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SHOT SHELL

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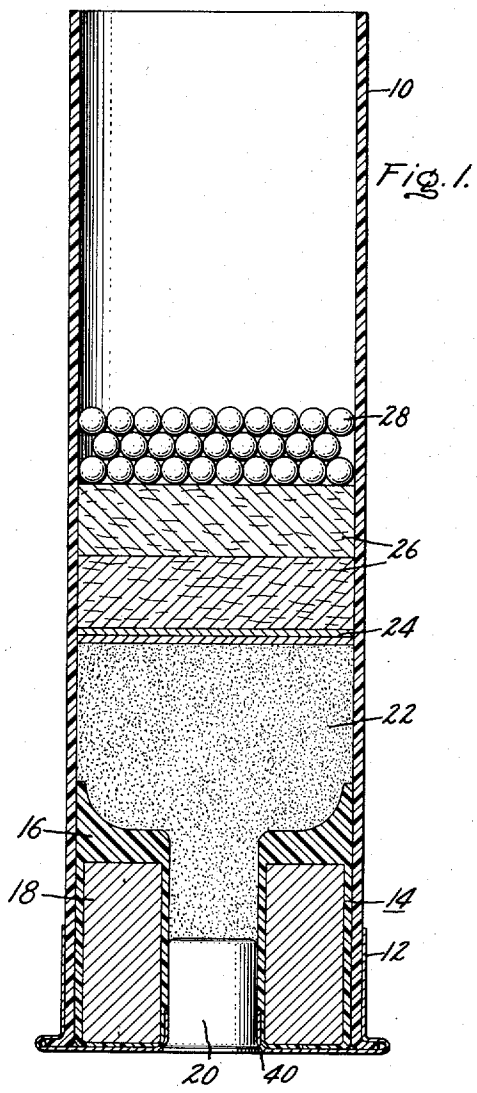


Fig. 1.

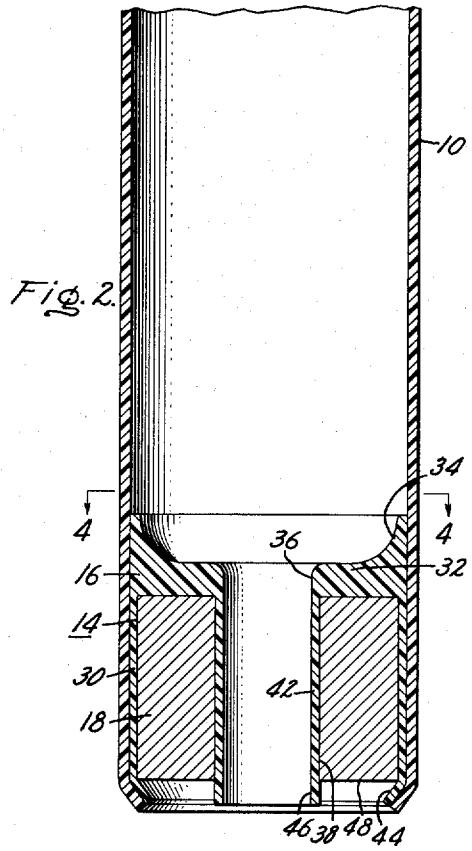


Fig. 2.

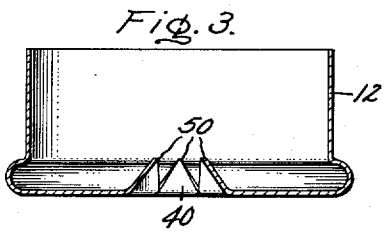


Fig. 3.

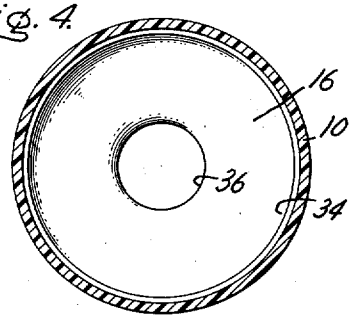


Fig. 4.

Inventors:
Benjamin K. Daubenspeck,
Theodore A. Olson,
Edward A. Rickey,
Justin H. Whipple,
by John H. Lewis Jr.
John W. Phipps
Nicholas Skovran
Their Attorneys.

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SHOTSHELL

Benjamin K. Daubenspeck, Stratford, Theodore A. Olson, Trumbull, Edward A. Rickey, Stratford, and Justin H. Whipple, Milford, Conn., assignors to Remington Arms Company, Inc., Bridgeport, Conn., a corporation of Delaware

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This invention relates in general to shot cartridges and more specifically to providing improved shotshell components which improve the reloadability and functioning of the shotshells.

