United States Patent [19]

Barr

[11] **3,865,038**

[45] **Feb. 11, 1975**

[54] **DETERRENT AMMUNITION PROJECTILE**

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[22] Filed: **July 13, 1973**

[21] Appl. No.: **378,855**

[52] **U.S. Cl.** **102/92.7,** 102/92.6, 102/93

[51] **Int. Cl.** **F42b 11/18,** F42b 31/00

[58] **Field of Search** 102/92.7, 41, 92.6, 92, 102/93

[56] **References Cited**

UNITED STATES PATENTS

2,983,224	5/1961	Prosen et al.	102/93
3,156,187	11/1964	Batou	102/92.7
3,385,215	5/1968	Jungermann	102/92.7
3,429,263	2/1969	Snyder et al.	102/92.7
3,439,619	4/1969	Bock et al.	102/92.7
3,528,662	9/1970	Merchant et al.	102/92.7
3,650,213	3/1972	Abbott et al.	102/92.7
3,714,896	2/1973	Young	102/92.7
3,733,727	5/1973	Jones et al.	102/92.7

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Attorney, Agent, or Firm—Reginald F. Pippin, Jr.

[57] **ABSTRACT**

Deterrent ammunition, including a projectile of soft elastic rupturable material, such as natural or synthetic rubber or plastic, having a charge of flowable material, such as finely divided particulate or powder, liquid or gas, carried in a cavity having relatively thin longitudinal rupture wall zones and thicker longitudinal strengthening zones bounding the cavity, with a generally ogive-forming nose section, having an overall effectively more rigid, yet soft elastic, piston-forming nose end, the elastic thicker longitudinal wall zones enabling outward flexing thereof in response to rearward piston movement of the piston-forming nose end on target impact. The projectile may be carried in and fired from a conventional cartridge case and ejected from the cartridge by ignition of propellant in the cartridge, which may effect gas pressure directly on the projectile rear end or on a pusher element or elements engaging with the projectile.

23 Claims, 5 Drawing Figures

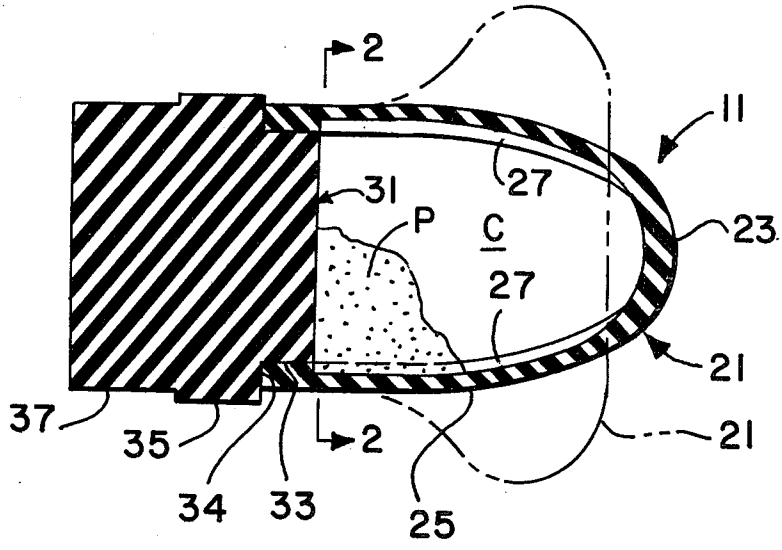
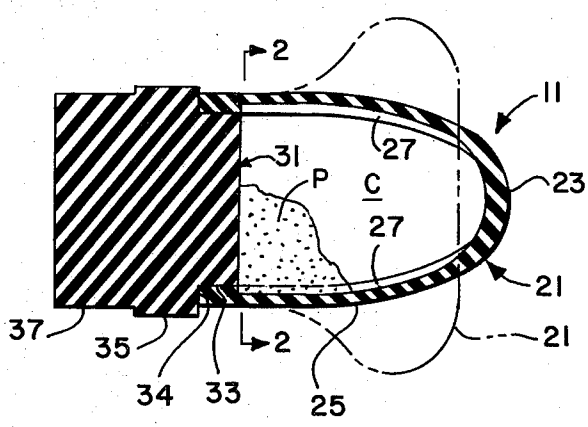


