United States Patent

Scanlon

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[54] **EXPENDABLE CASE WITH VENTED BASE CAP**

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[73] Assignee: **Remington Arms Company, Inc.,** Bridgeport, Conn.

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[52] **U.S. Cl.**.....**102/49.7,** 102/38, 102/DIG. 1

[51] **Int. Cl.**.....**F42b 13/28,** F42b 5/00

[58] **Field of Search**.....102/38, 40, 43, 44, 45, 49.7

[56] **References Cited**

UNITED STATES PATENTS

1,191,357	7/1916	Snyder	102/49.7
1,446,711	2/1923	Ludorf	102/49.7
1,812,010	6/1931	McBride	102/49.7
3,288,066	11/1966	Stadler et al	102/38

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[57] **ABSTRACT**

An expendable cartridge wherein a deformable casing is expelled from the gun upon firing along with the projectile. The substantially non-combustible breech end cap is vented so that the full explosive pressure within the casing does not act against the breech end cap and thus expulsion of the casing is facilitated. Cover means are mounted on the breech end cap to provide environmental portection and/or protection against accidental ignition.

10 Claims, 7 Drawing Figures

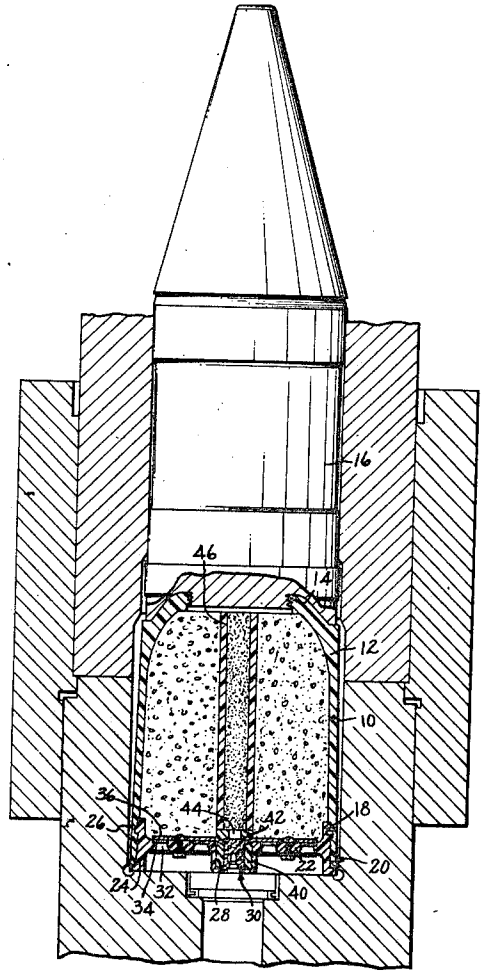


Fig. 1.

