

[54] ROTATING FIN

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

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 118,266, Feb. 24,
1971, abandoned.

[52] U.S. Cl. 244/3.23

[51] Int. Cl. F42b 15/14

[58] Field of Search 102/34.1, 37.1, 3;
244/3.24-3.3, 3.23

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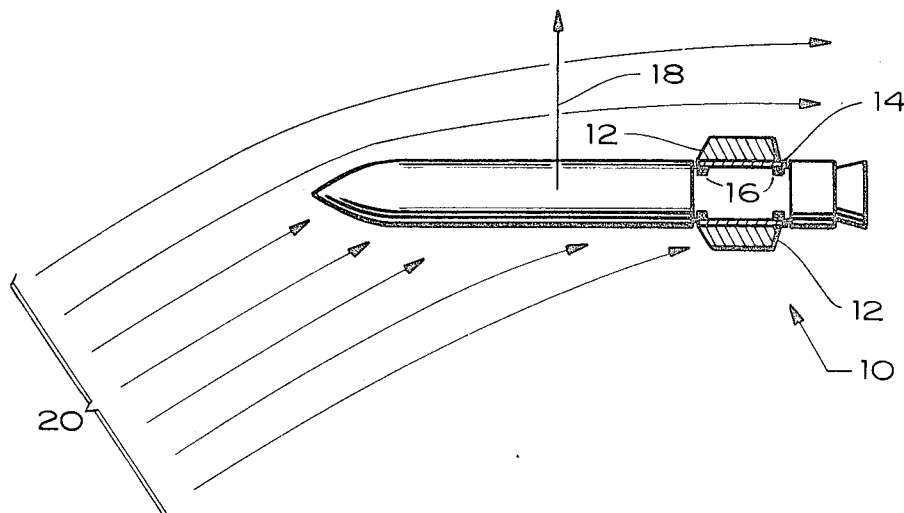
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[57] **ABSTRACT**

A rotatable sleeve with attached clipped double delta
shaped fins for mounting on a missile body so that the
fins may achieve a position of symmetry with respect
to incident air flow thereon without spinning-up.

2 Claims, 7 Drawing Figures



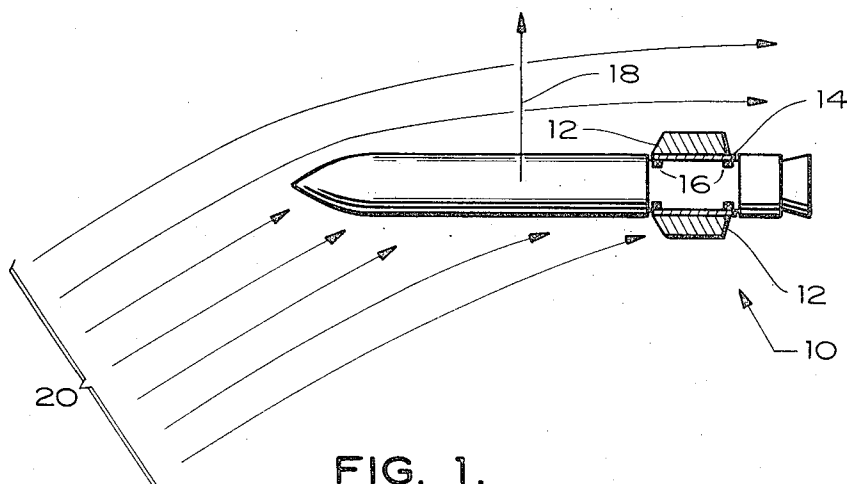


FIG. 1.

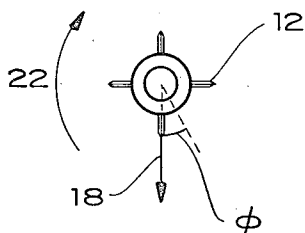


FIG. 2.

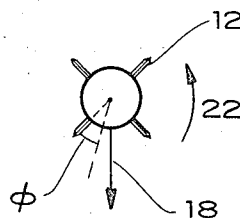


FIG. 3.

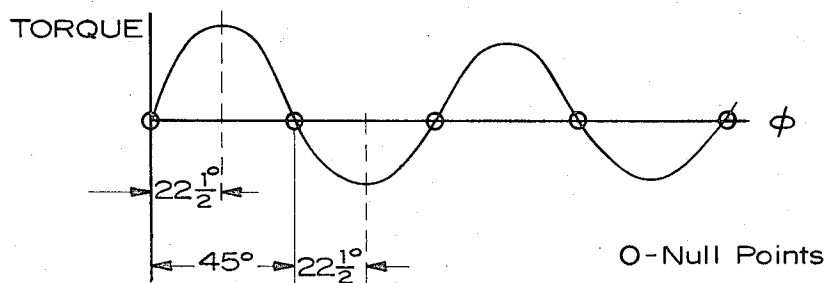


FIG. 4.

