March 27, 1962 G. G. OBERFELL 3,026,801

SHOTGUN SHELL

Filed July 27, 1959

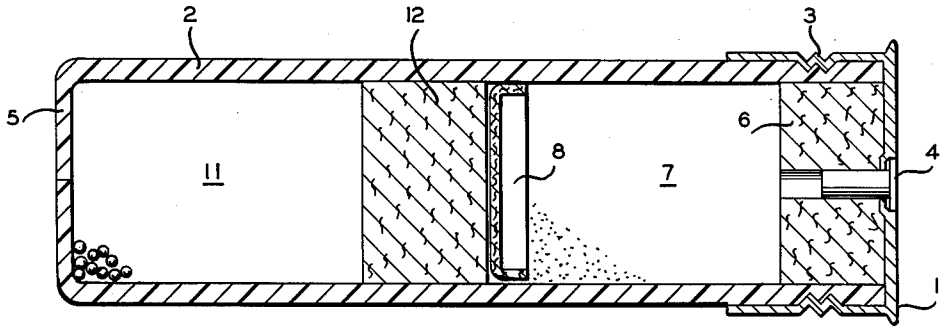


FIG. 1

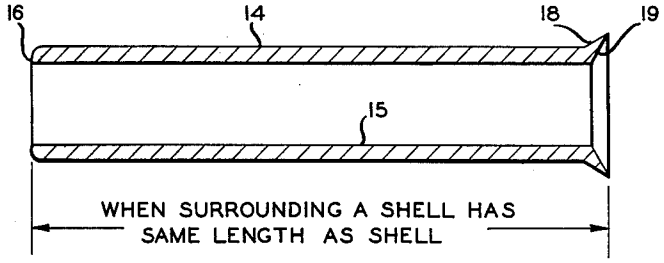


FIG. 2

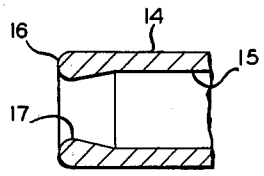


FIG. 2a

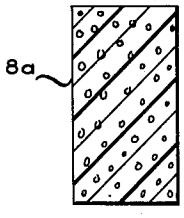


FIG. 3

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SHOTGUN SHELL

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This invention relates to improvements in shotgun shells and more specifically to such improved shells having a structure that enables improved power and penetration effects when shells having a powder and shot charge for small bore diameter guns are fired in guns of larger bore diameter. In one embodiment my invention comprises an encased shotgun shell having a structure comprising a thicker walled shell with an outside diameter suitable for chambering in a gun of a larger diameter and with a cylindrical inside volume of a diameter to receive a standard powder charge wad and shot charge for a smaller diameter gun. In another embodiment I contemplate an improved encased shotgun shell which comprises a standard shell casing in combination with an adaptor which permits firing the same in a gun of larger diameter. In any and all embodiments, including those described above, my invention includes such encased shotgun shells having disposed between the shot and the powder charges an expansible wad, i.e., a wad capable of expanding to effectively prevent the blow-by of gases around the shot charge. I define "encased shotgun shell" to cover all embodiments of my invention. The advantage of such encased shotgun shells with various types of shell case assemblies and with the expansible wad are better penetration of the shot, that is, less loss in range and power than has been obtained from prior art devices.

It is a principal object of my invention to provide an improved encased shotgun shell having therein an expansible wad. Another object of my invention is to provide an improved encased shot gun shell having improved shot penetration characteristics and more particularly having such shot penetration and power characteristics that approach or excell those of regular commercially available shells (i.e., conventional shells of the same gauge as the guns in which they are fired). A further object of my invention is to provide a process that comprises a new use for shells having expansible wads, and more particularly for such shells that have a cupped wad.

In the above and in the following remarks, when I use the term "gauge," I use it in its traditional sense to mean the number of round lead balls of the same diameter as the gun bore, required to make one pound. Examples of the nominal bore diameters of the various gauges are: 10 gauge—0.775 inch; 12 gauge—0.730 inch; 16 gauge—0.670 inch; 20 gauge—0.615 inch; 28 gauge—.550 inch; 410 bore—0.410 inch (Western Ammunition Handbook, publ. 1954 by Olin Mathieson Chemical Corp.). When I refer to shells or guns having a "larger gauge," I refer in this discussion to those having larger bore diameters, and similarly I refer to those having smaller bore diameters when discussing smaller gauges.