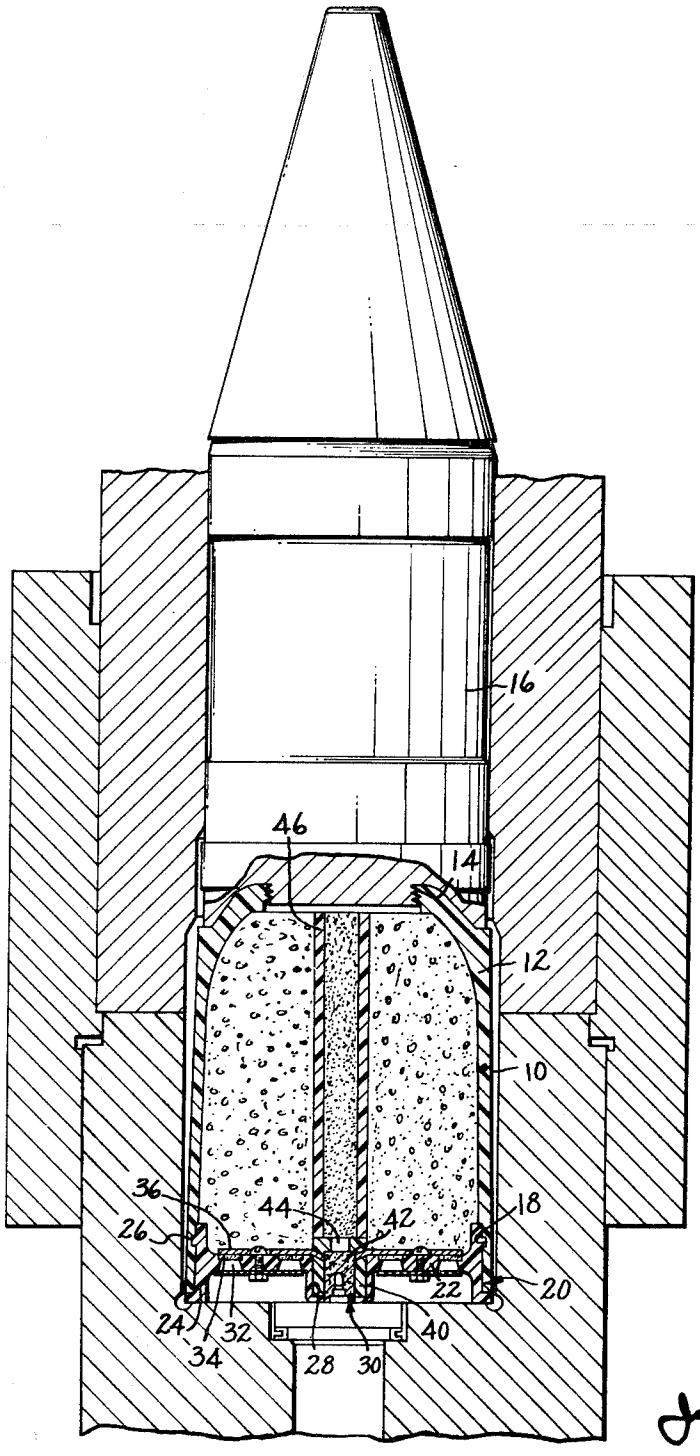
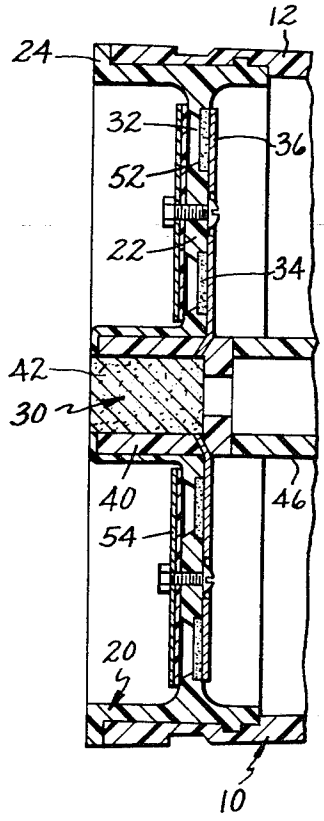


