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Sweeney et al.

[11] **3,791,303**

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[54] **DETERRENT AMMUNITION**

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[52] **U.S. Cl.** **102/92.7**, 102/41, 102/92

[51] **Int. Cl.** **F42b 11/18**, F42b 11/36

[58] **Field of Search** ..... 102/38, 41, 92, 92.7, 1 R

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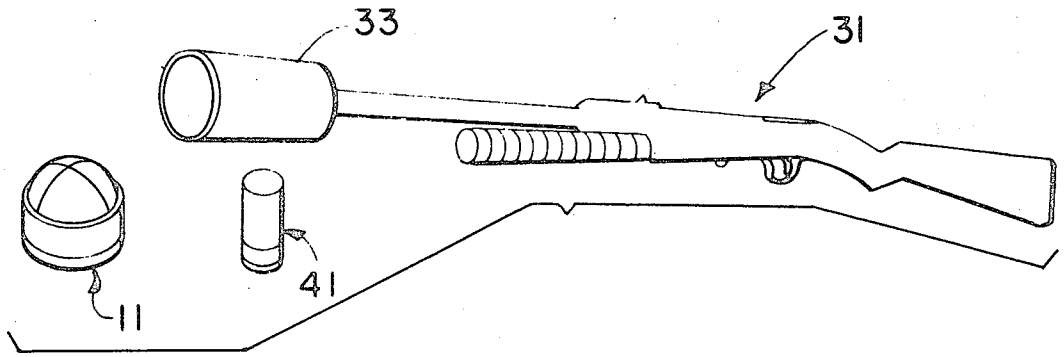
Attorney, Agent, or Firm—Reginald F. Pippin, Jr.

[57] **ABSTRACT**

Deterrent ammunition, including a liquid-filled hollow ball of easily flexible plastic material, which is scored to form orange-peel-like rupture sections on impact with a target. The ball is releasably secured in cradled relation for launching in a dual element sabot, including a cradle unit of low-density foam plastic with a rigid disc sabot backing element.

