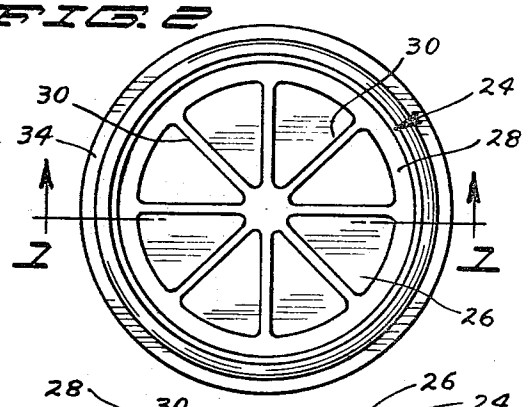
Oct. 26, 1971 G. L. HERTER ET AL 3,614,929

PLASTIC SHOTGUN SHELL

Filed April 21, 1969

FIG. 2



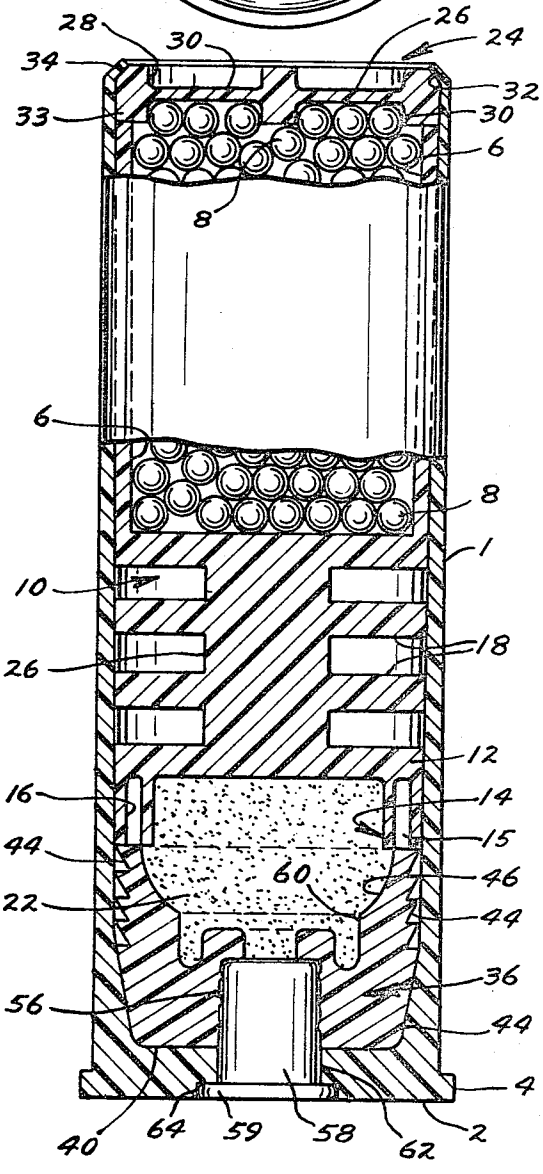
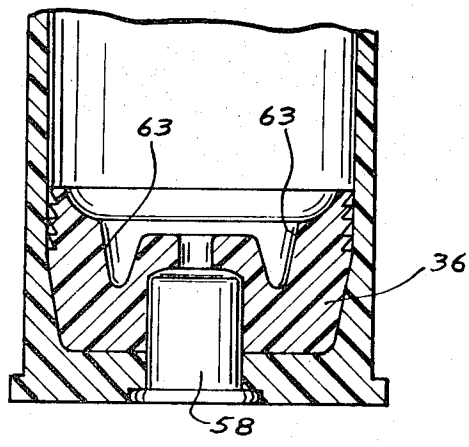


