

[54] **MISSILE WITH THRUST VECTOR AND AERODYNAMIC CONTROL**

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[58] Field of Search..... 102/49.4, 49.5; 244/3.21, 3.22, 3.24, 3.25, 3.26, 3.27, 3.28, 3.29, 3.3

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[57] **ABSTRACT**

A jet propelled missile is provided with jet spoilers at its trailing end for thrust vector control and with other spoilers forwardly of its center of gravity for aerodynamic control. Both the jet spoilers and the other spoilers are operated from the same control device. The other spoilers are located adjacent the trailing ends of fins located on the forward end of the missile and can be displaced between an inoperative position recessed in the surface of the missile and an operative position projecting outwardly from the outer surface of the missile. The side edges of the other spoilers which extend outwardly from the missile can be recessed for a portion of their length for increasing the efficiency of aerodynamic control.

5 Claims, 7 Drawing Figures

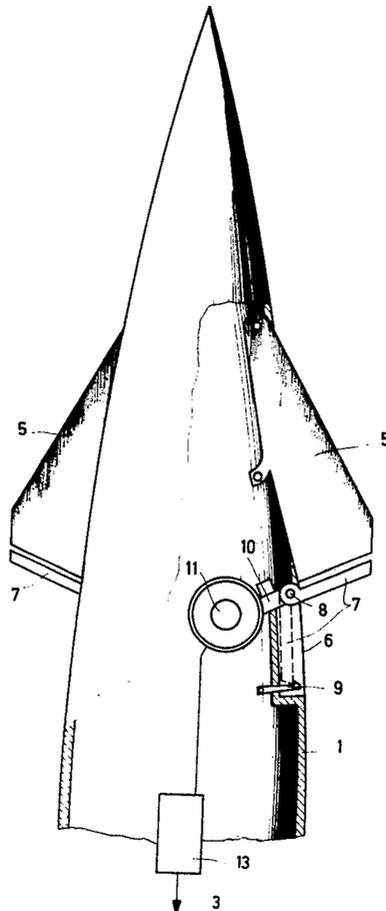


Fig.1

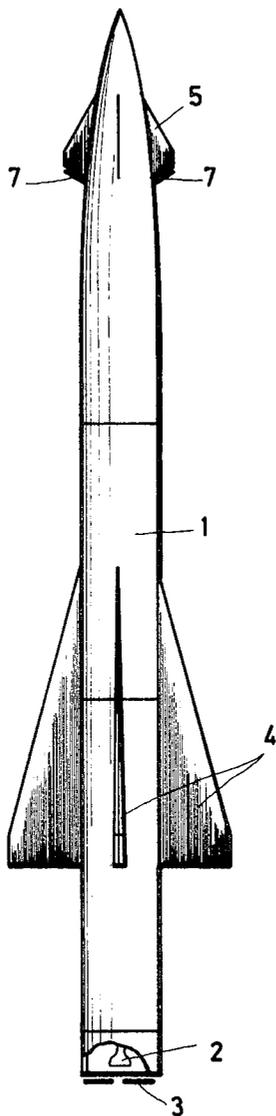
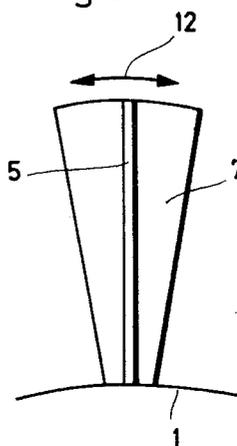


