United States Patent [19]

Barr

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[54] **CONCAVE-COMPOUND POINTED FINNED PROJECTILE**

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[52] **U.S. Cl.** **102/92.1,** 102/DIG. 7

[51] **Int. Cl.** **F41b 13/00**

[58] **Field of Search** 102/38, 42, 91, 52, 53, 102/67, 92.1, 92.4, 92.7; 273/106, 106.5; 244/3.24

[56] **References Cited**

UNITED STATES PATENTS

213,083	3/1879	Wright et al.	273/106.5
2,288,562	6/1942	Birkhofer et al.	273/106.5

FOREIGN PATENTS OR APPLICATIONS

619,192	3/1949	Great Britain	273/106.5

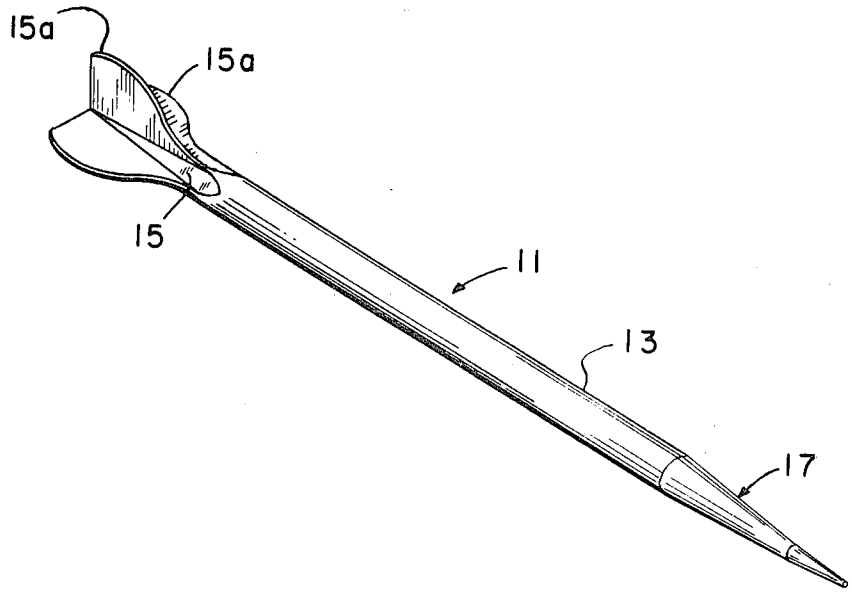
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[57] **ABSTRACT**

A projectile adapted to curl and tumble on impact with a target, and having a long cylindrical shank section with a concave tapered blunt nose and rear stabilizing fins.

4 Claims, 6 Drawing Figures



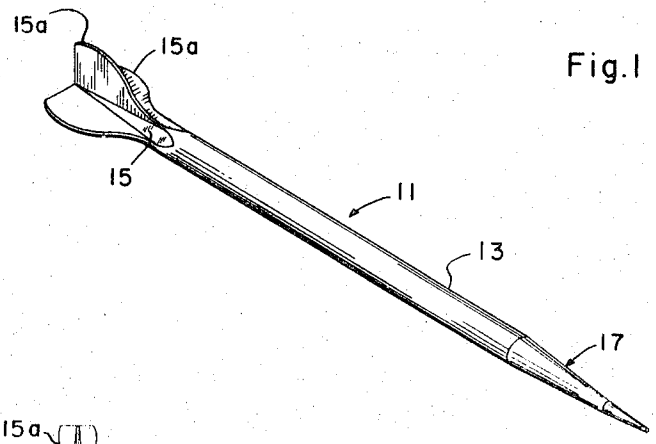
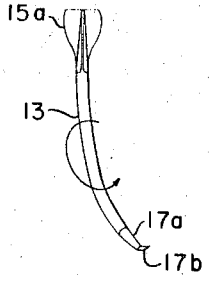


