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Flatau et al.

[11] **3,898,932**

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[54] **NON-HAZARDOUS RING AIRFOIL PROJECTILE FOR DELIVERY OF NON-LETHAL MATERIAL**

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[52] **U.S. Cl.** **102/66;** 102/65; 102/65.2; 102/90; 244/3.1

[51] **Int. Cl.** **F42b 13/46;** F42b 11/32

[58] **Field of Search** ..... 102/38, 92.1, 92.2, 92.3, 102/92.4, 92.6, 92.7, 56, 41, 64, 67, 90, 42 C, 65, 66, 65.2; 244/3.1

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[57] **ABSTRACT**

A rotatable airfoil projectile comprising a hollow closed circular ring wing surrounding a central open area with a non-lethal riot control agent positioned within the hollow ring. The projectile consists of an aerodynamic lifting body of a thick ring wing geometry which uses spin imparted to it from a launching means for its gyroscopic stability The combination of aerodynamic stability characteristics and high spin rate (i.e. above 2,000 rpm) results in a flat trajectory and extended range capability.

The projectile ruptures on impact due to centrifugal and impact forces to distribute the non-lethal riot control payload about the target area. The sub-sonic launch velocity avoids bodily harm due to impact with a person even at point-blank range.

9 Claims, 8 Drawing Figures

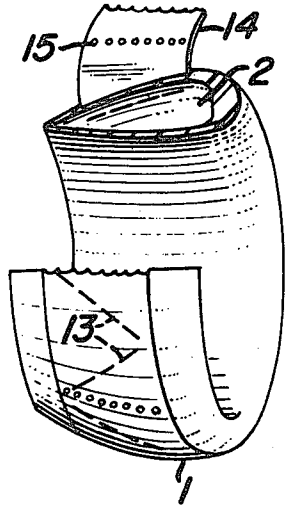


Fig. 1

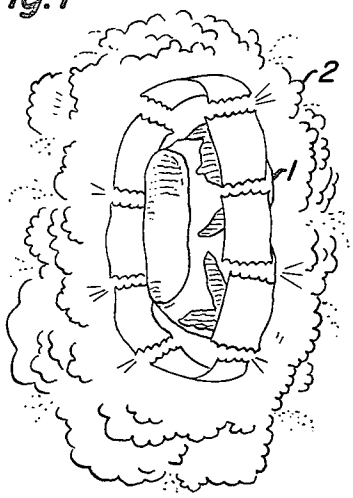


Fig. 2

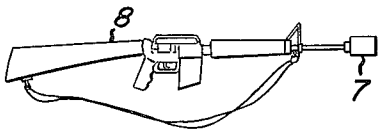


Fig. 3

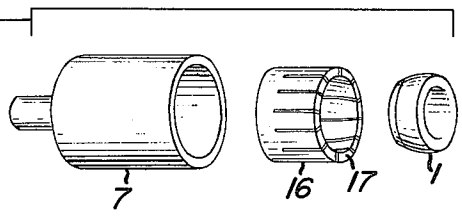


Fig. 4

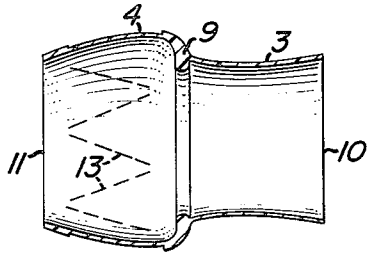


Fig. 5

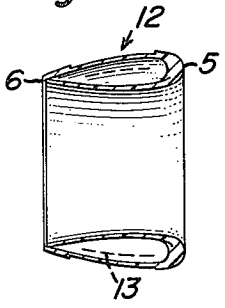


Fig. 6

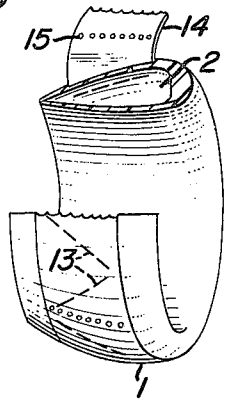


Fig. 7

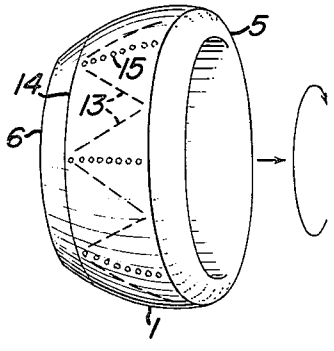
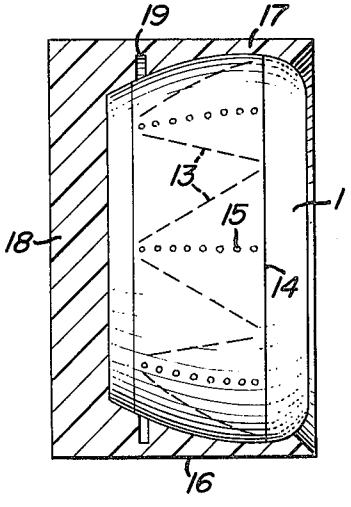