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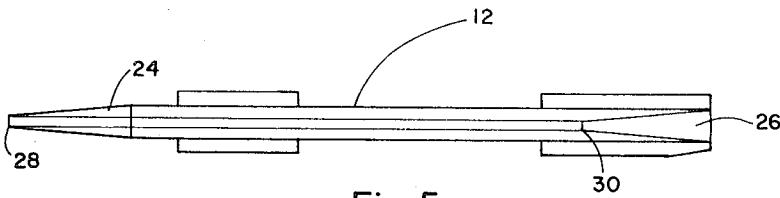


Fig. 5

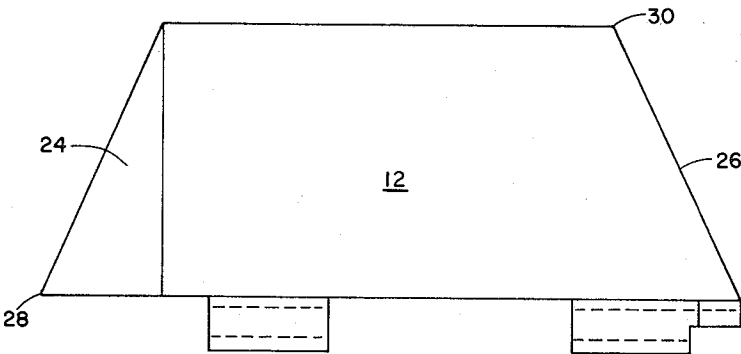


Fig. 6

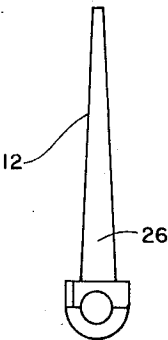


Fig. 7

1 ROTATING FIN

CROSS-REFERENCE TO RELATED APPLICATIONS:

This application is a continuation-in-part of Ser. No. 118,266 filed Feb. 24, 1971, and now abandoned.

BACKGROUND OF THE INVENTION

A recurrent problem in guided missiles is that of induced roll coupling. Induced roll coupling is caused by the torque induced by the change in air flow over the fins of a guided missile accompanying a turning maneuver.

When a missile is at an angle of attack the forces due to incident air flow on one side of the missile are greater than on the other side. Unless the fixed fins of the missile are at a null position, roll coupling will be induced. The present invention obviates the problem of roll coupling by providing the missile fins with means to achieve a position of symmetry, i.e., a null position, with respect to the incident air flow.

SUMMARY OF THE INVENTION

The present invention obviates problems incident to induced roll coupling. The invention comprises mounting the aft fins on a missile such as Sidewinder on a sleeve which is free to rotate about the missile axis. The sleeve is supported on bearings fore and aft and is free to rotate under the force induced on the fins mounted on the sleeve. The fins are of a clipped double delta configuration so that the fins and sleeve do not spin-up under the force induced by the change in air flow accompanying a turning maneuver. Instead, the fins are allowed to, and do achieve, a position of symmetry i.e., a null position with respect to the incident air flow.

DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view of the invention in cross section as it appears on a guided missile;

FIG. 2 is an elevational view of a back of the missile in one of its null positions;

FIG. 3 is an elevational view of a back of the missile in the other of its null positions;

FIG. 4 is a graph of torque caused by induced roll coupling versus the angle between a null position of the fins and a non null position of the fins for a four fin sleeve;

FIG. 5 is a plan view of the invention;

FIG. 6 is a side elevation view of the invention; and

FIG. 7 is an elevation view of the back end of the fin.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a missile 10 with stabilizing fins 12 connected to the missile by a rotatable sleeve 14. The sleeve is supported on bearings 16 fore and aft and is free to rotate under the force induced on the fins mounted on the sleeve. FIG. 1 shows the missile turning in the direction of arrow 18 causing the incident air flow 20 to be greater on the lower side of the fins than on the upper side. It is seen in FIGS. 2 and 3 that when

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the missile is in a turn as shown in FIG. 1, there is greater air flow over the bottom portions of the fins. If the fins are at an angle ϕ to the null position of FIGS. 2 and 3, one of the bottom fins will display a greater area with respect to the incident air flow than will the other fin. This will cause a missile with nonrotatable fins to spin in the direction of arrows 22.

The guidance system of the missile is unable to react quickly enough to cause the swivel nozzle to move quickly enough to compensate for this spin. The missile will thus veer off in a wrong direction.

The present invention obviates this problem incident to induced roll coupling. The sleeve is free to rotate under the force induced on the fin mounted on the sleeve. The fins are so shaped that the fins and sleeve do not spin under the force induced by the change in air flow accompanying a turning maneuver. Instead, the fins achieve a position of symmetry with respect to the incident air flow, that is, a null position. It is to be noted that a four fin rotatable sleeve will never rotate more than $22\frac{1}{2}^\circ$ to achieve a null position; an eight fin sleeve not more than $11\frac{1}{4}^\circ$, etc.

Fin 12 of FIG. 1 is shown in greater detail in FIGS. 5, 6 and 7. It is seen that the fin is of a clipped double delta configuration. The perimeter of the fin from point 28 to point 30 is rounded off. The forward portion 24 of the fin becomes increasingly thicker from front to back as does the main portion of the fin from top to bottom with the rear edge 26 of the fin being flat.

What is claimed is:

1. A device for obviating induced roll coupling in a guided missile comprising:
 - a missile having a generally elongated cylindrical body member for providing stabilized flight;
 - a plurality of fins mounted to freely revolve transversally in either direction to the longitudinal axis of said missile for allowing said fins to move during said missile flight;
 - said fins being streamline shaped members having a base aligned parallel with the longitudinal axis of said missile body, leading and trailing edges inclined with respect to said base, a tip of shorter axial dimension than said base dimension and spaced a substantial distance from said base forming a symmetrical member for aligning itself in the air stream; and
 - bearing means positioned on the circumference of said missile body and having a portion fixably secured to said base for holding said fins in spaced relationship to one another around the circumference of said missile body;
 whereby the fins rotate with respect to said missile body to seek a null position during flight of the missile and rotate to maintain this null position during missile turning maneuvers.
2. The device of claim 1 wherein the profile of said fin is tapered from said base to said tip and having a front portion tapered towards said leading edge from a plane perpendicular to said base and extending through the corner formed by the meeting of said leading edge and said tip edge.

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