FIG. 1

FIG. 3



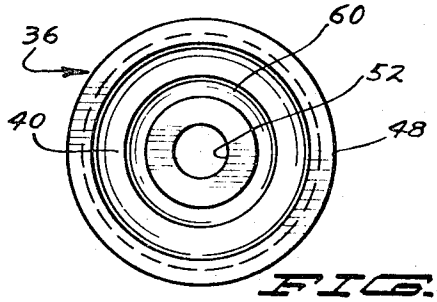


FIG. 4

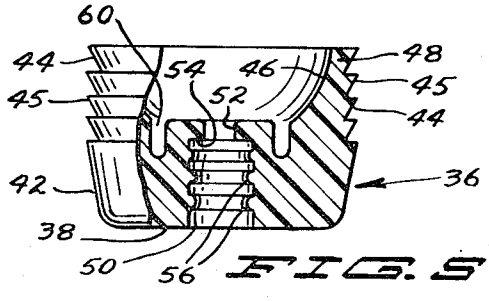


FIG. 5

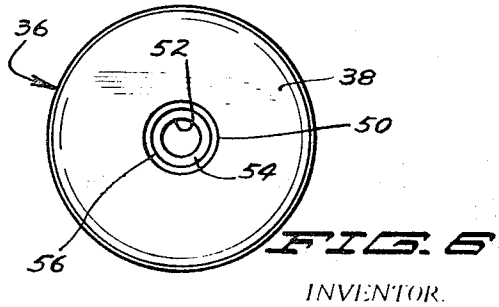


FIG. 6

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PLASTIC SHOTGUN SHELL

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U.S. Cl. 102—43 P 6 Claims

ABSTRACT OF THE DISCLOSURE

An all plastic shotgun shell comprised of a tubular plastic casing having an integral base wall with an aperture therein through which a primer extends, a plastic over-shot wad closing the end of said tubular casing opposite said base wall, a one-piece plastic shot cup and over-powder wad unit within the tubular casing, and a plastic base wad seated within said casing against said base wall. There is a non-binding fit between the primer and the aperture in the casing base wall, the primer being firmly gripped and held in place by means of a force fit between the primer and an axial pocket formed within the yieldable base wad into which the primer extends.

BRIEF SUMMARY OF THE INVENTION

The shotgun shell of this invention is particularly characterized by an all plastic structure which lends itself to relatively simple and inexpensive manufacturing, which is particularly adapted for multiple use and reloading of the several components, and which is specially constructed and arranged so as to eliminate the problem of distorting or rupturing the shell casing at its base end resulting from the pressures generated by an exploding charge detonated within the shell casing.

These basic objectives are realized by a unique design of the base or head end of the plastic shotshell which provides for the retention of a primer in the base wall of the shell in such a way as to prevent the exertion of undue outward force on the casing base wall by the primer as it is detonated. The great radial force transmitted by the primer to the base end of the shell casing upon detonation of the primer and propellant charge has been a major cause of cracking and rupturing of the base end of plastic shotshells. This problem is attributable, in part at least, to the base structure of prior art plastic shotshells wherein the primer is tightly fitted into a pocket or cavity in the base wall of the shell casing. In accordance with our new plastic shotshell design, the plastic casing of the shotshell is provided with an integral base wall having an aperture therein through which a primer extends in a relatively loose, free fit therewith. The primer is held in place by a plastic base wad having an axially extending, central cavity within which the primer is tightly fitted so as to be retained in the desired position. The shock and pressure transmitted by the detonating primer is absorbed almost entirely by the plastic base wad, which is formed from yieldable and resilient plastic material, thereby preventing the transmission of potentionally damaging forces and shock waves to the lower end of the shell casing and its base wall.

As a particularly advantageous feature of our improved plastic shotshell, we utilize a plurality of axially spaced rings projecting inwardly from the interior surface of the aforesaid central cavity in the base wad to grip the primer

and firmly hold it in place. As the base wad deforms under the pressure exerted by the exploding propellant charge within the shell casing, the rings on the base wad cavity are forced inwardly in tight, sealing engagement with the primer so as to prevent the leakage of combustion gases downwardly around the primer. Peripheral sealing teeth on the external surface of the base wad tightly engage the interior wall surface of the shell casing so as to preclude the leakage of gases between the base wad and the plastic casing.

