

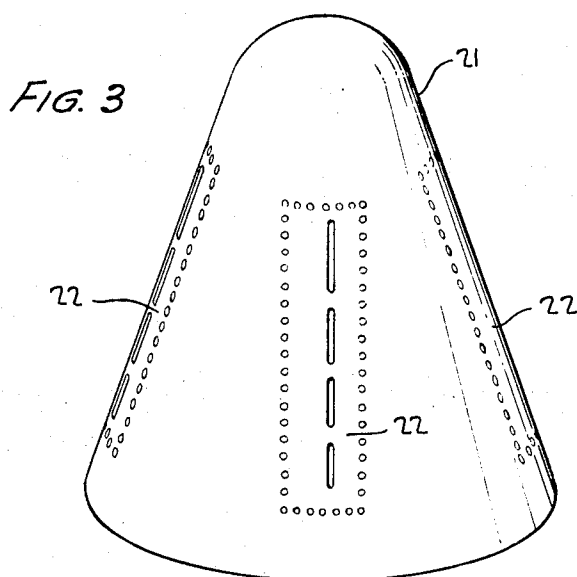
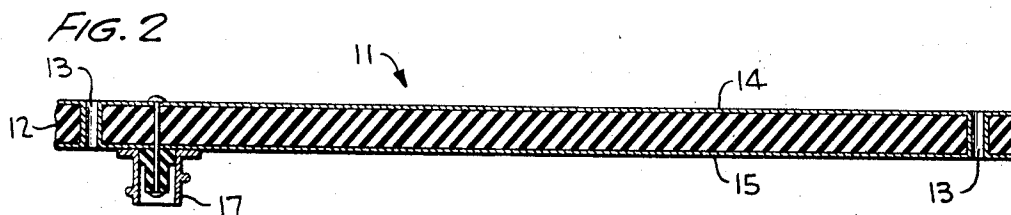
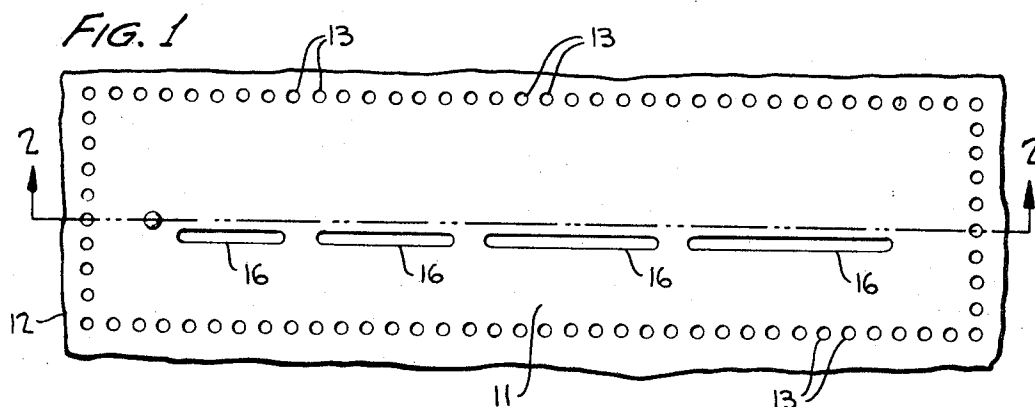
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SLOT ANTENNA BUILT INTO A DIELECTRIC RADOME

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SLOT ANTENNA BUILT INTO A
DIELECTRIC RADOMEHoward S. Jones, Jr., Washington, D.C., assignor to the
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4 Claims. (Cl. 343-771)

The invention described herein may be manufactured and used by or for governmental purposes without the payment to me of any royalty thereon.

This invention relates generally to antennas and more particularly to an antenna which is combined with and a part of a radome structure used on an aircraft, projectile, guided missile, or the like.

Airborne or vehicle-carried radar equipment is almost always covered by a plastic or dielectric radome which is substantially transparent to electromagnetic energy but which provides mechanical protection for the equipment and contributes to the streamlining of the vehicle. Situated within the radome itself is the antenna system of the radar equipment. Typically, the antenna system is servo-actuated to provide mechanical scanning. Although such structures have served their purposes satisfactorily in the past, they have become less satisfactory with the increased complexities and sophistication of today's modern radar equipment. There has been a pressing need for a reduction in both bulk and cost of radar equipment to make modern equipment competitive with less accurate equipment in many applications. With the advent of simple and compact phase shifting devices, electrical scanning of radar antennas has become practical, and servo-actuated antenna arrays have been replaced with fixed arrays. There has thus resulted some decrease in size, weight and expense in radar equipment; however, these improvements, while abating the problem, have not eliminated it. The search for other and more adequate solutions has continued. Attention has been focused on the radar antenna, and various attempts have been made to mount the antenna flush with the skin of the vehicle to achieve a reduction in bulk of the equipment. These attempts have not been entirely satisfactory since mechanical design of the vehicle and radar equipment is complicated resulting in greater cost.