FIG. 1



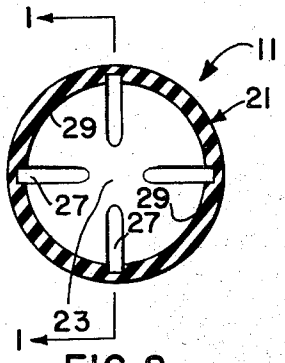


FIG. 2

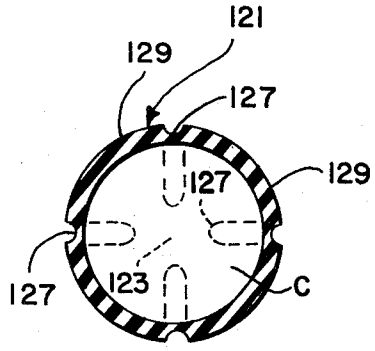


FIG. 3

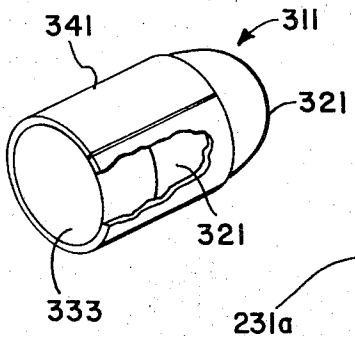


FIG. 5

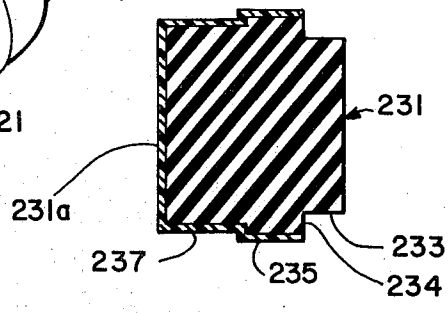


FIG. 4

DETERRENT AMMUNITION PROJECTILE

This invention relates to deterrent ammunition, and more particularly to personnel deterrent ammunition projectiles which are rupturable on impact, and which may be launched against a target with rupture occurring on impact, for cushioning of the impact forces, and, if desired, may deliver a flowable material on impact rupture. The projectile may be launched directly against rioting personnel to provide an impact shock or sting to the target personnel and, if so desired, to deliver a desired flowable material in the vicinity of the target personnel with substantially reduced hazard as compared to conventional ammunition.

Various materials and arrangements have been employed in an effort to control rioting or other disorderly personnel, while minimizing ultimate damage to the personnel being controlled. Fire hoses have been used for this purpose, but have been generally abandoned or found to be generally unsatisfactory, due to the very substantial injury potential, as well as the unfavorable image cast on firefighting units by their association with this tactical weapon. Water cannons have also been tried, and while the water cannon has advantages over the fire hose approach, it nevertheless has very substantial injury-producing potential. Technically, the fire hose and the water cannon systems utilize a similar principle of projecting a variable intensity water jet stream to unbalance and/or disarm an individual. Water cannons and fire hose also are large, heavy, cumbersome and normally require several persons for operation.

Also, various mechanisms have been employed, including launchable grenades and shells, for delivery of a desired charge of control agent to a target area. However, these prior mechanisms have various disadvantages, and the launched grenades or shells have conventionally been quite lethally hazardous to target personnel in the event of impact with such personnel.

It is an object and feature of the present invention to provide an improved personnel control deterrent ammunition projectile which provides relatively low lethality hazard to the target personnel, while enabling a substantial degree of deterrent control of such personnel by cushioned impacting of the target personnel with the impact-rupturable projectile, and, if so desired, by impact rupture delivery of a flowable charge of material to the target zone, through impacting of the rupturable projectile, the projectile carrying a charge of flowable dispersable material which is discharged on projectile impact contact with the target personnel or other target in the vicinity of target personnel.