A further beneficial feature of our improved plastic shotshell resides in the use of an annular groove in the top surface of the base wad, the downward flow of combustion gases into said groove on detonation of the propellent charge causing the opposed side walls of said groove to be forced apart, thereby assisting in moving said sealing rings and teeth into tight engagement with the primer and the plastic casing respectively.

In addition to the aforesaid plastic casing and base wad, the all plastic shell structure further includes a plastic shot cup and over-powder wad of unitary construction and a top closure wad which is preferably formed from the same relatively soft, plastic material as the base wad.

These and other objects and advantages of our invention will become readily apparent as the following description is read in conjunction with the accompanying drawings wherein like reference numerals have been used to designate like elements throughout the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical section view showing the all plastic shotshell of this invention;

FIG. 2 is a top view of the shell of FIG. 1 showing the top, closure wad;

FIG. 3 is a fragmentary, vertical section view showing the lower end of the shell of FIG. 1 and the shape of the base wad upon detonation;

FIG. 4 is a top plan view of the base wad of this invention;

FIG. 5 is an elevation view, partially in section, of the base wad; and

FIG. 6 is a bottom plan view of the base wad of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, we have shown in FIG. 1 a preferred embodiment of our improved, all plastic shotgun shell utilizing a tubular casing **1** having an integral base wall **2** at one end thereof. Casing **1** is preferably molded from relatively hard plastic material such as polycarbonate, base wall **2** being formed integrally with casing **1** during the molding operation so as to thereby provide a one-piece casing and base wall unit. By molding base wall **2** integrally with casing **1**, we have simplified the manufacturing procedure by eliminating the need for gluing, welding or otherwise bonding a closure base to the head or base end of tubular casing **1**. A peripheral flange **4** on base wall **2** serves as a contact element for an ejection mechanism in a shotgun.

Disposed within casing **1** is a shot cup **6** which contains a plurality of shot pellets **8**, and which preferably comprises one portion of a unitary shot cup and over-powder wad element designated generally by reference numeral **10**. Unitary element **10** is molded from pliable and yieldable plastic such as polyethylene, and includes a trans-

versely extending overpowder wad **12** at its bottom end. Depending from over-powder wad **12** is a powder enclosing and sealing skirt **14** comprised of inner and outer annular walls **15** and **16**. A plurality of spacing and sealing discs or rings **18** extend transversely outwardly from center post **20** of unitary over-powder wad and shot cup **10** and bear against the inside surface of tubular casing **1** at their outer ends. Central post **20** of element **10** is axially compressible to thereby provide a shock absorbing and cushioning effect to assist in absorbing the pressures generated by the detonation of a propellent charge **22** contained under over-powder wad **12**.

The open, upper end of tubular casing **1** is closed by means of a top closure wad **24** which is also molded from soft, yieldable polyethylene plastic. Closure wad **24** is comprised of a relatively thin, transversely extending central section **26** and a peripheral rim **28**. The necessary strength is imparted to central section **26** by means of a plurality of radially extending ribs **30** which extend along both the upper and lower surfaces of wall section **26**. The radial orientation of strengthening ribs **30** is shown in FIG. 2. Peripheral ring section **28** is beveled around its outer periphery on both the upper and lower faces thereof, the beveled surfaces being indicated at **32** and **33** in FIG. 1. The underside of top closure wad **24** bears against the top end of shot cup **6** and shot pellets **8**, and it is held in contact therewith by inwardly crimped upper end portion **34** of tubular casing **1** in the manner shown in FIGS. 1 and 2. Crimped end portion **34** of casing **1** is turned inwardly at a slight angle to conform to the angle of beveled surfaces **32** and **33** of closure wad **24**. The provision of beveled surfaces **32** and **33** and strengthening ribs **30** on both the upper and lower faces of closure wad **24** renders wad **24** reversible so as to eliminate the need for orienting it with a particular face directed upwardly during the assembly of the shotgun shell.