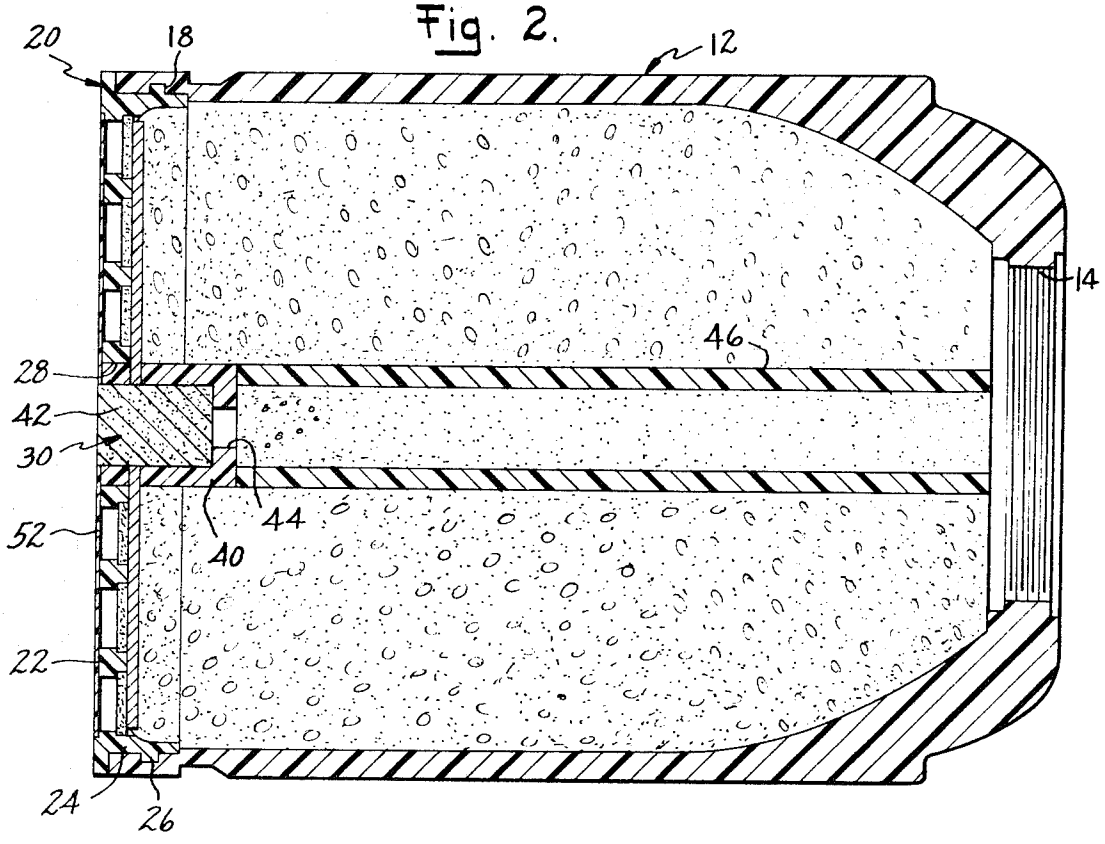
Fig. 7.



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Fig. 2.



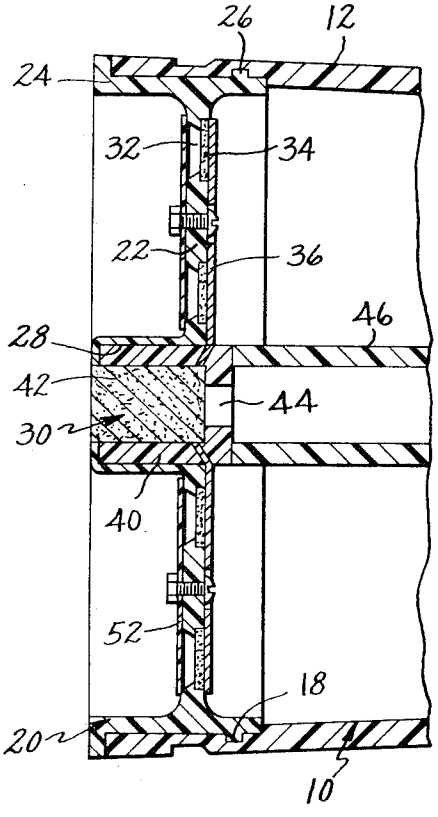


Fig. 3.

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Fig. 5.

