United States Patent

Abbott et al.

[15] **3,650,213**

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[54] FRANGIBLE FILLED-PROJECTILE AMMUNITION

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[73] Assignee: **AAI Corporation,** Cockeysville, Md.

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[52] **U.S. Cl.** .....**102/38,** 102/42 C, 102/92.7, 102/92

[51] **Int. Cl.**.....**F42b 5/02**

[58] **Field of Search**.....102/41, 92, 7, 43 C, 42, 42 C, 102/95, 93, 94, 38

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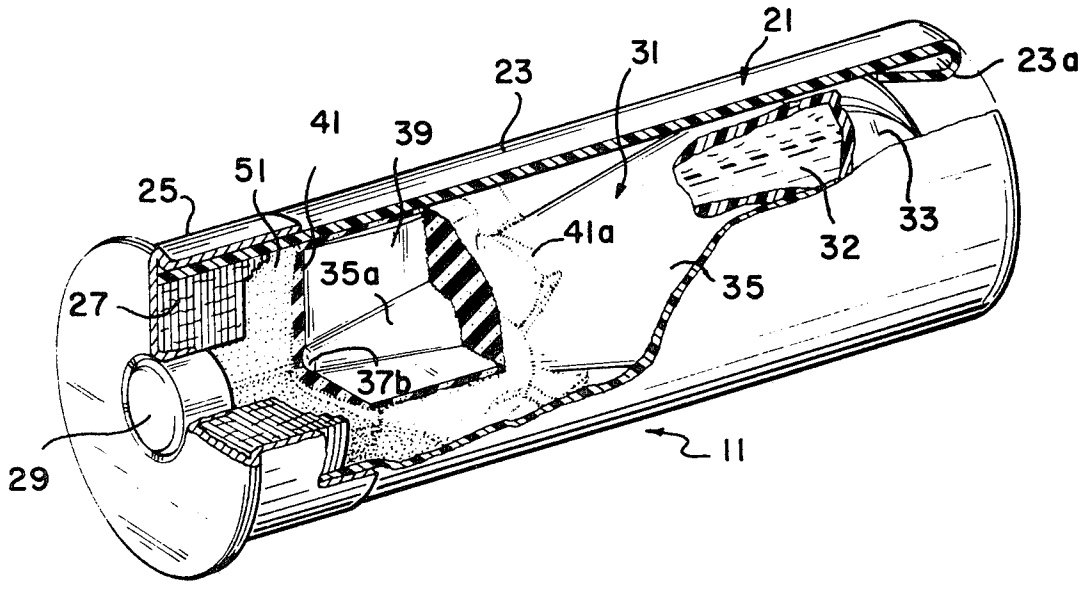
Primary Examiner—Robert F. Stahl
Attorney—Reginald F. Pippin, Jr.

[57] **ABSTRACT**

Ammunition is disclosed in which a generally teardrop shaped hollow projectile is formed of frangible plastic or other suitable material, the rear end of the projectile is finned and the forward rounded or ogive shaped end is scored or grooved for ease of rupture on impact, the projectile carries a payload of a desired flowable material such as a liquid, powder, or a gas, and preferably a liquid, for dispersion on impact at target, the projectile is carried in a cartridge case in which ignitable propellant powder is disposed adjacent the rear end of the projectile and adjacent a primer, there being a blanket of soft resilient flexible polyurethane foam surrounding and behind the rear finned area of the projectile and disposed between the fins and the propellant powder to retain the powder in place in a compact zone adjacent the finned rear of the projectile.

