Jan. 8, 1952 R. S. HOLMES 2,582,124

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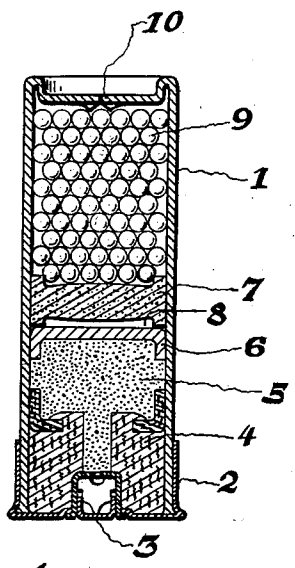


Fig. 1

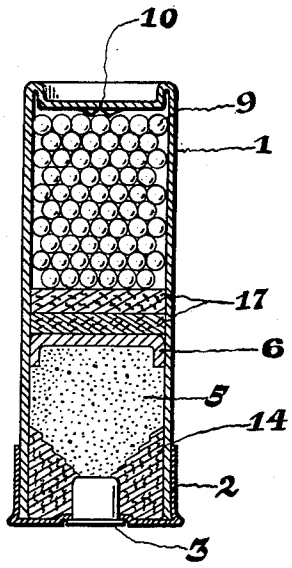


Fig. 2

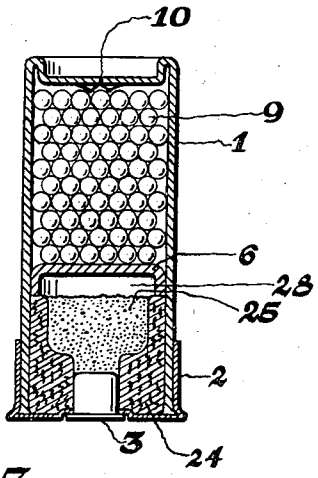


Fig. 3

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This invention relates generally to shot cartridges and particularly to shot cartridges of the type in which there is a positive seal between the combustion gases and the shot charge.

Numerous workers in the prior art have believed that the performance of shot shells would be improved by the provision of wadding of such character that a substantially hermetic seal would exist between the shot charge and the propellent charge thus to positively confine the powder gases behind the shot charge, both in the shell itself and in the gun barrel, and many proposals in this direction have been made. Experience demonstrated, however, that the rounds provided with the supposedly improved seal behaved in an undesirable manner, yielding patterns which were erratic and less suitable than the products which they were intended to supersede.

These experiences with substantially hermetic wadding led to the belief that some leakage of powder gas past the wadding was not only desirable but necessary to secure uniformity of patterns from round to round and satisfactory distribution of pellets in the pattern of the individual rounds. My observations have confirmed the correctness of that belief in so far as shot shells having a top wad (above the shot charge) are concerned. Wherefore, I have reasoned that absent gas leakage in such shells, the top wad (being of a character such as to encounter substantial resistance to travel through air) impedes and obstructs the travel of the shot pellets with resultant unsatisfactory patterns.

While it has heretofore been proposed, as in United States Patent No. 929,866, to eliminate the top wad and close the end of the shot shell tube by deformation and infolding of the side walls of the tube, and indeed substantial quantities of shot shells have been manufactured with the ends so closed, the lesson learned by the art with respect to the necessity of gas leakage has continued to prevail so that those shells whose end closures have been integral with the side walls of the tube have heretofore been provided with wadding between the shot charge and the propellent charge, which admitted of some gas leakage.

It is evident, of course, that such gas leakage represents a loss of propellent power and that the heat of the combustion gases in contact with the shot charge contributes to the tendency of the shot pellets to weld together, as well as to their tendency to foul the gun bore.

The object of the invention, generally stated, is to provide a shot shell in which leakage of

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gas past the wadding is minimized without the disadvantageous effects above described.

Another object of the invention is to provide a shot cartridge of the type described in which is incorporated a gun wad of such form and dimensions as to furnish an optimum gas seal with the gun barrel without adversely affecting the pattern.

Another object is to provide a gun wad which will furnish an effective gas seal and also be capable of withstanding the firing pressure without disintegrating.

Further objects will appear from the detail description taken in connection with the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view of a shot cartridge embodying this invention;

Figure 2 is a similar view showing another embodiment of this invention; and

Figure 3 is a similar view showing a further embodiment of the invention.

