United States Patent [19]

Kordas, Jr.

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[45] **June 26, 1973**

[54] **EXPENDABLE SHOTSHELL**

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

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[21] Appl. No.: **755,649**

[52] **U.S. Cl.**..... **102/43 P**, 102/42 C, 102/43 C, 102/DIG. 1

[51] **Int. Cl.**..... **F42b 7/06**

[58] **Field of Search**..... 102/38, 42, 42 C, 102/43, 43 P, 43 C

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[57] **ABSTRACT**

An expandable cartridge made of thermoplastic material which is adapted to contain the necessary propellant, projectile charge, etc., and which is explosively expelled from the gun along with the projectile charge. There are several modifications of the invention, each of which requires some means to slit, fracture, or rupture the outermost cartridge structure, which then permits the inner structure to be released thus facilitating the ultimate final release of the projectile charge from the expendable cartridge, which then falls to the ground much like conventional shot containers.

1 Claim, 14 Drawing Figures

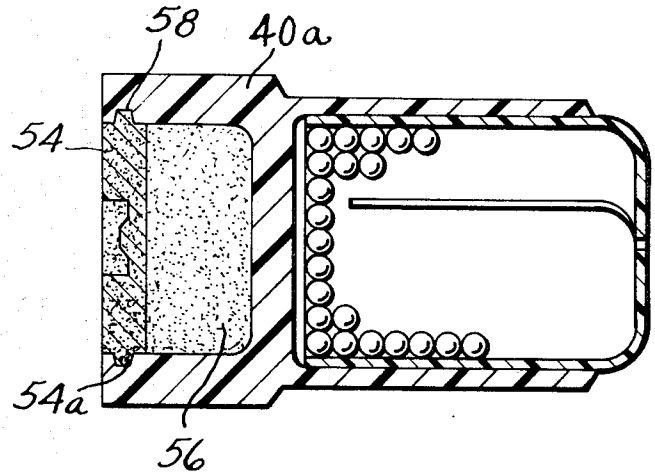

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Fig. 1.

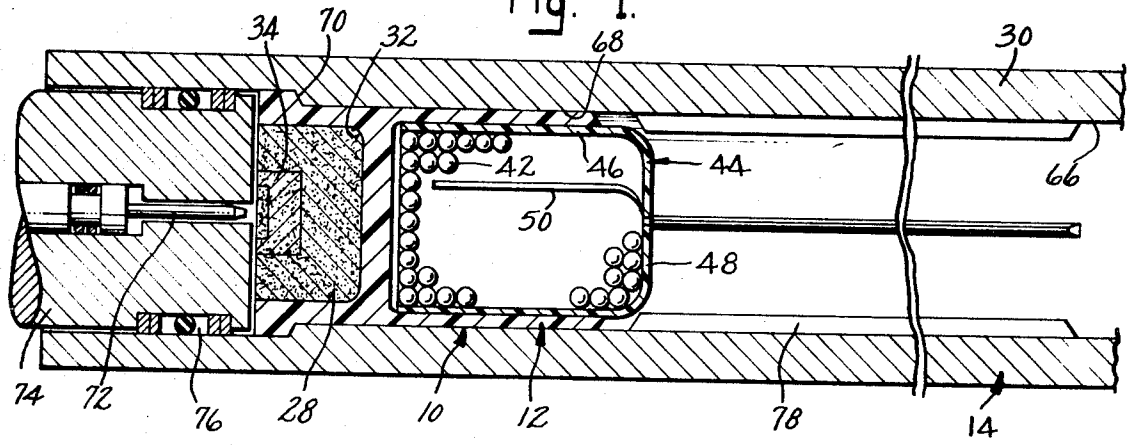

Fig. 2.

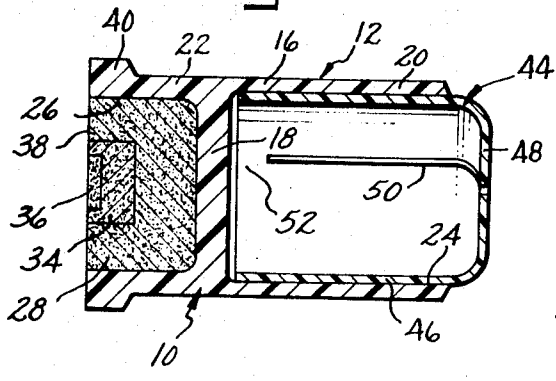

Fig. 3.

