

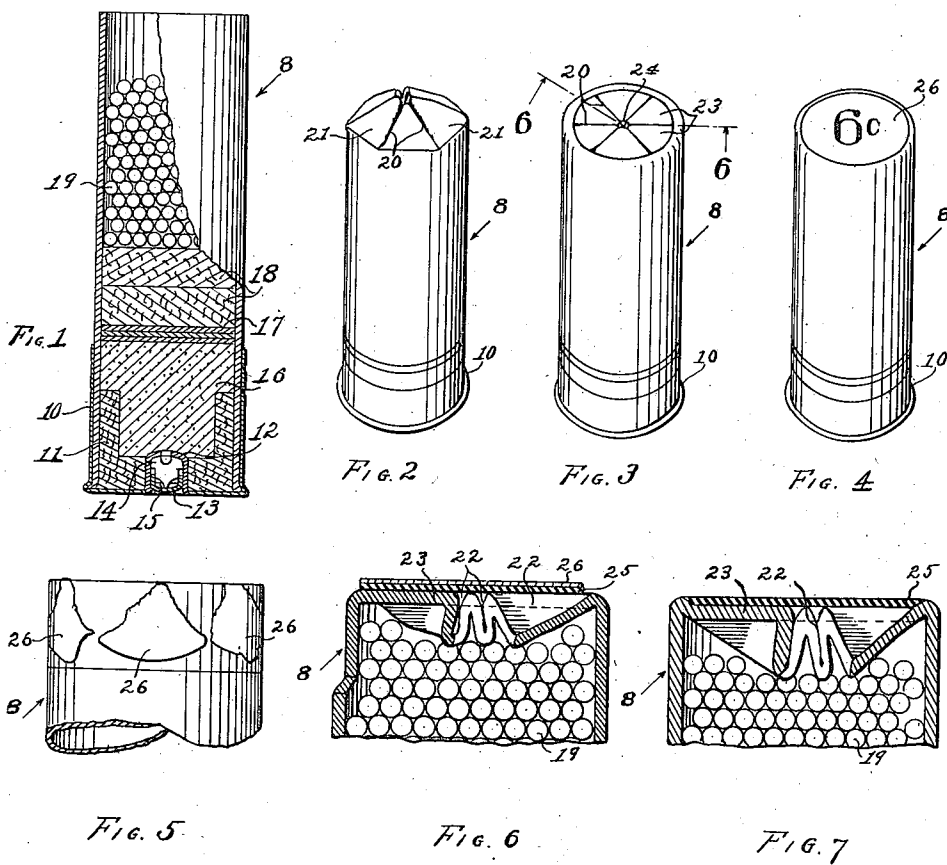
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AMMUNITION

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This invention relates to ammunition, particularly to shot shells, and contemplates improvements in the closing of the bodies of shot shells, in sealing the closure against the entrance of moisture, and in the control of firing and ballistics by the type and character of the body closure.

The invention is particularly adapted to shot shells having paper bodies, but in certain of its aspects is adaptable to bodies of other materials.

One object of the invention is to control the confinement and burning rate of the propellant powder by means of the body seal. An associated object is to provide a body seal which can be varied and adapted to the burning characteristics of different propellant powders in such a way as to secure the benefit of the maximum energy available in the combustion of the powder without the production of excessive pressure. By coordinating the body seal to the powder, the ballistic properties of powders hitherto regarded as inferior or unsuitable have been very greatly improved, and standard velocities have been secured with reduced charges of powder and without the production of excessive pressure.

A further object of the invention is to utilize the end portion of a cylindrical tube, usually a paper tube which constitutes the body of a shot shell, as an end closure, and to do this in a manner which not only eliminates the necessity for a separate end closure, usually called a "top wad," but actually improves the ballistic properties of the shell.

A further object of the invention is to provide a suitable means for sealing the ends of shot shell bodies, closed in the manner above-outlined or in any other desirable way, in such a manner as to control both pressure and ballistics by means of the seal.

A further object of the invention is to provide a sealing medium for the bodies of shot shells which is capable of proper adhesion and bonding to the waxed and ironed papers of which such bodies are constructed.

With these and other objects in view, the invention consists in the novel constructions, combinations and compositions hereinafter more fully described.

In the drawing:

Fig. 1 is a sectional elevation of a shot shell, primed, loaded, and ready for closing.

Fig. 2 is a perspective of such a shot shell body after it has been subjected to the first or preliminary closing operation in accordance with the invention.

Fig. 3 is a perspective of the body fully closed. Fig. 4 is a perspective of one form of finished shell, the end closure being covered by a sealing disk.