Current basewad designs are limiting the reloadability and functioning of today's shotshells. The limiting factors are breakdown of the basewad itself and excessive head expansion during firing due to the basewad failing to seal properly and failing to properly absorb the pressures generated in the shell when fired. The acceptable life of basewad designs currently being used is considered to be 3 or 4 firings.

The novel basewad design of the present invention will overcome the above-mentioned deficiencies. With the design of the present invention, the acceptable life of the basewad is considered to be 10 to 12 firings.

This invention consists of a basewad encased in a plastic (polyethylene) sleeve which is contoured at one end to provide a positive, gas sealing overlay. The basewad is sufficiently hard and pressure absorbing so that a minimum of firing pressure is transmitted to the head. Head expansion is therefore reduced, resulting in easier extraction and minimizing head resizing during reloading of the fired shell. In addition, this overlay-hard wad construction improves gas sealing over conventional basewads. The fact that the wad is completely enveloped in plastic means that no wad debris will be encountered in firing these shells. The wrap-around plastic skirt, tucked under the basewad, insures positive locking of the overlay. This means that the overlay will not be blown out of the shell on the second or third firing as can happen with paper overlays presently on the market. Since the flash hole in the basewad is also lined with plastic in this combination, no fibrous material will be exposed to the blast of the exploding primer. The resultant smooth even surface of the flash hole should contribute to more stable ignition.

Another important and substantial advantage of the present invention is that with the complete plastic wrap-around design of the filler basewad, the transfer of moisture from the basewad to the powder or from the powder to the basewad is essentially eliminated. In a plastic shell, this is an important feature, inasmuch as ballistics can be maintained for the shell over extended periods of time.

The loss of powder moisture increases firing pressures and the absorption of moisture by the powder will reduce firing pressures which naturally adversely affects velocity. The transfer of moisture, of course, depends on the relative difference in moisture content between the propellant powder and the basewad.

This moisture transferring limitation is extremely important with single base powders, i.e., those made by dissolving nitrocellulose in an ether-alcohol solvent, extruding and then drying out. On the other hand, the transfer of moisture does not affect the sensitivity of the double base powder, i.e., those made by gelatinizing nitrocellulose with nitroglycerin, to the same degree. When the powder absorbs moisture, there is a resulting loss of pressure and velocity which affects the performance of the shotshell. By segregating the powder and basewad with a plastic overlay, this transfer of moisture is essentially eliminated with the result being a more uniform and reliable product.

It is known that the combination of a plastic overlay and a basewad is old in the art. However, in the past, the impact strength of the basewad was limited because it was necessary that the basewad have a certain amount of resiliency in order for the basewad to expand sufficiently to act as a gas sealing means to protect the cartridge head. By providing a resilient plastic overlay which substantially encloses the basewad, it is possible to make the basewad substantially harder and more pressure absorbing and let the gas sealing function be performed almost entirely by the plastic overlay. Thus, with this combination, basewads can be made with materials which would not have been acceptable in the past.

The object of this invention is to provide a shotshell wherein the gas leakage around the basewad is substantially decreased and head expansion reduced.

It is another object of this invention to provide a plastic overlay which substantially encloses the basewad and prevents explosive gases from coming into contact with the basewad.

Another object of this invention is to provide an overlay which is effectively locked to the shotshell head.

Another object of this invention is to provide a plastic basewad overlay which permits the use of basewad having a hardness which were previously not acceptable.

Further objects will appear in the accompanying specification and claims in which:

FIGURE 1 shows a longitudinal sectional view of shot cartridge embodying the present invention;

FIGURE 2 shows a longitudinal sectional view of a shotshell casing with the basewad and plastic overlay positioned therein before a low base head is attached thereto;

FIGURE 3 shows a sectional view of the metal head prior to attachment to the shotshell shown in FIGURE 2; and

FIGURE 4 shows a cross-sectional view of the shell taken on Line 4—4 of FIGURE 2.

Referring to the drawings, FIGURE 1 shows an elongated tubular shotshell body or casing **10** which can be made of plastic, paper, metal or any other suitable material. A metal head portion **12** is attached to the lower end of the casing as explained below.

Positioned within the lower end of the shell body **10** is a pre-assembled basewad-plastic overlay combination **14** consisting of a plastic overlay **16** and a basewad **18**. The shotshell also includes the usual primer **20**, a propellant charge **22**, an over-powder wad **24**, filler wads **26** and the shot pellets **28**. The upper end of the shotshell body is closed off by any well-known closure means (not shown).