20 Claims, 11 Drawing Figures



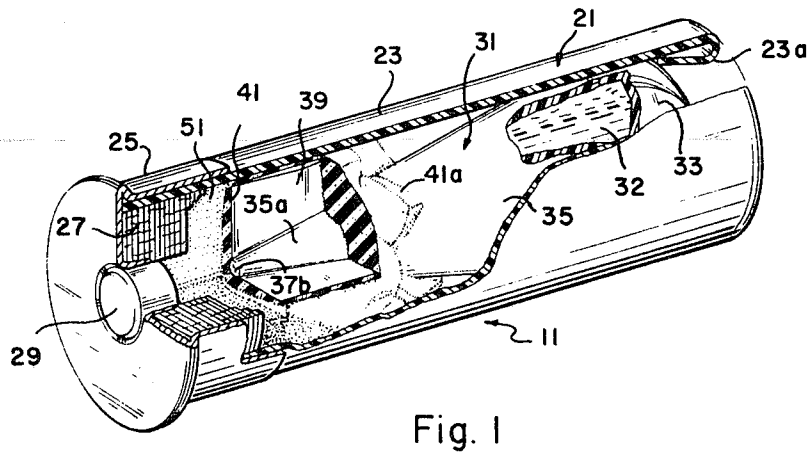


Fig. 1

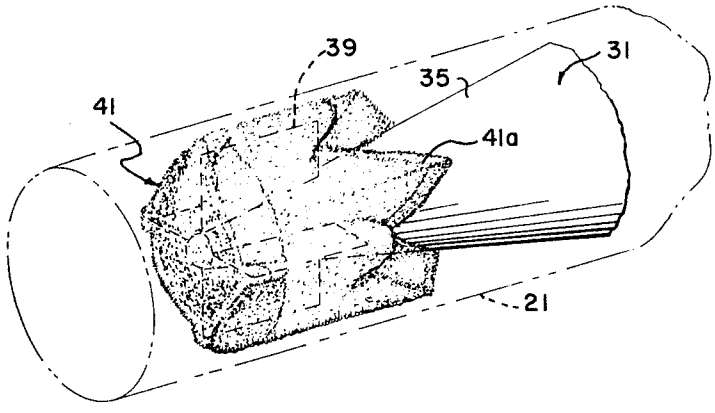


Fig. 2

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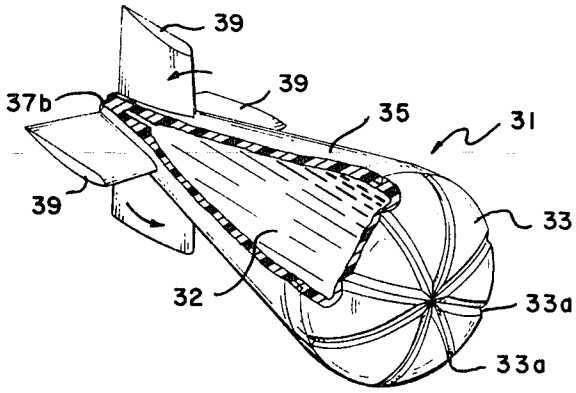