Fig. 5 is a fragmentary side elevation, showing the upper portion of the body of a fired shell, having segments of the sealing disk adhering thereto.

Fig. 6 is an enlarged, fragmentary, sectional elevation of a closed and sealed shell, the section being substantially on line 6—6 of Fig. 3. It will be noted that the sealing disk and its adhesive shown in Fig. 6 are not present in Fig. 3.

Fig. 7 is a modification, showing a different form of sealing means, the section line being similar to that used for Fig. 6.

As most clearly shown in Fig. 1, the shot shell comprises a body 8, a head 10 of a suitable material, preferably metal, within which head is contained a base wad 11, battery cup 12, primer cup 13, anvil 14, and a priming composition 15. When the head of the primer cup is struck by the firing pin and the priming composition thus ignited, the flame thereof ignites the charge of propellant powder 16, which powder is separated, by an "overpowder" wad 17 and one or more "filler" wads 18, from the shot charge 19. In the prior art a variety of devices have been used for closing the end of the shell body above the shot charge; very few of these devices have been successful. The universal commercial practice is to place a card or "top wad" on top of the shot charge, and then fold the upper half of the body stock above the top wad inwardly and downwardly 180°, its end resting on the top wad. Such a closure has a substantially fixed resistance to opening. No part of it can be varied to control pressure or ballistics. The properties of the body paper are fully determined by other considerations. Fragmentation of the top wad, resulting in a cloud of small "confetti" like bits which tend to obscure the target from the shooter, and in firing into the wind are blown back into the shooter's face, is obviously undesirable. On the other hand a heavy, hard, unbreakable top wad interferes with the movement of the shot and produces poor patterns.

It has been proposed hitherto to utilize the end portion of the body itself as a closure, but prior efforts along this line have been unsuccessful. While occasional good results were secured, they were not uniform or dependable. Variations from causes not entirely understood have resulted in lack of uniformity in shot pattern, and particularly in the frequent occurrence of

"blown" patterns. A "blown" pattern is one in which the shot scatter widely, comparatively few remaining within the normal area of shot spread.

The present invention contemplates closing the end of a shot shell with an end portion of the material of the body itself in a manner which, instead of producing "blown" patterns, effects an improvement in pattern, and may be correlated with such other components as powder and primer to effect loading economies and improved ballistics. In the portion of the body above the shot charge there are formed by an appropriate tool a number of creases 20 defining substantially triangular areas 21; the end of the body is thus drawn in to the frusto-conical form shown in Fig. 2. It is desirable, but not essential, that this operation precede the final closing operation. The body thus partly closed is then subjected to the action of a rotating die of such a configuration as to press the segments 20 into a plane, thus substantially completely closing the body with the flat segmental closure as illustrated in Fig. 3. This closure is preferably substantially in the plane of the end of the side wall. It has been found as a result of very exhaustive tests that it is definitely detrimental to indent the end closure to an appreciable extent. The efforts of the prior art to close shot shells with a portion of the body material have been substantially confined to displacing this material inwardly and downwardly to such an extent as to leave, above the transversely extending portion of the closure, a body rim of about the same height as the rim above the conventional top wad. Numerous tests of shot shells closed in this manner have been made, and ballistic defects, particularly "blown" patterns, were of frequent occurrence. Similar exhaustive tests of the closure above-described, in which the exterior surface of the closure is in or but slightly removed from the plane of the end of the body, have been quite free from "blown" patterns.

A section of the complete end closure is shown in Fig. 6. The creases identified as 20 in Fig. 2 have been completely closed and the adjacent material extends downwardly within the shell body as shown at 22; these folds separating segments 23, as seen in Fig. 3. A small aperture, or at least an unsealed juncture, remains at the center 24, and it becomes necessary to provide a seal therefor. It is likewise desirable to provide at the end of the shell a medium upon which may be printed or otherwise impressed such indicia as the size and character of the shot contained in the shell. The prior art discloses no means whatever for doing this, and the problem presents special difficulties by reason of the treatment of shell bodies. In American practice these bodies are invariably treated with a wax, which wax serves the dual purpose of preventing penetration of the body by moisture and preventing burning or charring of the body under the intense heat and violent motion of burning powder grains incident to firing. In the better quality of shot shells, the bodies are not only waxed but are additionally treated with such a waterproofing medium as China-wood oil. Moreover, the waxed bodies are brought to the proper exterior diameter by being forced through hard metal sizing dies. This results in a stock which is not only thoroughly impregnated with wax but is ironed very hard and smooth, so that ordinary bonding agents will not adhere to it. The present invention comprises the discovery of a

group of adhesives or sealing materials which can be made to adhere to shot shell body stock with such a tenacity that not only is the closure sealed against moisture but a definite and very substantial pressure is necessary to rupture the seal and permit the shot charge to move. Moreover, the adhesive and/or disk of material secured to the closure by the adhesive may be so selected as to require a predetermined pressure for the breaking of the seal, thus determining "confinement" of the powder charge and thereby controlling its burning characteristics. So far as applicants are aware this is the first time that the burning characteristics of propellant powder have been controlled by controlling the characteristics of the end seal of a shot shell body.