It is a further object and feature of the invention to provide an improved low-hazard riot control ammunition which enables the delivery of a marking or other desired liquid to the vicinity of a rioting person or persons, and which will rupture in an impact-cushioning fashion on impact, with good dispersion characteristics.

Still further objects, features and advantages will become apparent to one skilled in the art from a reading of the following description of a preferred embodiment, constructed in accordance with the invention, taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a longitudinal section view, on line 1—1 of FIG. 2, of a projectile according to the invention.

FIG. 2 is a view in cross-section on line 2—2 of FIG. 1.

FIG. 3 is a cross-section view similar to FIG. 2, illustrating a modification.

FIG. 4 is a cross-section view of a modified rear end section of a projectile according to the invention.

FIG. 5 is a perspective view, partially cut away for clarity, of a further modification utilizing a separate removable lateral reinforcing sleeve external of the projectile.

Referring now in detail to the figures of the drawing, a projectile 11 is provided, preferably formed in two major sections, including a nose and side wall section 21 secured to a rear section 31.

The nose and side wall section 21 is formed with a piston-forming nose end wall portion 23 and a side wall portion 25. Side wall portion 25 has weakened zones formed by spaced grooves or depressions in a face thereof, preferably the inner surface, as by longitudinal grooves 27 as shown. The thicker wall sections 29 between the longitudinal grooves 27 form elastically flexible longitudinal columnar and radial strengthening zones, and the ungrooved nose portion 23 forms a more rigid, yet elastic and shock cushioning, piston portion which is depressed rearwardly to effect outward bending of the annular side wall portion 25 upon impacting of the nose with a target or other object.

The thicker relatively more rigid rear section 31 has a shoulder 33, 34 onto and against which the nose and side wall section 21 is secured, as by adhesive or other suitable securing medium. The sections 21, 31 are preferably formed of natural or synthetic rubber, or other similar material, (preferably having a durometer of approximately 30–50), and a suitable rubber adhesive may be utilized. In an embodiment employing a projectile made of silicone rubber, a suitable example being silicone rubber sold by Dow Corning under the name RTV, a suitable adhesive has been found to be a silicone rubber adhesive marketed by Dow Corning under the designation RTV–732.

The base or rear section 31 has a rifling band 35 formed thereon to impart stabilizing spin to the projectile when the projectile is fired from a rifled barrel.

To provide additional strength, particularly for rifling engraving action, to the soft elastic rubber material, glass fibers or other strengthening fibers may be added to the rubber molding compound used in the base or rear section 31. While the rifling band is preferably on the base or rear closure section 31, a rifling band may alternatively be formed on a portion of the side wall portion 25, although this is not as desirable as it is preferred to employ a forward section 21 which is devoid of such strengthening media as glass fibers which are desirable to be utilized for rifling band forming section.

A cavity C is formed within and bounded by the nose and side wall section 21 and the rear section 31, in which may be disposed a suitable charge of flowable material, such as finely divided particulate or powder, e.g., tear gas powder, or liquid, P for dispersal through rupture openings formed along grooves 27 on impact of the projectile with a target or other object. Alternatively, while delivery and dispersal of a charge of flowable material P is preferred and most advantageous, the projectile may also be used without a charge of material in the rupturable cavity C, in which event the personnel impact deterrent utility of the soft rupturable projectile is employed, with the hydraulic gas compres-

sion and lateral expulsion and columnar bending cushioning advantages flowing from the piston nose **23** and bendably collapsible columnar zones **29** and rupturable lateral weakened zones **27** of the side wall **25,** being utilized for desired shock absorption so as to minimize personnel permanent damage or lethality on impact.