Fig. 8



NON-HAZARDOUS RING AIRFOIL PROJECTILE FOR DELIVERY OF NON-LETHAL MATERIAL

DEDICATORY CLAUSE

The invention described herein may be manufactured, used or licensed by or for the government for governmental purposes without payment to us of any royalty thereon.

Briefly stated, the present invention relates to a non-lethal ring air foil projectile adapted for use in pacifying or dispersing unruly persons such as, for example, mobs.

The wide spread mob violence of recent years has spurred the development of numerous mob control devices including notably rifle fired or tear gas grenades and other types of projectiles and also various hand-held weapons for use by military and civil police to control mob violence. Desirably the authorities should be equipped with projectile means to disperse or control mobs without killing, disfiguring or permanently injuring any members thereof.

Unfortunately, the mob control devices of a projectile nature proposed heretofore suffer from certain serious disadvantages. If fired from too close, e.g. point blank, the projectile can cause serious injury to a target individual. On the other hand, the usual mob control projectile, as for example a tear gas grenade, is not very accurate when fired from a distance great enough for the policeman to be out of range of injurious objects such as rocks which might be hurled by rioters.

It has now been discovered that the ring air foil munition disclosed in copending application of A. Flatau, Ser. No. 272,252, filed July 17, 1972, which in turn is a C.I.P. of Ser. No. 105,751, filed January 1971, now abandoned, is well adapted to mob control, particularly if modified into the structure of the present invention.

The munition projectile comprises a ring air foil or ring wing, i.e. a body of revolution generated by an air foil cross-section rotated 360° about an axis beneath and parallel to the longitudinal direction of the air foil cross-section. The hollow region internally of the ring wing houses the payload and explosive train. In particular, the munition projectile of the aforementioned copending application comprises an aerodynamic lifting body of a thick ring wing geometry which utilizes a spin in excess of about 2,000 rpm imparted thereto by the launching means for gyroscopic stability. Normally this projectile has a near neutral static stability and associated aerodynamic performance characteristics which provide predictable repeatable trajectories and extended range. These aerodynamic characteristics are based on the generation of a lift force, as gravity tends to pull the projectile downward, and the low drag shaping. To provide for payload capacity, the wing cross-section should exceed 25% of the chordal dimensions.

Important to use of a ring air foil projectile for mob control purposes is its relatively low launching velocity, being always launched at a subsonic velocity e.g. below about 300 ft/sec. Low launch velocity and an extended range are desired attributes for a mob control device which will not cause lethal injury on impact of the human body at point blank range, yet be capable of launch from a distance far enough to be out of the rock throwing range of rioters e.g. 50 to 100 meters.

The principal object of the present invention is to provide a projectile, containing a riot control payload, which will not cause lethal injury upon impact with the human body due to kinetic energy even at the point blank range.

Another object of the present invention is to provide a projectile containing a mob control payload, capable of being launched accurately from a distance.

A further object of this invention is to provide a frangible ring air foil which produces a high degree of payload dissemination at a target area.

Still other objects of the invention and the advantages of the invention will become apparent from the detailed description thereof hereinafter set forth.

Briefly stated, the ring air foil projectile of the present invention is a relatively thick ring wing. A non-lethal payload is to be carried inside the ring air foil and the materials and structure of the ring air foil are such that the ring air foil is frangible, rupturing on impact. The ring air foil wing material is stressed by the forces involved with its launch spin to very near the rupture point; the additional forces applied by impact then cause rupture releasing the payload.

For a more detailed description of this invention and disclosure of the preferred embodiments thereof, reference is now made to the attached drawing wherein:

FIG. 1 is a diagrammatic view showing the rupture of the ring air foil projectile;

FIG. 2 is a diagrammatic view showing a weapon adapter attached to the muzzle of a rifle;

FIG. 3 is an exploded view showing a weapon adapter to eject the projectile from the weapon, a sabot and the projectile;

FIG. 4 is a view of a preferred mode of projectile showing the projectile body with the inner wall extended;

FIG. 5 is a fragmentary view of the projectile;

FIG. 6 is a cut-away view of the projectile mode of FIG. 4 showing a break band, slits in the outer wall and internal configuration;

FIG. 7 is a view of the preferred mode of FIG. 6 showing the completed projectile and the projectile in the direction of flight and the sense of rotation in flight; and

FIG. 8 is a view showing the projectile mounted in the sabot for ejection from a weapon.