26 Claims, 4 Drawing Figures



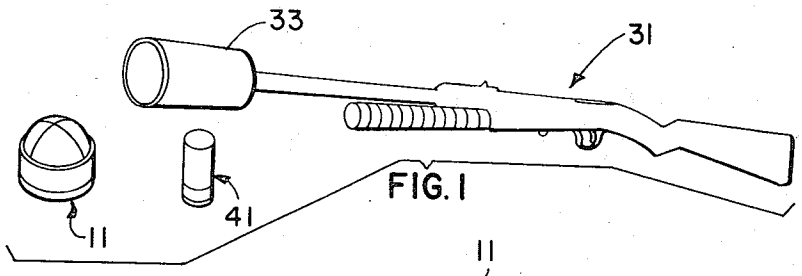


FIG. 1

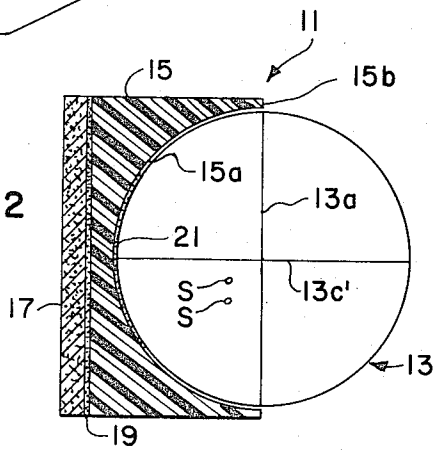


FIG. 2

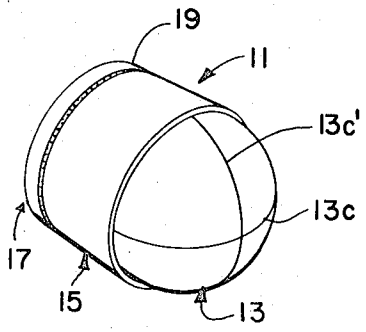


FIG. 3

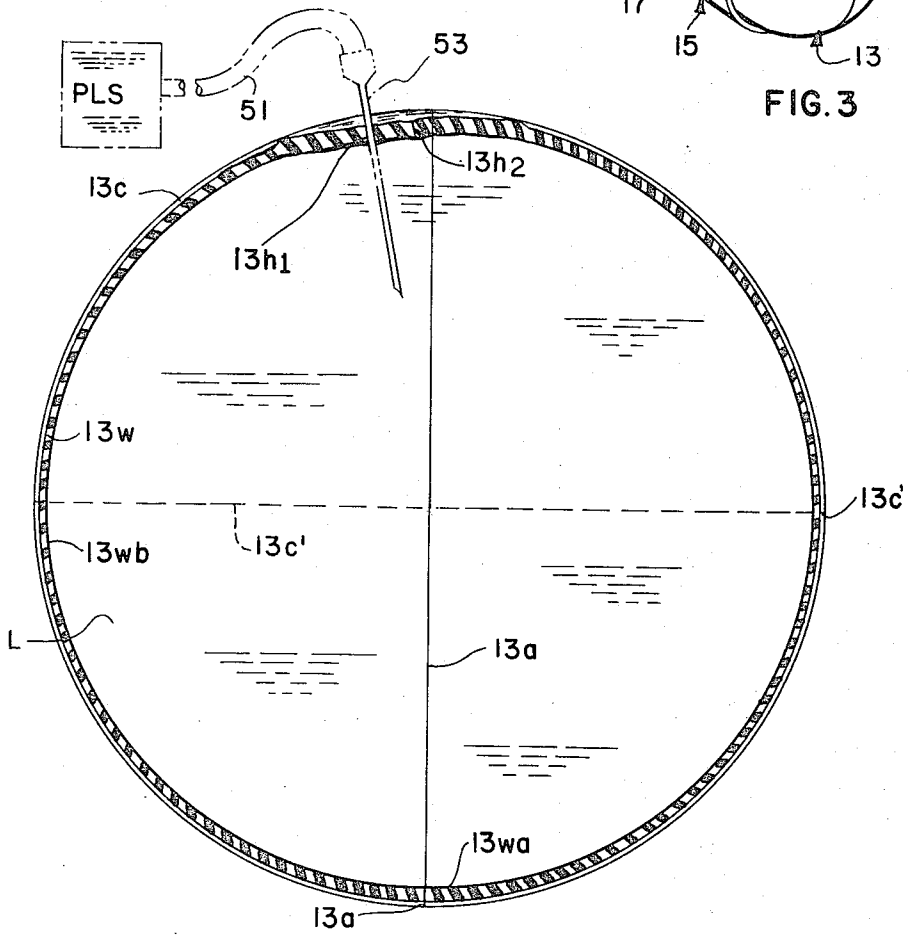


FIG. 4

DETERRENT AMMUNITION

This invention relates to deterrent ammunition, and more particularly to personnel deterrent ammunition which is rupturable on impact, and which may be launched directly against rioting personnel to provide an impact shock or sting to 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.

It is an object and feature of the present invention to provide an improved personnel control deterrent ammunition arrangement which is light-weight, enables use by an individual person, and which provides relatively low lethality hazard to the target personnel, while enabling a substantial degree of deterrent control of such personnel by impacting a rupturable liquid-filled projectile of special design on impact contact with the 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 on impact and be substantially non-effectively returnable in an effective form.

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 perspective view of the components of a deterrent ammunition system incorporating deterrent ammunition according to the present invention.

FIG. 2 is a section view of deterrent ammunition according to the present invention.

FIG. 3 is a perspective view of the deterrent ammunition of FIG. 2.

FIG. 4 is a section view, extending diametrally through the major circumferential extent of the ball projectile of FIGS. 2 and 3, and shown additionally in partial cutaway section to illustrate a method of filling of the projectile with liquid.

Referring now in detail to the Figures of the drawings, a projectile/sabot assembly 11 is provided, which may be suitably fired from an oversized tubular barrel extension 33 on the end of a shotgun 31 which may be of conventional construction. The tubular barrel extension 33 may suitably take the form of a shotgun barrel extension as illustrated in U.S. Pat. No. 3,318,033, although other tubular barrels or barrel extensions may be suitably employed. A propellant gas generating launching cartridge 41, such as that described in U.S. Pat. No. 3,672,301, or any other suitable construction, may be employed, or compressed air or other gas may be employed, as in the case of launching from a simple tube arrangement.

The projectile/sabot assembly 11 takes the form of a liquid-filled scored ball 13, which is releasably secured in cradled relation within a hemispherical recess formed in the forward face of a ball support cradle 15, which is formed of low-density material, and which in a preferred embodiment has taken the form of styrene foam. The ball is suitably releasably secured to the ball support cradle 15, as through the medium of a layer of rubber cement 21, which desirably is disposed in, and preferably restricted to, the bottom central zone of the hemispherical depression within which the ball is seated, in order to provide sufficient initial securing adhesion of the ball 13 to the cradle 15 for handling and loading, while enabling relative ease of separation of the ball 13 from the cradle 15 upon exit from the launching device, such as barrel extension 33 or other tubular barrel.