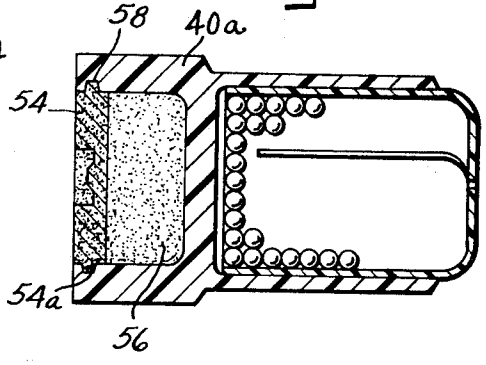

Fig. 4.

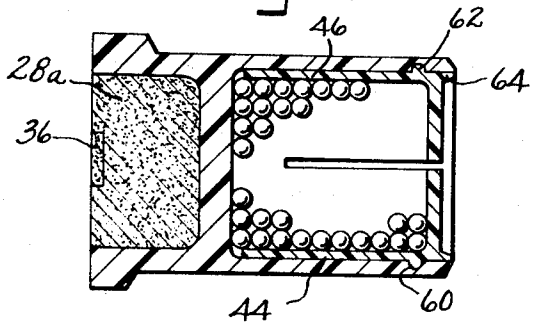

Fig. 7.

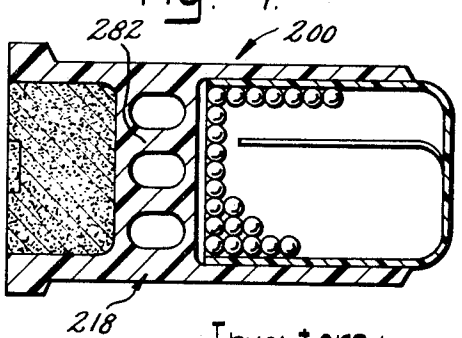

Fig. 5.

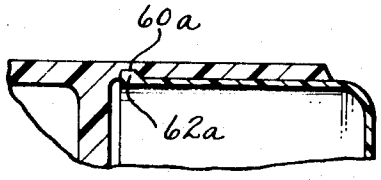

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Fig. 6.

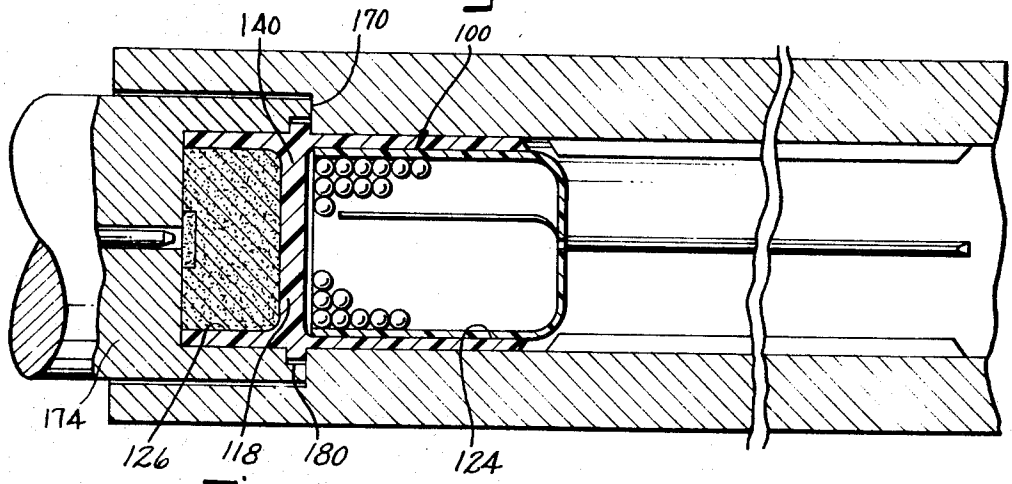

Fig. 8.