According to the present invention, a shot shell provided with a substantially self-sealing wad between the shot charge and the propellent charge has its end closed to confine the charges in such manner that there is no solid part, of the character of a top wad, to obstruct the movement of the shot pellets through space. Such is accomplished by combining the substantially self-sealing wad in a shot shell tube whose end closure is integral with the side walls of the tube and remains integral therewith upon firing. For example, the end closure disclosed in United States Patent No. 929,866 is admirably suited for the purpose. Therein the mouth of the tube is creased at six equidistant places and folded inwardly to form a closure which confines the charges within the shell. If desired, a water-resistant seal, as a suitable wax composition, may be applied to the closure without adversely affecting the ballistic properties, as the wax disintegrates upon firing and therefore does not impede the travel of the shot pellets in the manner experienced with top wads.

Since the present invention contemplates the disposition of a substantially self-sealing wadding between the propellent charge and the shot charge of a shot shell, such wadding will hereinafter be referred to as a "gun wad" in order to definitely distinguish the same from the top wad commonly employed to close the end of shot shells.

The present invention particularly contemplates the conjunction of an integrally closed shot shell tube with a self-sealing gun wad of

the character of a flanged disc arranged with the flanges to trail the web of the wad upon firing, i. e., with the flanges directed toward the base of the loaded shell. Such a flanged disc may be formed of consolidated fibrous sheet material, such as paper. Shells embodying self-sealing gun wads of this type in an integrally closed shell tube not only exhibit uniformity of pattern and elimination of lead deposit in the gun bore, but also exhibit a unique uniformity of report, marked reduction in "confettiing," and considerable reduction of powder residue in the gun barrel.

Referring now to Figure 1 of the drawings for an illustrative embodiment of the invention, a tube 1 formed of convolutions of paper or other suitable material is assembled with a base cup 2 usually constructed of metal, a priming assembly 3, and a base wad 4, in any suitable manner. The charge of propellent powder 5 is disposed within tube 1 above base wad 4 and thereover a gun wad 6 consisting of a flanged disc is placed in contact with the upper stratum of the propellent powder charge 5 and hence confines said charge.

As heretofore indicated, the gun wad 6 is preferably formed of consolidated fibrous sheet material such as paper and, for optimum sealing, it has been found that the depth of the flange should be about $\frac{1}{6}$ the diameter of the completed wad. When the depth of the flange is appreciably less than the lower limit mentioned, for example, 6% of the diameter, an efficient gas seal is not consistently obtainable. Increasing the depth of the flange beyond about $\frac{1}{3}$ the diameter increases the manufacturing difficulties without adding any advantage.

Thus, excellent gun wads for use in 12-gauge shot cartridges have been obtained by flanging circular discs of paper, 0.035'' in thickness, ranging from 0.875'' to 1.20'' in diameter, using a cupping die 0.720'' in diameter.

It has further been found that gun wads which are not subject to undesirable disintegration and delamination when fired in a gun are obtainable by the use of heavily calendered paper board. Impregnation of the cardboard with a high melting point wax composition is desirable, though not essential. While a variety of wax compositions, having melting point higher than about 50° C., has been found effective for the purpose, without adversely affecting the propellent powder charge, particularly good results have been obtained with the use of microcrystalline waxes of petroleum origin such as "Socony 2300" and "Moore and Munger 3300." For example, wads of cardboard were thoroughly impregnated with about 25% of their weight of wax by ten minutes' submersion in molten wax at 100° C. followed by ten minutes of centrifuging at 30° C.

Above the gun wad 6, one or more resilient wads 7 may be arranged. While the resilient wad may be in the form of a cylindrical fibrous wad, particularly favorable results are obtained with a resilient wad of the type described in United States Patent No. 1,659,649 and having dished faces, as shown in Figure 1.

Above the wad 7, a charge of shot 9 is inserted and the mouth of the shell is closed by a closure 10 integral with the side walls of the tube 1, such being accomplished by creasing the tube 1 near its mouth at, for example, six equidistant places, and then infolding the creased portion. While the closure 10 may be rendered water-resistant by the application of a suitable wax composition, it is important that the closure be

devoid of parts such as the usual top wad, which must be forced ahead of the shot charge upon firing. Upon firing the shell provided with such an end-closure, the infolded portions of the tube straighten out but remain integral with the side walls thereof.