Fig. 1



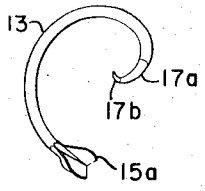


Fig. 5

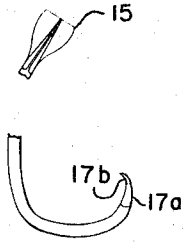


Fig. 4

Fig. 6

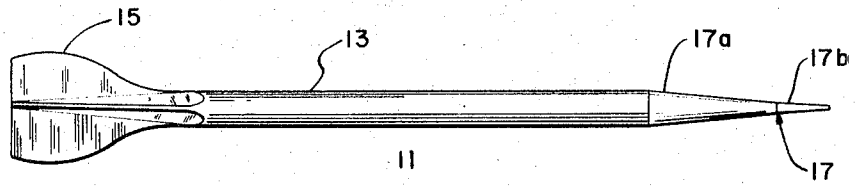


Fig. 2

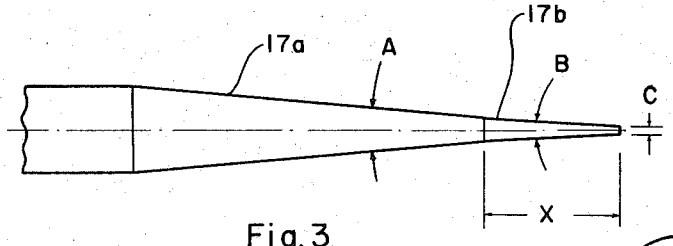


Fig. 3

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CONCAVE-COMPOUND POINTED FINNED PROJECTILE

This invention relates to fin-stabilized projectiles and is particularly applicable to small needle-like finned projectiles commonly referred to as flechettes or flechette projectiles.

Flechette projectiles such as shown in U.S. Pat. No. 2,939,395 are highly advantageous in their ability to travel long distances at high velocities, with good accuracy. For maximum effectiveness after impact as an antipersonnel weapon it is desirable that these flechettes be stable along their air flight path and curl and tumble upon impact with a soft, dense target. This tumbling action occurs at a certain minimum velocity. While projectiles will tumble to some degree if the velocity is sufficiently great at impact, it is desirable that the required or critical impact tumbling velocity be as low as possible. This invention aids in decreasing the required target impact velocity for a finned projectile to tumble within an effective travel of one or two projectile lengths after impact.

Tumbling action may be caused by a pitching moment applied at the nose of the projectile, which is of sufficient magnitude that it cannot be balanced by the fins, or which causes the projectile to bend or curl so that the fins are no longer operative in the new medium. Although a fin-stabilized projectile is stable during air flight, by weakening the nose section through formation in a desired concave shape according to the invention, the projectile is given an increased capability of bending and producing an unbalancing pitching moment after impact on striking a denser medium such as an animal. The concave shape of the nose section reduces the strength at the point where the highest loads are applied and deforms the point causing a high pitching moment and resulting in tumbling of the entire projectile at a lower velocity than with a conventional-nosed fin-stabilized projectile.

It is accordingly a major feature of the present invention to provide an improved projectile in the form of a flechette which is capable of a reasonable accuracy in flight but which will tumble in a desired manner on impact at a relatively lower velocity with a higher density target and is capable of reasonable handling in assembly without point deformation.

It is also a feature of this invention to provide a fin-stabilized projectile with a small blunt end having a lowered impact tumbling velocity. While flechettes having a needle sharp pointed configuration can produce low velocity impact tumbling action, such configurations are difficult to handle in assembly, etc., without damage and consequent deterioration of air flight performance characteristics. The long concave point can accomplish the same action although the very tip has a small blunt face rather than a perfect point. With the present invention the projectile may have a blunt nose end diameter of as much as .1 caliber (the body diameter of the flechette being defined as one caliber).

Still other objects, features and attendant advantages will become apparent to those skilled in the art from a reading of the following detailed description of a single embodiment constructed in accordance with the invention, taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a perspective view of a flechette according to the invention,

FIG. 2 is a side elevation of the flechette of FIG. 1,

FIG. 3 is an enlarged fragmentary view of the pointed nose section of the flechettes of FIGS. 1 and 2,

FIGS. 4, 5 and 6 are schematic illustrations of typical configurations of a flechette according to the invention, and after impact, and particularly in the condition it assumes during tumbling after impact.