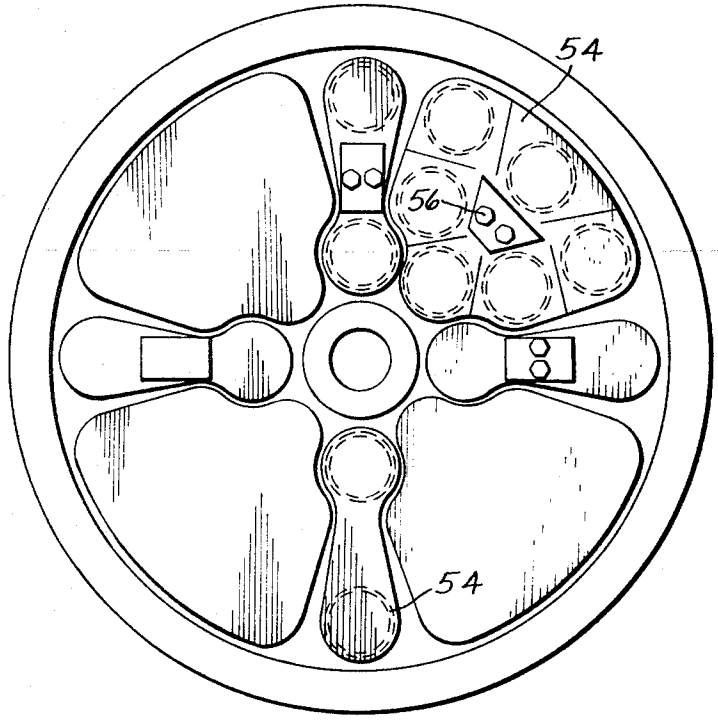


Fig. 4.

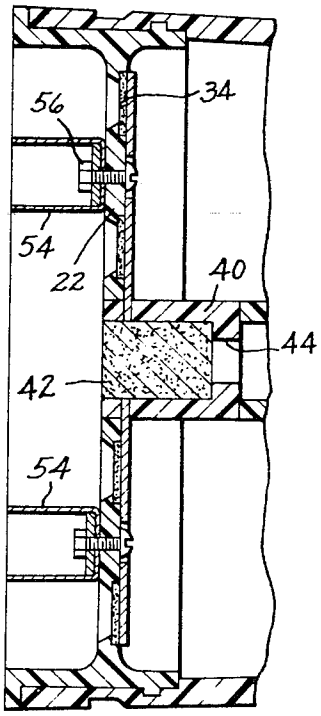
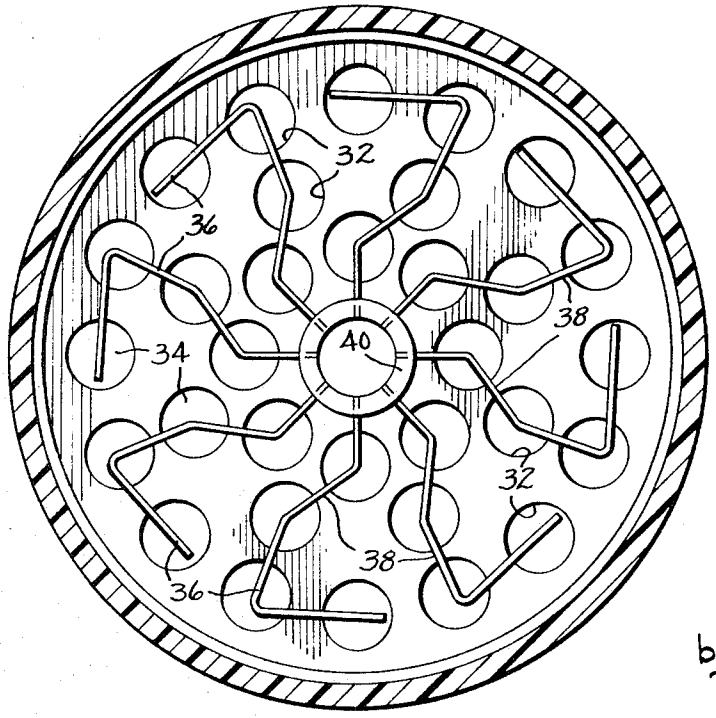


Fig. 6.



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EXPENDABLE CASE WITH VENTED BASE CAP

This invention relates to ammunition for firearms and in particular to improvements to expendable cartridges in which the body casing is designed to be expelled from the muzzle of the gun along with the projectile means as a result of the action of the explosive gases generated by the burning propellant.

