

[54] **RAIN RESISTANT, HIGH STRENGTH,
ABLATIVE NOSE CAP FOR HYPERSONIC
MISSILES**

[75] Inventors: **Laird D. Kinnaird; Seth B.
Moorhead, Jr.; James L. Casadevall,**
all of Orlando, Fla.

[73] Assignee: **The United States of America as
represented by the Secretary of the
Army, Washington, D.C.**

[22] Filed: **Dec. 3, 1971**

[21] Appl. No.: **204,591**

[52] U.S. Cl. **102/105, 244/117 A**

[51] Int. Cl. **F42b 11/00, F42b 13/00**

[58] Field of Search..... 102/105; 244/117 A,
244/23

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UNITED STATES PATENTS

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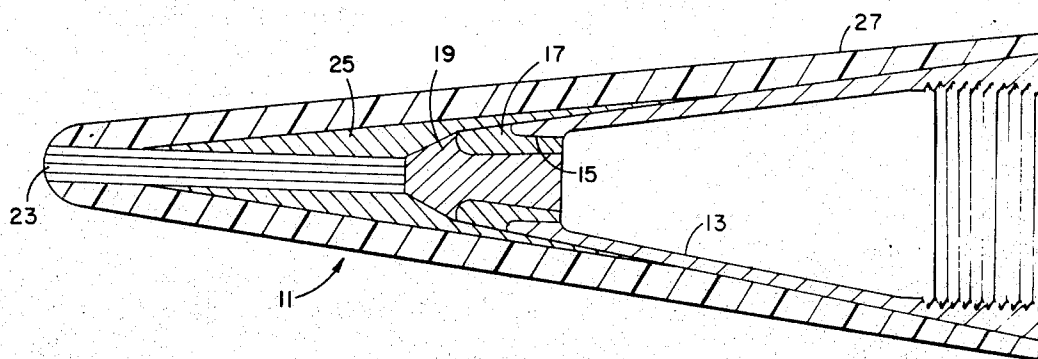
Primary Examiner—Robert F. Stahl

Attorney—William G. Gapcynski, Lawrence A.
Neureither et al.

[57] **ABSTRACT**

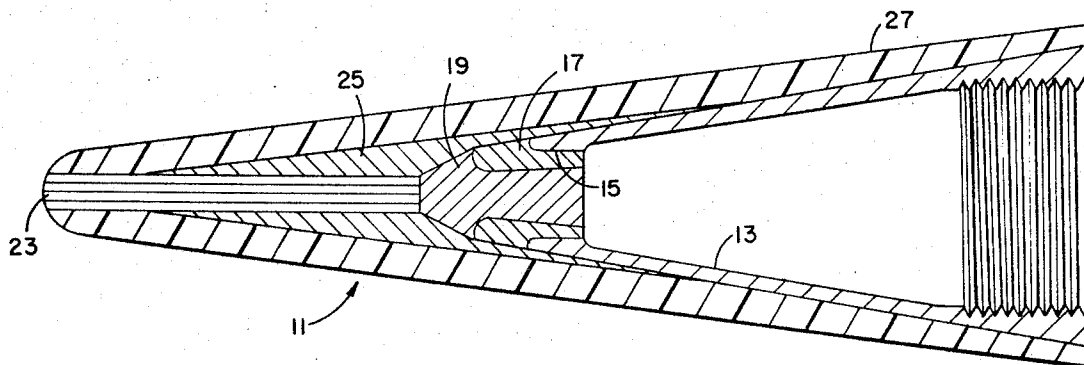
An ablative nose cap for slender type missiles in which the nose cap has a base member for securing the nose cap to the missile proper, an insulation member at the head end of the base member, a back-up nose tip mounted relative to the insulation member, a unidirectional fiber rod in front of the back-up tip and an outer wrap of reinforced phenolic about the outer surfaces of the several members to provide an outer ablative cover. The nose cap is designed for hypersonic speeds and for maintaining its structural and thermal integrity after particle impact encounters with rain, ice or dust at hypersonic velocities.

7 Claims, 1 Drawing Figure



PATENTED JUL 17 1973

3,745,928



Laird D. Kinnaird
Seth B. Moorhead Jr.
James L. Casadevall,
INVENTORS

BY

Jack W. Voigt
James T. Deaton

RAIN RESISTANT, HIGH STRENGTH, ABLATIVE NOSE CAP FOR HYPERSONIC MISSILES

BACKGROUND OF THE INVENTION

In missiles, there is a need for a nose cap that can be suited to slender vehicles and capable of operating with high ballistic factors in the supersonic and hypersonic (6,000–25,000 ft/sec) flight regime. It is also important that the nose cap remain sharp during ablation and that the nose cap be capable of carrying high structural and shock loads without failure. The nose cap must maintain vehicle integrity after particle encounter with rain, ice or dust at hypersonic velocities. Present nose caps are unable to attain these requirements.