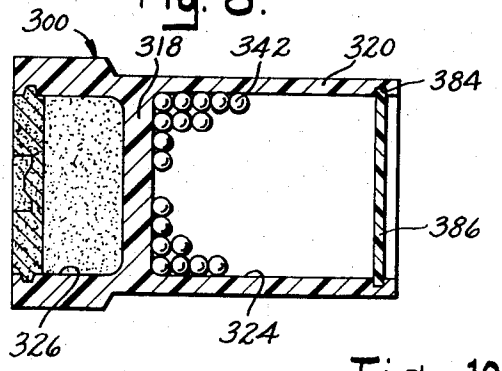

Fig. 9.

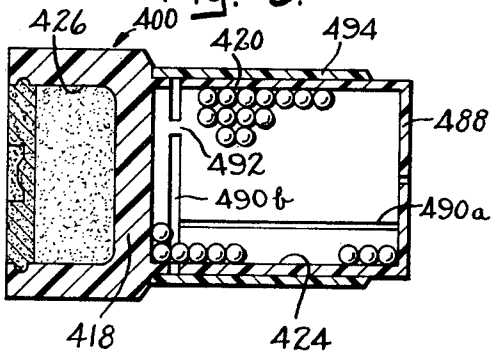

Fig. 10.

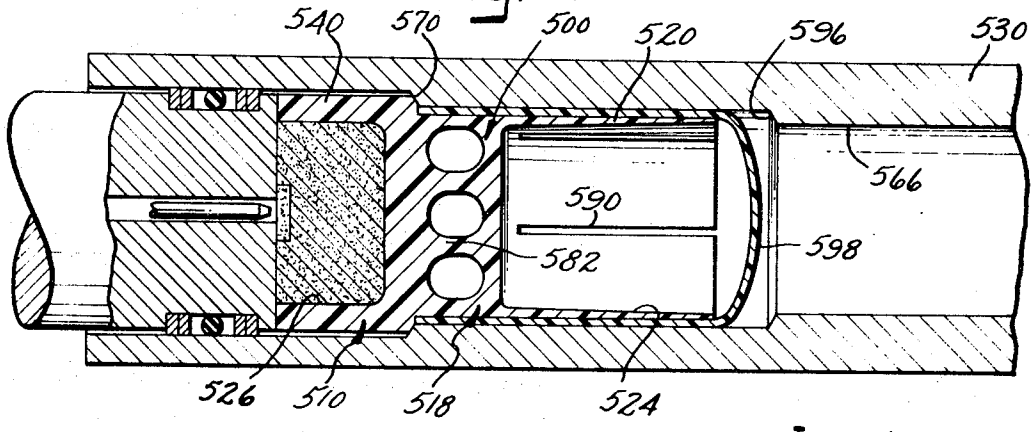

Fig. 9A.

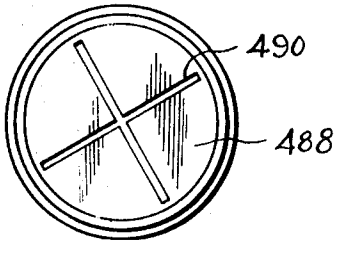

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Fig. 11.

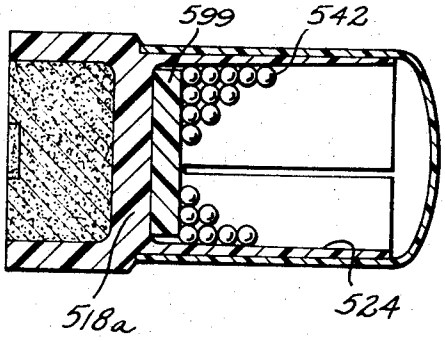


Fig. 12.

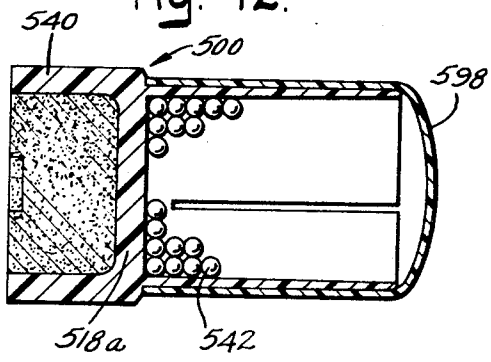
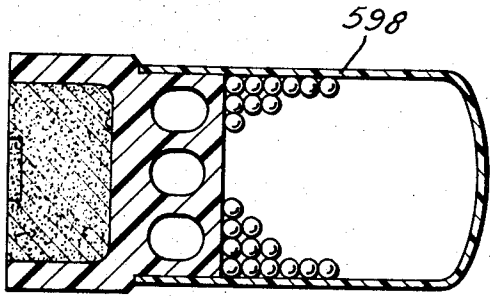


Fig. 13.