In recent years, considerable effort and expense have been expended — particularly by or for the military — to develop so-called caseless ammunition to replace the conventional brass or other metal cased cartridges. In addition to the decrease in weight and decrease in volume, such caseless ammunition is attractive to the military because such caseless ammunition does not require metallic cases which must be recovered in the field for re-use (particularly the larger artillery cases). Because the entire cartridge is expelled from the muzzle of the gun, (the propellant in the form of gaseous products of combustion) the gun system can be simplified over conventional guns which require elaborate extraction and ejection means.

A second approach to this problem is the expendable cartridge wherein a substantially non-combustible casing is provided to give the necessary environmental protection to the propellant and which is entirely expelled from the gun in solid form. The expendable case concept is described more fully in copending applications, Ser. No. 686,508, filed Nov. 29, 1967 and Ser. No. 755,649, filed Aug. 27, 1968.

The present invention provides an improved expendable plastic cartridge casing which is expelled in solid form from the muzzle of the gun along with the projectile. The plastic body protects the propellant during storage and handling from moisture and unintentional ignition, and provides structural rigidity. An expendable cartridge made from such a body is only slightly heavier than equivalent caseless ammunition but on the other hand, it avoids or substantially minimizes many of the problems of caseless ammunition such as lack of waterproofing, poor structural strength, and poor resistance to premature or undesirable ignition due to cigarettes, sparks, or flying hot fragments, cook-off in a hot gun chamber, etc.

This invention is particularly useful for expendable cartridges for large size shells, e. g. artillery cases such as 152 mm, although the inventive concept may also be used for smaller caliber ammunition. Preliminary work, however, has been with the 152 mm and thus all drawings and discussion will be limited to this size of ammunition.

In extending the expendable case concept to large artillery ammunition, e. g. 152 mm, it was evident that a base or breech cap was required in order to provide adequate protection to the much larger quantities of propellant which were provided within the ammunition casing. Protection was needed against accidental ignition by flash flame, cigarettes, and spalling as well as the ordinary protection required against impact and shock, etc. during handling and/or storage which might tend to damage the ammunition if not properly protected. However, it was known from previous experience that if a solid plastic base cap was used, the casing would not be expelled upon firing because the explosive pressure within the casing would react against the full area of the base cap and prevent expulsion of the casing.

The present invention is the solution to the problem of expulsion of expendable cases where a substantially non-combustible base cap is used.

It was found that case expulsion could be achieved by venting the base cap. With the case expulsion problem solved, the next step was to provide protection to the vent openings and the exposed propellant. The first successful attempt to shield the vent opening was accomplished by attaching a thin film of Mylar polyester film to the periphery and the initiator perforation or opening on the outside face of the base cap. This permitted the Mylar sheet to be blown away since it was attached to the adjacent base cap by a weaker adhesive bond. If there was any plastic debris caused by the blowing open of the Mylar plastic film it was either burned up or swept out of the gun chamber when the projectile and casing (including the base cap) were expelled.

Although it was necessary to attach the Mylar plastic sheet to the outside face of the base cap in order to achieve expulsion, it is believed that a weaker sheet of Mylar plastic — or other plastic — which would rupture sooner or under less pressure can be made to perform adequately if attached to the inner face of the base cap, depending on the tensile strength and toughness of the plastic and the amount of pressure within the casing.

Although the firings with Mylar plastic film were successful, it was felt that additional protection for the vent openings was desirable. This was accomplished by fastening flexible fingers of metal (e. g. brass, steel) on the outer face of the base cap to cover the vent openings so that the metal fingers would adequately protect the vent openings before firing and would hinge outwardly as the pressure inside the case increased. Inasmuch as it was found necessary to vent the casing in the early stages of combustion or ignition, individually molded propellant discs, which were made of a faster-acting propellant than the main propellant charge, were inserted in the vent openings with each disc connected to the initiator — or primer — by means of a mild detonating fuse. This assured the venting of the openings before the pressure within the casing built up so as to prevent retention of the casing in the gun chamber.