Fig. 4

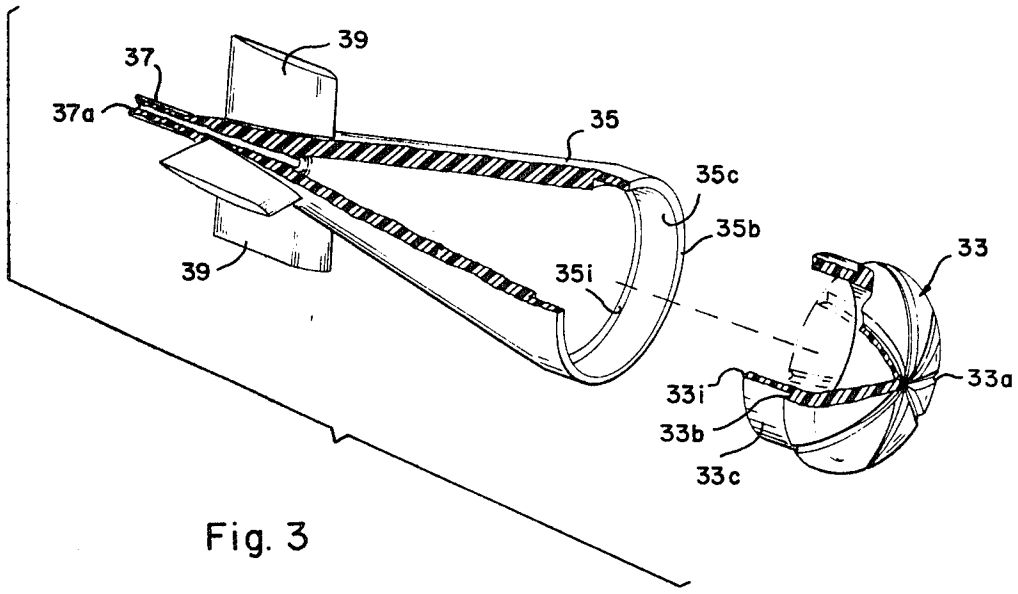

Fig. 3

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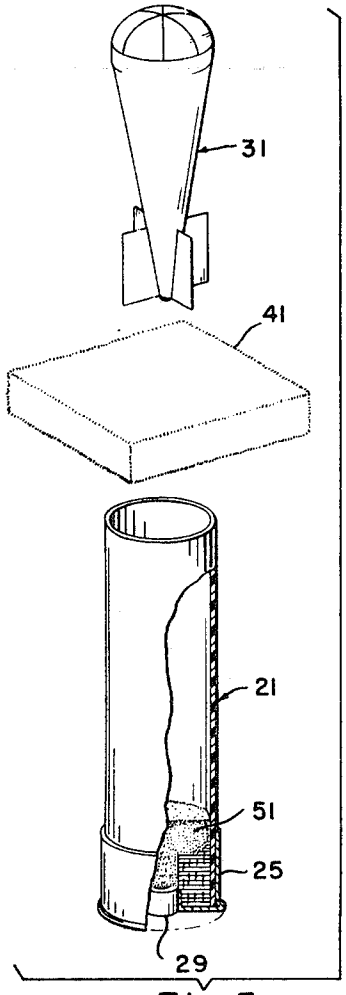

Fig. 5

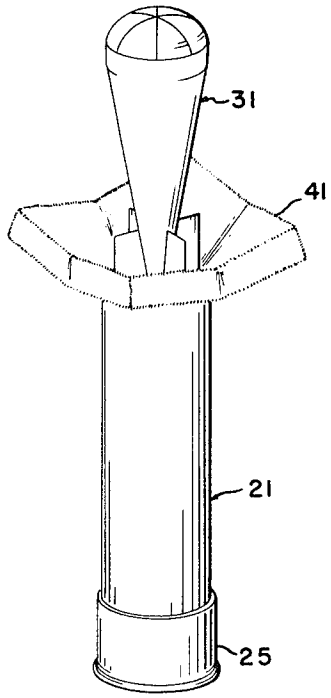

Fig. 6

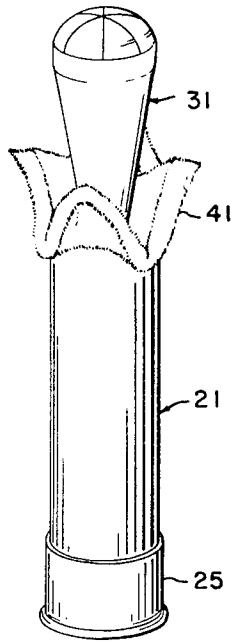

Fig. 7

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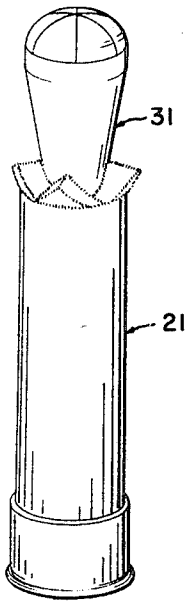