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EXPENDABLE SHOTSHELL

This invention relates to shotshells for firearms and in particular to expendable shotshell bodies designed to be expelled from the muzzle of the firearm along with the shot charge or projectile 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 case cartridges. In addition to the decrease in weight and the decrease in volume, such caseless ammunition is attractive to the military because they do not require metallic cases which must be recovered in the field for re-use (particularly the larger artillery cases). Caseless ammunition is also cheaper and can have real functional advantages. For example, because the entire cartridge is expelled from the gun, the gun system can be simplified over conventional guns which require elaborate extraction and ejection means. For purposes of this discussion, combustible cases, wherein the casing is made of a combustible material, are included with caseless ammunition.

The present invention relates to another approach which avoids some of the problems encountered with caseless ammunition and which enjoys almost all of the advantages of caseless ammunition.

Caseless ammunition has not been widely accepted to date because of certain disadvantages which have not as yet been overcome. Thus, caseless cartridges are not waterproof, are structurally weak, and are susceptible to premature or undesirable ignition due to cigarettes, cook-off in a hot gun chamber (especially automatic gun systems), and the like. Solid propellants for such cartridges have a tendency to break up when being handled or loaded, particularly in automatic or autoloading firearms. At present, dimensional control of the propellant is difficult and costly to attain and must be done by grinding or machining.

The present velocities available in conventional ammunition, i.e., with metal cases, have been limited by the pressure that can be contained safely by existing guns and ammunition cases. In either a caseless or expendable cartridge, the pressure and consequently the velocity is not limited by the strength of a conventional case. It has long been known that firearms can be designed and made which will be able to withstand much higher pressures than presently made and limited by conventional brass cases. The limiting factor then becomes the gas seal which must replace the obturating function now being performed by the metal cases.

The present invention provides an expendable plastic shotshell case or body which is expelled from the muzzle of the firearm along with the shot or other projectile. The plastic body protects the propellant during storage and handling from moisture, unintentional ignition as well as providing 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 the problems mentioned above.

It can be seen that the major object of this invention is to provide an expendable shotshell having substantially all of the advantages of caseless ammunition and having none of certain of its disadvantages.

Another object of this invention is to provide a cartridge having a body which is expelled from the muzzle of a firearm.

Still another object of this invention is to provide a cartridge that protects the propellant from its environment during storage and handling but which leaves no casing in the firearm chamber to be extracted after firing.

A further object of this invention is to provide a cartridge that has a case which provides a thermal barrier against accidental ignition and provides sufficient strength for use in automatic or autoloading firearms while leaving no case to be extracted after firing.

Still a further object of this invention is to provide a cartridge with a body that contains propellant and priming means as well as projectile means, which body is expelled through the muzzle of a gun.

An additional object of this invention is to provide an expendable body shotshell having a separate pre-slit shot container and a gun barrel having means therein to strip the body away from the pre-slit shot container, thus facilitating releasing of the projectiles after the shell leaves the muzzle of the firearm.

A still additional object of the invention is to provide an expendable body cartridge having a pre-slit projectile chamber and a frangible body cover designed to rupture or fracture upon firing, thus facilitating release of the projectile after the shell leaves the muzzle of the gun.

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

FIG. 1 is a sectional side elevation of one form of expendable body for the cartridge which is the subject of this invention shown in position in a firearm chamber;

FIG. 2 is a sectional side elevation of the form of expendable body shotshell loaded with solid propellant which is shown in FIG. 1;

FIG. 3 is a sectional side elevation of an expendable body shotshell of the type shown in FIG. 2 loaded with loose or granular propellant held in place by a molded propellant disc;

FIG. 4 is a sectional side elevation of an expendable body shotshell of the type shown in FIG. 2 modified to provide a snap lock groove means at the front end of the body to secure the shot protector to the body;

FIG. 5 is a sectional side elevation of a portion of an expendable body shotshell showing a snap lock groove means provided at the rear of the projectile chamber to secure the shot protector to the body;