It is therefore an object of this invention to provide a radar antenna which occupies no space within the radome, is extremely light in weight, and is very inexpensive to manufacture.

It is another object of the invention to provide a radar antenna which is flush mounted in the skin of a vehicle but not attended with disadvantages heretofore associated with flush mounted antennas.

According to the present invention the foregoing and other objects are attained by providing flush mounted dielectric loaded slotted waveguide antenna arrays which are fabricated as an integral part of a radome structure.

The specific nature of the invention, as well as other objects, aspects, uses and advantages thereof, will clearly appear from the following description and from the accompanying drawing, in which:

FIG. 1 is a plan view of an antenna array in a radome section constructed according to the invention;

FIG. 2 is a cross-sectional view of the antenna-radome section shown in FIGURE 1; and

FIG. 3 is a perspective view of a radome incorporating a plurality of antenna arrays according to the invention.

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In most cases dielectric radomes used for aircraft and missile radar application vary in thickness between 0.050 to 0.250 inch. The materials used for these radomes are usually materials that have low loss characteristics and fairly low dielectric constants. Dielectric loaded waveguide antennas are designed according to the invention from the same dielectric substrates used in the radome and made as a part of the overall structure.

Referring now to the drawings and more particularly to FIGURES 1 and 2 wherein there is shown a slotted waveguide antenna array 11 fabricated as an integral part of a dielectric radome section 12. The waveguide for the array is formed by drilling holes 13 through the radome surface at close intervals in a rectangular pattern. The holes 13, as well as the exterior and interior surfaces 14 and 15 enclosed by them, are electroplated with copper or other suitable metal. The holes may then be filled with a suitable dielectric to make the radome mechanically whole. Provisions are made to leave radiating slots 16 on the broad exterior face of the waveguide in the electroplating process. Alternatively, the slots 16 may be etched after the electroplating process. The dimensions of the rectangle formed by the holes 13 depend upon the antenna design parameters, i.e., the operating frequency and the dielectric material. The interval of spacing between the holes 13 also depends on the operating frequency band and is very small compared to wavelength. The electroplated holes thus form the side and end walls of the waveguide. The waveguide antenna is excited from a standard coaxial-to-waveguide input 17 located along a longitudinal center line $\lambda/4$ in the dielectric medium away from a row of holes 13 forming an end wall of the waveguide. The flat dielectric has a low impedance and matches very well with a 50 ohm coaxial input.

FIGURE 3 shows a complete, practical antenna and radome structure. The radome may of course take any desired shape but is here illustrated as a conical section 21. Spaced about the radome section 21 are a plurality of integral waveguide antenna arrays 22. It is apparent from the figure that the radome surface can be fully utilized. Furthermore, each antenna array can be located to obtain optimum decoupling between radiators.

A variety of techniques may be employed to form the waveguide. For purposes of economy and speed of manufacture, all the holes defining the side and end walls of the waveguides in the radome structure can be drilled in one operation with a multiple drill bit head. A particular advantage of the invention is that all modifications and innovations required by any specific application can be incorporated during the radome manufacturing process thereby simplifying the antenna system design.

It will be apparent that the embodiment shown is only exemplary and that various modifications can be made in construction and arrangement within the scope of the invention as defined in the appended claims.

I claim as my invention:

1. An integral radome-antenna structure comprising:

(a) a radome made of a thin, low loss dielectric material;

(b) said radome having a plurality of closely-spaced holes drilled therein to define the mechanical boundaries of a waveguide antenna;

(c) said holes and the surfaces of said radome enclosed by said holes being plated with a thin layer of metal; and

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(d) the thin layer of metal on the exterior surface of said radome having at least one radiating slot.

2. An integral radome-antenna structure as defined in claim 1 further comprising: a coaxial-to-waveguide connector connected to said thin layers of metal from the interior surface of said radome.

3. An integral radome-antenna structure comprising:

(a) a radome made of a thin, low loss dielectric material;

(b) said radome having a plurality of closely-spaced holes drilled therein to define the mechanical boundaries of a plurality of wave-guide antennas;

(c) said waveguide antennas being oriented with respect to one another to obtain optimum decoupling therebetween;

(d) said holes and the surfaces of said radome enclosed

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by said holes being plated with a thin layer of metal; and

(e) the thin layers of metal on the exterior surface of said radome having at least one radiating slot.

4. An integral radome-antenna structure as defined in claim 3 further comprising: a plurality of coaxial-to-waveguide connectors equal in number to the number of waveguide antennas in said radome, said coaxial-to-waveguide connectors being connected to said thin layers of metal of each waveguide antenna from the interior surface of said radome.

No references cited.

HERMAN KARL SAALBACH, *Primary Examiner*.

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