As illustrating that the invention is not limited to any particular form of base construction or resilient wadding, the embodiment shown in Figure 2 is provided with a base wad 14 of different type and construction from that illustrated in Figure 1, and being constructed, in a well known manner, of compressed paper. Moreover, in the embodiment shown in Figure 2, the resilient wads 17 are of a more conventional structure than the corresponding part of the Figure 1 embodiment, the same being plain cylindrical wads of hair-felt or other suitable composition. Otherwise, the reference characters indicate parts identical to the corresponding parts of the Figure 1 embodiment.

A further variation is shown in Figure 3, which differs from the preceding embodiments in that the base wad 24 is provided with extended side walls, upon the ends of which rest the flanges of gun wad 6. In this embodiment, the propellent charge 25 consists of a fast-burning powder, and an air space 28 exists in the powder chamber. In the Figure 3 embodiment, the resilient wadding utilized to reinforce the gun wad 6 in the previous embodiments is omitted when a shot shell of short length is desired, the shell 1 being shortened by the distance ordinarily taken up by the resilient wadding, such as 7 or 17. Otherwise, the parts are identical with the embodiments previously described. Comparable parts may, of course, be omitted from the precise forms shown in Figures 1 and 2 to shorten those shells.

Shot cartridges which are provided in accordance with this invention with an end-closure, which is integral with the shell body and with a self-sealing gun wad of the character described, have been found to possess outstanding advantages. Improved patterns, that is, less dispersion of the shot, are obtained and at the same time there is greater uniformity of the patterns in successive firing of the cartridges. Smearing of the gun bore with streaks of lead, a characteristic disadvantage of prior art cartridges, has been entirely eliminated. These advantages have been accompanied by others, such as increased uniformity in the report of successive shots, a considerable reduction in the amount of "confetti," that is, the fragments of paper and wad material which appear in front of the gun after a cartridge is fired, and a considerable reduction in the amount of residue from the powder which remains in the gun barrel.

When a cartridge, loaded as above described, is fired in a shotgun, the flanges of the wad are forced into sealing engagement with the gun barrel by the pressure of the powder gases. The fact that a gas-tight seal results and is maintained throughout the entire travel along the gun barrel has been substantiated in many series of tests in which instantaneous flash photographs were made of the shot charge as it emerged from the gun muzzle. Furthermore, the gun wads are recovered intact after firing, in the form of practically flat discs.

The advantageous results obtained with shot shells constructed in accordance with the present invention are illustrated in the following table of comparative test data. The test results were obtained from firing forty rounds of each of car-

tridges A, B, and C. Cartridge B was constructed as shown in Figure 1 of the drawings and cartridge A was identical therewith save that a flat disc card wad was utilized in the place of the gun wad 6. Cartridge C was identical with cartridge B save that the integral closure 10 for the end of the tube was replaced by the usual top wad closure. The loading, both propellant and projectile, of all rounds involved in the test was identical.

	Cartridge A	Cartridge B	Cartridge C
Lead deposited in gun barrel grains	0.481	0.00	0.00
Pattern—percentage of pellets in 30 inch circle at 40 yds. (80 rounds):			
Average	65	71	60
Maximum	76	79	75
Minimum	49	60	38
Confetti (40 rounds) cc	100	62	70
Pressure lbs. per sq. in.	8,500	9,200	9,000
Muzzle velocity ft./sec.	1,208	1,231	1,230
Instrumental velocity over 40 yards ft./sec.	850	865	864

The lead, pattern, pressure, and muzzle velocity determinations given in the above table were carried out in accordance with conventional methods well known in the art.

The confetti measurement represents material caught on a screen of 0.02'' mesh opening in a space 4 feet wide and 13 feet long in front of the gun. The measurements were made by pouring the material into a graduated cylinder, tapping lightly, and taking the reading.

In the foregoing table, it will be seen that the present invention has brought about an appreciable improvement in the uniformity of the patterns without smearing the gun barrels with lead, and there has also been a considerable reduction in the confetti.

In addition to the foregoing improvements, shot cartridges of this invention are characterized by a greater uniformity in sound when fired. Instrumental measurement of the sound produced by the two types of cartridges indicated about twice as much variation in the amplitude of sound with cartridge A as with cartridge B. Improved cleanliness of burning of the powder charge is another advantage shown by the cartridges of this invention.