The remaining element of our all plastic shotgun shell is a functionally important base wad designated by reference numeral **36**. Base wad **36** is formed from soft, yieldable plastic preferably polyethylene, and is of generally cylindrical configuration as is shown in FIGS. 4, 5 and 6. The bottom surface **38** of base wad **36** is substantially flat and planar so as to seat flush against flat inner surface **40** of base wall **2** when base wad **36** is inserted into the base or head end of tubular casing **1** in the position shown in FIG. 1.

At its lower end, base wad **36** has a substantially conical outer wall surface **42** which nests within and conforms to inner conical wall surface **44** at the lower end of tubular casing **1**. A plurality of longitudinally spaced rings **44** are provided around the outer periphery of base wad **36** at its upper end, rings **36** terminating at relatively sharp edges **45** to thereby define a plurality of spaced teeth in vertical cross-section as shown in FIGS. 1 and 5. Edge portions **45** of rings **44** engage the inner wall surface of tubular casing **1** and assist in holding base wad **36** in place. The upper end of base wad **36** is dished inwardly and is defined by concave top wall **46** which cooperates with over-powder wad **12** to form the space within which propellent charge **22** is contained. Relatively thin wall section **48** at the upper end of base wad **36** between top wall **46** thereof and the outer peripheral surface of wad **36** is readily compressible and deformable, thereby rendering base wad **36** particularly effective as a cushioning and shock absorbing device.

Extending axially of base wad **36** and disposed substantially centrally thereof is a tubular cavity or pocket **50** within which a primer is received and retained in a manner hereinafter described. The upper end of primer cavity **50** communicates with the powder containing space above top wall **46** of base wad **36** through a reduced diameter flash passage **52**. The smaller diameter of flash passage **52** compared to the diameter of tubular cavity **50** provides a shoulder **54** against which the upper end of a primer abuts. The primer gripping and retaining function

of cavity **50** may be improved by providing a plurality of longitudinally spaced rings **56** along the surface thereof. Rings **56** project radially inwardly from the wall surface of cavity **50** and are sized to tightly grip a primer **58** shown in place in FIG. 1. Base wad **36** further includes an annular groove **60** formed within upper wall **46** thereof between flash passage **52** and the peripheral surface of wad **36**. Groove **60** serves a dual function as both a means of reshaping base wad **36** as required after use and as a pressure transmitting surface in a manner explained below.

Referring again to FIG. 1, it will be seen that base wall **2** is provided with an aperture **62** through which primer **58** extends. A slightly larger diameter recess **64** in the bottom face of base wall **2** serves as a seat for the rim **59** of primer **58**. It is to be noted that base wall **2** has a thickness somewhat greater than that of the vertically extending portion of tubular casing **1** to increase the strength of base wall **2** and improve its ability to satisfactorily withstand the shock and pressure generated by the explosion of propellent charge **22**. However, it is also to be noted that base wall **2** has a thickness substantially less that the length of primer **58**, whereby primer **58** is contained over the greater portion of its length within tubular cavity **50** of base wad **36**. Central aperture **52** in base wall **2** is sized so that it has a diameter equal to or slightly greater than the maximum diameter permitted for primer **58** within tolerance limitations. For example, if primer **58** has a maximum diameter of .242 inch, then the minimum diameter of aperture **62** will be .242 inch. By virture of this structural arrangement, primer **58** may be inserted freely through aperture **62** into tubular cavity **50** in a non-binding, relatively loose fit with aperture **62**. Primer **58** is actually firmly gripped and held in place by tubular cavity **50** of base wad **36**. This is accomplished by sizing the diameter of cavity **50** so that it is significantly less than the diameter of primer **58**. Thus, after passing freely through aperture **62** in base wall **2**, primer **58** must be forced upwardly into reduced diameter cavity **50**. As primer **58** is forced into cavity **50** the yieldable and resilient plastic material of base wad **36** which defines cavity **50** is compressed radially outwardly and then flexes inwardly in tight, gripping engagement with the exterior surface of primer **58**. The secure retention of primer **58** within cavity **50** is further insured by rings **56** which are of even smaller diameter than cavity **50** and thus bear against primer **58** very tightly. Because primer **58** is firmly gripped and held in place by base wad **36** and is not in tight, friction contact with aperture **62** of base wall **2**, the outward forces exerted by primer **62** when it is struck by a firing hammer and explodes are absorbed almost entirely by yieldable and resilient base wad **36**. A very minimum amount of shock and pressure is transmitted to base wall **2**, with the result that cracking and deforming of plastic base wall **2** is effectively prevented.