As is shown in FIG. 1, the frangible ring air foil 1 is adapted to fragment upon impact, releasing its payload 2 into the impact area. The ring air foil 1 (FIGS. 4–7) is a ring with an inner wall 3 and an outer wall 4 joined at leading edge 5 and trailing edge 6 with space between walls for payload 2. Walls 3 and 4 are, of course, contoured to be airfoil shapes and together have a thickness to chord ratio ratio in excess of 20%.

Since a principal object of the present invention is to provide a non-lethal launched (rather than thrown or hurled) projectile; the material used for the ring air foil should be particularly light weight, even soft, such as plastics, rubber, etc. Brittle light weight plastics are known to the art and, therefore, the actual materials from which projectile 1 is fabricated form no part of the present invention. In addition, thin wall sections or pre-weakened wall portions, particularly in outer wall 4, may be employed to facilitate rupture upon impact. Such expedients are too well known for detailed discussion thereon. Illustrated by the drawing is a preferred construction of the ring air foil projectile intended to insure rupture on impact, yet permit relatively rough handling without rupture prior to launch. Since the ring air foil projectile is a low velocity device with a sub-

sonic launch velocity usually not exceeding about 300 ft/sec, frangibility can be assured by relating high spin to wall strength. Centrifugal force due to spin loads the wing wall very close to its rupture point. Thereafter, even a soft impact will increase wall stresses beyond the rupture point.

It may be noted that mechanical launch means such as a rifle and adapter 7 (FIG. 2) are capable of imparting spin in excess of 2,000 rpm, normally 4,000–6,000 rpm. Spin stressing the wing wall offers several safety features. The ring wing material can be made strong enough for safe handling, even mishandling without rupture. Also in the event any ring air foil projectile does land without rupture and payload release and then is hurled back by a rioter, it will not normally rupture or fragment upon impact (for lack of prestressing through spin). Although a rifle launch means has been illustrated, the projectile could be fired from a pistol adapter or a special hand-held weapon designed for this non-lethal use only.

The importance of non-lethality makes the preferred size range for the non-lethal air foil of the present invention surprisingly narrow i.e. 2–3 inch diameter. The minimum size projectile should be too large to impact principally in someone's eye, yet the largest projectile should be small enough so that its impact energy will not crush the face.

A desirable attribute of the non-lethal ring air foil projectile of the present invention is that accuracy and a relatively extended range are combined with the relatively low launch velocity of below about 300 ft/sec, preferably 250–300 ft/sec. The ring air foil projectile launched from a rifle mounted adapter 7 (See FIG. 2) is accurate to about 100 meters (or yards). As compared to tear gas grenades, the ring air foil has the advantage of a relatively flat trajectory.

In the preferred embodiment illustrated in the drawing, the frangible ring air foil 1 is an envelope type container fabricated of a soft and resilient material such as soft rubber or plastic. Inner wall 3 is formed (e.g. molded) integral with outer wall 4 joined by shoulder 9. Inner wall 3 nests within outer wall 4, with the edge 10 of inner wall 3, being heat sealable in conventional manner to the edge 11 of outer wall 4 after a payload 2 is loaded between inner wall 3 and outer wall 4 to form trailing edge 6. Thus, the diametric extents of our ring air foil final shape are defined by the exposed surfaces of walls 3 and 4 and band 14 which overlays wall 4. Leading edge 5 and trailing edge 6 define the longitudinal extent of our projectile. The ring air foil projectile structure illustrated is a modified Clark-Y air foil. The ring wing is thick, made so by blending two air foils having different thickness to chord ratios in back-to-back relationship. Their respective thickness to chord ratios is nominally 22% and 11% and the resultant ring air foil having a thickness to chord ratio of 28.5%. However, other back-to-back air foil cross-sections are contemplated as being within the scope of this invention so long as such other ring wings have a nominal thickness to chord cross-section ratio of at least 20%.

The payload 2 which may be any material adequate to meet the requirements of the intended non-lethal given applications such as powder, liquid, encapsulated gels or liquids, and pelletized lacrimatory materials can be loaded between walls 3 and 4 by conventional filling and dispensing apparatus in conventional manner prior to sealing off trailing edge 6.

