

United States Patent

[11] 3,553,432

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 [73] Assignee
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by the Secretary of the Navy

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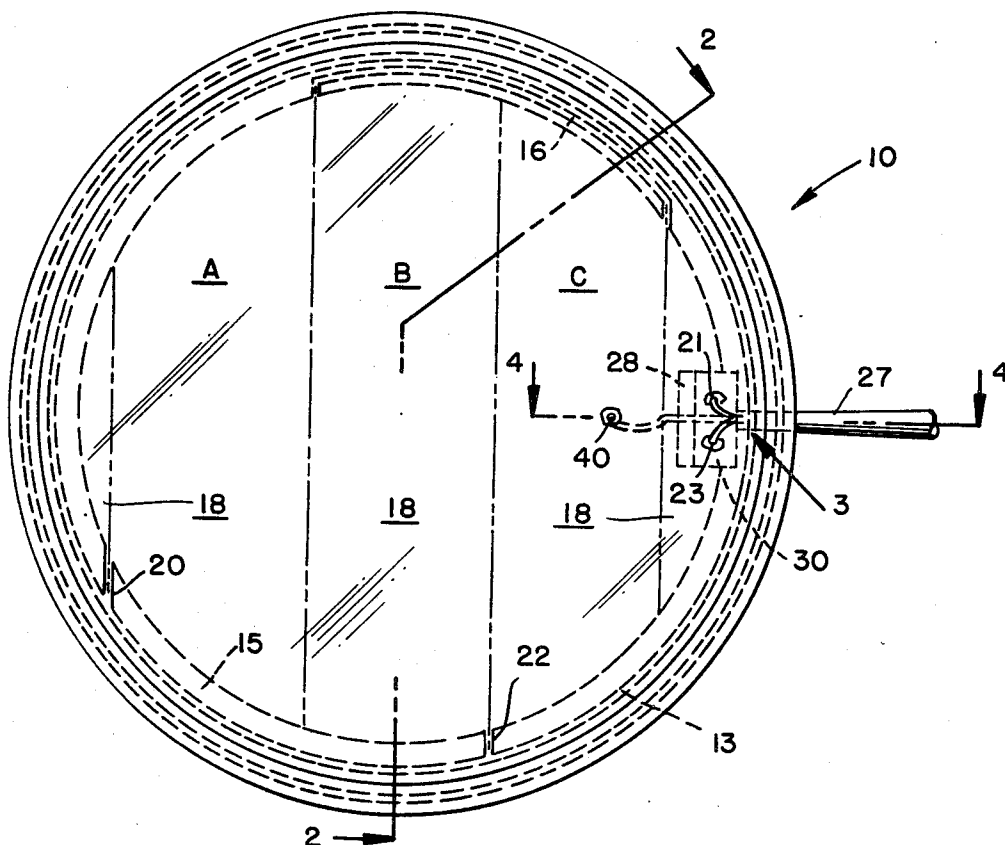
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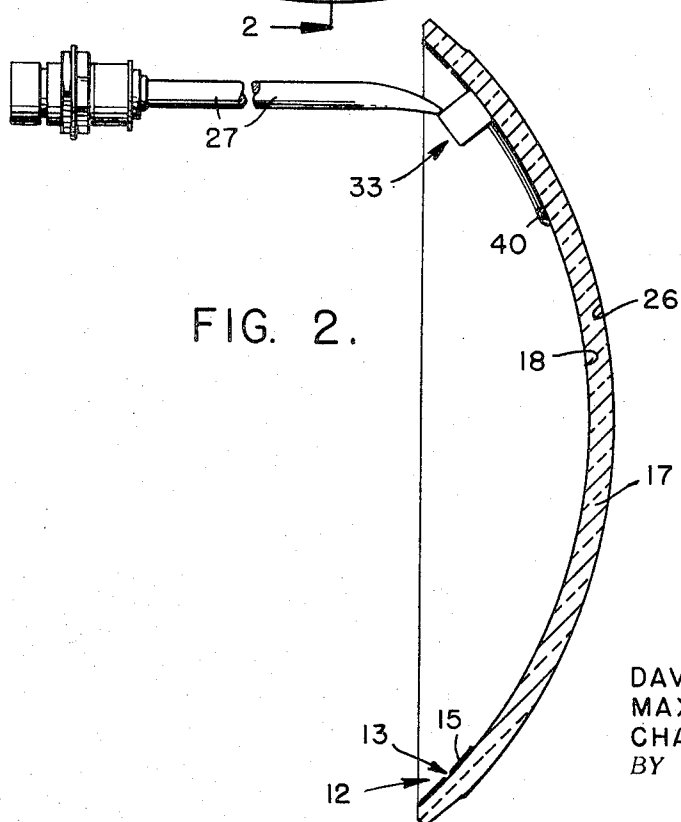
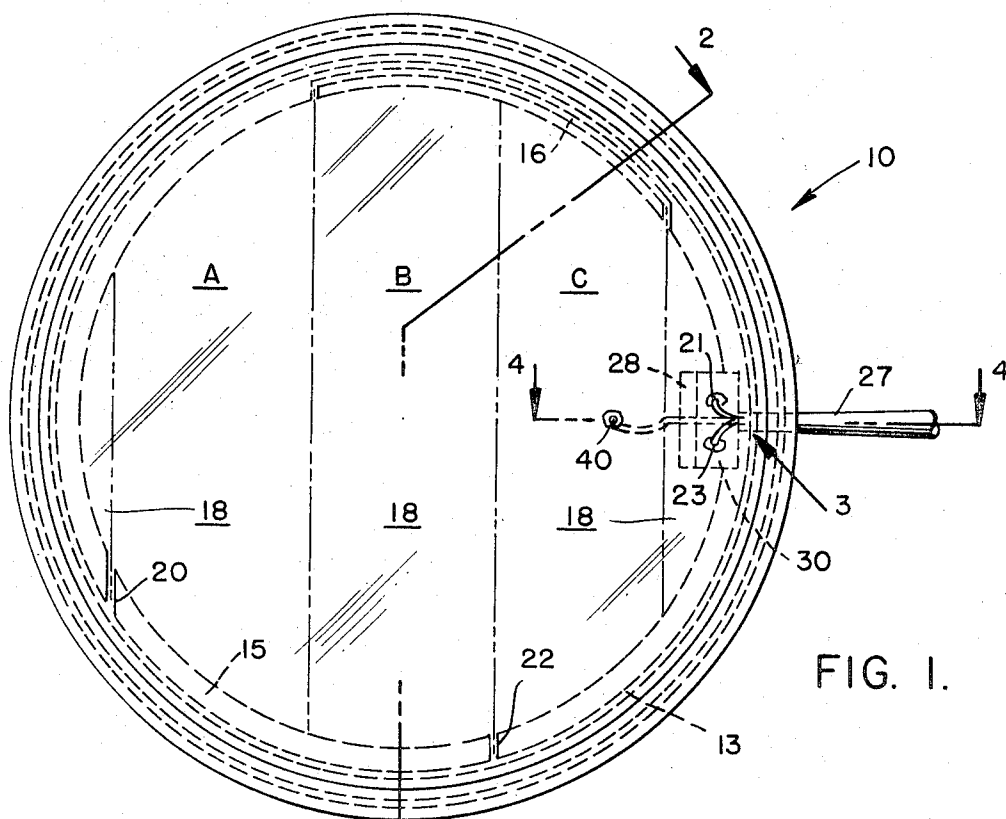
[54] **HEATED DOME WINDOW**
1 Claim, 5 Drawing Figs.