From the foregoing description, it is evident that the invention is not limited to the details of construction shown in the several embodiments, but that, so long as a substantially self-sealing gun wad is properly coordinated within a shell tube whose mouth is integrally closed, various changes may be made in the other details of construction without departing from the spirit of the invention. It is, therefore, to be understood that the invention is not limited to the specific details shown and described.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A shot shell having a tube, a propellent charge and a loose shot charge within the tube, a flanged disc wad between the propellent charge and the shot charge, and an end closure integral with the tube and contiguous with the shot charge.

2. A shot cartridge having a shell, a charge of propellent powder therein, a gun wad consisting of a flanged disc of consolidated fibrous material pressed into contact with and enclosing the upper portion of the said powder charge, a shot charge above the said wad and contiguous with said shell, and a closure consisting of the forward end of the said shell folded inwardly against the shot charge.

3. A shot cartridge having a shell, a charge of propellent powder therein, a gun wad consisting of a flanged disc of fibrous material pressed into contact with and enclosing the upper portion of the said powder charge, said wad being impregnated with a high melting point wax, a shot charge above the said wad and contiguous with said shell, and a closure consisting of the forward end of the said shell folded inwardly against the shot charge.

4. A shot cartridge having a shell, a charge of propellent powder therein, a gun wad consisting of a flanged disc of fibrous material pressed into contact with and enclosing the upper portion of the said powder charge, said wad being impregnated with a microcrystalline wax, a shot charge above the said wad and contiguous with said shell, and a closure consisting of the forward end of the said shell folded inwardly against the shot charge.

5. A shot cartridge having a shell, a charge of propellent powder therein, a gun wad consisting of a flanged disc enclosing the upper portion of the said powder charge, the length of the flanges of the disc being substantially one-tenth to one-third the diameter of the disc, a shot charge above the said wad and contiguous with said shell, and a closure consisting of the forward end of the said shell folded inwardly against the shot charge.

6. A shot cartridge having a shell, a charge of propellent powder therein, a gun wad consisting of a flanged disc pressed into contact with and enclosing the upper portion of the said powder charge, the depth of the said flanged disc being substantially one-tenth its diameter, a shot charge above the said wad and contiguous with said shell, and a closure consisting of the forward end of the said shell folded inwardly against the shot charge.

7. A shot cartridge having a shell, a charge of propellent powder therein, a gun wad consisting of a flanged disc pressed into contact with and enclosing the upper portion of the said powder charge, at least one resilient wad and a shot charge superposed on the said flanged disc, said shot charge consisting of a multiplicity of pellets confined solely by said shell, and a closure consisting of the forward end of the said shell folded inwardly against the shot charge.

8. A shot cartridge having a shell, a charge of propellent powder therein, a gun wad consisting of a flanged disc pressed into contact with and enclosing the upper portion of the said powder charge, at least one resilient wad having a dished face adjacent to the said flanged disc, a shot charge over the said wad and contiguous with said shell, and a closure consisting of the forward end of the said shell folded inwardly against the shot charge.

9. A shot cartridge having a shell, a charge of propellent powder therein, a gun wad consisting of a flanged disc of pressure-resistant material over the said powder charge, a shot charge above the said wad and contiguous with said shell, and a closure consisting of the forward end of the said shell folded inwardly against the shot charge.

10. A shot shell having a tube, a propellent charge and a loose shot charge within the tube, a flanged disc wad between the propellent charge

and the shot charge, said wad being pressed into contact with the propellent charge to confine the same, and an end closure integral with the tube and contiguous with the shot charge.

11. A shot shell having a tube, a propellent charge and a shot charge within the tube, a flanged disc wad between the propellent charge and the shot charge, said wad being disposed in the shell with its web portion in spaced relation to the propellent charge to provide an air space therebetween, and an end closure integral with the tube and contiguous with the shot charge.

12. A shot shell having a tube, a propellent charge and a loose shot charge within the tube, a substantially self-sealing gun wad between the propellant charge and the shot charge, and an end closure integral with the tube and contiguous with the shot charge.

13. In a shot shell having a tube, a propellant charge and a loose shot charge within the tube, a gun wad between the propellant charge and the shot charge, and an end closure over the shot charge; the improvement that the end closure is integral with the tube and contiguous with the shot charge, and the gun wad includes a flanged disc whose flanges are faced toward the propellant charge.

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