Upon the detonation of primer **58** and the explosion of propellent charge **22**, base wad **36** will be deformed and compressed downwardly in the manner shown in FIG. 3. The relatively small thickness of wall section **48** permits upper wall surface **46** of base wad **36** to be compressed downwardly and radially outwardly to the position shown in FIG. 3 in response to the downward force exerted by the combustion gases within the space between over-powder wad **12** and base wad **36**. Teeth-like sealing rings **44** will be forced downwardly and pressed together to thereby provide a cushioning and shock absorbing effect as top, concave wall **46** of base wad **36** is urged downwardly. Due to its concave shape, wall **46** will also receive and transmit force radially outwardly with he result that pointed, peripheral edges **45** of sealing rings **44** will be forced outwardly into tight contact with the inside surface of tubular casing **1**. An effective seal will thus be provided along the lower,

inside surface of casing **1** to prevent expanding gases from flowing downwardly between base wad **36** and casing **1** towards base wall **2**. The pressure of the combustion gases acting within annular slot **60** of base wad **36** will also cause the side walls of slot **60** to be forced apart in the manner shown in FIG. 3. As the outside side wall **61** of slot **60** moves outwardly it assists in moving peripheral teeth **44** into tight, sealing contact with the inside surface of tubular casing **1**. Inside wall **63** of slot **60** will be forced inwardly, thereby assisting in pressing rings **56** of cavity **50** into very tight, sealing engagement with primer **58**. The firm contact of resilient, pliable polyethylene rings **56** against primer **58** provides a very tight seal which prevents the leakage of combustion gases downwardly around the outside surface of primer **58**. The compression and deformation of polyethylene base wad **36** in the manner described above provides very effectively for the cushioning and absorption of the forces and shock waves generated by the exploding propellent charge with the result that the lower end of relatively hard plastic casing **1**, as well as base wall **2**, are extremely well protected against deformation or cracking upon detonation of the propellent charge. Moreover, as noted above, since primer **58** is firmly gripped within yieldable base wad **36** and fits relatively loosely within aperture **62** of base wall, **2**, the outward forces transmitted from primer **58** when it is detonated are substantially entirely absorbed by yieldable and deformable base wad **36**, thereby eliminating the cracking or deformation of base wall **2** which frequently occurred on prior art plastic shotgun shells having the primer tightly held within an aperture in the plastic base wall.

Polyethylene base wad **36**, being resilient as well as yieldable and deformable, will normally return to its original shape after the shotshell in which it is used has been fired. Thus, plastic casing **1** and base wad **36** may be reloaded and reused a considerable number of times. If primer cavity **50** does expand radially upon detonation of the primer, annular slot **60** in upper wall **46** of base wad **36** may be utilized to compress the walls of cavity **50** back inwardly to their original diameter. This is accomplished by inserting a sleeve or tubular extension on a reloading tool into slot **60** and exerting downward force on base wad **36** as it is pressed into the lower end of tubular casing **1**. The downward force exerted by the reloading tool on the bottom of annular groove **60** will compress the lower end of base wad **36** and assist in forcing the side walls of cavity **50** inwardly to their original position.

Although we have shown and described our improved all plastic shotshell with respect to preferred embodiments thereof, those skilled in the art will readily appreciate that various changes could be made in the shotshell design without loosing the benefits of the particular base wad structure described herein. For example, base wad **36** could be held in place by being wedged into the lower end of casing **1** rather than by using peripheral teeth **44**. Also, in lieu of contact rings or teeth **44**, a plurality of dimples in the outer surface of base wad **36** could be utilized to hold base wad **36** in the plastic case. Also, although rings **56** on the inside wall surface of primer cavity **50** assist in holding primer **58** in place, they are not essential. As long as the diameter of primer cavity **50** is sized properly so that it is substantially less than the diameter of primer **58**, the yieldable plastic walls of cavity **50** will firmly and tightly engage primer **50** and effectively hold it in place after it is forced into cavity **50**.

