June 13, 1961 R. O. ROBINSON, JR., ET AL 2,987,999

PROTECTIVE COVER

Filed Feb. 12, 1959

2 Sheets-Sheet 1

FIG. 2.

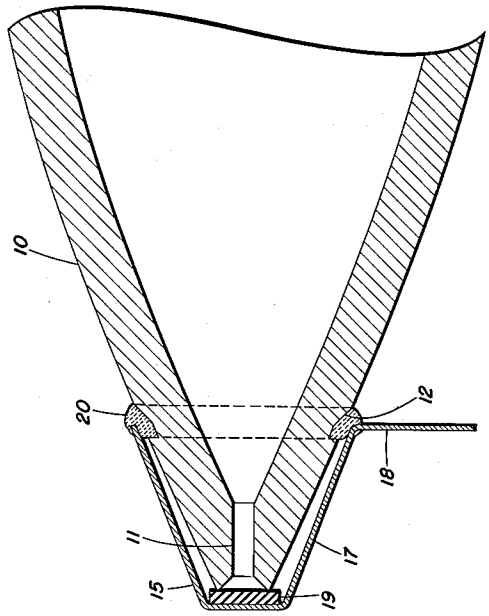
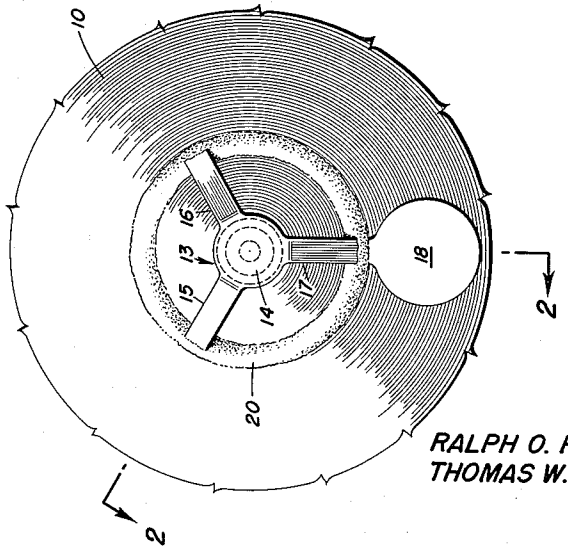


FIG. 1.



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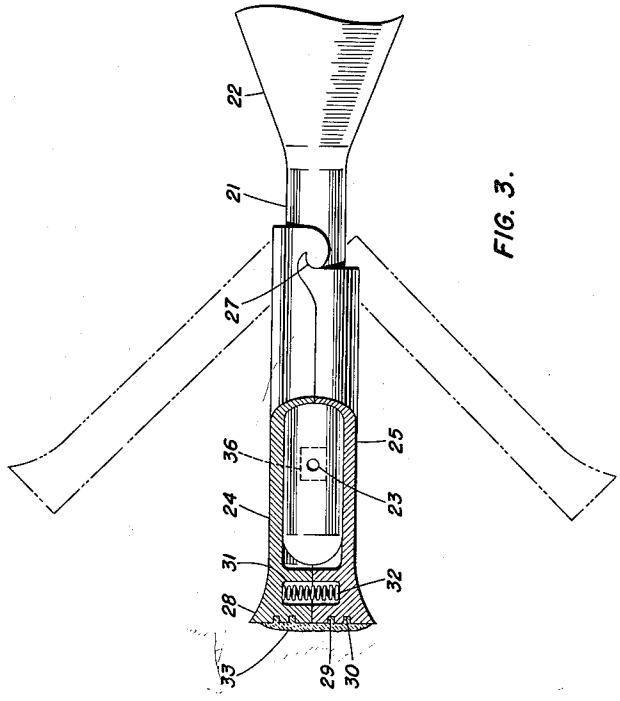


FIG. 3.

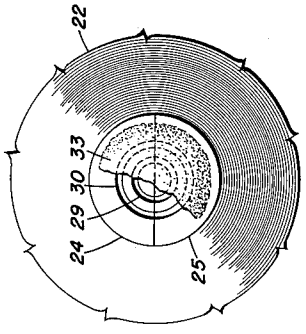
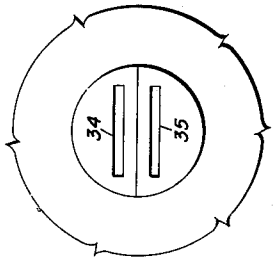


FIG. 4.