Therefore, it is an object of this invention to provide a nose cap that is capable of operating on high acceleration vehicles that reach ballistic factors in the supersonic and hypersonic flight regime.

Another object of this invention is to provide an ablative nose cap that is capable of carrying high structural and shock loads without failure.

A further object of this invention is to provide a nose cap that maintains vehicle integrity after rain, ice or dust encounter at hypersonic velocities.

SUMMARY OF THE INVENTION

In accordance with this invention, a nose cap is provided that includes a body structure that is generally frustoconical in shape and has provisions at the forward end for receiving an insulating member. Supported by the insulating member is a back-up nose tip. Forward of the back-up nose tip, unidirectional fibers in the form of a center reinforcement rod is mounted. About the center reinforcement rod, the back-up nose tip, the insulating member, and the body structure, outer layers of molded fiber reinforced plastic is mounted. This structure provides a nose cap that is capable of carrying high structural and shock loads and still maintain vehicle integrity after particle encounters at hypersonic velocities. This is accomplished by allowing the center rod and outer ablative materials to be eroded away and by providing the back-up, refractory and impact resistant, nose tip that takes over when the ablative materials have been eroded or ablated away.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE of the drawing is a sectional view through a nose cap according to this invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawing, nose cap 11 includes body structure 13 with opening 15 at one end which mounts insulating material 17 that acts as heat insulation for back-up nose tip 19. Heat insulating member 17 is secured to the forward end of body structure 13 by conventional heat resistant bonding material. Back-up tip 19 is secured to heat insulating member 17 by conventional bonding adhesive. Heat insulating material 17 is preferably made from materials such as quartz phenolic, silica phenolic, zirconium or the like. This heat insulating member may be molded or machined. Back-up tip 19 is preferably made from tungsten impregnated with 17 percent copper, but may also be made from tungsten, tungsten copper, tungsten moly, tungsten silver, tungsten tantalum, or other refractory metal as the particular case may warrant.

Center reinforcement rod 23 is made of unidirectional high strength fibers that run down the center of the nose cap to provide high bending and longitudinal strength. Reinforcement rod 23 is preferably made of unidirectional quartz roving impregnated with phenolic resin, but may also be made from silica, glass or other unidirectional fibers. Further, a first outer layer 25 of bonded silica or quartz phenolic covers a portion of the reinforcement rod, the back-up nose tip, the insulating member and a portion of the body structure, and an outermost layer 27 of spiral wrapping of silica phenolic forms the outermost layer of the nose cap. Outermost layer 27 is spirally wrapped on edge in a tapering manner as illustrated by the cross hatching in the drawing. After assembling, the entire nose cap is cured under temperature and pressure as required such as for example approximately 4 hours at approximately 330°–350° F. After curing, the nose cap is then ready for use except for smoothing of the outer surface if desired.

In operation, inclusion of end grain high strength center rod 23 enables the nose tip to carry high shock and static loads and the favorable fiber orientation provided by the end grain rod allows the nose to stay sharp during ablation. Back-up tungsten tip 19 provides impact protection when center rod 23 has been ablated away. The cone angle and tip radius of the nose cap illustrated is not critical and can be varied as required by aerodynamic and/or structural requirements.

We claim:

1. A nose cap comprising a body member that has a generally frustoconical outer surface and a forward end with an opening therein, a heat insulating member mounted at the forward end of said body member and in said opening of said body member, said heat insulating member having an opening therethrough, a refractory metal back-up tip secured to and mounted in said opening of said heat insulating member, a center reinforcement rod mounted forward of said back-up tip, and ablative fiber reinforced plastic about the outer surface of said body member, said heat insulating member, said back-up tip and said center reinforcement rod to form said nose cap.

2. A nose cap as set forth in claim 1, wherein said heat insulating member is made from materials selected from the group consisting of silica phenolic, quartz phenolic and zirconium.

3. A nose cap as set forth in claim 2, wherein said back-up tip is made from refractory metal selected from the group consisting of tungsten, tungsten moly, tungsten copper, tungsten silver, and tungsten tantalum.

4. A nose cap as set forth in claim 3, wherein said back-up tip is made from the metal tungsten impregnated with 17 percent copper.

5. A nose cap as set forth in claim 4, wherein the fibers of said reinforcement rod are selected from the group consisting of quartz, silica, and glass.

6. A nose cap as set forth in claim 5, wherein said ablative fiber reinforcement plastic includes a first outer layer of quartz phenolic and an outermost layer of silica phenolic.

7. A nose cap as set forth in claim 6, wherein said heat insulating member is made from molded silica phenolic.

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