In the drawings:

FIGURE 1 shows in cross section an encased shot gun shell embodying my invention;

FIGURES 2 and 2A illustrate an adaptor and one modification thereof suitable for use with certain types of conventional shells to form an encased shotgun shell; and

FIGURE 3 represents another type of expansible wad. Throughout the drawings the same numbers represent the same elements on the drawing unless otherwise noted.

It has long been known to use adaptors in order to fire a smaller gauge shell in a larger gauge gun. Generally, these adaptors are fitted into both the barrel and chamber and reduce the diameter of both, and are in effect smaller gauge barrels (see U.S. Patent 1,555,854 to Hill). The

reason this has been done is to attempt to obtain the same results as if weapons were changed by the expedient of changing the ammunition and using the adaptor. This procedure in the past has yielded a considerable loss in power, i.e., in penetration ability of the shot charge expelled from a shotgun. I have discovered how to improve upon or substantially eliminate the power and/or penetration losses involved when following this technique of employing an adaptor. I accomplish this by employing an "expansible wad" which is capable of expanding to the diameter of the gun barrel and thereby minimizing the blow-by of gases. The power loss problem is particularly aggravated when a small gauge shell is adapted to fire in a large gauge gun because of the great difference in the diameters of the shell and the bore of the gun. By the practice of my invention the shell case assembly can either comprise a shell case having an extra thick wall which renders it adaptable to a larger gauge gun and which also contains shot and powder charges for a smaller gauge gun, or which is a coventional shell fitted into an adaptor (the adaptor in combination with the shell case in this instance comprising the shell case assembly), and in all cases including the expansible wad.

So much of my invention as comprises the improved encased shotgun shell having a shell case assembly with an extra thick wall, as noted above, may be of conventional materials which are wax impregnated cardboard, but more preferably comprise polyolefinic materials such as those produced by the process taught in the United States patent to Hogan and Banks, No. 2,825,721, issued March 4, 1958. The advantage of shells of this nature are that the shell casings can be hand loaded and used for considerable periods of time before being discarded. The advantage of this material and the manner of manufacturing it are disclosed not only in said U.S. patent to Hogan et al., but also in my copending applications, Serial Nos. 596,522 filed July 9, 1956, entitled "Firing Tubes for Firearms," now abandoned and 815,014 filed May 22, 1959, entitled "Improved Shotgun Shell," now abandoned (on which I am coinventer with Robert G. Atkinson). My invention also comprises adaptors which may be made of any material, e.g. steel, but preferably are also made of polyolefinic materials made as described in said Hogan et al., patent.

In FIGURE 1 is shown an encased shotgun shell, the external structure of which comprises a head or base **1** which may be of any conventional material, e.g., drawn brass, to which is sealed a case assembly **2**. The outside diameter of the shell case asembly **2** is that for shells to be fired in a gun of larger gauge, as further explained below. The sealing may be effected by means such as the crimps **3** which are conventional and well known in the art. The head also receives and supports a primer **4** in a well known manner. The muzzle end of the encased shotgun shell may be closed by an evanescent closure **5**. One such closure is a rolled closure preferably using a frangible, disintegrating top wad such as those made by cutting discs from paperboard sheets (chipboard) 0.025 inch thick which have been immersed for 30 minutes in a sodium silicate solution of 1.1 specific gravity and then dried at 125° F. as taught in the U.S. patent to Holmes No. 2,582,125, issued January 8, 1952. Another type of closure is accomplished by creasing the tube of **2** near its mouth at, for example **6** equidistant places and then enfolding the creased portion to provide a suitable closure **5**. Both types of evanescent closures are taught in said U.S. patent to Holmes.