The projectile **11** may be suitably mounted in and fired from a conventional cartridge having ignitable propellant therein, and a pusher, of conventional or other desired design, may be utilized to impart propellant gas forces to the projectile if so desired. Securing of the projectile **11** in a cartridge case may be effected as by crimping of the forward end zone of the case (not shown) about and into gripping relation with the annular surface **37** rearward of rifling band **35.**

In operation, the projectile **11** will be ejected from a barrel bore, preferably a rifled bore for suitable spin stabilization and accuracy, and impact of nose **23** with a target or other object will effect relative rearward movement of the piston-forming nose **23** toward the forwardly moving piston-forming base or rear section **31,** and/or vice versa, as generally indicated in phantom line in FIG. **1,** effecting shock-absorbing columnar collapse of stiffening column zones **29** and shock-absorbing compressive action on the powder, liquid, or gas contents P, in cavity C, all of which results in rupture of weakened zones **27** and lateral ejection of the flowable material P from the cavity C through ruptured zones **27.** Impact forces may also ultimately effect rupture along the connection zone between sections **21** and **31,** at shoulder **33, 34,** and thereby further effect ejection of the material P.

A modification is illustrated in cross section in FIG. **3,** in which the longitudinally weakened zones are formed by external longitudinal grooves in the outer annular surface of the side wall and nose section **121,** and extending to the piston-forming nose portion **123.** The thicker and columnar stiffer soft elastic zones are indicated at **129.**

A further modification is illustrated in FIG. **4,** in which a reinforcing annulus in the form of a cup or shell **231**a forms the effective rear face and annular rifling band surface **235** of the rear section **231** for a projectile having a forward side wall and nose section **21,** as in FIGS. **1** or **3,** suitably secured thereto as at shoulder **233, 234** as in the embodiment of FIG. **1.** The shell annulus **231***a* may be suitably formed of thermoplastic resin, preferably low-density material such as polyethylene, or nylon or other thermoplastic resin may be employed if desired for a given utilization. The resin may be suitably reinforced with glass or other reinforcing fibers incorporated in the molding compound, if desired, particularly as an aid in rifling engraving upon firing and travel of the projectile along a rifled barrel bore. In this embodiment, the silicone rubber or other molding compound for main central and forward portion of base or rear section **231** is preferably molded in situ in the previously formed cup or other effective annulus **231***a*, thereby aiding in securement thereto, although separate formation and subsequent assembly may be effected, with set back compressive forces on the main central rubber portion of base **231** serving to provide frictional gripping action between the contiguous interfacing wall surfaces of this rubber central portion and the cup annulus **231***a* upon firing and rifling-effected spin-up action on the cup annulus **231***a.*

In FIG. **5,** a further modification is illustrated, in which the barrel bore and rifling engagement, during travel of the projectile **311** along a barrel bore, is effected by a split sleeve annulus **341,** which effectively encompasses the major longitudinal extent of the projectile, including the rear or base section **333** and the cylindrical or straight side wall portion of side wall and nose section **321.** In this embodiment, the rifling band on the projectile is eliminated and the sleeve **341** serves to engrave the rifling and effect spin-up to itself and the projectile **311,** which may otherwise take the form of one of the preceding embodiments of FIGS. **1** or **3,** or other suitable embodiment within the teachings hereof. Sleeve **341** may be suitably split longitudinally and will be expanded radially into rifling engraving engagement with a barrel bore as a function of set-back forces on the projectile during firing. A pusher, preferably an obturating pusher disc of standard construction and utilization, not shown, may be suitably employed to transmit forward propulsion forces from the propellant gases of a cartridge to the projectile **311** and sleeve **341** upon firing of the projectile, and this pusher may also engage the rifling in rotation-imparting relation to aid in imparting rotation to the projectile **311** through forward driving action on and frictional face contact with the rear face of the rear section **333** of the projectile and the rear face of the expandible sleeve **341.** The sleeve **341** also aids in protecting the projectile during travel along the barrel bore, as well as providing a desired reduction of any tendency of the rubber or other soft elastic projectile walls to grip and unduly retard the projectile during travel along the barrel bore. Upon exit from the barrel the split sleeve **341** will separate and be discarded from the projectile under centrifugal and other forces thereon, and by utilizing a suitably low density material for the sleeve **341,** the secondary projectile dangers therefrom may be minimized, the high drag/low mass relationship then resulting in relatively quick dissipation of the sleeve travel energy, and the low mass will itself minimize danger of damage on any inadvertent impact. To this end, the sleeve is preferably formed of low density material such as low density polyethylene, or other suitably low density material such as other thermoplastic or other resins.