FIG. 6 is a sectional view of an alternate form of expendable body shotshell shown in position in a shotgun chamber;

FIG. 7 is a sectional side view of an expendable body with the cushioning means integrally formed with the body;

FIG. 8 is a sectional side view of an expendable body shotshell wherein the shot containing chamber is closed off by a top wad snapped into place within the body;

FIG. 9 is a sectional side view of a modified expendable body shotshell where the body includes an integral hinged shot containing portion which is retained in place by means of a separate retaining sleeve;

FIG. 9A shows a top view of the cartridge shown in FIG. 9;

FIG. 10 is a sectional side view of a type of expendable cartridge having a frangible cover member which

fits on the outside of the body and over the shot chamber;

FIG. 11 is a sectional side view of a modified design where the transverse wall means is solid and a separate cushioning wad is provided inside the shot chamber;

FIG. 12 shows a modification of the expendable cartridge shown in FIG. 10 in which the transverse wall means is solid; and

FIG. 13 shows another modification of the expendable cartridge in which the body shot protector is eliminated and the frangible cover is the sole shot container in this modification.

Referring now to the drawings, FIG. 1 illustrates one form of an expendable body 10 for a cartridge 12 positioned in an associated gun 14 before firing. It should be understood that although the drawings shows the invention incorporated in a shotshell, it is intended that the invention applies equally to other conventional projectiles such as so-called rifled slugs and industrial slug loads, etc. For the sake of consistency, all further reference in this specification will be to a shotshell load.

Body 10, and corresponding bodies in modifications described later, can be made by injection molding, cold-forming, or any other conventional method of making plastic articles. Although generally any grade of olefinic polymer or co-polymer can be used, polyethylene is especially suitable for use in the body. Other plastics which are suitable are ABS and ABS alloys (TERPOLYMER OF ACRYLONITRILE, BUTADIENE AND STYRENE), flexible vinyls, polyamides, cellulosics, polycarbonates, and others having suitable impact properties.

Body 10 comprises a tubular member 16 and an imperforate, transverse wall or web member 18, which divides the tubular member 16 into tubular wall portions 20 and 22. (See FIG. 2). Transverse wall 18, together with tubular wall portions 20 and 22, define an open-ended, forward shot cavity or chamber 24 and an open-ended, rear propellant cavity or chamber 26, respectively. Wall member 18 must be substantially imperforate in order to insure that the full thrust of the explosive gases, generated in the propellant chamber after ignition of propellant 28, is directed to propel the body 10 through the gun barrel 30. The explosive gases cannot be permitted to enter the shot chamber 20 where it might melt the shot pellets or affect their trajectories. The intersection of web 18 and tubular wall portion 22 is formed as a radius 32 to avoid a stress riser that would cause the web to be blown or sheared out on firing.

Propellant means 28 for the present invention can be either a molded one-piece solid propellant, loose or granular propellant, liquid, or gelled. FIGS. 1 and 2 show the use of a one-piece molded solid propellant 28 in which a recess (not numbered) is formed in which a primer cup 34 is positioned and secured by any well-known means. Primer cup 34 also has a recess (not numbered) in which a primer 36 (either loose or molded) is secured. Primer cup 34 is made of solid propellant which may or may not be the same propellant as the main propellant charge 28—depending on the desired ballistics. The main propellant charge 28 is held in propellant chamber 26 by an interference fit, by an adhesive, or by any other conventional means. Primer cup 34 and primer 36 can be similarly secured to the main propellant charge. Obviously, the primer cup can be eliminated and the primer inserted directly in a pocket formed in the main propellent charge (See FIG. 7).

Primer 36 is covered by foiling paper (not shown) or other suitable means and the propellant-primer assembly is sealed by a thin film of suitable plastic 38 which can either be fastened with an adhesive or heat-sealed to body 10. Alternately, coatings such as epoxy, can be used to seal the primer-propellant assembly.

A rim or shoulder 40 is formed on the outside diameter of the body 10 to provide a surface for head spacing and support against the firing pin blow. Sufficient restraint is provided to hold the shell back for efficient propellant ignition and burning but restraint is low enough so that the shoulder 40 will release before peak pressure is reached and the entire shell will be expelled from the muzzle.