Internally of the shell and adjacent the base and primer is disposed a base wad **6** which has an opening therein to provide communication between the primer and the powder charge **7**. At the muzzle end of the powder charge, i.e., at the end of the charge opposite the primer

is disposed an expansible wad **8**, in FIGURE 1 shown as a "cupped wad." This cupped wad is formed from a flat circular member and comprises a disc having flanges such that the diameter of the wad when flat (i.e., the diameter of the flat circular member) is about 0.075 to 0.250, preferably 0.100 inch–0.200 inch, larger than the nominal bore diameter of the larger gauge gun in which it is to be fired, at least in the 10, 12, 16 and 20 gauges. These wads serve to expand diametrally under the pressure of gases when the shell is fired in order to prevent blow-by of the gases generated by the powder charge. Holmes did not contemplate sealing the bores of guns larger than the shell designed for use therein. The disc and flange dimensions are dictated by the relative gauge sizes of the shell and the gun bore and the above-stated rule. The diameter, when flat, of these wads constructed in this fashion, is thus substantially equal to such diameter for conventional prior art wads sized for the larger gauge gun bore, e.g., an encased shotgun shell with a 20 gauge shot and powder charge designed for firing in a 12 gauge gun would have a wad equivalent in effective diameter to a conventional prior art 12 gauge wad. This structure permits the unique cooperation which enables the obtention of improved power and penetration characteristics according to my invention. The manufacture and structure of cupped wads are taught in their entirety in said Holmes patent, as are the top wad closure structures **3**. The reader is referred to this prior art to complete the discussion thereof, inasmuch as I do not claim my invention in the cupped wad per se but only in my novel combination of an expansible wad and an encased shotgun shell, which combination provides a shotgun shell suitable for shooting a smaller gauge shell in a larger gauge gun.

I use the term "expansible wad" as the generic term to refer to the various types of wads such as cupped wad **8** and the compressible wad shown in FIGURE 3. In the preferred embodiment, the expansible wad is sized according to the gauge of the gun in which the shell is to be fired. To put it another way, the best practice of this invention requires a wad that is oversized respective to the shot and power charge but properly sized for the gun. Expansible wads are sized to seal the bore of a gun that is at least 0.045 inch larger than the bore of the gun that the shell internal diameter is based on as computed from the nominal diameters stated above.

Between the expansible wad and the shot charge **11** is disposed a filler wad **12** which is preferably of a molded paper or other conventional composition. This filler wad is designed to make up for differences in the internal dimensions of the shell when various types of powders are used in the powder charge **7**. The employment of filler wads is well known in the art and is described briefly in said Holmes patent. There can be one or a plurality or such filler wads. If desired, a card wad can be inserted between the filler wad and the expansible wad.

In one embodiment the shell case assembly **2** has an extra thick wall and comprises an integral cylindrical tube having an outside (O.D.) diameter suitable for chambering in a shot gun of any selected gauge or bore. However, the inside diameter (I.D.) of the shell case assembly **2** in this embodiment is that of a shell of a smaller gauge, so that the shot and powder charges are confined in spaces of substantially the same size as they would be if in fact they were disposed in a shell that was to be chambered in said smaller gauge gun. For example, the O.D. could be that for a 12 gauge gun and the I.D. could be the I.D. of a shell suitable for chambering in a 20 gauge gun.

Typical chamber dimensions are given on page 28 of "The Shotgunner's Book (a Modern Encyclopedia)" by Col. Charles Askins, published 1958 by the Stackpole and Heck, Inc., Harrisburg, Pennsylvania (hereinafter "Askins").

In another embodiment of my invention, the shell of FIGURE 1 could be dimensioned both as to the I.D. and O.D. of the shell case assembly **2** as is a conventional shotgun shell. Of course, the expansible wad ought to be oversized as explained above. In such case my invention requires the shell be used with the adaptor of FIGURE 2. This adaptor comprises a substantially cylindrical body **14** having a rounded surface **16** at the muzzle end thereof and having an external length and O.D. corresponding, respectively, to the length after firing of the shell the adaptor is to hold (1/16") and the diameter of a conventional shotgun shell ("larger shell"). By this construction a short encased shotgun shell can be fired in guns chambered for shells of longer length. The I.D. **15** of the of the adaptor at the breech end is about 0.007 to 0.014 inch less in diameter than is the typical chamber diameter for the small gauge shells to be fitted thereinto. The O.D. of the tube **14** at the breech end is about 0.005 to 0.012 inch less than the typical chamber diameter for the large gauge gun. Both the I.D. and O.D. are tapered to a smaller diameter toward the muzzle end; the taper can be as indicated by "Askins," or more preferably modified from Askins by tapering about 30–50 precent more to provide a larger diameter at the breech than at the muzzle.

