United States Patent

Blair

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[54] BOMBLET

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[73] Assignee: **The United States of America as represented by the Secretary of the Navy**

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[52] **U.S. Cl.** **102/4**, 102/7.2, 244/3.23

[51] **Int. Cl.** **F42b 25/16**

[58] **Field of Search** 102/2–4, 7, 7.2, 102/6; 244/3.22–3.29

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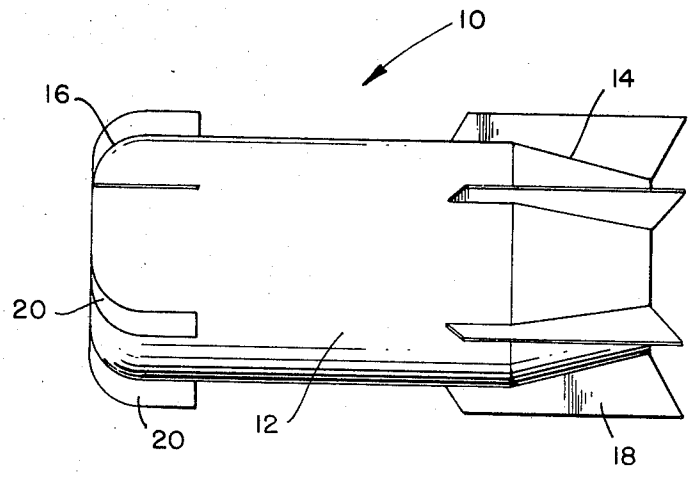
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[57] **ABSTRACT**

A bomblet is provided with forward air vanes having a pitch angle which imparts a spin and rearward fins which are straight and serve only to maintain stability. The fins protrude only slightly beyond the bomblet silhouette and do not extend past the hexagonal packaging envelope.

3 Claims, 3 Drawing Figures



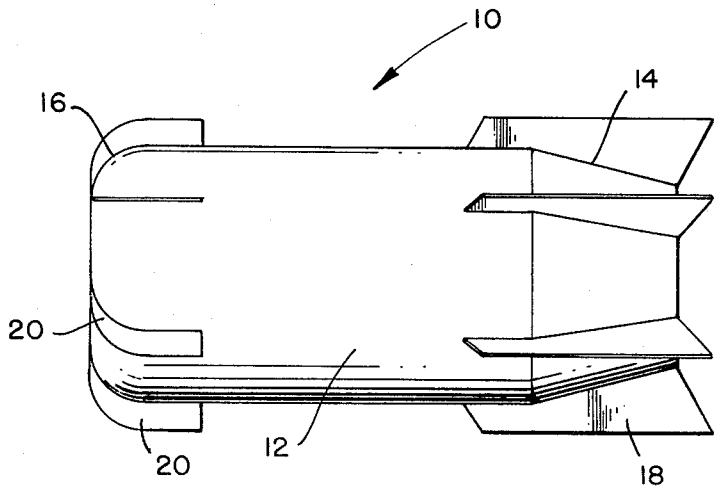


FIG. 1.

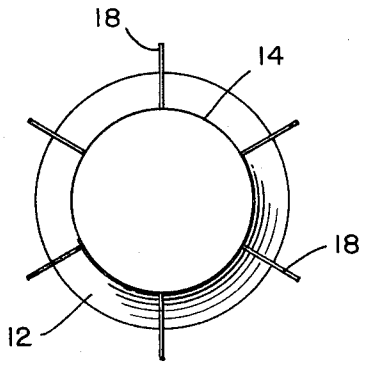


FIG. 2.

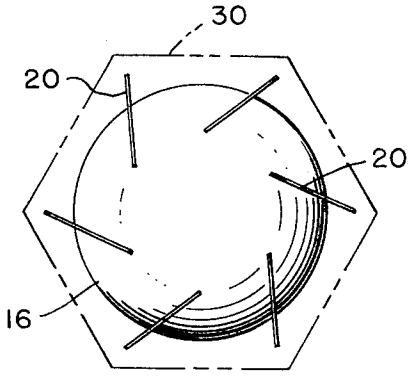


FIG. 3.

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BOMBLET

BACKGROUND OF THE INVENTION

Mathematical analysis has shown that antipersonnel/material weapons are far more effective when composed of large numbers of clustered bomblets which are released and scattered over large areas than when utilized as massive bombs. To date the use of magnus lift from spinning bomblets has resulted in dispersion of 1,000 feet lateral/1,000 feet altitude. Computed trajectories of lifting bodies show that dispersion angles as high as 4,000 feet lateral/1,000 feet altitude are possible. Ground launched bomblets (air gun) have been able to achieve about 75 percent of the theoretical dispersion when launched at "pretrimmed" conditions. Aircraft releases, however, attain only 25 percent of the theoretical because of bomblet oscillations and coning motion which prevents the bomblets from dispersing from the nominal trajectory. Investigations are presently being conducted in the United States, England and Australia on self dispersing bomblets. No one has been able to solve the inherent coning motion which lifting bodies experience when freely falling through the air. J. H. W. Shannon has had the greatest degree of success to date with two bomblet shapes which are long thin cylinders (length = 5.7 diameter). Dispersion is gained by flying at trim angles varying from 4.1° to 10°. The coning motion is kept low by keeping fin cant below 10 minutes of arc for fin spans of one caliber.

