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2,936,710

HIGH MACH DECELERATION DEVICE

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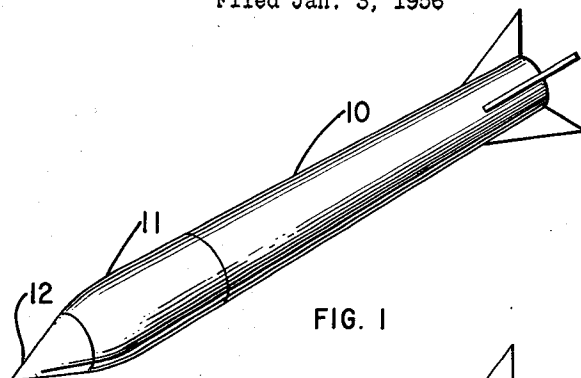


FIG. 1

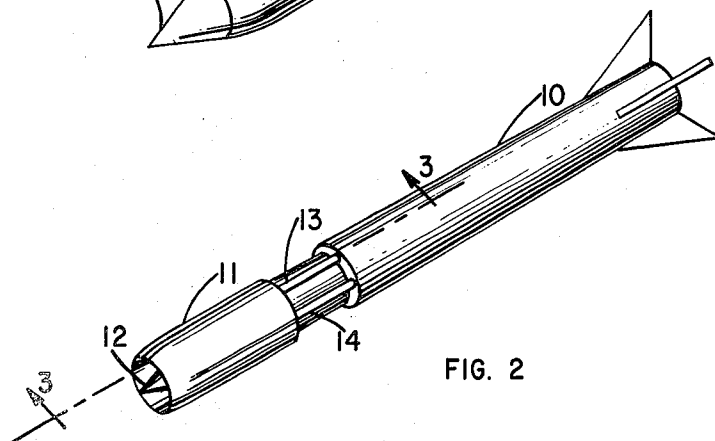


FIG. 2

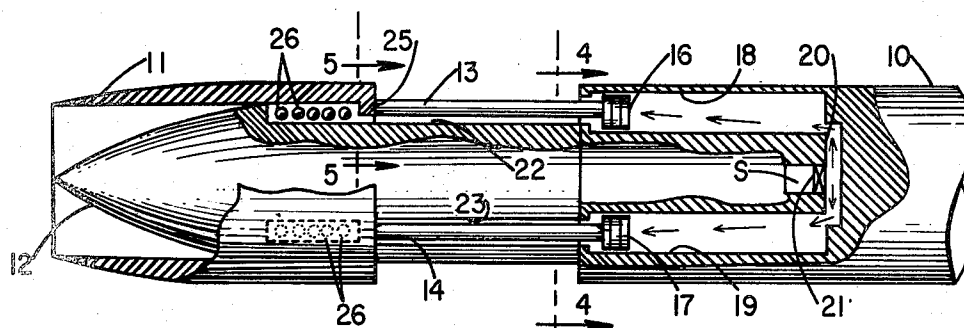


FIG. 3

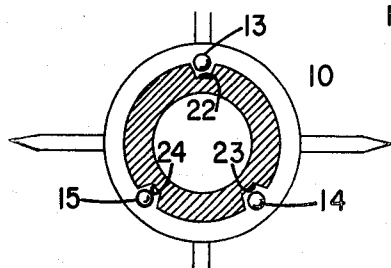


FIG. 4

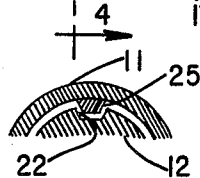


FIG. 5

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HIGH MACH DECELERATION DEVICE

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3 Claims. (Cl. 102—50)

This invention relates generally to aerodynamic deceleration devices, and more particularly to a high Mach deceleration device for increasing the drag on a missile in a longitudinal direction.

It is a primary object of this invention to provide a high Mach deceleration device which, upon operation, not only increases the longitudinal drag on the missile but simultaneously spoils nose lift thereby increasing the stabilizing moment of the missile about its center of gravity.

Another important object is to provide a decelerating device which will slow a missile sufficiently to enable a parachute to be used and which is so designed that the possibility of the decelerating device fouling the parachute lines is avoided.

An auxiliary object of the invention is to provide a deceleration device which simultaneously serves to protect measuring instruments or the like normally housed in the nose piece of the missile.

These and other objects and advantages of this invention are attained by providing a thin shell at the forward portion of the missile immediately preceding the nose cone. This shell is adapted to be telescoped over the nose cone by sliding forward, to provide, in effect, a substantially flat nose shape. Not only is the longitudinal drag increased by a large numerical factor as a result of this flat nose shape, but so positioning the shell over the nose cone destroys any nose lift so that the missile stability moment about its center of gravity is substantially increased and the direction of the missile relative to the earth will therefore be stabilized.

As a further consequence of the above described arrangement, there is no possibility of fouling parachute lines, normally extending from the rear portion of the missile, and, the shell surrounding the nose piece in its operative position will help protect any instruments normally housed therein.