The reason for the greater taper in the I.D. is to assure that shells will fit tightly enough to prevent their separating from the adaptor during handling, firing, unloading, and loading. An alternative structure disposes near the muzzle end of the adaptor a tapered shell-gripping ring **17** (FIGURE 2A) which must be between 0.010 inch and 0.020 inch less in diameter than the portion **15** of the I.D. of the adaptor. Except for substituting the tapered ring for the tapered I.D., the adaptor of FIGURE 2A is otherwise conformed as is that of FIGURE 2. This is disposed so that the muzzle end of the shell is gripped by **17** and thus prevents separation of shell and adaptor during handling, loading, firing and unloading.

One end of the adaptor is rimmed and contoured on the outside at **18** to properly fit the chamber of the shot gun. The inner portion of the adaptor is contoured at **19** to receive the base **1** of a shotgun shell and to dispose it so that there is no change in the head-space adjustment of the gun when employing encased shotgun shells having the adaptor of FIGURE 2 in combination therewith. As with FIGURE 1 the wads used in the shells for this adaptor should be oversized so that they can seal the bore of the gun in which the shell is to be fired.

FIGURE 3 shows another embodiment **8***a* of an expansible wad that can be employed in the structure of FIGURE 1. The wad **8***a* comprises a cylindrically shaped cellular cellulose acetate plug or cushion which, when fired, is greatly compressed in an axial dimension and thereby expanded diametrally, thereby effecting a sealing action across the bore of the gun. A particular advantage of this cushion is that it reduces distortion of shot with which it comes in contact during the events of firing. To assure proper sealing in the bore, these wads should be made extra long in their axial dimension. Wads of such material are described on pages 745 and 748 of "The Hunter's Encyclopedia," published by Stackpole and Heck, Inc., Harrisburg, Pennsylvania, and edited by Raymond R. Camp.

Data obtained during firing tests indicates that the improvement in penetration is substantial when practicing my invention. The apparatus used in these penetration tests consisted of a rectangular trough with the ends omitted, and having a cross sectional dimension of approximately 6¾ x 8 inches and a length of 29 and ¼ inches. Cardboard, i.e., printer's chip boards such as the material used to back up paper tablets were disposed on 1 inch centers along the box and the box was positioned 40 yards from the muzzle of the gun. The chip-

boards for consistent results must be stored in a controlled humidity atmosphere until just prior to the tests. A suitable storage apparatus comprises a closed portable soft drink cooler having a good drying agent (e.g., silica gel) therein. The penetration test result is expressed as the maximum number of cards within the box that are actually and completely penetrated by at least 50 percent of the number of pellets which penetrated card No. 1 (i.e., first or front card in the box).

The penetration test result is obtained by plotting the percent of the pellets penetrating a card against the card number, using the number of pellets penetrating card No. 1 as 100 percent and then reading the number of cards penetrated by 50 percent of the pellets from the curve obtained by plotting. This accounts for the fractional portions of cards reported in the data below.

In the following data, nomenclature such as the following is used: 12/20. This nomenclature means that a 20 gauge shell is being fired in a 12 gauge gun by fitting a 20 gauge shell into the adaptor of FIGURE 2. A "cup" means cupped wad. The chipboards were all of about equal thickness.

(1) 20/20 with cupped wad; hand load; 26 grains smokeless powder; 1 ounce No. 7½ shot; 50 percent penetration=14.5 cards.

(2) Same as 1 except gun was Winchester 97 with encased shell 12/20; 26 grains smokeless powder, 1 ounce No. 7½ shot, cup wad, Winchester 12/20; vent sleeve and control choke; 50 percent penetration=14.0 cards. 12/20 cup.

(3) Same as 2 except no cupped wad. 50 percent penetration=10.5 cards. 12/20 no cup.

(4) Same as 3 except using a different 12 gauge gun; 50 percent penetration=13.0 cards; 12/20 cup.