FIG. 5.



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3 Claims. (Cl. 102—92.5)

The present invention relates generally to protective devices for aerial vehicles; more particularly it relates to improved displaceable seals for use with pressure probes or radomes of guided missiles.

Guided missiles require information regarding static pressures and/or ram pressures in order to maneuver properly. Such missiles ordinarily employ pressure probes and/or radomes having ports connected with appropriate equipment for measuring such static or ram pressures. It is important that these ports be kept free of foreign bodies if the measuring equipment is to function properly. That is, during the handling of guided missiles prior to launching thereof they may be subjected to a variety of environmental conditions which would be deleterious to the proper functioning of pressure measuring equipment. Such conditions would include ocean waves, high winds, ice, shock, and vibration. Moreover, since the launching of a guided missile is a complicated operation under optimum conditions, it is desirable that seals be provided that will remain in place during handling and launching operations but which will be removed automatically and positively after the missile has been launched.

One object of the present invention, therefore, is to provide a displaceable seal which, in one embodiment, may be used to close the inlet port at the forward end of a guided missile radome prior to missile launching for preventing the entry of foreign substances into the interior of the missile, but which will be automatically and positively displaced after missile launching for permitting operation of apparatus within the missile.

The invention seeks, as another object, to provide a displaceable seal which, in another embodiment, may be used for closing the port or ports of a missile nose probe until after missile launching.

A further object of the invention is to provide a displaceable seal which employs a low melting point alloy for securing said seal in position on a missile nose or nose probe, which alloy may only be melted by the coincident occurrence of a high velocity air flow and the resultant high stagnation temperature which occurs only during missile flight.

Still another object of the invention resides in the provision of a displaceable seal which, in both embodiments, will be characterized by its extreme simplicity and ease of application.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is a front elevation showing one embodiment of the displaceable seal installed in operative position on the front end of a missile radome;

FIG. 2 is a sectional view on the line 2—2 of FIG. 1;

FIG. 3 is a side elevation, partly in section, showing a modified embodiment of the invention, the positions of the sections of the seal being shown in broken lines as they would appear immediately prior to separation from a missile nose probe;

FIG. 4 is a front elevation of the embodiment shown in FIG. 3; and

FIG. 5 is a front elevation showing a modified slot arrangement for use with the embodiment of FIGS. 3 and 4.

Referring more particularly to the drawings, and first to FIGS. 1 and 2 therof, the numeral 10 indicates the forward end portion of a radome of an aerial missile. The nose of the portion 10 is formed with a port 11. A groove 12 is cut into the wall of the missile portion 10 near the nose thereof, and receives an annular deposit of low melting point alloy, as will be described in more detail hereinafter.

The seal of FIGS. 1 and 2 comprises a body 13 which is formed of flat sheet metal and includes a hub 14 and preferably three radially directed equally spaced arms 15, 16 and 17, the arm 17 terminating in a relatively large circular tab 18. As shown in FIG. 2 the body 13 of the seal is mounted on the nose of the radome forward end portion 10 with the hub 14 confronting the open end of the port 11. A sealing gasket 19 is confined between the inner face of the hub 14 and the forward end of the nose of the portion 10, for effectively sealing the port 11 and preventing entry of foreign substances into the interior of the radome. The arms 15, 16 and 17 are bent rearwardly and have their free end portions anchored in a deposit 20 of low melting point alloy, such as "Cerrobend," produced by the Cerro de Pasco Corporation, New York, N.Y. The composition of "Cerrobend" is 50% bismuth, 26.7% lead, 13.3% tin and 10% cadmium, and its melting temperature is 158° F. Other properties of "Cerrobend" are as follows:

Approximate specific heat liquid	.040
Approximate specific heat solid	.040
Approximate latent heat (B.t.u./lb.)	14
Approximate coefficient of thermal expansion ° C	.000022
Yield temperature	158
Weight lbs./in.^{3}	.339
Tensile lbs./in.^{3}	5990
Maximum load 30 sec. lb./in.^{2}	10,000

In use, after installation of the seal on the radome portion 10, said seal will effectively prevent entry of foreign substances into the interior of the missile, with the overall result that delicate measuring equipment or other apparatus within the missile will not be adversely affected during missile handling prior to the launching thereof. The properties of the low melting point alloy "Cerrobend" are such that the seal will be firmly anchored in place and will withstand the rough handling normally accorded missiles during transport thereof to the launching site.