Inasmuch as the present invention is believed to be in the basewad-overlay combination and their relationship to the shotshell, these elements will be explained in greater detail.

The plastic overlay **16** includes an elongated tubular wall portion **30** having approximately the same diameter as the body **10** so that when the overlay is positioned within the body, a tight fit is effected between the wall portion **30** and the lower end of the shell body.

Integral with and transversely extending from the tubular wall portion **30** is a transverse under-powder wall portion **32** which separates the propellant charge **22** from the basewad **18**. Extending upwardly from the transverse wall portion **32** and providing an extension to the tubular wall portion **30** is a tapered skirt means **34** which functions as a gas seal to prevent explosive gas from escaping down behind the basewad.

The transverse wall portion **32** also has a central opening **36** therein which is in alignment with an axial and

elongated basewad hole **38** and a hole **40** in the metal head **12**. These three holes **36**, **38** and **40** constitute the flash hole means in which the primer is located and through which the flame from the detonated primer escapes to ignite the propellant charge **22**. As can be seen in FIGURE 2, an elongated, tubular wall portion **42**, concentric with the tubular wall portion **30**, is integral with and projects downwardly from the periphery of the central opening **36** through the hole **38** in the basewad to provide a smooth lining for the flash hole means.

It can be seen from FIGURE 2 that the lower end **44** of the tubular wall **30** and the lower end **46** of the inner wall portion **42** extend downwardly past the lower end face **48** of the basewad when the basewad is inserted in the plastic overlay so that the basewad is enclosed by the plastic overlay except for the lower end face **48** of the basewad.

The shell assembly procedure begins with the full insertion of the basewad into the overlay. The overlay-wad is then positioned in the shell body and the lower ends crimped inwardly to permit entrance into the head **12**. (See FIGURES 2 and 3.) The overlay-wad and body combination are then inserted into the half-headed cap shown in FIGURE 3. Prongs **50** in the head are coned inwardly to insure easy insertion into the tubular extension **46** of portion **42**. When the head is finally attached to the shotshell body (after the final heading operation), the rim of the cap is closed on itself and on any outwardly flared part of the shell body, as shown in FIGURE 1. Moreover, the overlay skirt portions **44** and **46** are tucked under the basewad both in the rim area and in the primer area. The prongs **50** on the head are opened up by the cavity punch during the heading operation and firmly grip the overlay tube against the basewad. From the above, it can be seen that with the tucking in of the overlay lower skirt portions **44** and **46**, the basewad is substantially entirely enclosed by the plastic overlay.

As mentioned previously, this use of the plastic overlay gas sealing means permits the use of materials in basewad construction which were not used previously because they were ineffective for this purpose. A suitable wad for this combination has been made by several different methods. All of these wads have sufficient resistance to deformation under pressure to produce the desired results.

In one method of making the wad, hard maple wood fibers are coated with sodium meta-silicate and sodium aluminate solutions. The proportions of silicate to aluminate are about four to one, and the total additive is about 10 percent of the weight of the fiber as received. The components are blended in a mixer with the addition of the aluminate dissolved in the water equivalent of about 3 percent of the fiber weight. When thoroughly mixed, the silicate is added in the form of an approximately 40° Baumé solution meta-silicate solution with sufficient water to be equivalent to about 4 percent of the fiber weight. After mixing in the silicate, the composition is dried to about 6 percent moisture content based on the original fiber weight. The dried composition is then used for compression molding of the wad in a conventional tableting type machine.

Another method of making a suitable wad uses normal Portland cement as a binder with maple and other fillers, such as plastic flour (and/or asbestos fibers) plus wax. A typical mixture found to be satisfactory is:

	Percent
Maple fiber	51.3
Plastic flour (phenolic plastic waste material)	47.5
Asbestos	1.0
Wax (synthetic hard waxes or microcrystalline petroleum waxes)	0.2

Percentages are dry weight.

About 4 to 12 percent of Portland cement, based on the total weight of the fibers, is added to the composition. The method of preparing the composition is to mix the filler ingredients intimately in a suitable mixer. The

cement is added as a dispersion in a water equivalent of about 5 to 8 percent of the total filler weight. After the cement addition, the mixing is continued until the cement is completely blended with the other materials. This mixture requires no drying but the wads (made by compression molding) should be aged for at least 24 hours at room conditions for best results.