[52] **U.S. Cl.**..... **219/522,**
 2/14; 219/203, 219/543; 338/309
 [51] **Int. Cl.**..... **H05b 3/06**
 [50] **Field of Search**..... 219/522,
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 338/308—9

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ABSTRACT: A transparent domical nose fairing of a guided missile is coated with an interrupted metallic film and electrically connected to a power source for heating the fairing when icing is likely. The film is preferably applied on the inner surface over substantially all of the transparent area so that it also acts as a shield against radio frequency interference. If desired the external surface may be covered by an antireflectance coating to enhance the "vision."





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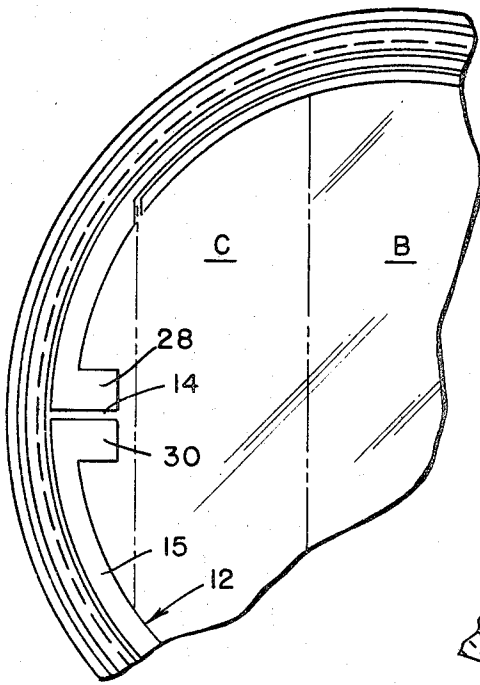


FIG. 3.