Fig. 8

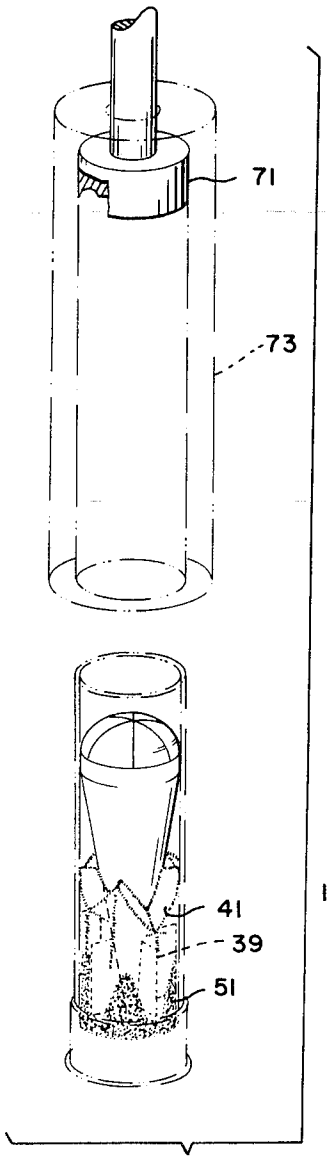

Fig. 9

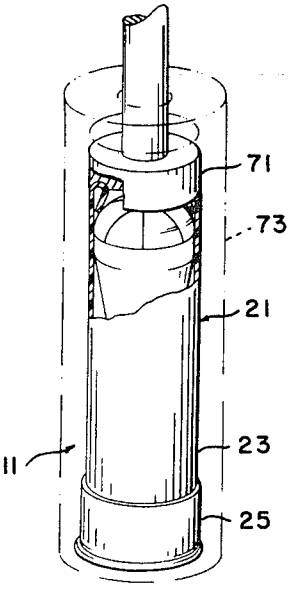

Fig. 10

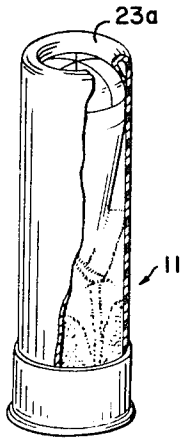

Fig. 11

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FRANGIBLE FILLED-PROJECTILE AMMUNITION

This invention relates to ammunition having frangible filled projectiles which are projected to a target for rupture and dispersion of their filled charge on impact with a target.

It is a feature of this invention to provide ammunition having a lightweight finned hollow projectile which carries a charge of flowable material for dispersion on impact.

It is a further feature to provide ammunition of this character, in which the projectile has a special teardrop shape for minimizing turbulence, and has fins disposed along and about the tapered rear surface, with a resilient padding disposed about the tapered and finned rear surface to resiliently maintain desired positioning of the propellant powder in a compact zone adjacent the rear of the projectile.

Still other objects and attendant advantages will become apparent from a reading of the following detailed description of a preferred embodiment constructed according to the invention, taken in conjunction with the accompanying drawing wherein:

FIG. **1** is a partial cutaway perspective view of a cartridge according to the invention.

FIG. **2** is a further fragmentary view of the illustrative cartridge, the cartridge case being shown in phantom for clarity of illustration of certain parts.

FIG. **3** is an exploded view of a projectile according to the invention and prior to assembly and filling.

FIG. **4** is a partially cutaway perspective view of the projectile of FIGS. **1** and **2** in assembled and filled form.

FIG. **5** is a perspective exploded view of the cartridge case after propellant loading, together with the projectile and powder retaining blanket or pad prior to assembly in the cartridge case.

FIGS. **6–10** are schematic views of successive assembly operations, and FIG. **11** is a further partial cutaway view of the completed cartridge.

Referring now in detail to the Figures of the drawings, cartridge **11** is adapted to be fired from a conventional smooth cylindrical bore percussion fire shotgun, and includes a case **21**, a fin stabilized liquid filled projectile **31** frangible on target impact, a propellant powder charge **51**, and a soft resilient blanket **41** disposed about and rearward of the rear finned area of the projectile **31**.

Case **21** includes a cylindrical sheath which is preferably of a suitable plastic such as linear polyethylene, although such may be formed of any other suitable material such as a paper composition, etc. Case **21** has a conventional rimmed brass cup base with a base wad **27**, of suitable plyed paper, plastic, or composition construction, and a percussion primer **29**, which may be of any conventional or desired construction for igniting the propellant powder charge **51** upon percussive firing of the primer **29**.

