

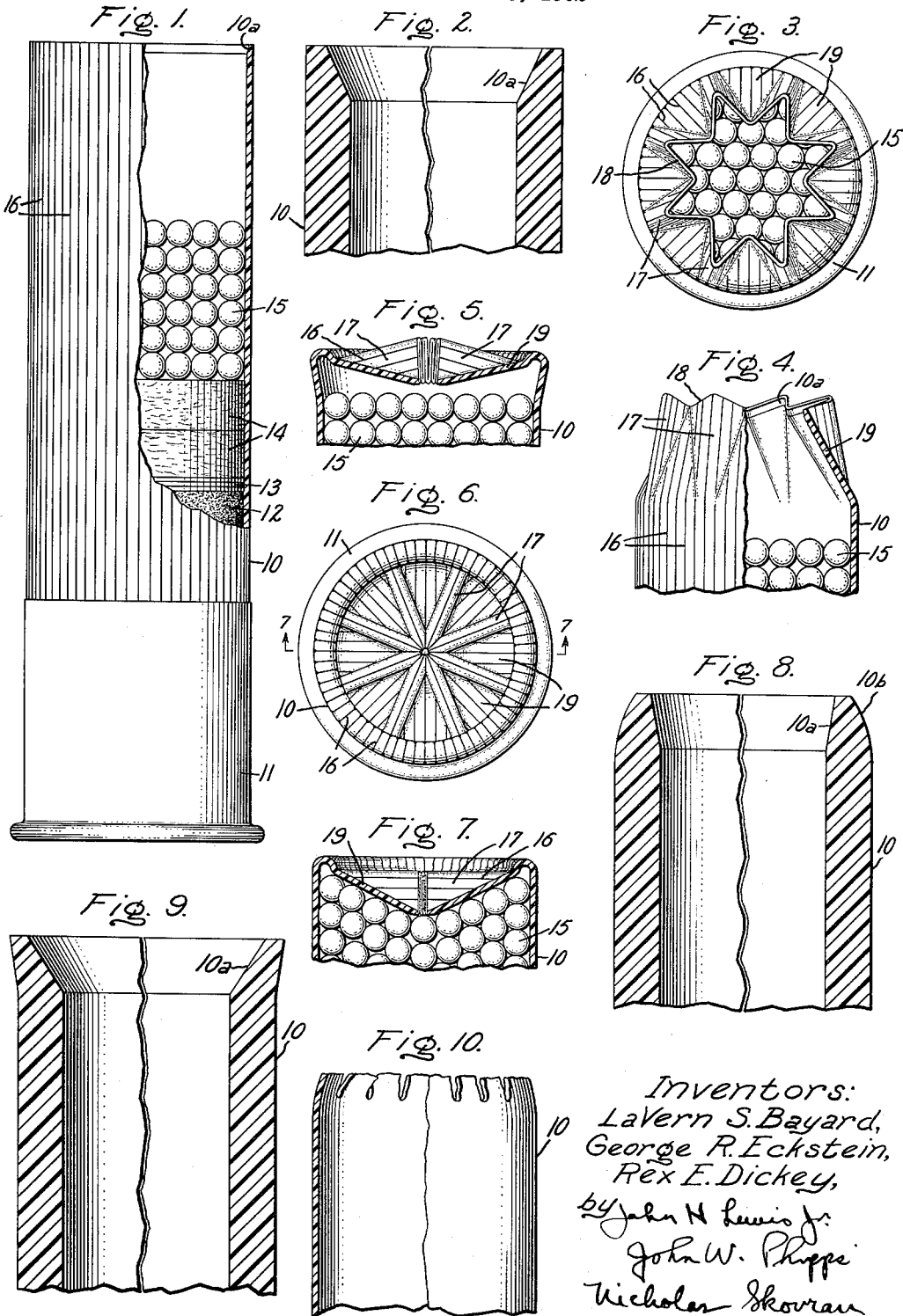
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SHOTSHELL

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1

3,215,075
SHOTSHELL

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1 Claim. (Cl. 102—42)

The present invention relates to shotshells and is particularly concerned with shotshells having a plastic body wherein the end of the plastic body is crimped to provide a closure for the shell.

This invention is an improvement over the shotshell disclosed in prior U.S. Patent No. 3,055,302 and relates in general to necessary improvements for practical reloading of plastic body shotshells.

The existing shotshell designed includes a body thickness of approximately .030" and is closed with an operation which includes spin sealing the center hole, as explained in Patent No. 3,055,302. This spin sealing is necessary to stop shot leakage of small size shot, such as used in target shooting, and further provides a breathing seal that is ideal for shells used in bad weather conditions.

In order to provide a suitable plastic shell especially designed to permit repeated reloadings of target shells, several closure requirements are apparent:

(1) A spin seal is not necessary for the weather conditions of target shooting;

(2) A spin seal cannot be tolerated if it disturbs the continuity of the shell mouth for reloading;

(3) The center hole must be small enough within the original closure to hold shot as small as No. 9;

(4) The center hole produced by any of the available reloading tools must be small enough to hold No. 9 shot;

(5) The appearance of the closure must be appealing both originally and as a reload; and

(6) The strength of the original closure as well as the reloaded closure must meet predetermined standards.