According to the structure of the preferred mode of the invention illustrated in the drawing, recess 12 is formed in outer wall 4 (by conventional molding techinique) and slits 13 are formed in outer wall 4 in a non-continuous saw-tooth slit line configuration (by conventional die cutting techniques). A resilient break band 14, of a flexible material which has a low elongation under load, has perforations 15 formed therein (by conventional perforation means). Band 14 is mounted adhesively within recess 12 with each line of perforation 15 set so one end thereof coincides with the intersection of two lines of slits 13 at border of recess 12; the opposite end of the line of perforations 15 then becomes located one-half way between a pair of intersecting lines of slits 13 at the opposite border of recess 12 (as may be seen in FIG. 7). The band 14, which is added before introducing payload 2, prevents the opening of slits 13 during introduction of the payload 2 within the projectile 1, during storage, shipping and handling of the loaded projectile, and even during its flight prior to impact with the target.

Perforations 15 control the strength of break band 14 so that centrifugal force loads due to spin in flight (in excess of 2,000 rpm) preload break band 14 to near structural failure, so that break band 14 will be deformed and open on impact with the target, as shown in FIG. 1, disseminating the payload at a target area.

When the ring air foil projectile is launched from an adapter 7 attached to a weapon 8, e.g. a rifle, propulsion forces cause the sabot 16 to separate from adapter 7, releasing ring air foil 1 into its relatively flat trajectory. Sabot 16 is fabricated from a light-weight (foam) material with a plurality of fingers 17 formed therein. Fingers 17 are torn away from base 18 of sabot 16 at undercut 19 in flight by centrifugal force to permit projectile 1 to separate in flight from sabot 16. Adapter 7 will normally be designed to impart the desired spin rate to projectile 1. Sabot 16 breaks into a plurality of pieces, slows rapidly and drops to the ground almost immediately.

Desirably, the projectile wall is thickened and shaped to form a shoulder 9 at the point of intersection of inner wall 3 and outer wall 4 with enough weight of material to act as ballast for center of gravity control for the ring air foil. In flight, projectile 1 flies in an attitude with rounded edge portion 5 leading, feathered edge portion 6 trailing, and the projectile rotating in a clockwise direction, as shown in FIG. 7. The smooth low drag airfoil shaping minimizes velocity decay and spin decay of the projectile in flight conserving the launch imparted kinetic energy and centrifugal forces. Thus, impact at short or nominal ranges e.g. 30–100 meters creates a large and rapid increase in the circumferential loading of band 14 at one or more of the rows of perforations 15 in the break band, in sufficient excess of the load already imposed on it by centrifugal forces to break the band 14 completely at one or more of these rows of perforations. Immediately, the full centrifugal force of the payload bears against the outer wall 4 of the projectile 1 so that the dashed slits 13 structurally fail, deform, and open up, releasing the payload 2 as shown in FIG. 1. The high tangential velocity of the individual payload particles (due to the high spin rate of the projectile) disperses the payload into a cloud in the target area upon release from the ruptured projectile.

The low drag, flat trajectory due to lift, and accuracy of the ring air foil projectile enables it to be aimed and

fired at a point target from a distance so that only that amount of payload needed to expose a point target to the effects of the payload agent need to be delivered thereto. This eliminates the necessity to contaminate a large area in order to assure that a point target is exposed to the payload agent. For example, the ring air foil projectile can be fired into a window from about 100 meters or to hit a specific individual at 30–50 meters.

What is claimed:

1. In a projectile having an annular ring shape with a substantial tear drop airfoil cross-section defining a hollow interior and being defined by major annular inner and outer substantially curvilinear surfaces defining the diametric extent of said shape and being terminated by leading and trailing edges which define the longitudinal extent of said shape, the improvement comprising a non-lethal incapacitating payload disposed within the hollow interior of said projectile and being confined by an outer resilient structure forming said shape further including rupturable means which ruptures upon impact with the target for disseminating said payload.

2. The projectile of claim **1** wherein said rupturable means defines at least a part of one of said surfaces.

3. The projectile of claim **1** wherein said rupturable means is in the form of a band.

4. The projectile of claim **3** wherein said band will not rupture during launch at velocities up to 300 ft/sec and a spin velocity of at least 2,000 RPM's.

5. The invention of claim **1** wherein said rupturable means is a composite band which has at least one weakened portion.

6. The invention of claim **5** wherein said weakened portion comprises perforations through said band.

7. The invention of claim **1** wherein the said rupturable means is preloaded to near rupture when spinning at over 2,000 RPM's when traveling in its flight trajectory.

8. The projectile of claim **1** wherein said rupturable means is composed of a band of non-elastic material disposed over the payload portion of said projectile.

9. The projectile of claim **8** wherein said band is preloaded to near its structural failure point due to centrifugal force created by the spin of the projectile so that the band will fail and disseminate said payload upon impact with a target.

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