Projectile **31** has a generally teardrop shape with a generally rounded nose section **33**, a straight tapered rear section **35** and a finned rear section having fins **39** nested within blanket **41**. Projectile **31** is retained in case **21** through retaining engagement of its forward nose end by annular in-rolled or crimped retaining lip **23***a* formed at the end of case sheath **23**.

Projectile **31** has two sections **33** and **35** formed preferably of easily moldable thermoplastic materials such as nylon and polyethylene, and which are capable of withstanding the momentary high temperature burning of propellant powder charge **51** without melting or rupturing. Sections **33** and **35** are joined together along their annular shouldered interfitting junctions **33***b*, **33***c*, **33***i*, and **35***b*, **35***c*, **35***i*, as by suitable bonding such as cement, spin-welding, etc., the rear end of the section **35** being initially formed with a fill tip **37** having a fill bore **37***a* and extending rearwardly of fins **39** for filling the projectile with a desired flowable material, preferably a liquid, after uniting of the two sections **33** and **35**. The projectile is preferably incompletely filled to enable expansion on anticipated temperature rises above the ambient temperature existing during projectile sealing after filling; however, it is desirable that only the minimum requisite expansion space be left void within the projectile in order to maximize payload content. The extent of liquid filling **32** is thus dependent upon the coefficient of thermal expansion of the liquid and any normally expected temperature rise thereof in use. After filling, the projectile fill tip **37** is closed, as by melt sealing with a hot concave-ended iron, to form a hermetic closure **37***b*.

The projectile nose section **33** has suitable grooving formed therein, preferably radial V-grooves **33***a* radiating from the center of the nose section along the outer surface thereof, in order to achieve ease of multi-directional rupture of the nose section on target impact, and wide lateral dispersal and essentially aerosoling of the flowable liquid material **32** in the target impact zone. Grooves **33***a* also aid in holding the nose section **33** during spin-welding of the two sections **33**, **35** together. With this target-impact-frangible liquid-filled projectile, it is possible to fire through a glass window, including a conventional multilayered auto safety glass window, and effect dissemination of the liquid fill in a cloud of tiny liquid droplets within the target area beyond the window which may be perforated, as by being either partially or completely broken by the projectile, dependent upon the projectile velocity and glass strength. By employing a highly volatile liquid agent as the liquid fill **32**, this target impact dispersal, whether against a wall, through a window or otherwise, is materially enhanced. Particular choice of an agent or agents **32** is dependent upon the desired end result; thus, for disabling a human fugitive a liquid fill **32** of CS or CN liquid solution is effective in bringing about temporary disabling and control of persons from a substantial distance such as, for example, 100 yards away from point of cartridge firing. A suitable CS liquid solution may be formed of about 1 to 30% by weight of CS, and the remainder of methylene chloride or other suitable volatile liquid solvent.

To aid in achieving desired accuracy, such as firing through a window in a distant auto or building, the projectile **31** is provided with fins **39**, which are canted in the range of about 1–5 degrees, preferably about 4 degrees, and formed in an air-foil shaped longitudinal sectional configuration. The canting of fins **39** gives a rotational stabilizing motion to the projectile in flight and the air foil shape of the fins aids in this gyroscopic stabilization by the angularly directed air-foil lift forces as well as providing a low turbulence low drag surface for maximizing velocity, range, and accuracy. In addition, the included taper angle formed by the outer tapered surface of rear section **35** should desirably be the maximum permissible while still providing the desired generally laminar flow therealong and past airfoil fins **39**. This has been indicated to lie in the general range of about 20 degrees. It is for this reason of desired laminar flow, as well as the desire to accommodate a maximum payload of liquid fill that the preferred projectile configuration has a substantially straight tapered surfaced rear section **35**; the straight taper enabling maximum internal volume with an included taper angle near the limit for laminar flow. The nose section **33** is generally rounded for maximum payload holding capacity consistent with desired low wind resistance and maximum radial dispersal upon rupture on impact.