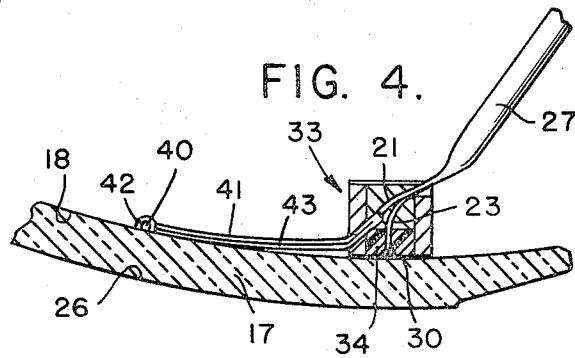
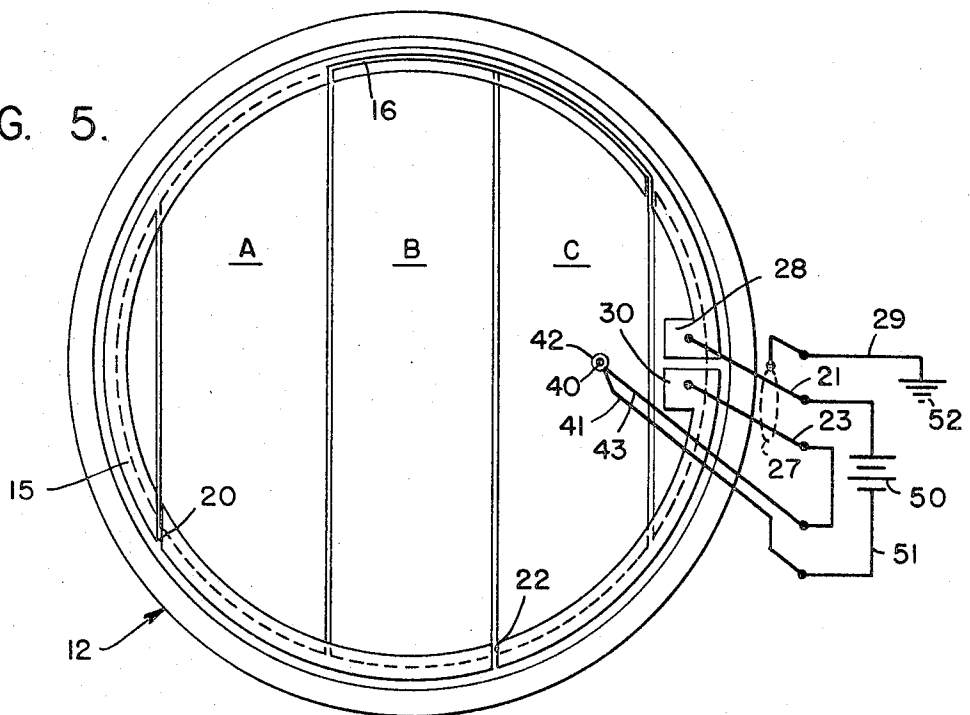


FIG. 4.

FIG. 5.



HEATED DOME WINDOW

GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

The use of metallic film coatings on windows, in order to provide a means for heating the window has found many applications both in the automotive and aircraft fields. Applications have of course included both flat and curved windows.

One example of a commercial supplier is the Sierracin Corporation, of Burbank, California, which is the assignee of a number of pertinent U.S. Pats. concerning conductive windshields, e.g., No. 2,991,207 and No. 3,041,436. The use of a Sierracin product known as Sierracin 3 as a shield for radio frequency radiation is found in U.S. Pat. No. 3,325,825 to Charles Christianson et al., assignors to the United States of America as represented by the Secretary of the Navy. However, so far as is known, the technology has not extended to heating and shielding a window with a spherical configuration.

SUMMARY OF THE INVENTION

The window according to the present invention forms a nose portion of a guided missile or the like and, therefore, it was necessary that the window be designed with the aerodynamic characteristics of the missile in mind. The simplest shape with the desired aerodynamic characteristics is considered to be domical in substantially the form of a segment of a sphere.

Further, a sensing device in the nose of such guided missiles needs to "see" through a substantial portion of the window. Since the formation of ice on the window would not only be detrimental to vision but could also seriously affect aerodynamic stability of the system, a means of preventing icing was also considered necessary.