Outstanding among the adhesives usable for this purpose is a composition comprising a solution of rubber and/or a rubber like material in a wax or wax like material. The "rubber" may be any of a number of natural and artificial materials commonly so identified, and the rubber like material may be such an acrylic acid resin as butyl methacrylate or a solid aliphatic hydrocarbon produced by suitably polymerizing some of the unsaturated hydrocarbons produced in the cracking of petroleum, such for example as a polymer of isobutylene. The wax or wax like substance may include paraffin wax, beeswax, spermaceti, candillilla, carnauba, asphalt, and their natural or synthetic equivalents or mixtures thereof. A preferred composition comprises between 15% and 85% by weight of pale crepe rubber and 15% to 85% of 120° to 140° paraffin wax. A suitable amount of butyl methacrylate may be added, likewise a stabilizer, pigments, and vulcanization accelerators. It is preferably prepared by heating the wax to a temperature between 180° and 220° F. and adding the rubber in small fragments. The temperature is thereafter maintained at about 180° F. until the pieces of rubber are sufficiently softened to permit of disintegration by agitation. The composition is then agitated until the desired viscosity is secured, this viscosity being not less than 8000 seconds measured on a Scott viscometer at 90° C. Such a composition can be rolled into a self-sustaining film having considerable stretch and may be given a number of colors. It is thermoplastic, and when applied to the end of a shot shell under suitable heat adheres to the shell material with adequate and controllable tenacity. A suitable indicia, such as a shot size, may be impressed therein; preferably, however, a wax-rubber composition of suitable properties is first applied to one side of a disk of suitable paper, and such a disk is secured to the shot shell closure under heat. A shot shell sealed in this manner is illustrated in Fig. 6, the adhesive film being identified by numeral 25 and the disk of paper or other material which may be printed upon being identified by numeral 26. When such a shot shell is fired both the adhesive film and the paper are ruptured along the margins of the segments 23 and the closure itself straightens to substantially its original cylindrical form, the segments of the sealing disk adhering thereto, as illustrated in Fig. 5.

It will be obvious that by proper selection of paper or card 26 and adhesive 25 there can be secured any degree of "confinement" of the shell contents (including the propellant powder) up to the tensile strength of the body paper. An

accurate control of ballistics thus becomes possible.

While a wax-rubber composition of the type heretofore described is preferred, the invention comprises the discovery of other adhesive and sealing materials, usable either by themselves or in conjunction with a disk of paperlike material. These comprise a variety of thermo-plastic resins, such as the polyhydric alcohol esters of polybasic acids, the polymerized cumarones and indenones and mixtures thereof of which the composition known as "Nevendine" is an example, the reaction product of a terpene with maleic acid or anhydride, a polystyrene resin, chlorinated rubber, the phenol aldehydes and their derivatives, a toluene sulphonamid such as the composition commercially known as "Santolite," the natural resins, the polyvinyl esters, the polymerized unsaturated hydrocarbons, and the composition commercially known as "Mitchell Rand No. 35." With some of these resins the use of a plasticizer is desirable. As an adhesive, there are also available the water, alcohol or other fluid dispersions of casein-latex and the solvent dispersed cellulose esters and modifications and mixtures thereof.

It has also been found feasible to roughen the hard smooth surface of the closure by abrasion, and thereby secure the adhesion of sealing material which does not otherwise properly bond. Such abrasion in addition to roughening the surface, removes a substantial portion of such a waterproofing oil as may be contained therein, thereby facilitating penetration by the adhesive.

In another modification of the invention, the disk of paper or paperlike material may be omitted, and the strongly adherent body or sheet of wax-rubber or other suitable material constitute the entire seal. As heretofore indicated, such a seal may be variously colored and the desired indicia branded or otherwise impressed therein. When this is done, and even when a paper disk is used, it may be desirable to indent the closure slightly from the end of the cylindrical body, as indicated in Fig. 7. The sheet or body of sealing material either with or without a paper disk may substantially fill the indent.