Thus, the problem is to provide a plastic shotshell to which a strong closure can be provided which will prevent the smaller sizes of shot from falling out through the center hole and which, after firing, will have a smooth, undeformed mouth end so that the shotshell will be adaptable for easy, repeated reloadings.

FIGURE 10 shows a deformed mouth end of a plastic shotshell which has been crimped and spin sealed by the method disclosed in Patent No. 3,055,302 and then fired. It can be seen that the spin sealing operation has bored a series of slots in the shell mouth end and that the explosively discharged shot pellets have deformed the mouth end to such a degree that reloading of such a shell is difficult, if not impossible. With the apparently very large interest in reloading of shotshells, this defect and the invention by which the defect is cured becomes very important in a commercial sense.

It is the object of this invention to provide a plastic shotshell which is especially designed to permit and facilitate hand reloading of the used shotshell.

It is another object of this invention to provide a plastic shotshell which is designed to decrease or eliminate mouth end scuffing and curling caused by explosively actuated shot pellets.

It is yet another object of this invention to provide a plastic shotshell which is designed to facilitate folding

2

and crimping of the front end of the shotshell so that the folded segments come together in a closer fitting relationship and thus form a minimum size of center hole.

It is yet another object of this invention to provide a compact, strong and efficient closure to a plastic shotshell without the necessity of spin sealing.

It is yet another object of this invention to provide a plastic shotshell which is capable of repeated reloadings utilizing existing standard reloading tools.

Other objects and advantages will become apparent from a consideration of the following detailed description taken in connection with the accompanying drawings wherein a preferred embodiment of the invention is shown. It should be appreciated that, although the invention is shown in the drawings and mentioned in the specification, as being used with the "Rib-Lok" crimping construction of Patent No. 3,055,302, there are other possible crimps with which the invention can be utilized. The invention, of course, is intended to include all such variations and modifications as fall within the spirit of the invention and scope of the appended claims.

In the drawings:

FIGURE 1 is a view partially in side elevation and partially in section of a shotshell having a skived mouth portion;

FIGURE 2 is a blown-up sectional view of the skived mouth;

FIGURE 3 is a top plan view of the shotshell shown in FIGURE 1 after it has been subjected to the first step in the preferred closing operation, namely, the star crimping of the upper end of the shotshell body;

FIGURE 4 is a side elevation partially in vertical section of the closure end portion of the shotshell body as seen in FIGURE 3;

FIGURE 5 is a vertical section of the partially closed mouth end of the shotshell;

FIGURE 6 is a top plan view showing the final closed position of the closure end of the shotshell body;

FIGURE 7 is a vertical sectional view taken along the line 7—7 of FIGURE 6;

FIGURE 8 is a sectional view of a modified skived mouth end of a shotshell;

FIGURE 9 is a sectional view of another modification of a shotshell skived mouth end; and

FIGURE 10 is a side view of a deformed shotshell mouth end showing slots caused by the spin sealing operation.

As shown in FIGURE 1, the shotshell, according to the illustrated exemplary embodiment of the invention, comprises a cylindrical tubular body 10 formed of plastic material and a head 11 preferably of brass or other suitable metal, to which the lower end of the body is suitably secured and within which is contained the usual base wad, battery cup, primer cup, anvil, and priming composition. Above the base wad is placed a powder charge 12 which is separated by one or more over-powder wads 13 and one or more filler wads 14 from the shot charge 15. The free end of the body 10 extending above the shot charge is adapted to form the integral closure of the invention which retains the shot charge in place. As can be seen in FIGURE 2, the outer end of the tubular body 10 is skived to provide a tapered end portion 10a which angles outwardly from the inner wall surface of the body wall to the mouth of the shotshell.

The tapered end portion 10a is the crux of the present

invention. Shells produced in this fashion, when tested, show that the area that has been profiled is not hit by the explosively projected shot. This phenomenon is difficult to explain but apparently the shell mouth flares so rapidly that the shot column does not deform rapidly enough to rub the critical area. This, of course, results in an essentially undeformed shell mouth which is an improvement for reloading the shells.

A second very important advantage of skiving the shell end portion is that the thickness of the plastic material which must be folded many times in order to provide the crimp closure, is decreased thus facilitating folding of the plastic and thus permitting the ends of the folds to come closer together so that the size of the center hole of the closure is decreased. This center hole is not critical in the above-cited patent since a spin-seal operation seals off the opening and prevents moisture from entering the shell and also prevents small shot pellets from leaving the shell. However, the spin-seal operation results in the grinding away of portions of each of the folded segments so that when the shell is fired and the forward end of the tubular wall body is returned to its original uncrimped position (see FIGURE 10), there remains a plurality of slots in the mouth end of the plastic shotshell. This, of course, is objectionable from a reloading standpoint.