In the above data runs No. 2 and 4 show a vastly improved penetration over that obtained with the encased shells that does not employ the expansible wad (run No. 3). A comparison of runs No. 2 and 4 with the firing of shells in guns of the gauge of the shell (run No. 1) shows that very slight losses in penetration are realized when practicing this invention. The penetration obtained in runs No. 2 and 4 also serves to illustrate the variation in results to be obtained from one gun to another. The data definitely illustrates that the expansible wad is essential to the practice of the invention in order to obtain the desired advantage and characteristic of an improved penetration as compared with prior art techniques. As mentioned above, this enables the person firing a gun to obtain the advantages of a plurality of guns by the expedient of changing ammunition, rather than by having to change guns.

The pattern efficiencies obtained in the practice of my invention are approximately 10 percent less than those obtained when conventional shells are fired, i.e., one "degree of choke" is lost. The term "degree of choke" refers to chokes designated as "full"; "modified," "Improved Cylinder," and "True Cylinder" (no choke) as described in "The Mysteries of Shotgun Patterns" by myself and others, published through Oklahoma State University Press, Stillwater, Oklahoma, 1957, which yield pattern efficiencies of 70, 60, 50 and 40, respectively. To compensate for this, the choke adjustment is changed one choke degree (in the direction to increase pattern efficiency) or the range is decreased about 5 yards. Conversely, if one desires to obtain the effect of a decrease in the amount or degree of choke adjustment, then this is achieved by firing shells constructed as herein described.

By the use of the construction of FIGURES 2 or 2A, a small gauge shell of conventional structure can be fired in a gun that is chambered for shells that are longer than conventional shells, e.g., a "magnum" type gun. Length of the shell refers to the length after firing, in accordance with the convention in the art.

While my invention has been described with respect to certain specific embodiments and features, it is not my intention that the following claims be limited specifically thereto, but to include all those equivalents thereof which would be obvious to one skilled in the art having this disclosure before him.

I claim:

1. A cartridge adapted to be placed in the chamber of the barrel of a shotgun and fired therein comprising in combination a shotgun shell having its external diameter substantially smaller than the diameter of said chamber and a length after firing not greater than the length of said chamber, and a generally cylindrical one-piece adapter sleeve closely surrounding said shell in concentric frictional contact therewith, said sleeve having its inside diameter before assembly into position surrounding said shell slightly smaller than the outside diameter of said shell, said sleeve having its outside diameter slightly smaller than but adapted to closely fit said chamber, whereby said sleeve will not separate from said shell during normal handling of said cartridge including loading, firing, and ejecting said cartridges in and from said chamber of said shotgun, said sleeve being of a length not greater than the length of said chamber and not greater than the length of said shell after firing, said shell being hollow and containing in series from its breech to its muzzle a primer, a charge of gun powder, an expansible wad, and a charge of shot.

2. The combination of claim 1 in which said expansible wad is adapted to expand upon firing said cartridge in said chamber to completely fill the cross-sectional area of said barrel.

3. The combination of claim 2 in which said sleeve comprises a polyolefinic plastic.

4. The combination of claim 3 in which said sleeve consists essentially of solid polyethylene.

5. A cartridge adapted to be placed in the chamber of the barrel of a shotgun and fired therein comprising in combination a shotgun shell and a generally cylindrical one-piece adapter sleeve closely surrounding said shell in concentric contact therewith, said sleeve having its inside diameter before assembly into position surrounding said shell slightly smaller than the outside diameter of said shell, said sleeve having its outside diameter slightly smaller than but adapted to closely fit said chamber, whereby said sleeve will not separate from said shell during normal handling of said cartridge including loading, firing, and ejecting said cartridges in and from said chamber of said shotgun, said sleeve being of a length not greater than the length of said shell after firing, said shell being hollow and containing in series from its breech to its muzzle a primer, a charge of gun powder, an expansible wad, and a charge of shot.

6. The combination of claim 5 in which said expansible wad is adapted to expand upon firing said cartridge in said chamber to completely fill the cross-sectional area of said barrel.

7. The combination of claim 6 in which said sleeve comprises a polyolefinic plastic.

8. The combination of claim 7 in which said sleeve consists essentially of solid polyethylene.

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