It is highly desirable that the fins **39** be intact upon the projectile **31** leaving case **21**; however, when formed of relatively easily frangible plastic material, such as nylon, these fins **39** may readily be ruptured or cracked if there should exist substantial quantitative unevenness of distribution of powder charge **51** in the areas between the fins **39**. To prevent this difficulty, blanket **41** of soft resilient elastic material, such as polyurethane foam or polyethylene foam, etc., is disposed to extend about and behind the fins **39** and tapered rear surface area **35***a* therebetween. Fins **39** are of a slightly smaller diameter than the internal diameter of case sheath **23**, enabling the foam blanket **41** to be inserted into the cartridge case **21** by simple axial downward insertion of the projectile into the vertically upright case **21** as shown in FIGS. **6–8**, after initial assembly and loading of the case with primer **29** and powder charge **51** as shown in FIG. **5**. While other blanket configurations, such as circular, may be employed, the preferably

square blanket configuration enables ease of accommodation of the blanket between the fins, and as will be noted from FIGS. 1, 9, and 11, the propellant powder charge is thereby gently but effectively retained essentially within a chamber bounded by the base wad 27, primer 29, case sheath 23 and soft elastic foam blanket 41. The amount of powder charge 51 extending along the thin wall zone between blanket 41 and case sheath 23 is relatively small and maintained of sufficient quadrilateral evenness relative to its quantity as to obviate breakage of the quadrilaterally disposed fins 39 upon firing of the cartridge. It will be appreciated that the elastic resiliency of the blanket 41 will enable accommodation of various quantities of powder charge, while exerting a desired gentle resilient retaining action on the charge.

After completion of longitudinal insertion of the projectile 31 in case 21, as shown in FIG. 9, the case sheath 23 is inrolled or crimped as with a conventional end-rolling tool 71 while the case 21 is radially restrained by a guide cylinder 73, thereby completing the formation of the cartridge 11 to the final configuration of FIGS. 1 and 11.

While the invention has been shown and described with respect to a single illustrated and preferred embodiment, it will be apparent that various modifications and improvements may be made without departing from the scope and spirit of the invention. Accordingly, the invention is not to be limited by the illustrative embodiment, but only by the scope of the appended claims.

What is claimed is:

1. Ammunition comprising:
a cartridge case,
a projectile disposed in said case and having a rear end on which are disposed stabilization fins in spaced relation about the surface thereof,
resilient padding disposed rearwardly and laterally of and circumferentially enfolding and encompassing said rear end and associated fins and extending between the radially outer ends of said fins and said case inner wall and into the void zones between said fins,
and ignitable propellant powder disposed and resiliently retained in a chamber formed rearward of said padding and generally defined at its forward end by said padding.

2. Ammunition according to claim 1,
said projectile being a hollow thin-walled frangible shell along its length and including a bulbous nose and a tapered rear end on which said fins are disposed,
said shell being frangible on target impact by said bulbous nose,
said projectile having a charge of flowable material for dispersion on target impact and rupture of said bulbous nose.

3. Ammunition according to claim 2,
said fins being integral with the portion of said projectile forming said rear end thereof.

4. Ammunition according to claim 3,
said projectile being formed of molded low density plastic material,
said charge of flowable material being liquid.

5. Ammunition according to claim 4,
said projectile having a rounded nose which is scored for ease of rupture upon target impact,
said projectile being incompletely filled with said liquid charge to enable expansion of said liquid upon heating thereof.

6. Ammunition according to claim 5, said case having an in-rolled forward end engaging said rounded nose in annular retaining relation along a line of contact therewith.

7. Ammunition according to claim 6,
said projectile nose being arcuately diametrally scored to form grooves intersecting at the forward central zone of said nose.

8. Ammunition according to claim 7,
said nose being cup-shaped and said rear section being conically shaped,
said cup-shaped nose being secured to said conically shaped rear section along a shouldered line of juncture therebetween.

9. Ammunition according to claim 8,
said nose and rear sections being formed of thermoplastic material and being spin welded together.