SUMMARY OF THE INVENTION

The Aero-Lift bomblet has the following advantages over those being studied by other investigators.

a. Short compact shape with no long tail boom or wasted space.
b. The six fins do not extend past the hexagonal packaging envelope allowing high density packing.
c. There are no moving or sliding parts to jamb.
d. The fins are rugged enough to withstand rough handling tests.
e. This bomblet shape is designed to make use of the maximum lift attainable by flying at $\alpha = 30°$.
f. By shifting the fins back in increments of 0.2 inches the trim angle will be reduced approximately 10°. The reduction of dispersion will fill the "hole in the middle" which develops in impact patterns of high dispersing bomblets.
g. The unique slanted air vane creates air scoops at trim causing spin which works together with the bomblets polar and transverse moment ratio to keep the bomblet on a constant heading. Pitching and coning are thus eliminated.
h. The changing direction of the incident airstream as the bomblet approaches ground impact creates a torque on right hand spinning bomblets which will cause them to veer to the right. A left hand spinning bomblet will veer to the left thereby increasing lateral dispersion when mixed loads of right and left hand spinning bomblets are used.

This bomblet utilizes the body lift generated by flying through the air at pitch angles of 10° to 40°. It is designed to package well in a cluster and, when released from high speed aircraft (300 to 450 knots) to utilize the available kinetic energy towards dispersion.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of a bomblet according to the invention;

FIG. 2 is an end view looking forward; and

FIG. 3 is an end view looking aft.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the illustrated embodiment, FIGS. 1–3, the bomblet **10** comprises a cylindrical body section **12** with a tapered tail section **14** and ogival nose section **16**. The tail or aft section is fitted with planar fins **18** each of which fins are aligned with one of the family of planes passing through the longitudinal axis of body **12**.

The nose section **16** also carries a plurality of fins **20**. Fins **20**, however, unlike aft fins **18**, are set at an angle to the above mentioned planes. The fins **20**, in this embodiment are orthogonal to a circle defined by a projection of body section **12** projected upon a cross-sectional plane orthogonal to said longitudinal axis.

To date all aircraft flight tests have been performed on solid aluminum shapes because this best represents a steel fragment shell with fuze and explosive load. All tests have utilized the basic body shape shown in FIG. 1. The blunt nose shape contributes to the high trim angle at which this bomblet flies; sharper nose shapes and bigger fins would tend to reduce trim and dispersion. It is conceivable that the nose radius could be made larger or smaller, that the boat tailed section could be made longer or shorter and that the fins and center of gravity of the bomblet can be varied to optimize the performance of this bomblet.

The aero-lift bomblet is aerodynamically stable when flying at an angle of attack of 22.5°. The trim angle can be increased by moving the fins forward or decreased by moving them back. Pitch damping is increased by reducing the length of the fins, however, the margin of stability is decreased also. When the fins are shorter than 1.4 inches a marginally stable condition exists. The lift coefficient reaches a maximum of 1.45 at $\alpha = 30°$.

When released from an aircraft at air speeds of 300 to 450 knots the bomblet experiences transient pitch oscillations and coning motion which damp out rapidly. The bomblet then trims out at an angle of 30° and utilizes the aerodynamic lift generated by its unique flight condition to achieve dispersion from a nominal ballistic trajectory.

What is claimed is:

1. An aerial missile comprising:
a body having a generally cylindrical midsection and forward and aft contoured surfaces;
said forward surface having a circular end face of smaller radius than the radius of said cylindrical midsection and joined thereto by a curved surface the profile of which is substantially a quadrant arc;
said aft surface having an end face of a radius smaller than said cylindrical midsection and joined thereto by a smoothly tapered conical surface;
a plurality of aerodynamic fins on said body at said forward section extending outwardly therefrom in planes at acute angles to the longitudinal surface of said body and parallel to the longitudinal axis thereof; and
a like plurality of aerodynamic fins on said body at said aft surface extending outwardly in planes normal to said surface and extending from a point forward of said conical surface at least to said end face of said aft surface.

2. The bomblet of claim **1** wherein
said rear fins have forward and aft surfaces angling from forward to aft as they extend from said body.

3. The bomblet according to claim **1** wherein
the fins number six aft and six forward and said fins are so positioned as to lie fully within the envelope of a circumscribed hexagonal envelope.

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