These and other methods of affixing a sealing medium or a sealing medium and a paper-like disk to a shot shell closure which is formed from a portion of the body material are to be construed as falling within the scope of the appended claims, it being broadly new to seal a closure of this character in any manner. It is likewise broadly new to coordinate the closing and sealing of the body with the propellant powder in such a manner as to control the burning rate and pressure produced by powder combustion by means of the closure and sealing, and the claims to this aspect of the invention are likewise entitled to a broad construction.

In the claims, a "rubber-like material" means any natural or synthetic rubber or equivalent thereof as herein described; and a "wax-like material" means any of the natural waxes herein described or their natural or synthetic equivalents.

What is claimed is:

1. A shot shell comprising a substantially cylindrical body of deformable material and an exteriorly planar end closure integral with said body and flush with the end thereof, said closure comprising a plurality of abutting segments and folds joining said segments, said closure including the segments and folds being integral with said body.

2. A shot shell comprising a substantially cylindrical body of deformable material and an exteriorly planar end closure integral with said body and positioned at the end thereof, said closure comprising a plurality of abutting segments having margins and integral folds of said body material depending from the margins of said segments.

3. A shot shell comprising a substantially cylindrical body of deformable material and an exteriorly planar end closure integral with said body, positioned at the end thereof, and comprising a plurality of portions in the plane of the end closure and integral downwardly and inwardly extending folds of said body material joining the said portions.

4. In a shot shell, the combination comprising a substantially cylindrical body of wax impregnated deformable material and an exteriorly planar end closure integral with said body and flush with the end thereof, and comprising a plurality of abutting segments and folds joining said segments, said closure including the segments and folds being integral with said body, and a thermoplastic adhesive seal affixed to said planar end closure.

5. In a shot shell, the combination comprising a substantially cylindrical body of wax impregnated deformable material and an exteriorly planar end closure integral with said body and flush with the end thereof, and comprising a plurality of abutting segments and folds joining said segments, said closure including the segments and folds being integral with said body, and a seal for said closure including a wax-like material and a rubber-like material.

6. In a shot shell, the combination comprising a substantially cylindrical body of wax impregnated deformable material and an exteriorly planar end closure integral with said body and flush with the end thereof, and comprising a plurality of abutting segments and folds joining said segments, said closure including the segments and folds being integral with said body, and a seal for said closure including an adhesive containing a wax-like material, a rubber-like material and a stabilizer.

7. In a shot shell, the combination comprising a substantially cylindrical body of wax impregnated deformable material and an exteriorly planar end closure integral with said body and flush with the end thereof, and comprising a plurality of abutting segments and folds joining said segments, said closure including the segments and folds being integral with said body, and a seal for said closure including a wax, rubber, and a polymer of isobutylene.

8. In a shot shell, the combination comprising a substantially cylindrical body of wax impregnated deformable material and an exteriorly planar end closure integral with said body and flush with the end thereof, and comprising a plurality of abutting segments and folds joining said segments, said closure including the segments and folds being integral with said body, and a seal for said closure comprising a paper-like disk secured to said planar end closure by a thermoplastic adhesive.

9. In a shot shell, the combination comprising a substantially cylindrical body of wax impregnated deformable material and an exteriorly planar end closure integral with said body and flush with the end thereof, and comprising a plurality of abutting segments and folds joining said segments, said closure including the segments

and folds being integral with said body, and a seal for said closure comprising a paper-like disk secured to said planar end closure by an adhesive comprising 15% to 85% pale crepe rubber, 85% to 15% paraffin wax having a melting point between 120° and 140° F., and a stabilizer.

10. In a shot shell, the combination comprising a substantially cylindrical body of deformable material and an exteriorly planar end closure flush with the end of said body and comprising a plurality of segments and folds of said body material joining said segments, said folds diminishing in depth toward the periphery of said body and merging with the planar end thereof, and a seal for said closure comprising a disk of paper-like material of such size as to completely cover and extend beyond the outer ends of said folds, said disk of paper-like material being secured to said planar end closure by a thermoplastic adhesive.

11. In a shot shell, the combination comprising

a substantially cylindrical body of a wax impregnated fibrous material, an exteriorly substantially planar end closure of said fibrous material integral with said body and comprising abutting segments and inwardly and downwardly extending folds of said fibrous material joining said segments, and a sealing disk of paper-like material secured to said closure by a thermoplastic adhesive comprising a wax-like material and a rubber-like material.

12. A shot shell comprising a substantially cylindrical body of deformable material and an exteriorly planar end closure integral with said body and flush with the end thereof, said closure comprising a plurality of planar abutting segments located in the plane of the end closure and folds of said body material joining said abutting segments.

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