Finally it was considered highly desirable to shield the components within the missile nose from radio frequency interference (RFI).

By the present invention we have provided a spherical window having means for heating the window over substantially the entire viewing area automatically upon encountering temperatures below a certain predetermined number of degrees and, at the same time, providing over the same area an effective radio frequency interference shield.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a plan view of the convex surface of a spherical window according to the invention;

FIG. 2 is a cross-sectional view of the window taken along line 2-2 of FIG. 1;

FIG. 3 is a fragmentary view of the concave side of the window of FIG. 1 with parts removed for clarity;

FIG. 4 is an enlarged cross-sectional view of the window taken along line 4-4 of FIG. 1; and

FIG. 5 is a modified plan view similar to FIG. 1 showing, in schematic form, the electrical connections to the window.

DETAILED DESCRIPTION OF THE INVENTION

Looking at FIGS. 1 and 2, the window assembly is designated by the numeral 10. The window may be manufactured of any suitable transparent material 17 (FIG. 2) but, since a preferred embodiment has been manufactured of glass, the part 17 may be referred to later as the glass window or the window glass or simply the glass. The inner or concave surface of the glass in this instance is coated with a metallic coating known as Sierracote 3, a product of Sierracin Corporation of

Burbank, California. The periphery of coating 18 is in electrical contact with the inner of two bus elements 12, 15 plated on the periphery of the glass. The bus elements complete the coverage of the inner surface of glass 17 but are separated by a narrow gap 13.

Conductive coating 18 comprises three center panels A, B and C which are electrically connected in series by the several sections of the inner bus member 15 and two smaller side sections not lettered which do not contribute to the heating function. These side sections of film 18 do, however, complement the other metallic films and coatings to provide shielding against radio frequency (RF) radiation. In a practical embodiment the surface 26 is covered by an antireflectance coating.

Electrical connection between the window coating panels A, B, C and the power source is furnished through conductors 21, 23 which are housed in a flexible shielding conduit 27 and terminating at the window in a terminal box 33 (FIG. 2). Control of the electrical current from the source through panels A, B, C is provided by a temperature sensitive switching element 40 in contact with but electrically isolated from the film 18. In the present system the element 40 comprises a thermister having a resistance of $2,750 \pm 100$ ohms at 122° F. and zero power dissipation. The element 40 may advantageously be covered with a suitable potting compound indicated at 42 in FIG. 4. Element 40 is connected in series with the heating panels and the power source as will be more clearly seen in the following description with respect to FIG. 5.

Bus bar members 15 comprises several sections formed by openings gaps at 16, 20 and 22 shown in FIG. 1 and a gap 14 more clearly seen in FIG. 3. The segment severed from bus 15 by gap 16 is in electrical contact with panels B and C while the segment between gaps 20 and 22 similarly connects panels A and B. The gap 14 (FIG. 3) separates two enlarged portions 28, 30 of bus 15, which enlarged portions serve as attachment means for the attachment of conductors 21, 23 respectively (FIG. 5). Space between conductors inside junction box 33 may be filled with potting compound 34 as shown in FIG. 4.

FIG. 5 shows how current from the source indicated at 50 flows for example through conductor 21, when thermister 40 is conducting, to portion 28 of bus 15. The portion of bus 15 between gaps 14 and 20 is in electrical contact with panel A which has its opposite end connected by a bus member between gaps 20 and 22 to one end of panel B and panel B is similarly connected to panel C. Panel C is connected to the bus segment between gap 22 and gap 14 which has the enlarged portion 30 attached to conductor 23. Obviously the circuit may be provided with switch means in addition to thermister 40 to break the circuit when desired.

We claim:

1. Transparent dome means comprising;

a domical segment of transparent material of practically uniform thickness having inner and outer surfaces;

a first electrically conductive coating, relatively thin and transparent, and covering substantially all of one of said surfaces, except for a relatively narrow peripheral area; said coating being separated into a plurality of elongated heating panels of relatively large area and a pair of relatively smaller side segments;

a second electrically conductive coating on said one of said surfaces substantially filling said peripheral area and having discrete portions thereof in electrical contact with certain edges of said heating panels such that said panels are electrically connected in series;

means including a temperature responsive solid state switching device for causing a flow of electrical current serially through said panels when ambient temperature prevails below a selected value and to block the flow of current when ambient temperature prevails above said selected value;

said first and second coatings in combination constituting an effective shield against penetration of the transparent material by radio frequency radiation; and an antireflectance coating on the other of said surfaces.