Fig.3



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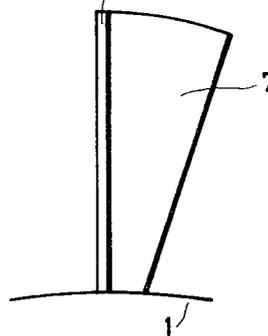
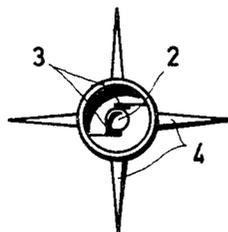
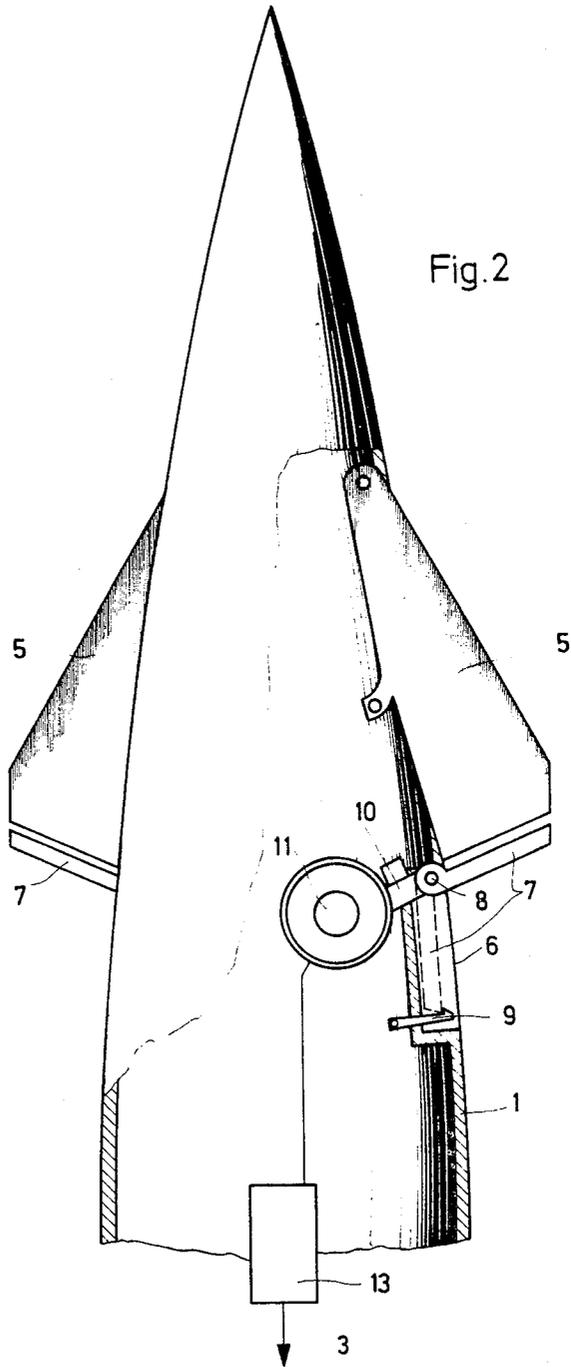
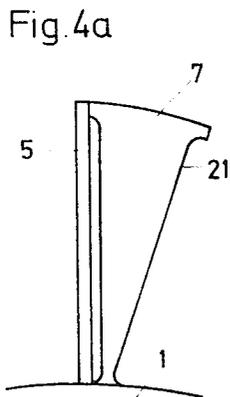
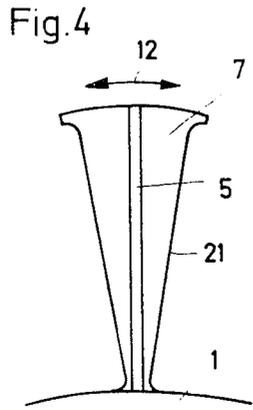


Fig.3a

Fig.1a





MISSILE WITH THRUST VECTOR AND AERODYNAMIC CONTROL

SUMMARY OF THE INVENTION

The present invention concerns a jet propelled missile provided with thrust vector controls and aerodynamic controls with both of the controls regulated by the same device and, more particularly, it is directed to the arrangement of the aerodynamic controls.

Missiles with both thrust vector and aerodynamic controls have the advantage, unlike missiles provided only with thrust vector control, that they can be controlled after the completion of the powered phase of jet propulsion and at the start of the trajectory, unlike missiles controlled only aerodynamically; see "A4" in F. Mueller "Leitfaden der Fernlenkung," Deutsche Radar-verlagsgesellschaft m.b.H., 1955, page 148. In this publication, the missile was controlled over mechanically coupled jet and rear surface controls. Such a solution requires, in addition to a higher mechanical expenditure, considerable space which is only available in larger missiles. Further, long storage periods are frequently necessary, particularly for missiles used for military purposes, where a mechanically complicated construction suffers, for example, due to corrosion or oxidation of the lubricants used, so that the proper functioning of the missile after prolonged storage is jeopardized.

Therefore, it is the primary object of the present invention, to provide a missile with a simple construction for effecting both thrust vector and aerodynamic control and particularly for avoiding mechanical coupling between the two types of control apparatus.

In accordance with the present invention, a missile is afforded with thrust vector control in the form of jet spoilers located at the rearward end of the missile and is provided with aerodynamic control by spoilers mounted on the missile forwardly of its center of gravity and at the trailing edge of fins projecting outwardly from the forward end of the missile. Preferably, the spoilers used for aerodynamic control can be moved from an inoperative position recessed in the outer surface of the missile to an operative position extending outwardly from the outer surface of the missile.

The arrangement and design of the thrust vector controls and the aerodynamic controls formed in accordance with the present invention are characterized in particular by their simple mechanical construction and the high degree of compatibility of the two different controls. Since the jet spoilers and the aerodynamic spoilers are operated by the same device, the magnets for the jet spoilers can also be used for positioning the aerodynamic spoilers so that the construction of the missile is simplified by reducing the number of parts required.

During the flying stage of the missile, its aerodynamic drag and its aerodynamic properties are not disturbed by the spoilers used for aerodynamic control, since these spoilers are retained in recesses in the missile surface and are displaced into the operative position only after the main burning and thrust of the jet propulsion has ceased.