While the invention has been described with respect to several physical embodiments, it will be apparent that various modifications and improvements may be made without departing from the scope and spirit of the invention. For instance, the projectile of FIG. **5,** without a rifling band, may have its spin imparted thereto solely by frictional or other interengagement with a driving pusher disc or a sabot if so desired. In such event, or otherwise, the rear face of base or rear section **333** may be provided with grip enhancing means, such as radial spoked or other suitable recess in or on its surface. Accordingly, the invention is not to be limited by the illustrative embodiments, but only by the scope of the appended claims.

I claim:

1. Deterrent ammunition, comprising,

a projectile formed by a rupturable flexible side wall section with a cavity formed therein and having an annular bounding wall with annularly spaced plural longitudinally extending thinner weakened rupturable longitudinal wall zones which are substantially weaker than interconnecting relatively thicker

structurally reinforcing side wall sections between said thinner weakened zones,

said side wall section being open at its rear end for securement to the forward end of a separate base section,

nose and base sections closing said cavity at its forward and rearward ends,

and a flowable dispersable material charge in said cavity for dispersal upon impact of said projectile with a target,

said base section being a separate body secured at its forward end to the open rear end of said rupturable flexible side wall section along an annular rupturable shouldered connection zone therewith,

said base section being relatively substantially more rigid as a body than said wall section and forming a forwardly moving piston acting against said charge and said side wall section upon impact of said nose with a target mass, to thereby enable rupture along one or more of the respective zones.

2. Deterrent ammunition according to claim **1,**

said nose and wall sections being formed of relatively soft elastic, material rupturable at said thinner weakened zones in response to internal cavity pressures thereon as a function of impacting said nose section with an object; and said thicker side wall sections being outwardly flexible in response to said internal cavity pressure and rearward impact movement of said nose section.

3. Deterrent ammunition according to claim **2,**

said wall section having a plurality of convex wall sections, with longitudinally grooved sections therebetween and forming said longitudinally extending thinner wall zones.

4. Deterrent ammunition according to claim **2,**

said nose section having a generally ogive shape and including a relatively thick piston nose portion, with a relatively flexible annular wall section extending rearward of said piston nose section and forming a flexible connection between said piston nose section and said base section.

5. Deterrent ammunition according to claim **1,**

said base section being substantially thicker and stronger than said flexible side wall section,

said base section being reinforced with glass fiber filling.

6. Deterrent ammunition comprising

a projectile formed by a rupturable flexible side wall section with a cavity formed therein and having an annular bounding wall with annularly spaced plural longitudinally extending thinner weakened longitudinal wall zones which are substantially weaker than interconnecting relatively thicker structurally reinforcing side wall sections between said thinner weakened zones,

nose and base sections closing said cavity at its forward and rearward ends,

and a flowable dispersable material charge in said cavity for dispersal upon impact of said projectile with a target,

said projectile having a rifling band thereon,

and a relatively rigid reinforcing annulus forming a portion of said base section,

said rifling band being formed on said reinforcing annulus.

7. Deterrent ammunition according to claim **6,** said reinforcing annulus being a reinforcing cup.

8. Deterrent ammunition according to claim **7,** said reinforcing cup being formed of thermoplastic resin.

9. Deterrent ammunition according to claim **8,** said reinforcing cup being formed of glass-filled thermoplastic resin.

10. Deterrent ammunition, comprising

a projectile formed by a rupturable flexible side wall section with a cavity formed therein and having an annular bounding wall with annularly spaced plural longitudinally extending thinner weakened rupturable longitudinal wall zones which are substantially weaker than interconnecting relatively thicker structurally reinforcing side wall sections between said thinner weakened zones,

said side wall section being open at its rear end for securement to the forward end of a separate base section,

and nose and base sections closing said cavity at its forward and rearward ends,

said base section being a separate body secured at its forward end to the open rear end of said rupturable flexible side wall section along an annular rupturable shouldered connection zone therewith,

said base section being relatively substantially more rigid as a body than said wall section and forming a forwardly moving piston acting against said charge and said side wall section upon impact of said nose with a target mass, to thereby enable rupture along one or more of the respective zones.