10. Ammunition according to claim 9,
said padding being soft resilient elastic foam material.

11. Ammunition comprising:
a cartridge case,
a projectile disposed in said case and having a finned rear section,
resilient padding disposed about said finned rear section of said projectile,
and ignitable propellant powder disposed and resiliently retained in a chamber formed rearward of said padding and generally defined at its forward end by said padding,
said projectile being hollow and having a nose end frangible on target impact,
said projectile having a charge of flowable material for dispersion on target impact and rupture of said nose end,
said projectile having a teardrop shape with a tapered rear end on which are disposed stabilization fins in spaced relation about the surface thereof, said fins being integral with the portion of said projectile forming said rear end thereof,
said projectile being formed of molded low-density plastic material,
said charge of flowable material being liquid,
said projectile having a rounded nose which is scored for ease of rupture upon target impact,
said projectile being incompletely filled with said liquid charge to enable expansion of said liquid upon heating thereof,
said case having an in-rolled forward end engaging said rounded nose in annular retaining relation along a line of contact therewith,
said projectile nose being arcuately diametrally scored to form grooves intersecting at the forward central zone of said nose,
said nose being cup-shaped and said rear section being conically shaped,
said cup-shaped rear section being secured to said conically shaped rear section along a shouldered line of juncture therebetween,
said nose and rear sections being formed of thermoplastic material and being spin welded together,
said padding being a blanket of soft resilient elastic foam material surrounding and encompassing the rear finned section of said projectile,
said blanket extending circumferentially into contact with the inner surface of said case, whereby both to generally retain said propellant powder and to cushion said finned rear end of said projectile.

12. Ammunition according to claim 1,
said padding being a blanket of soft resilient elastic foam material surrounding and encompassing the rear finned section of said projectile,
said blanket extending circumferentially into contact with the inner surface of said case, whereby both to generally retain said propellant powder and to cushion said finned rear end of said projectile.

13. Ammunition according to claim 12, said case having an in-rolled forward end annular bead engaging the nose end of said projectile in annular end retaining relation within said case and between said bead and said resilient foam blanket.

14. Ammunition according to claim 1,
said case having an in-rolled forward end annular bead engaging the forward end of said projectile in retaining relation.

15. Ammunition according to claim 14,
said case having a tubular forward section formed of thermoplastic pressure deformable material,

said bead being formed at the forward end of said tubular section.

16. Ammunition according to claim **1**,

said resilient padding being an effective circumferential blanket of soft resilient easily frangible material which serves as a temporary frangible cushion for said finned rear section and as a resilient powder retainer for said ignitable propellant powder,

said soft resilient elastic padding blanket being formed of material which will effectively disintegrate upon firing of said ignitable propellant powder.

17. Ammunition comprising:

a cartridge case,

a projectile disposed in said case and having a finned rear section,

resilient padding disposed rearwardly of and laterally circumscribing said finned rear section of said projectile,

and ignitable propellant powder disposed and resiliently retained in a chamber formed rearward of said padding and generally defined at its forward end by said padding,

said projectile being hollow along its length and having a nose and frangible on target impact,

said projectile having a charge of flowable material for dispersion on target impact and rupture of said nose end,

said projectile having a teardrop shape with a tapered rear end on which are disposed stabilization fins in spaced relation about the surface thereof, said fins being integral with the portion of said projectile forming said rear end thereof,

said padding being a blanket of soft resilient elastic foam material surrounding and encompassing the rear finned section of said projectile,

said blanket extending circumferentially into contact with the inner surface of said case, whereby both to generally retain said propellant powder and to cushion said finned rear end of said projectile.

18. Ammunition according to claim **17**,

said blanket having a polygonal peripheral configuration.

19. Ammunition according to claim **18**,

said polygonal configuration being quadrilateral.

20. Ammunition according to claim **19**,

said polygonal quadrilateral configuration being substantially square, and

said fins being four in number,

the corners of said square blanket being interfolded into and about the surface of the projectile between said fins.

* * * * *