Referring now in detail to the Figures of the drawings, a flechette projectile **11** is provided, having a smooth walled cylindrical main body section or shank **13** with a tail section **15** having stabilizing fins **15***a* formed thereon as by swaging of the metal from the cylindrical body section into the configuration as indicated in FIG. 1. The forward end of the projectile has a concave compound angle point **17**, formed by two adjoining frusto-conical surfaces **17***a* and **17***b*. The frusto-conical section **17***a* is formed with a greater included angle A than the included angle B formed by the surface of frusto-conical section **17***b*. It has been found that a very advantageous construction of the invention, which provides good flight accuracy, with good handling characteristics and desired tumbling action, is attained with a projectile as illustrated in FIGS. **1–3** in which the dimensions, material and treatment are as follows:

Total length of flechette	= 1.6 – 1.7 inches
Included angle A	= 10 – 12°
Included angle B	= 5 – 7°
Tip diameter C	= .004 – .010 inches
Cylindrical body diameter D	= .065 – .075 inches
X	= .10 – .12 inches
Heat treatment — entire projectile length to hardness of R_c40 to R_c50	

Best results have been obtained with an included angle A of 10° and included angle B of 6°, the preferred tip diameter C being 0.004 – 0.005 inches, cylindrical body diameter D 0.070 inches, total length of flechette 1.67 inches, and X being 0.11 inches, this being particularly most advantageous for employment in cartridge casings of .22 caliber ammunition employing the flechette and sabot arrangement of U.S. Pat. No. 2,939,395.

In operation, the projectile is propelled by a suitable means, such as through initial gas pressure propulsion while carried in a barrel by a sabot as in U.S. Pat. No. 2,939,395, which sabot may be stripped from the projectile as by a stripper as shown in U.S. Pat. No. 2,811,901. Upon impact with a target, the concave nose section **17** will bend, first along the weakest tapered section **17***b*, causing a high pitching moment to be applied to the nose of the projectile. This introduces a tumbling action and causes additional bending of the projectile to a generally curled configuration such as the configurations indicated schematically in FIGS. **4–6.** The finned section may in some instances break loose from the remaining body portion, as generally illustrated in FIG. **6.** The tumbling action transmits much more of the energy of the projectile to the target. Without tumbling, the projected area of the crosssectional envelopes of the projectile transmits the energy to the target. With tumbling, the side projected area with flechettes of for instance a 10:1 length/cross-sectional envelope transmits over ten times the energy over the same distance. The tumbling projectile will thereby effect considerably more damage to a relatively soft and thick target, such as an animal, than would otherwise be effected by passage of the projec-

tile thereinto or therethrough in the straight elongated form.

While the invention has been described with respect to a preferred physical embodiment, it will be readily apparent to those skilled in the art that various modifications and improvements may be made without departing from the scope or spirit of the invention. Accordingly, the invention is not to be limited by the specific illustrative embodiment, but only by the scope of the appended claims.

That which is claimed is:

1. A one piece projectile adapted to curl and tumble on impact with a target, comprising: a long cylindrical shank section, a blunt nosed concave tapered forward end section integral with and materially shorter than said shank section, and a rear section integral with said shank section and having integral stabilizing fins formed thereon.

2. A projectile according to claim **1,** said concave tapered forward end section having a substantially flat tip end and being formed with two distinct adjoining tapered frusto-conical surfaces having an annular junction line between said cylindrical shank section and said flat tip end, the forwardmost of said frusto-conical surfaces forming a smaller longitudinally extending included angle between its diametral surfaces than the other said frusto-conical surface and being substantially shorter than the other frusto-conical surface.

3. A projectile according to claim **2,** said smaller longitudinally included angle formed by said forwardmost frusto-conical surface being in the range of approximately 5–7°, said other adjoining rearward frusto-conical surface longitudinally included angle being in the range of approximately 10–12 °, the ratio of said forwardmost frusto-conical surface length to the other adjoining frusto-conical surface length being about 1–3, and the ratio of the length of said shank and tail sections to the length of said forward end concave section being at least 3–1, with a total length to shank diameter ratio of at least 15–1.

4. A flechette projectile according to claim **3,**

said projectile length being approximately 1.65 inches,

said forwardmost included angle of taper being approximately 10°,

the included angle of the other said tapered surface being approximately 6°,

the tip end being flat and of a diameter of approximately 0.005 inches,

the cylindrical shank diameter being approximately 0.070 inches,

the axial length of the forwardmost frusto-conical surface section being approximately 0.11 inches,

and the projectile hardness being between R_c 40 and R_c 50.

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