The present invention eliminates the spin-seal operation of Patent No. 3,055,302. Moreover, although the crimped shotshell is no longer waterproof, as is the spin-sealed closure, the skived end portion permits the crimping of the plastic shell to result in a small center hole through which small shot pellets (e.g., No. 9 shot) will not move. The combination of the non-scuffing aspect of the invention and the elimination of the spin-seal operation results in a clean, undeformed shell mouth which is capable of being reloaded many times in available existing hand-loading apparatus.

One solution to the problem of providing suitable plastic shotshells which can be easily reloaded includes inserting a simple operation in the shell-loading process after priming by which the mouth of the shell is profiled. The extreme mouth is reduced to approximately 0.012" thickness and the angle of the cutting is approximately 5½° on each side.

Although the above figures indicate preferred dimensions, further tests were made varying these dimensions and it appears that satisfactory results can be obtained with a mouth thickness of between about 0.010"-0.020" and a skive angle of between about 3°-10°.

The plastic material of the body 10 is one having the desired tensile strength and stiffness for normal handling and proper functioning in the firearm, and having the necessary flexibility to enable the closure to be folded. Suitable plastic materials for this purpose are linear polyethylene, copolymer of polyethylene, ethyl cellulose, cellulose acetate, and styrene butadiene acrylonitrile terpolymer. The body is preferably formed by extrusion and other suitable processing steps which develop adequate strength. Both its inner and outer surfaces may be smooth, or its outer surface may be provided with longitudinal ribs 16, as illustrated in the drawings.

The following discussion will relate to the closure means of Patent No. 3,055,302, one example of a crimping environment in which the present invention can be used.

The first operation in the closing of the body consists in producing a preliminary star crimp in the upper free end as shown in FIGURE 3, this operation being carried out by a star crimping tool (not shown). The star crimp formation consists of a plurality of equally spaced, outwardly-projecting, radial folds 17 having their fold lines perpendicular to the upper end edge 18 of the body, and having their triangular side walls connected along oblique fold lines to triangular segments 19 extending between the folds.

Having regard to the diameter of the body, the wall thickness, the minimum size of center hole best suited to the purpose of the invention, and the number of folds, experience has shown that the mouth thickness and the angle of taper of the skived portion are important considerations in the provision of a satisfactory closure. For example, in a case of a shotshell having an approximate outside diameter of 0.787", an approximate wall thickness of 0.030", and using the eight-fold closure of Patent No. 3,055,302, a mouth thickness of about 0.012" and a taper angle of about 5½° on each side has proved to be the most satisfactory dimensions, as explained above.

As fully explained in the prior patent mentioned above, a crimping tool is used to fold the end of the plastic shell into the eight-fold configuration shown in FIGURE 3. The folds are gradually deepened to the point where the folds of edge 18 come together at the apices of the segments 19 being formed between the folds. During the folding operation, the plastic material is cold-worked and as a consequence, the fold pattern becomes permanently established. The side walls of the folds 17 are brought together to form a series of radial rib formations projecting upwardly from the downwardly and inwardly inclined segment portions 19, the inner edges of the side walls of the folds formed from the edge 18 of the body being brought into substantially closed relation to form the wall of the center hole where they are in effect locked against opening movement. This results from a toggle action which takes place as the fold lines along the bases of the side walls of the folds, which are slightly longer than the upper fold lines, are forced below the dead center point.

FIGURES 8 and 9 show two other modifications whereby the shotshell mouth end is tapered to provide desirable closure characteristics. The modification of FIGURE 8 shows a shell having an outwardly tapered face 10a and an inwardly directed mouth end portion 10b. This profile is excellent for insertion into a cartridge loading machine dial and consistent puckering for closure. However, the inwardly directed mouth end portion 10b results in less effective obturation of the explosive gases than is found in the modifications of FIGURES 2 and 9.

The modification shown in FIGURE 9 offers better obturation but would cause difficulty in dial insertion during loading of the shell.

What is claimed is:

In a shotshell, a body comprising a tubular body of deformable thermoplastic material, said tubular body having an inner wall surface which is straight throughout the major portion of the length of said shotshell body, a star crimp formation body closure formed from an integral extension of the upper mouth end of said body, said body closure comprising a plurality of equally spaced, outwardly projecting, radial folds having their fold lines perpendicular to the upper end edge of the body, and having their triangular side walls connected along oblique fold lines to triangular segments extending between the folds, said radial fold lines lying in a substantially flat plane normal to the axis of said body, the edges of said folds defining a central hole, said body mouth end having a profiled inner wall face which is continuous with and upwardly and outwardly inclined from said straight inner wall surface, said profiled mouth end portion being adapted to facilitate folding of the closure and essentially eliminate objectionable scuffing of the shotshell mouth by explosively projected shot pellets, said tubular body having a mouth end thickness of not less than 0.010" to not more than about 0.020", the profiled inner wall face of the body mouth end being inclined at an angle of 3°-10° to a projection of said straight inner wall face.

5

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