A better understanding of the invention will be had by referring to a preferred embodiment thereof as shown in the accompanying drawings, in which:

Figure 1 is a perspective view of a high Mach missile in descending flight;

Figure 2 is a view of the missile of Figure 1 showing the decelerating device in its operative position;

Figure 3 is a cut-away view partly in cross section of the missile taken in the direction of the arrows 3—3 of Figure 2;

Figure 4 is a cross section taken in the direction of the arrows 4—4 of Figure 3; and,

Figure 5 is a cross section of a portion of the decelerating device taken in the direction of the arrows 5—5 of Fig. 3.

Referring to Figure 1, there is shown a missile 10 with a decelerating device 11 surrounding a forward portion of the missile immediately preceding the missile nose cone 12. As shown, the decelerating device 11 forms an aerodynamically clean surface with the missile fuselage 10 and nose piece 12. Preferably, the device 11 comprises a thin cylindrical shell having an outside

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diameter corresponding to the outside diameter of the adjacent portions of the missile.

In Figure 2, the cylindrical shell 11 is shown in its operative position for inducing high longitudinal drag. Any suitable means may be employed for telescoping the shell 11 over the nose cone 12. One means for effecting this movement comprises a series of piston rods, two of which are shown in Figure 2 at 13 and 14 and a third of which is shown in Figure 4 at 15. A minimum number of such rods would be three spaced 120° circumferentially about the forward portion of the missile, as shown in Figure 4, to insure balanced forces acting on the end of the shell with respect to its axis.

As shown most clearly in Figure 3, the piston rods such as rods 13 and 14 are rigidly secured to the rear end of the shell 11 and terminate in pistons 16 and 17 operable within piston cylinders 18 and 19 in the missile fuselage 10. The cylinders 18 and 19 are connected to a manifold passage 20 passing through a valve 21 to a high pressure source S. Alternatively, ram air pressure could be used as a pressure source.

The forward portion of the missile is provided with a reduced diameter in order to accommodate the thickness of the cylindrical shell 11 and thereby insure aerodynamic streamlining when the shell is retracted. As shown in Figures 3 and 4, this reduced portion is preferably provided with a series of longitudinal grooves 22, 23, and 24 corresponding to the number of piston rods and positioned to accommodate a portion of the piston rod diameters. These grooves also serve as ball bearing races together with the inside cylindrical surface of the shell for accommodating three sets of ball bearings, one set within the groove 22 being designated 26. The rear end of the cylindrical shell to which the piston rods are affixed includes three radially directed keys such as the key 25 shown in Figs. 3 and 5, which serve the dual function of confining the respective sets of ball bearings in their respective grooves and guiding the shell in its longitudinal movement, by projecting partially into the grooves. The use of three sets of ball bearings distributed circumferentially 120° prevents any possibility of binding of the shell during its longitudinal movement.

In operation, assume that the missile is entering the atmosphere from a high altitude at a speed of Mach 15. In response to either automatic timing mechanism within the missile or altitude sensitive means, high pressure from the source S is introduced into the cylinders by opening of valve 21 to urge the cylindrical shell 11 forwardly over the nose piece 12. It will be noted that the shell has a sharp leading edge and is of relatively thin construction so that there is not a large aerodynamic resistance offered to this movement. Forward motion of the shell 11 is checked when the piston heads 16 and 17 reach the end of the cylinders 18 and 19. In the operative position shown, static air will be trapped between the nose cone 12 and the inside surrounding portion of the shell 11 so that an effectively flat nose shape results thereby inducing an extremely high longitudinal drag on the missile. Further, all nose lift will be spoiled so that the stability moment of the missile about its center of gravity will be effectively controlled by the tail surfaces and thus increased.

After the missile has been decelerated to a subsonic speed, a conventional retarding parachute may be ejected and the missile subsequently recovered in a conventional manner. The positioning of the shell about the nose piece serves as added protection for instruments housed within the nose of the missile.

It will thus be seen that the present invention provides a reliable and simplified means for decelerating a missile from a high Mach number to a low speed without rendering the missile unstable. Modifications within the scope

and spirit of this invention will occur to those skilled in the art. The deceleration device is therefore not to be thought of as limited to the particular system described and shown for illustrative purposes.

What is claimed is:

1. In a missile having a generally cylindrical body including a forward portion terminating in a nose piece having a forward tip, a high Mach decelerating device for decelerating said missile, comprising: a shell of substantially the same outside diameter as the body of said missile, said shell having a front annular end surrounding said forward portion; and means for sliding said shell and nose piece relative to each other to bring said forward tip of said nose and said front annular end into substantially coplanar relationship so that said shell substantially surrounds said entire nose piece whereby the lift on said nose piece is spoiled.

2. A high Mach deceleration device for decelerating a missile, comprising, in combination: a missile body having a forward portion; a nose cone secured to said forward portion; a thin cylindrical shell surrounding said forward portion; and means for telescoping said shell

from said forward portion over said nose cone to define between a substantial portion of the outside surface of said nose cone and the inside surface of said cylindrical shell an annular air pocket blocking the flow of air between said outside surface of said nose cone and the inside surface of said cylindrical shell whereby the lift on said nose cone is spoiled.

3. A device according to claim 2, in which said forward portion comprises a reduced diameter section defining, with the inside cylindrical surface of said shell, an annular space; bearing means in said annular space; said means for telescoping said shell comprising piston-cylinder means operatively connected to said shell and missile body; and a source of high pressure adapted to be connected to said piston-cylinder means.

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