Although the drawing shows various ways of confining the shot pellets 42 in shot chamber 24, FIGS. 1 and 2 show the use of a shot protector 44 which functions as a shot container as well as the closure means for the cartridge. Shot protector 44 is preferably made of plastic material and includes a tubular side wall portion 46 which is open at its rear end and closed off by a transverse closure wall 48 at the mouth or front end thereof. Slit means 50 are provided across the closure wall 48 and extending down the tubular side wall to a point adjacent the open end but falling short a predetermined distance to provide an unslit portion 52 which functions as a hinge means, as explained later. A small unslit portion (not shown) may also exist at the center of the front face to secure the multiple sections together at the front, thus holding the shot in place until firing. Shot protector 44 is slidably positioned in the shot chamber 24 and secured therein by any well-known means, such as an interference fit, which would be the cast in FIGS. 1 and 2.

The preceding discussion has referred to the modification shown in FIGS. 1 and 2. However, various modifications can be made to this cartridge design within the meaning of the invention.

FIG. 3 shows an expendable cartridge similar to the one shown in FIG. 2 with some modifications. One change is that the supporting rim or shoulder 40*a* extends further to the front than the shoulder 40 shown in FIG. 2.

Other ways in which FIG. 3 differs from FIG. 2 are that primer 36 is positioned and secured to a pelletized powder disc 54 which holds loose propellant powder or granules 56 in propellant chamber 26. Groove 58 is formed at the rear end of body 10 and extends inwardly into the propellant chamber so that a cooperating rim 54*a* on disc 54 can be snapped into holding relationship therewith.

FIG. 4 shows a solid molded propellant 28*a* positioned in the propellant chamber and a primer 36 positioned in a recess (not numbered) in the solid propellant 28*a*. This figure also shows the use of a groove 60 located at the front end of the tubular side wall 46 which cooperates with a corresponding locking rim 62 on the forward end of the shot protector 44 to lock the shot protector within the shot chamber. A forwardly extending rim or foil 64 may be located on the shot protector to assist in opening up of the shot protector after it is expelled from the muzzle of the gun.

FIG. 5 shows a similar interlocking means to that shown in FIG. 4 except that the groove 60*a* and locking

rim **62***a* are positioned at the rear end of the shot chamber.

The preceding discussion has related primarily to the expendable cartridge. However, this type of ammunition requires redesigning of conventional firearms to be able to fire the ammunition. FIG. **1** shows that gun barrel **30** has a longitudinal bore **66** through which the projectiles and the cartridge case are explosively propelled. A gun chamber **68,** formed in the rear or breech end of the barrel, has an inwardly projecting abutment **70** which acts as a locating and stop means for shoulder **40** of the expendable cartridge. The position of this abutment **70** locates the cartridge in the gun chamber and provides necessary support to the cartridge so that the primer can be ignited by the firing pin **72** which conventionally moves slidably through the gun bolt **74.** A gas seal **76,** of the type shown in U.S. Pat. No. 3,166,864, issued on Jan. 26, 1965 to J. J. Scanlon, Jr., is shown in FIG. **1** between the gun bolt and the chamber to prevent the explosive gases from escaping through the rear of the gun barrel and out the receiver. A similar sealing system **72***a* is also used to seal the firing pin. Obviously, any type of gas seal can be used for the gun bolt and the firing pin.

Located as part of the barrel adjacent the front end of the cartridge when the cartridge is in position in the gun chamber are cutters or lands **78.** These cutters **78** can be full length or short and are designed to be impacted by the explosively projected cartridge. The cutters function to cut or fracture the tubular wall portion **20** of the shell body in a plurality of places. Once cut the shell body opens up or peels back after being explosively expelled from the gun barrel much like conventional shot containers. The shot protector **44** and the enclosed shot are thus freed from the body **10** so that the shot protector can open up like a clam (because of the slit means **50** and hinge means **52**) to permit the shot pellets to proceed towards the target without interruption.

The clam closure can be molded to provide built-in stress to assist opening. As molded, the part would be in a partially open position. On loading the part would be forced to a closed position thereby causing stress in the part that will cause it to open when restraint is removed.

It is preferable to locate the cutters **78** near the gun chamber or the origin of the bore where the velocity is minimum since it is known that sabot cutters placed near the muzzle are damaged by the high velocities.