As noted, the ball support cradle 15 is formed of low-density styrene foan or other suitable low-density foam plastic or other low-density suitable cradling material, and provides a high drag/weight ratio. Secured to the rear face of ball support cradle 15, as through the medium of a layer of rubber cement 19, is a relatively rigid disc sabot 17, which may be suitably formed of resin-impregnated fiber board such as Homosote composition board. This rigid disc sabot 17 serves to provide the necessary rigidity for the projectile/sabot assembly to enable efficient launching under the influence of the propellant gas, and the combination of this relatively thin yet rigid disc sabot 17 with the substantially lower density and softer ball support cradle 15, enables the effective launching of the liquid-filled ball 13 without rupture of the ball at the launching site or in the course of launching. In addition, the composite relatively low mass of the composite cradle/sabot 15, 17 enables a relatively fast velocity decay of the cradle/sabot 15, 17 after exit of the projectile/sabot assembly 11 from the launching muzzle and separation of the ball 13 from the cradle/sabot 15, 17.

Separation of the liquid-filled ball 13 from the cradle/sabot 15, 17 is assisted by formation of an annular forward shoulder 15*b* on the forward surface of ball support cradle 15, and by the preferred restricted securing of the ball 13 to the ball support cradel 15 at the bottom central zone of the ball support cradle forward hemispherical recess, with a resultant unsecured annular separation zone between the ball 13 and the ball support cradle in the area of the hemispherical recess rearwardly of the annular forward shoulder 15*b*, as generally indicated in exaggerated form in FIG. 2.

Liquid-filled ball 13 takes the form of a preferably substantially spherical ball which is formed of an easily flexible plastic material which is capable of being punctured for loading of water or other liquid, and of being resealed, and which is also capable of being scored according to the invention, and which will rupture along its score lines upon impact with a target. A suitable elastomeric plastic material for this purpose has been found to be EVA (ethylene vinyl acetate), although

other plastic or rubber materials may be employed as may be found suitable, such as polyethylene.

The ball 13 has a conventional seam line 13*a* formed between two hemispherical halves which have been suitably joined together according to conventional ball-making technology, and these two hemispherical halves form a ball with a wall 13*w* having a thin relatively thicker annular wall portion 13*wa* in the vicinity of annular seam 13*a* than in the wall portions 13*wb* which are in the zone generally transverse to the seam line 13*a*. This wall thickness varies smoothly between these two thick and thin zones, as will be noted from the sectional view of FIG. 4. Thus, two generally opposed maximum weakened zones are provided substantially midway between and transverse to the seam line 13*a*. Annular score lines 13*c*, 13*c'* are formed in the external peripheral surface of spherical wall 13*w*, which score lines preferably extend normal to the seam line 13*a*, so as to intersect in the thin wall zones 13*wb*, and in the instance of two such score lines it is desired that these score lines extend and intersect substantially normal to one another, as shown for instance in FIG. 3. While more than two annular score lines may be provided, it has been found that two annular score lines are adequate from a practical standpoint.

The score lines 13*c*, 13*c'* preferably extend to a constant depth around the periphery of the spherical wall 13*w*, and may be formed as by a blade, while effecting relative angular motion between the blade and the ball 13. Alternatively, the score lines may be formed in the wall mold for the ball 13.

It will be noted that the score lines 13*c*, 13*c'* intersect in the zone of the thinnest and weakest sections 13*wb* of wall 13*w*, and this assists in enabling ease of rupture, and a desired mode of rupture, of the ball upon impact with a target.

The ball 13 is filled with a suitable liquid such as water, or in the event that marking is desired, the liquid may be a colored marking liquid of desired constituency, including colored water or other liquid, or other suitable liquid or flowable material content may be contained within the ball 13. It is desired that the liquid L substantially fully fill the ball cavity, as this will aid in insuring rupture of the ball on impact, due to the substantially incompressible liquid volume and the flexible rupturable and spherical form of the scored thick/-thin containment wall 13*w*.