The environmental protection, e. g. waterproofing, afforded to the cartridge by the metal shields did not compare with the Mylar sheet although the metal shields were superior to the Mylar sheet in preventing premature ignition or physical damage to the cartridge. To provide the optimum design in which both types of protection are available, the metal shield and plastic sheet can be used together.

It is the object of this invention to provide a vented base cap to an expendable case cartridge in order to facilitate case expulsion.

It is another object of this invention to provide a large caliber expendable cartridge which is adequately protected from environmental damage as well as accidental ignition.

Other objects of this invention will be apparent from the specification and drawings in which:

FIG. 1 is a sectional side elevation of a loaded expendable cartridge incorporating the present invention in position in the chamber of a gun;

FIG. 2 is a sectional side elevation of a loaded expendable cartridge in which a Mylar plastic sheet is used to shield the vent openings.

FIG. 3 is a sectional side elevation of the breech end portion of a loaded expendable cartridge wherein flexible metal fingers are used to cover the vent openings.

FIG. 4 is a sectional side elevation of the breech end portion of a fired expendable cartridge of the type shown in FIG. 3.

FIG. 5 is an end view of the base cap showing the positioning of the metal cover shields.

FIG. 6 is a view taken along Section A—A in FIG. 3 and shows the vent openings in the base cap with the propellant discs therein with the mild detonating fuse connections between the primer and the propellant discs.

FIG. 7 is a sectional side elevation of the breech end of a loaded expendable cartridge wherein flexible metal fingers and a plastic sheet are combined to shield the vent openings.

Referring now to the drawings, FIG. 1 illustrates an expendable cartridge 10 having a body casing 12 with a threaded portion 14 at its front or mouth end adapted to receive projectile 16 and groove 18 at its rear or breech end adapted to receive a base cap 20. Body casing 12 and base cap 20 are made of deformable plastic material, such as polycarbonate or polyethylene, which are substantially non-combustible under ordinary conditions of firing and are designed to be expelled from the gun muzzle along with projectile 16 upon firing of the cartridge.

Base cap 20 includes a transverse wall section 22 and a cylindrical side wall section 24, a portion of which constitutes an outwardly extending rim 26 which fits with groove 18 to lock the base cap to the body casing 12. Epoxy cement (not shown) can also be utilized to make the connection between the base cap and the body casing more positive.

Although shown as a separate element, it should be obvious that base cap 20 can be integrally molded as one piece with the body casing 12. Moreover, it is possible to cold form a suitable plastic casing with an integral base cap by known cold forging methods. Finally, it is obvious that other means of connecting a separate base cap to the body casing, e. g. ultrasonics or spin welding, can be used.

Base cap 20 has a central opening 28 therein in which an initiator means 30 (here shown as an electrically fired primer) is mounted. In addition to the initiator opening, the base cap also has a plurality of vent openings 32 in the transverse wall section 22 (See FIG. 6). As can be seen in FIG. 4, these openings 32 are recessed at the inside face of transverse wall 22 in order to accommodate molded propellant discs 34 which are secured therein, preferably by adhesives. The openings 32 then flare outwardly to the outer face of the transverse wall.

The propellant discs 34 are connected to the primer means 30 by lengths of mild detonating fuse 36, such as Pyrocore detonating fuse. The fuse can be attached at points 38 on the inside face of the transverse wall by any well known means, e. g. adhesives.

The initiator means 30 comprises a molded propellant cup 40 which is consumed upon firing and which is attached to the transverse wall by any well known means. Initiator mixture 42 is secured within the cup 40 and by means of flash hole 44 communicates with the interior of the body casing.

Attached to the front end of propellant cup 40 is a combustible flash tube 46 which extend axially through main propellant charge 48. Inside the flash tube and in communication with the initiator 30 is a booster propellant charge 50, preferably of black powder, which is used to ignite the main charge 48. Obviously, depending on the desired ballistics, the size of the cartridge and projectile, and the amount of the main propellant charge, the use of the booster propellant charge may not be required. If not required, the initiator 30 would then be in direct communication with the main propellant charge 48 by means of the flash hole 44.