An alternative version of the expendable cartridge discussed above is shown in FIG. **6.** This modification shows a plastic body **100** with transverse wall or web **118** separating the body into a shot chamber **124** and a propellant chamber **126.** Integrally formed with the body **100** and extending radially is a ring seal **140** located adjacent web **118,** which forms an obturating seal and is positioned in a circumferential recess **180** of gun bolt **174** and clamped against chamber abutment **170.** Upon firing, the ring **140** is sheared off body **100** and remains in the gun after the rest of the cartridge is expelled from the gun barrel. The obvious drawback of this modification is that the sheared-off ring **140** must be extracted and ejected from the gun. This modification does give good predetermined restraint force based on the shear strength of the plastic.

The expendable case shot shell shown in FIG. **6** can be made to function so that the rim **140** and the body remain intact during firing and completely exit the bore. This can be done by providing some clearance between the rim **140** and the chamber so that the rim is not clamped and providing a chamfer at the front of the rim so that the rim will be forced down instead of being sheared off.

FIG. **7** shows an expendable cartridge similar to the one shown in FIG. **2** except that the body **200** has transverse wall or web **218** including an integrally formed cushioning section **282.** Obviously, the cushioning section can be made in a variety of designs and can be lengthened or shortened depending on the load of pellets and/or propellant desired.

FIG. **8** shows another modification wherein a body **300** has a transverse web **318** which with the body defines shot chamber **324** and propellant chamber **326.** The propellant and priming means are similar to the modification shown in FIG. **3.** Differing from FIG. **3** is the method of closing off the shot chamber and containing the shot charge **342** therein. Tubular wall **320** of body **300** includes a circumferential groove **384** in which a top wad **386** is snapped in place. Top wad **386** is preferably made of some frangible material which will disintegrate upon firing so as to avoid obstructing the flight of the shot charge. It can be appreciated that a shot container can be utilized with this modification. Either a shot cup or combination shot chamber—wad column can be inserted within the shot chamber **324.**

FIG. **9** shows a further modification of an expendable cartridge. This modification shows a one-piece plastic body **400** having an integral web **418** which, with body **400,** defines shot chamber **424** and a propellant chamber **426.** Shot chamber **424** is defined in this modification by transverse web **418,** tubular side wall portion **420,** and an integrally formed transverse closure wall member **488.** As can be seen in FIG. **9A,** the closure wall **488** has a plurality of transverse slits **490** which extend longitudinally down the tubular side wall **420** as slits **490a** and then circumferentially at the lower end of the shot chamber as slits **490b.** This arrangement of slits is effected by molding a plurality of segments (any number can be made — 2, 4, etc.), like flower petals, so that when closed, they form a cylinder closed at the front. The unslit portions **492** actually hold the segments to the transverse web **418** and are the link which makes the tubular side wall **420** integral with the rest of the body. In loading the cartridge, the shot charge is placed in the end formed by the segments with the segments spread to form a conical shape. The segments are drawn closed to form a cylinder which encloses the shot and a plastic sleeve **494** is slipped over the segmented wall portions to retain the shape and complete the shell assembly. On firing, sleeve **494** will be cut by the body cutter or land **78** (FIG. **1**) to remove the restraint effected by the sleeve so as to permit the release of the shot in flight from the muzzle. Alternately, sleeve **494** may be of a frangible plastic, and removed from the body by the shock of firing.

As with the other modifications, cushioning means can be provided by molding a collapsible section in the shell body similar to conventional shotshell wads or by inserting a separate cushioning material, such as felt, cork, or plastic foam within the shot chamber under or to the rear of the shot charge. (See reference numeral **599** in FIG. **11**).

A different design principle is illustrated in FIG. **10,** i.e., shot release by shattering or complete breakup of

a portion or all of the shot containing part of the shell by the shock of firing and/or forces exerted by an abutment or by a constriction in the gun bore.