After the missile is launched, the high stagnation temperature appearing at the nose thereof will quickly melt the "Cerrobend" deposit 20, when air flow impinging on the tab 18 will displace the seal from the nose of the radome and thereby clear the port 11 for the entry of air.

Referring now to the embodiment of the invention shown in FIGS. 3, 4 and 5, the numeral 21 indicates a pressure probe which is mounted on the nose of a missile, a portion of which nose is shown at 22. The probe 21 is formed in its side wall with an inlet port 23. The seal constituting the embodiment shown in FIGS. 3, 4 and 5 includes a body having semi-cylindrical cooperating sections 24 and 25 which are connected at their rear ends by curved tongue and groove hinge parts defining displaceable hinges 27 and which are formed with flared forward end portions 28 having concentric grooves 29 and 30 in their end faces. Inwardly of the forward ends of the sections 24 and 25 are mating recesses 31 which cooperate to define a chamber for receiving a normally compressed helical spring 32. As best seen in FIG. 3, the sections 24 and 25 snugly receive the forward end of the probe 21 and effectively seal the opening 23 for preventing the entry of foreign substances into the interior of the probe.

Normally retaining the sections **24** and **25** in mating relation, for defining the seal, is a deposit of low melting point alloy **33**, which may be of "Cerrobend" having the properties described in connection with the embodiment of the invention as shown in FIGS. 1 and 2 of the drawings. The deposit **33** completely fills the grooves **29** and **30** and covers the outer end faces of the sections **24** and **25** for retaining the sections in assembled relation, the hinge **27** securing the corresponding rear end portions of the sections **24** and **25** against displacement.

In use, when a missile utilizing the seal constructed as described above is fired, air flow at high temperature will impinge on the deposit **33** for melting the same, when continuing air flow, accompanied by the expanding effort of the spring **32**, will urge the sections **24** and **25** outwardly to the positions shown in dotted lines in FIG. 3. Further outward movement, which will be brought about by the aforementioned air flow, will cause separation of the hinge **27**, when the sections **24** and **25** will be blown clear of the missile. Air flow may then enter the opening **23** in the probe **21**.

In lieu of the concentric grooves **29** and **30**, parallel rectangular grooves may be employed; such grooves are shown at **34** and **35** in FIG. 5. Also, if desired, supplemental sealing means may be placed over the opening **23** within the sections **24** and **25**, as shown in dotted lines at **36** in FIG. 3.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In combination with an aerial missile having a nose portion formed with a port, and a groove formed in the nose portion remote from the port, a displaceable seal having a body and a plurality of arms, said body confronting the port and said arms extending along the nose portion and terminating above said groove, a gasket between the body and the port for sealing said port, a deposit of low melting point alloy in the groove and imbedding end portions of said arms for anchoring said seal on said nose portion, and means carried by one of said arms and acted upon by a high stagnation temperature high velocity air flow for displacing the seal from the nose portion upon melting of the alloy deposit during flight of the missile.

2. A displaceable seal as recited in claim 1, wherein said last mentioned means consists of a flat sheet metal tab bent to extend into the path of the air flow.

3. In combination with an aerial missile, a nose portion upon said missile, said nose portion terminating in a forward end having an air inlet port therein, said nose portion having a circumferential groove in the exterior surface thereof, said groove being spaced from said inlet port, a one piece displaceable seal for said opening, including a hub positioned in confronting relationship to said forward end and overlying said port, said hub having an area greater than the area of said port, a plurality of arms attached to said hub and arranged to extend back therefrom along the exterior surface of said nose portion, said arms terminating above said groove, and a gasket positioned between said hub and said forward end and completely closing said port, a deposit of a low melting point alloy in said groove, said deposit imbedding the terminal ends of said arms to thereby anchor said seal on said nose portion, said deposit being meltable by a high velocity, high temperature air flow occurring subsequent to launching of the missile to thereby free said displaceable seal, and means upon one of said arms upon which said air flow impinges to thereby remove said seal from said nose portion when said deposit has melted.

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