A suitable wad can also be made from fibers coated with gypsum ($CaSO_4 \cdot H_2O$) by simple mixing. A solution of polymerized resin dispersion containing the necessary water of hydration is added to the mix. A typical mixture is:

	Percent
Hardwood fiber—or 46½% hardwood+46½% plastic flour	93
Plaster of Paris	7
By fiber wt. of 5% polyvinyl alcohol solution	9

The use of more concentrated polyvinyl alcohol solutions would improve the impact strength of the wad.

The prepared molding compositions for the various kinds of wads can be aged indefinitely at normal conditions before use.

Instead of using polyvinyl alcohol solution, it has been found that other polymerized resin dispersions can also be used in the last mentioned method. Thus, such resin dispersions as polyvinyl chloride, polyvinyl acetate, and styrene butadiene can also be used in place of polyvinyl alcohol.

From the foregoing description, it is obvious that the invention is not intended to be limited to the details of construction shown in the drawings or explained in the specification but rather as defined in the claims.

What is claimed is:

1. A shot cartridge having a shell, said shell comprising a tubular casing having one end thereof closed off by a head, a propellant charge positioned within said casing and spaced from said head, a basewad positioned within the casing between the propellant charge and the head, flash hole means in said basewad adapted to receive a priming device, and an overlay means substantially completely enclosing said basewad thus providing a tight seal between the basewad and the head, the basewad and the tubular casing, and the basewad and the propellant charge.

2. A shot cartridge as recited in claim 1 wherein said overlay means comprises an integral, molded, resilient member having an outer tubular wall casing which fits between the basewad and the shell casing, a transverse wall portion intermediate the ends of the outer wall casing and underlying the propellant charge, an opening in the transverse wall portion which is in alignment with and provides an extension of said flash hole means, and a tubular liner integral with and projecting downwardly from the periphery of said transverse wall opening into said flash hole means to define a continuous lining for the flash hole means.

3. A shot cartridge having a shell with a head at one end thereof, a propellant charge spaced from said head, a basewad having a central opening therein, said basewad being positioned between said propellant charge and said head, and resilient means substantially completely enveloping said basewad to provide a positive gas-sealing overlay.

4. A shot cartridge as recited in claim 3 wherein said resilient means comprises a transverse wall portion positioned between the propellant charge and the basewad, skirt means extending upwardly from said transverse wall portion to act as a gas-sealing means, and tubular side wall means projecting downwardly from the transverse wall between the basewad and the lower portion of the shell, the lower end portion of said side wall means being turned inwardly and held positively in place between the bottom face of the basewad and the head.

5. A shot cartridge as recited in claim 4 in which a tubular liner means projects downwardly from said transverse wall portion through aligned flash holes in said base-

wad and said head and having the lower ends of the tubular liner means extend inwardly between the basewad and head, thus forming a continuous and secured lining for said flash holes.

6. A shot cartridge having a shell with a head at one end thereof, a propellant charge spaced from said head and positioned within said shell, a basewad having a central opening therein positioned between said propellant charge and said head, said basewad being sufficiently hard and pressure absorbing so that a minimum of firing pressure is transmitted to the head, and a plastic overlay means which substantially completely envelopes said basewad to provide a positive gas seal.

7. In a shotshell having a head at one end and a propellant charge spaced therefrom, the combination of a basewad and resilient overlay designed to prevent excessive head expansion during firing due to the basewad failing to seal properly and failing to properly absorb the pressures generated in the shell when fired, said combination comprising said basewad which is sufficiently hard and pressure absorbing so that a minimum of firing pressure is transmitted to the head, and said resilient overlay substantially entirely enclosing said basewad to prevent explosive gas pressure from coming in contact with said basewad and said casing head thus preventing excessive head expansion.

8. In a shotshell as recited in claim 7 wherein said basewad is made of hard maple wood fibers coated with sodium meta-silicate and sodium aluminate.

9. In a shotshell as recited in claim 7 wherein said basewad is made from fibers coated with gypsum and mixed with a polymerized resin dispersion.

10. In a shotshell as recited in claim 7 wherein the essentially major ingredient making up the basewad is fibers with a relatively minor portion of binder, said binder comprising about 4–12% of Portland cement based on the total weight of the filler and minor amounts of wax.

11. In a shotshell as recited in claim 7 wherein said basewad is made of filler material comprising primarily substantially equal portions of maple fibers and plastic flour and a relatively minor portion of asbestos, and a binder material comprising about 4–12% of Portland cement based on the total weight of the filler and minor amounts of wax depending on the ultimate basewad physical characteristics desired.

12. In a shotshell as recited in claim 7 wherein said basewad is made essentially of approximately equal portions of hardwood fibers and plastic flour with varying minor amounts of gypsum and polyvinyl alcohol, depending on the ultimate characteristics desired.

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