11. Deterrent ammunition according to claim **10,**

said nose and wall sections being formed of relatively soft elastic material rupturable at said thinner weakened zones in response to internal cavity pressures thereon as a function of impacting said nose section with an object, and said thicker side wall sections being outwardly flexible in response to said internal cavity pressure and rearward impact movement of said nose section.

12. Deterrent ammunition according to claim **11,**

said wall section having a plurality of convex wall sections, with longitudinally grooved sections therebetween and forming said longitudinally extending thinner wall zones.

13. Deterrent ammunition according to claim **11,**

said nose section having a generally ogive shape and including a relatively thick piston nose portion, with a relatively flexible annular wall section extending rearward of said piston nose section and forming a flexible connection between said piston nose section and said base section.

14. Deterrent ammunition according to claim **13,**

said base section being substantially thicker and stronger than said flexible side wall section.

15. Deterrent ammunition according to claim **13,**

said base section being formed of rubber being reinforced with glass fiber filling.

16. Deterrent ammunition according to claim **11,**

said nose section having a generally ogive shape and including a relatively thick piston nose portion, with a relatively flexible annular wall section extending rearward of said piston nose section and forming a flexible connection between said piston nose section and said base section,

said base section being formed of glass fiber filled material.

17. Deterrent ammunition according to claim **10,**

said nose and wall sections being formed of relatively soft elastic material rupturable at said thinner weakened zones in response to internal cavity pressures thereon as a function of impacting said nose section with an object, and said thicker side wall sections being outwardly flexible in response to said internal cavity pressure and rearward impact movement of said nose section,

a relatively rigid reinforcing annulus disposed about said projectile,

said relatively rigid reinforcing annulus having a circumferentially weakened longitudinal separation zone enabling radial expansion of said annulus for rifling engraving engagement with a barrel bore as a function of set-back forces on said projectile during firing.

18. Deterrent ammunition according to claim **17,**

said reinforcing annulus being longitudinally split along said weakened separation zone.

19. Deterrent ammunition according to claim **18,**

said reinforcing annulus being a longitudinally split sleeve separable from said base, side walls and nose sections of said projectile after exit from a rifled barrel bore.

20. Deterrent ammunition, comprising

a projectile formed by a rupturable flexible side wall section with a cavity formed therein and having an annular bounding wall with annularly spaced plural longitudinally extending thinner weakened longitudinal wall zones which are substantially weaker than interconnecting relatively thicker structurally reinforcing side wall sections between said thinner weakened zones,

and nose and base sections closing said cavity at its forward and rearward ends,

said nose and wall sections being formed of relatively soft elastic material rupturable at said thinner weakened zones in response to internal cavity pressures thereon as a function of impacting said nose section with an object, and said thicker side wall sections being outwardly flexible in response to said internal cavity pressure and rearward impact movement of said nose section,

said projectile having a rifling band thereon,

and a relatively rigid reinforcing annulus forming a portion of said base section, said rifling band being formed on said reinforcing annulus.

21. Deterrent ammunition according to claim **20,**

said reinforcing annulus being a reinforcing cup.

22. Deterrent ammunition according to claim **21,**

said reinforcing cup being formed of thermoplastic resin.

23. Deterrent ammunition according to claim **22,**

said reinforcing cup being formed of glass-filled thermoplastic resin.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,865,038

DATED : February 11, 1975

INVENTOR(S) : Irwin R. Barr

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading [73] add ---Assignee: AAI Corporation, Cockeysville, Maryland ---.

Column 3, Line 50, change "resin" to ---resins---.

Signed and Sealed this

Thirty-first Day of May 1977

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

UNITED STATES PATENT AND TRADEMARK OFFICE

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