FIG. **10** shows a gun barrel **530** having a longitudinal bore **566** with a first chamber abutment **570** which functions in the same manner as abutment **70** in FIG. **1.** Second abutment **596** is located in the gun bore adjacent to the front end of expendable cartridge **500,** which is shown in position for firing in FIG. **10.**

Cartridge **500** includes a molded plastic body **510** having an integrally formed transverse wall means **518** which, with body **510,** defines a shot chamber **524** and a propellant chamber **526.** Wall means **518** includes a cushioning section **582** integrally formed therewith similar to the showing in FIG. **3.**

The propellant chamber **526** etc., are similar to the showing in FIG. **3** and need not be repeated here. There are differences, however, in the shot chamber and closure thereof.

Shot chamber **524** is defined at its rear by the transverse wall means **518** and at its sides by tubular body side wall portion **520** which is integrally formed with the wall means **518.** A plurality of slits **590** in side wall **520** extend longitudinally to the mouth end thereof to form a plurality of wall segments much like conventional shot containers in use today which are adapted to pull back and release the shot pellets enclosed therein after being expelled from the muzzle of the gun. Closing off the open end of the tubular side wall portion **520** is a frangible cup-shaped cover **598** which fits over the segmented side wall **520** to hold it in shape and retain the shot therein. The rear end of the cover **598** is secured in some manner, e.g., an interlocking groove (not shown) in the forward face of transverse wall **518.** Obviously, other methods of attaching the cover **598** to the body **510** can be utilized.

Upon firing, the cartridge **500** reacts in the same manner as previously explained. When sufficient pressure has built up (almost instantaneously), the shoulder **540** will release and the entire cartridge will move forward in the gun chamber. When the forward end of the explosively propelled cartridge impacts at relatively low velocity against abutment **596**—or at a greater velocity against a conventional gun choke, the frangible cover **598** will break up whereupon the segmented side wall portion **520** will be free to open up upon being expelled from the muzzle.

Although abutment **596** is shown adjacent the chamber, it should be appreciated that the abutment may be located anywhere down the gun bore. Also, a tapered bore restriction (not shown) may also be successfully employed.

Cover **598** is made of a frangible plastic which will provide adequate strength for handling but which will break up upon firing. Among materials which would be suitable are polystyrene, rigid vinyls, polyamides, cellulosics, acrylics, chlorinated polyether, phenoxy, polysulfone, and thermosetting plastics such as phenolics, melamines, ureas, alkyds, polyesters, allylics, etc.

Shoulder **540** constitutes a special feature of the design. In addition to the restraint feature, i.e., holding the shell in the chamber after firing until sufficient pressure is built up, etc., the shoulder also serves as an obturator gas check and a means to clean the bore. This part of the shell, i.e., the shoulder **540,** is made of polyethylene or some non-frangible material. Because it remains intact during firing and it is larger than the bore, it will sweep the bore clean of particles left by the frangible part of the shell and any powder residue from preceding shots.

FIG. **11** shows a modified expendable cartridge of the type shown in FIG. **10.** This modification shows a solid transverse wall **518**a and a separate cushioning wad **599** positioned under the shot charge **542** and within the shot chamber **524.**

FIG. **12** shows the loaded expendable cartridge shown in FIG. **10** but without the gun details and without the integral cushioning section in the transverse wall means.

FIG. **13** shows a modified expendable cartridge similar in some respects to that shown in FIG. **10** except that the tubular side wall portion **520** is omitted. The frangible cover **598** is the sole shot container in this modification. Obviously, this design loses some of the shot protecting and gun bore protecting advantages found in shot containers since the frangible cover will break up upon firing so that there will be little or no plastic between the shot charge **542** and the gun bore during the time the shot is travelling through the gun bore.

What is claimed is:

1. A cartridge casing adapted to be completely expelled from the muzzle of a firearm, said casing comprising: a tubular plastic body having an interior and an exterior; transverse wall means fixed to and extending across the interior of said body; and an enlarged portion on the exterior of said body forming shoulder means thereon, said shoulder means being closely laterally adjacent to said wall means, and said shoulder means tapering outwardly and longitudinally along said body, said shoulder means being operative to initially resist forward movement of said casing when chambered and fired, and said shoulder means further being operative, upon development of a predetermined chamber pressure, to subsequently permit said casing to be propelled substantially intact through a firearm muzzle.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,741,122 (D-46) Dated June 26, 1973

Inventor(s) MARTIN W. KORDAS, JR.

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

Col. 6, Line 27, "chamber" should read --container--.

Signed and sealed this 17th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

NS/pkh
2-27-1974.

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