We claim:

1. An all plastic shotshell comprising in combination:

a tubular casing constructed entirely of relatively hard, polycarbonate plastic, said casing having a tubular case wall and terminating at one end in an integral base wall to provide a one piece casing and base wall unit, said base wall being substantially flat and of uniform thickness, and having a central aperture sized to permit the insertion of a primer therethrough in a free, non-binding fit therewith, the thickness of said base wall being substantially less than the length of the primer to be inserted therethrough and greater than the thickness of said tubular case wall;

a relatively soft, yieldable plastic closure wad secured within the opposite end of said tubular casing;

a one-piece plastic shot cup and over-powder wad unit disposed within said tubular casing; and

a base wad of relatively soft, yieldable plastic material positioned within said casing in abutting contact with the inside surface of said base wall and defining with said over-powder wad a space for a propellent charge, said base wad having an elongated, central cavity in alignment with said aperture in said base wall and sized to engage a primer inserted therein in firm, gripping contact therewith.

2. A shotshell as defined in claim **1** wherein:

said closure wad has a beveled surface extending circumferentially around its outer periphery and is held in place by a short, inwardly crimped portion of said opposite end of said tubular casing which bears against said beveled surface of said closure wad in conforming engagement therewith.

3. A shotshell as defined in claim **1** and further including:

a primer received within said central cavity of said base wad and extending through said central aperture in said base wall, said aperture in said base wall being of equal or greater diameter than said primer inserted therethrough, and said central cavity in said base wad having a diameter slightly less than that of said primer received therein, whereby said primer extends through said base wall aperture in a free, non-binding fit therewith and is received in a force fit with said central cavity of said yieldable, plastic base wad so as to be tightly engaged and retained by the walls of said base wad cavity.

4. A shotshell as defined in claim **1** wherein:

a plurality of longitudinally spaced rings project inwardly from the wall surface of said base wad cavity, said rings being sized to tightly grip said primer and thereby assist in holding it in place; and

said base wad includes an annular groove in the upper surface thereof between said central cavity and the outer periphery of said base wad, the downward flow of pressurized combustion gases into said groove upon detonation of said propellent charge causing the opposed side walls of said groove to be forced apart, thereby forcing said rings on said central cavity into tight, sealing engagement with a primer contained within said cavity.

5. A shotshell as defined in claim **4** wherein:

said base wad further includes a plurality of longitudinally spaced, circumferentially extending sealing teeth on its peripheral surface, said teeth being in contact with the inside surface of said tubular casing and being forced into sealing engagement therewith as said base wad deforms in response to the pressure generated by the detonation of said propellent charge.

6. An empty, primed shotgun shell to be assembled with shot and powder charges into a shotshell, comprising:

a tubular casing constructed entirely of relatively hard unyielding plastic, said casing having a tubular case wall and a transverse base wall formed integrally with each other in a single, one piece construction, said base wall having substantially flat inner and outer surfaces and a substantially uniform thickness across the entire width thereof, said base wall further having a central aperture therein to accept a primer therein in a non-binding fit;

said aperture having a counterbore adjacent the outer

surface of the base wall to define a depressed ledge adjacent the outer surface;

a primer projecting into and through said aperture in the base wall in a non-binding relationship to the periphery of the aperture, said primer having a peripheral bead seated on said ledge;

and a base wad of relatively soft yieldable plastic material positioned within said casing in abutting contact with the inner periphery of the tubular case wall, said base wad further having a substantially flat bottom surface bearing against the inner surface of said base wall over substantially the entire width thereof, and an elongated central cavity aligned with the aperture in the base wall and receiving and tightly gripping the primer and retaining the primer in a stationary position.

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ROBERT F. STAHL, Primary Examiner

U.S. Cl. X.R.

102—43 C, 95; 112—44