Filling of the ball 13 with liquid L may be suitably effected by injection of liquid through a canula 53 which may be connected to a suitable pressurized liquid source through a tube 51. This pressurized liquid source may take various forms, including a conventional water faucet under standard water pressure conditions. The canula 53, when inserted through the wall 13*w*, will form a small hole 13h1, and a second small hole 13h2 is preferably formed adjacent the hole 13h1 in order to enable air venting while injecting liquid through the canula 53. Upon completion of the filling of the ball 13, both holes 13h1 and 13h2 are sealed, preferably by using a small soldering iron to locally melt the plastic of wall 13*w* and seal the wall over the holes 13h1 and 13h2, as generally indicated at S, S in FIG. 2.

It is highly desirable that the score lines of the ball 13 be disposed in such a manner as to assure that the ball will not fail along the score lines at launching. The preferred and most advantageous score line orientation for the ball 13 in the pre-launch configuration of the projectile/sabot assembly 11 is that shown in FIGS. 2 and 3, in which the score lines 13*c* and 13*c'* intersect on the centerline of the projectile/sabot assembly 11. The sabot thus substantially complementarily supports the weak section of the ball upon launch, and the set-back forces result in insufficient force being supplied to the other forwardly oriented thin section as to cause rupture in this zone at launch for practical launch purposes, which may be for instance up to approximately 160 feet per second muzzle launch velocity. In a practical embodiment of the invention, an approximately 3-inch diameter ball 13 has been formed of EVA, with a wall thickness varying between 0.030 inches in the zone of wall section 13*wb* at the intersection of score lines 13*c*, 13*c'*, and 0.060 inches at the seam zone adjacent the seam zone, and with score lines of 0.015 –0.025 inch depth. It will be appreciated that these are illustrative figures, and may be varied for a given material or desired instance of utilization of the invention.

In operation, the projectile/sabot assembly 11 is inserted into the tubular barrel extension 33, with the rigid composition disc sabot 17 forming an effective gas seal with the rifled or unrifled walls of the tubular barrel launch section, and with the ball 13 extending forwardly toward the muzzle end of the barrel tube. Upon firing of the launching cartridge 41, the resultant propellant gases will effect forward motion of the projectile/sabot assembly 11 by pressure on the rear face of the rigid disc face 17, and the ball 13 will be effectively cradled by its ball support cradle 15 during the forward motion of the assembly by the action of the propellant gases on the rigid disc sabot 17 and the resulting application of the set-back forces to the assembly 11. Upon exit of the projectile/sabot assembly 11 from the nozzle of the launching barrel or tube, the air resistance on low mass cradle/sabot 15, 17, including particularly the annular shoulder 15*b* and the space between the ball and the cradle, will result in the cradle/sabot 15, 17 separating and dropping away from the ball 13, and subsequent early dropping of the cradle/sabot 15, 17 to the ground, with the ball 13 continuing downrange to its point of impact at the target zone. Upon impact of the ball 13 with the ground personnel, or the ground, or other target, the ball will split along the score lines in the manner of an opened orange peel, due to the prescoring along the score lines 13*c*, 13*c'* and the thin-walled construction at the score line intersection. This impact splitting of the scored ball skin 13*w* is enhanced by the substantially full filling of the ball 13 with liquid L, with little or no vent space, as impact compression or deflection of the spherical ball configuration on impact causes a decrease of the ball volume, with inherently little or no liquid compression, and resultant rupture occurs along the weakened score zones.

The striking velocity as a measure of the "hurt" which may be delivered to the rioter or other personnel to be controlled, can be readily controlled by varying the muzzle velocity as a function of the propellant gas pressure, the angle of fire and the range, and this striking velocity, for a given ball weight, will generally determine the intensity of sting or unbalancing impact shock applied to the rioting personnel or other target. As a result of the splitting of the ball wall 13*w* in the orange peel quadrant configuration as noted above, the target personnel will be deprived of any use of the thus spent projectile as an effective return projectile to

throw back at the person initially launching the projectile. As distinguished from ordinary projectiles whose fragments form substantially hazardous penetrating particles on impact with a target, this ball projectile may generally be termed as non-fragmenting in the usual sense of the word as to fragments which are themselves penetrating and harmful to the personnel, as the orange peel split flexible skin quadrants of the plastic skin 13w are themselves relatively light-weight and highly flexible. Upon rupture of the ball and opening of the projectile in the orange peel configuration, the liquid L will be discharged against and in the vicinity of the target.

While the invention has been described with respect to the single illustrative 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 to the illustrative and preferred embodiment, but only by the scope of the appended claims.

