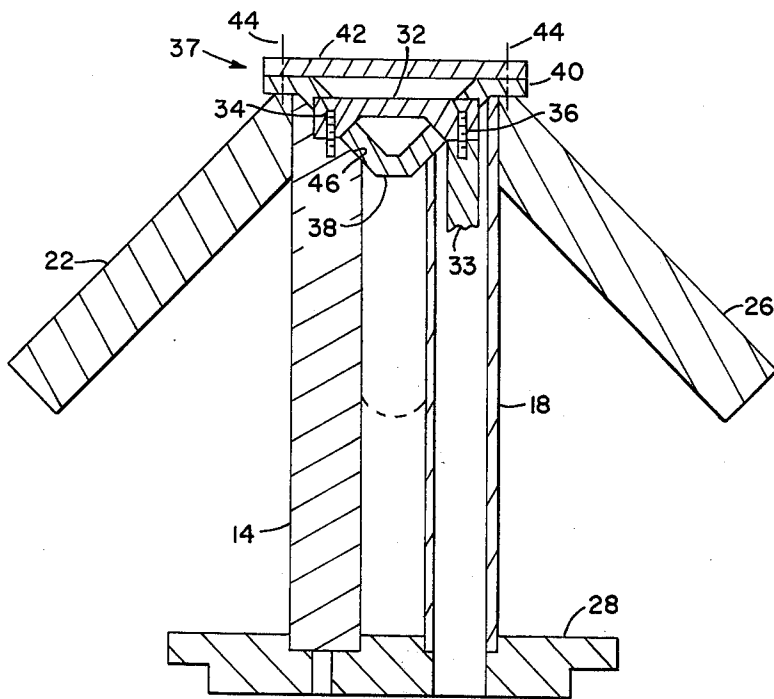


FIG. 2

HARDENED ANTENNA ELEMENT COVER

BACKGROUND OF THE INVENTION

Prior antenna elements of a radar system used ceramic type material where dielectric materials were required. The use of ceramics in a complex configuration was judged to be incompatible with a nuclear environment. The most severe nuclear effect imposed on the assembly is thermal radiation. A material investigation program was undertaken to facilitate selection of materials suitable for a radome window. Three classes of material were investigated; opaque materials which can char, opaque materials which can sublime and ceramic materials having high thermal conductivity. Analyses of ceramic materials subjected to the thermal radiation environment indicated that the ceramic which could best withstand thermal shock was marginal with regard to resistance to crack. The analyses considered only a simple model which did not contain stress riser, external loading or support boundary constraints. Due to the mounting constraint and complex geometry with regard to thermal shock, ceramic type materials were judged to be inadequate for a small cover design.

For orientations where thermal radiation is incident on two element posts, a large temperature differential can exist from the front to the rear of each exposed post. Due to the thermal expansion property of the metal post, the posts want to bend toward those posts shaded from the radiation. Since the heated posts are connected to the relatively cooler shaded posts, by means of the element cover, contact surface forces are imposed on the cover. Analyses of this thermal loading situation indicated that external loads on the element cover could be as high as 3,000 pounds. This boundary loading along with the direct absorption of the thermal radiation requires a unique element cover design.

No information exists on the phenomenological behavior of ablative materials subjected to combined thermal and surface force loading. To develop a design compatible with loading conditions it was necessary to conduct tests in a simulated thermal environment. The present cover of polytetrafluoroethylene filled laminated fiberglass successfully withstood the environment. While material ablated from the external surfaces of the cover, little effect was experienced on the interior which contained the cross-over wires. The material remained stable with no apparent warpage. This is an extremely important characteristic when one is concerned with sealing requirements. This material exhibits a unique self-cleaning behavior in that the laminates tend to ablate away in layers and leave a clean surface. The primary function of the fiberglass is to provide the required reinforcement while the primary function of the Teflon is to provide the thermal protection.

SUMMARY OF THE INVENTION

The hardened cover of the present invention is disposed to provide weather protection (rain and thermal conditions) for elements of a radar system. The elements are a pair of dipoles in normal relation. Each dipole assembly includes a base disposed for support of a pair of posts having a dipole arm carried thereby. One post is hollow and the second post is solid. Each dipole

arm is supported by respective hollow and solid posts. The feed is carried in the hollow post and each post is in normal relation to the base. The dipole arms are disposed in annular relation to the base. The cross-over wires, cross over each other in spaced relation, to connect respective arms of each dipole. The cover of polytetrafluoroethylene filled laminated fiberglass includes a substantially inverted conical portion and an upper member secured to the tops of each post.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of the antenna elements and cross-over wires with the cover removed.

FIG. 2 is an elevational sectional view of the antenna elements taken along line 2—2 of FIG. 1, showing the cover in place.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 1 an antenna element 10 for a radar includes four posts 12, 14, 16, and 18, spaced 90° apart. A plurality of dipole arms 20, 22, 24, and 26 are secured to posts 12, 14, 16, and 18, respectively. A base 28 supports the posts. Posts 12 and 14 are solid and posts 16 and 18 are hollow. A first cross-over wire 30 connects dipole arms 20 and 24. A second cross-over wire 32 crosses under wire 30 and connects dipole arms 22 and 26. The cross-over wires are secured to the solid posts by screws 34 and to the conductor 33 in the hollow posts by screws 36. Conductor 33 is the feed for the antenna element.

To protect the antenna element against rain and thermal radiation, a cover assembly 37 is positioned atop the antenna element. Cover assembly 37 includes a lower substantially frusto-conical member 38 having an annular flanged portion 40, and an upper flat plate 42. Plate 42 and section 38 are secured to the antenna element by screws 44. The posts are provided with a cut back portion 46, as shown in FIG. 2, to receive the conical surfaces of frusto-conical member 38 therebetween.

The cover assembly consists of glass cloth impregnated with a polytetrafluoroethylene resin compound or binder. Some such polytetrafluoroethylene filled laminated fiberglass are identified as Dilecto sheets by the Budd Company, and Fluorglas by Dodge Industries.

We claim:

1. In an antenna element including a pair of dipole assemblies, cover means for protecting said element against rain and thermal radiation comprising:
 - a. a frusto-conical member mounted on top of said dipole assemblies; and,
 - b. an upper plate mounted on top of said frusto-conical member;
 - c. said plate and said frusto-conical member comprised of polytetrafluoroethylene filled laminated fiberglass.
2. An assembly as set forth in claim 1 wherein said dipole assemblies include a pair of dipoles each comprised of a solid and hollow post having a dipole arm extending therefrom and a cross-over wire extending from each said hollow and solid post, said cross-over wires being disposed in crossed, spaced relation.

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