It is to be noted that the molded propellant discs 34 are made of faster burning propellant than is found in the main propellant charge 48 so as to assure that the vent openings are clear during the early stages of ignition.

The drawings illustrate three modifications of the invention wherein the major difference between the designs is the method of protecting the vent openings and the exposed propellant therein. FIG. 2 shows one method in which a thin sheet of plastic material 52, such as Mylar polyester film, can be attached to the base cap 20 in order to close off the entire base portion of the casing except for the primer opening. The Mylar plastic cover means 52 must have sufficient strength to protect the cartridge during handling and storage and keep foreign matter away from the vent opening. The plastic sheet must also provide the necessary protection against accidental ignition, as discussed above.

A preferred method of shielding the vent openings is shown in FIGS. 3, 4, and 5. As shown in FIG. 5, a plurality of flexible metal flaps or fingers 54 are mounted on the outer face of the transverse wall by any well known method, such as the bolt and nut means 56. Upon firing, the metal flaps are explosively forced outwardly to hinge in the manner shown in FIG. 4. Also, upon firing, the deformable plastic body casing and base cap are explosively projected forwardly, and are deformed inwardly so that they are expelled through the gun bore behind the projectile. Nothing remains in the gun chamber which must be removed before the next cartridge is loaded and fired. In the case of the Mylar plastic sheet, if there is any plastic debris which is separated from the plastic sheet, it is either swept away or it is burned up by the hot propellant gases.

Attention is directed to FIG. 4 to the spacing of the transverse wall 22 from the breech end of the base cap. This recessing of the base cap wherein the transverse wall is moved in a distance at least equal to the length of one finger, is important since it eliminates any doubt that the flexible fingers will open up before the body casing and attached base cap move forwardly.

FIG. 7 shows a modification in which a Mylar plastic sheet, as shown by reference numeral 52 is combined with metal finger shields 54 to provide a maximum amount of protection. The Mylar sheet is especially vulnerable to penetration by spall, or molten metal, which may be sprayed inside a tank cupola, for example, when a tank is hit by enemy fire. The metal fingers, on the other hand, do not provide the necessary water-

proofing protection since water could enter the casing through the vent openings if the case were submerged. However, adequate waterproof protection can still be achieved in cases using the metal shields only by coating the propellant grains by methods presently available.

While the venting means are disclosed as constituting a plurality of circular openings, it should be mentioned that it is possible to vary the number of openings as well as the size and configuration of openings. Obviously, the important thing is that venting area be provided so that the full thrust of the explosive gases is not against the base cap and that the flexible flaps transfer only minimal thrust to the cap.

What is claimed is:

1. An expendable cartridge wherein the casing as well as the projectile means is adapted to be expelled through a smaller diameter gun bore upon firing, said cartridge comprising a deformable plastic casing having a breech end and a forward mouth end, separate projectile means positioned in and extending forwardly from said forward end of said casing, a transverse wall means closing off said breech end and having initiator means located therein, said transverse wall means being made of substantially non-combustible plastic material and having venting means therein through which the explosive pressure generated within the casing upon firing is vented so as to decrease the area of said cap means against which the explosive pressure acts thus facilitating expulsion of said casing, and metallic cover means mounted on said cap means to cover said venting means so as to protect the vented area and the exposed propellant from the environment and accidental ignition.

2. An expendable cartridge wherein the casing as well as the projectile means is adapted to be expelled from the gun upon firing, said cartridge comprising a deformable casing having a breech end and a forward mouth end, projectile means positioned in said forward end of said casing, a transverse wall means closing off said breech end and having initiator means located therein, said transverse wall means having venting means therein through which the explosive pressure generated within the casing upon firing is vented so that the explosive pressure is not directed against the transverse wall means, means to act as shielding means for said venting means to provide necessary protection to the said venting means prior to firing, said casing and transverse wall means being made of substantially non-combustible, plastic material, an initiator opening in said transverse wall means, said initiator means mounted in said opening and having communication with a main propellant means located within said casing, means connecting said initiator means with a second propellant means positioned in said venting means, said second propellant means adapted to ignite upon firing so as to blow said shielding means away from said transverse wall means so as to uncover said venting means.