We claim:

1. Deterrent ammunition comprising
a hollow ball formed of flexible rupturable and sealable material and forming an internal cavity with a relatively thin surrounding wall,
a charge of liquid in said cavity and dispersable upon impact rupture of said ball,
said ball being externally scored for ease of rupture,
a rigid relatively low density gas-sealing discarding disc sabot
and a ball support cradle of low density material and having a forward cup-shaped face engaging said ball in cradling relation,
said rigid disc sabot and cradle being secured together,
and said ball being releasably secured to said cup-shaped face of said cradle.

2. Deterrent ammunition according to claim 1,
said ball having at least one substantially annular score line.

3. Deterrent ammunition according to claim 1,
said ball being externally scored along two peripheral intersecting score lines.

4. Deterrent ammunition according to claim 3,
said two peripheral intersecting score lines being annular and intersecting at two points.

5. Deterrent ammunition according to claim 4,
said two peripheral intersecting score lines being disposed substantially normal to one another and forming separable substantially spherical quadrants.

6. Deterrent ammunition according to claim 5,
said ball being spherical, and having an annular zone of greater thickness than the thickness of two opposing lesser thickness zones separated by said annular zone,
said two points of intersecting score lines being disposed in said lesser thickness zones.

7. Deterrent ammunition according to claim 6,
said score lines being of substantially constant depth.

8. Deterrent ammunition according to claim 7,
said ball comprising two hemispheres having a juncture line substantially normal to said score lines.

9. Deterrent ammunition according to claim 8,
said two points of intersection of said intersecting score lines being substantially coaxial with said sabot and cradle.

10. Deterrent ammunition according to claim 1,
said ball being externally scored along two peripheral intersecting score lines,
said two peripheral intersecting score lines being annular and intersecting at two points,
said ball being spherical, and having an annular zone of greater thickness than the thickness of two opposing lesser thickness zones separated by said annular zone,
said two points of intersecting score lines being disposed in said lesser thickness zones.

11. Deterrent ammunition according to claim 1,
said score lines being external and of substantially constant depth.

12. Deterrent ammunition according to claim 11,
said ball being spherical, and having an annular zone of greater thickness than the thickness of two opposing lesser thickness zones separated by said annular zone,
said two points of intersecting score lines being disposed in said lesser thickness zones.

13. Deterrent ammunition according to claim 12,
said ball comprising two hemispheres having a juncture line substantially normal to said score lines.

14. Deterrent ammunition according to claim 13,
said two points of intersection of said intersecting score lines being substantially coaxial with said sabot and cradle.

15. Deterrent ammunition according to claim 1,
said ball being externally scored along two peripheral intersecting score lines,
said two peripheral intersecting score lines being annular and intersecting at two points,
said two points of intersection of said intersecting score lines being substantially coaxial with said sabot and cradle.

16. Deterrent ammunition according to claim 1,
said ball being releasably bonded to said cradle.

17. Deterrent ammunition according to claim 1,
said ball being releasably bonded to said cradle with an elastomeric cement.

18. Deterrent ammunition according to claim 17,
said elastomeric cement comprising rubber cement.

19. Deterrent ammunition according to claim 18,
said low-density cradle being formed of a resilient foamed plastic.

20. Deterrent ammunition according to claim 19,
said resilient foamed plastic comprising styrofoam.

21. Deterrent ammunition according to claim 20,
said rigid disc sabot being formed of fiberboard.

22. Deterrent ammunition according to claim 1,
said ball being a sphere and being effectively substantially fully filled with said liquid.

23. Deterrent ammunition according to claim 1,
said ball being formed of an elastic flexible thermoplastic material.

24. Deterrent ammunition according to claim 23,
said ball being formed of ethylene vinyl acetate.

25. Deterrent ammunition according to claim 1,
said ball having at least one substantially annular score line,
said ball being externally scored along two peripheral intersecting score lines,
said ball being spherical, and having an annular zone of greater thickness than the thickness of two opposing lesser thickness zones separated by said annular zone,

said two points of intersecting score lines being disposed in said lesser thickness zones,
said score lines being of substantially constant depth,
said ball comprising two hemispheres having a juncture line substantially normal to said score lines,
said two points of intersection of said intersecting score lines being substantially coaxial with said sabot and cradle,
said ball being releasably bonded to said cradle with an elastomeric cement,
said low-density cradle being formed of a resilient foamed plastic.

26. Deterrent ammunition according to claim **25**, said ball being formed of ethylene vinyl acetate.

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