Furthermore, because the aerodynamic spoilers are positioned forwardly of the center of gravity of the missile, the spoiler forces act on a long lever arm. Accordingly, the aerodynamic spoilers can be small in size so that the aerodynamic resistance of the missile is only

slightly increased when the spoilers are moved into the operative position.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side view of a missile embodying the present invention;

FIG. 1a is a rear end view of the missile illustrated in FIG. 1;

FIG. 2 is an enlarged partial view, partly in section, of the missile shown in FIG. 1 disclosing the arrangement of an aerodynamic spoiler;

FIG. 3 is a view, taken transversely of the missile, showing one of the aerodynamic spoilers illustrated in FIG. 2;

FIG. 3a is a view of the aerodynamic spoiler shown in FIG. 3, in a displaced position;

FIG. 4 is a view, similar to FIG. 3, of another embodiment of the aerodynamic spoiler; and

FIG. 4a is a view similar to FIG. 4 with the aerodynamic spoiler located in a displaced position.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, a jet propelled missile 1 is shown having a propulsion unit nozzle 2 and a pair of jet spoilers 3 at its trailing end for guiding the missile about two axes. On the outer surface of the missile just ahead of its trailing end, four aerodynamic fins 4 are arranged spaced equiangularly apart.

At the forward end of the missile spaced rearwardly from its nose and ahead of its center of gravity are four destabilizer fins 5 also disposed equiangularly apart. These fins 5 impart favorable conditions to the missile at the commencement of its flight shortly after the launching and, as a result, make it easier to guide.

Immediately rearwardly of each fin in the fuselage or surface of the missile 1 is a trapezoidally shaped recess 6 containing a spoiler 7 having the same shape as the recess, see FIGS. 2 to 4. The spoiler is pivotally mounted in the recess about an axis 8 so that it can be displaced between an inoperative position within the recess, shown in dashed lines, and an operative position, shown in full lines, extending outwardly from the outer surface of the missile and at the rearward end of the fin 5. Within the recess, a latch 9 is arranged for holding the spoiler 7 in the inoperative position shown in dashed lines. The latch is operated by means of a magnet system, not shown.

After the burnout of the jet propulsion system, when the jet spoilers 3 used for guiding the missile 1 are no longer effective, the spoilers 7 are released by displacing the latches 9 and springs 10, note FIG. 2, bias the spoilers outwardly into the operative position at the rearward end of the fins 5. To prevent the spoilers from being driven back into the recess 6, due to windgusts and the like, in the operative position they are locked in place in a known manner. In FIGS. 3 and 4 the spoiler 7 is shown positioned symmetrically relative to the fin 5, however, it can be displaced through a plane

extending transversely of the axis of the missile in the direction indicated by the double arrows 12.

The jet spoilers 3 and the spoilers 7 are compatible with a stabilizing system, not shown, of the missile so that they can be regulated and positioned by a single guide circuit 13 by means of the same control signals. Accordingly, the trajectory of the missile is controlled in the same manner, regardless of whether the jet spoilers 3 or the spoilers 7 are controlled by the same signal.

If the missile 1 is used in the supersonic range, slit-shaped recesses 21 are formed in the side or lateral edges of the spoilers which extend from the end adjacent to the outer surface of the missile to the other end spaced outwardly from the outer surface of the missile. The recesses extend for the greater part of the length of the sides of the spoilers 7. As a result, when a spoiler 7 is deflected or displaced into the position shown in FIG. 4a, an opening or interval is provided by the recess 21 along the trailing end of the fin 5 and the aerodynamic efficiency of the fins 5 and of the spoilers 7 is increased.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A jet propelled missile including first means for thrust vector control and second means for aerodynamic control for the application of transverse forces, control means for regulating both of said first and second means, and fins extending in the axial direction of said missile and positioned on and extending outwardly from said missile forwardly of its center of gravity; wherein the improvement comprises that said first

means includes first spoilers located at the trailing end of said missile, and said second means includes second spoilers positioned adjacent the trailing edges of said fins and forwardly of the center of gravity of said missile, said spoilers arranged to be displaced between an inoperative position and an operative position and in the operative position said second spoilers project outwardly from the outer surface of said missile at the trailing edges of said fins.

2. A jet propelled missile, as set forth in claim 1, wherein said second spoilers comprise a first end located adjacent the outer surface of said missile in the operative position, a second end located spaced outwardly from the outer surface of said missile in the operative position, and a pair of spaced side edges extending between said first end and said second end and said side edges being recessed inwardly toward one another for a portion of the length thereof between said first and second ends.

3. A jet propelled missile, as set forth in claim 2, wherein said missile having recesses formed in its outer surface for receiving said second spoilers in the inoperative position, and the first ends of said second spoilers being pivotally secured to said missile within said recesses.

4. A jet propelled missile, as set forth in claim 3, wherein a displaceable latch member is located within each of said recesses for holding said second spoilers in the inoperative position within said recesses.

5. A jet propelled missile, as set forth in claim 4, wherein a spring means is arranged within said missile in engagement with said second spoiler for biasing said second spoiler into the operative position when said latch member is released.

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