3. An expendable cartridge as recited in claim 2 wherein said venting means comprises a plurality of vent openings in said transverse wall means, said shielding means comprising at least one impermeable member of waterproof material attached to the outside face of said transverse wall means and covering at least the areas of said vent openings, said member being structurally weaker than said transverse wall means so that the shielding member will fail before the transverse wall means upon firing of said second propellant means.

4. An expendable cartridge as recited in claim 3 wherein said shielding member comprises a metal shield which hinges rearwardly of said transverse wall means upon firing to uncover said vent opening and thus effect a venting for the explosive pressure within said casing.

5. An expendable cartridge as recited in claim 2 wherein said second propellant means is faster burning than said main propellant means so that the shielding means is blown out during the early stages of ignition.

6. An expendable cartridge wherein the casing as well as the projectile means is adapted to be expelled from the gun upon firing, said cartridge comprising a deformable casing having a breech end and a forward mouth end, projectile means positioned in said forward end of said casing, a transverse wall means closing off said breech end and having initiator means located therein, said transverse wall means having venting means therein through which the explosive pressure generated within the casing upon firing is vented so that the explosive pressure is not directed against the transverse wall means, means to act as shielding means for said venting means to provide necessary protection to the said venting means prior to firing, wherein said shielding means comprises an impermeable member of waterproof material and at least one hingeable metal shield mounted over said venting means.

7. An expendable cartridge as recited in claim 6 wherein said transverse wall means is located forwardly of the breech end of said casing so as to be spaced a predetermined distance from the forward bolt face of the associated gun, said predetermined distance being at least as great as the length of said hingeable metal shield.

8. An expendable cartridge wherein the casing is adapted to be expelled from the gun barrel along with the projectile, said cartridge comprising a deformable casing having means at the front end thereof securing a projectile means thereto and cap means at the opposite end closing off the breech end of the casing, venting means in said cap means through which explosive pressure generated within said casing upon firing can be vented so as to decrease the area of said cap means against which the explosive pressure acts thus facilitating expulsion of said casing, means mounted on said cap means to cover said venting means so as to protect the vented area and the exposed propellant from the environment and accidental ignition, a main propellant charge positioned within said casing and a primer means positioned in said cap means so as to be in communication with said main propellant charge, said venting means comprising at least one opening in said cap means, a molded propellant means positioned in said opening and secured therein, and detonating fuse means connecting said primer means and said molded propellant means so that upon firing of said cartridge said molded propellant means is ignited almost instantaneously so as to explosively force said cover means outwardly from said covering position.

9. An expendable cartridge wherein the casing is adapted to be expelled from the gun barrel along with the projectile, said cartridge comprising a deformable casing having means at the front end thereof securing a projectile means thereto and cap means at the opposite end closing off the breech end of the casing, venting means in said cap means through which explosive pressure generated within said casing upon firing can be vented so as to decrease the area of said cap means against which the explosive pressure acts thus facilitating expulsion of said casing, means mounted on said cap means to cover said venting means so as to protect the vented area and the exposed propellant from the environment and accidental ignition, said venting means comprising at least one opening in said cap means, said cover means comprising a metallic member which hinges outwardly from but remains attached to the outer face of said cap means so that no part of the cartridge remains in the gun chamber after firing.

10. An expendable cartridge wherein the casing is adapted to be expelled from the gun barrel along with the projectile, said cartridge comprising a deformable casing having means at the front end thereof securing a projectile means thereto and cap means at the opposite end closing off the breech end of the casing, venting means in said cap means through which explosive pressure generated within said casing upon firing can be vented so as to decrease the area of said cap means against which the explosive pressure acts thus facilitating expulsion of said casing, means mounted on said cap means to cover said venting means so as to protect the vented area and the exposed propellant from the environment and accidental ignition, said cover means comprising an impermeable member of waterproof material and at least one hingeable metal member mounted over said venting means.

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