Sept. 25, 1962 C. E. MILLER ETAL 3,055,301

AMMUNITION

Filed March 13, 1961

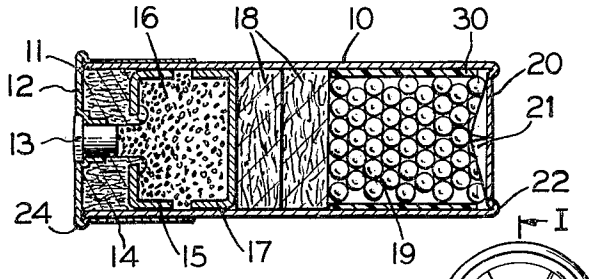


FIG - 1

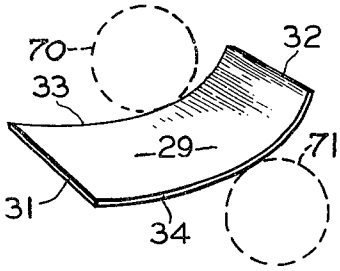


FIG - 2

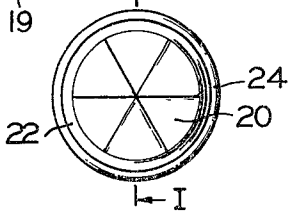


FIG - 6

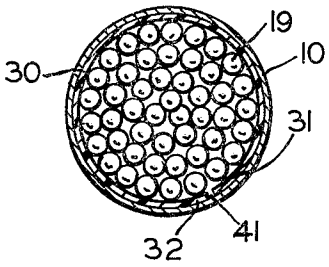


FIG - 3

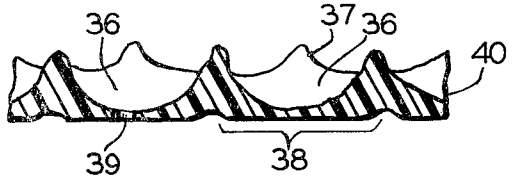


FIG - 5

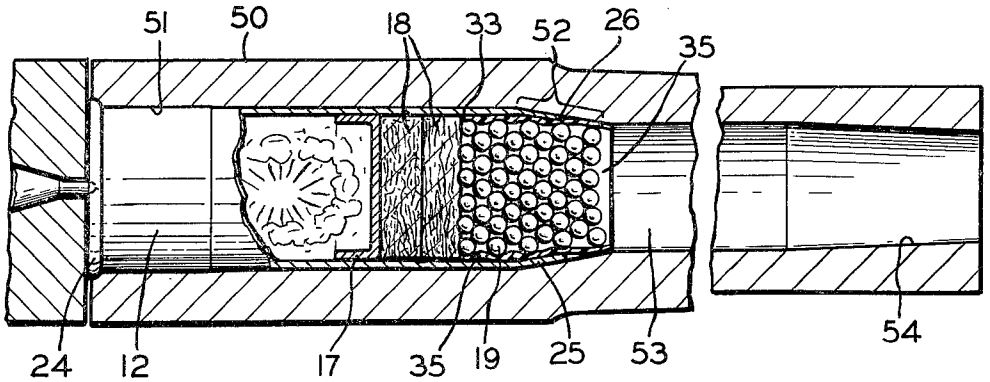


FIG - 4

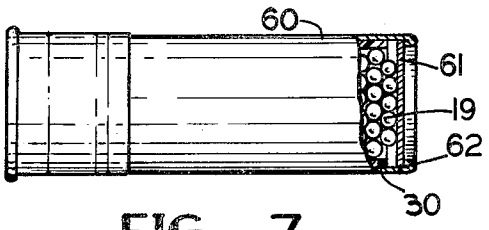


FIG - 7

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AMMUNITION

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This invention relates to ammunition and more specifically to new and improved cartridges for shotguns.

Shotgun shells, with a conventional brass-headed tubular paper case are well known. More recently, shell cases of light metal and of plastic have also been available. No matter what the tubing in which it is incased, a shot shell is a rather special container which must function not only for storing its charge including priming, wadding, powder and shot without deterioration, but also for initiating the powder and for projecting shot through an end closure. Despite firing, the case must not come apart, and the closure must be adapted not only to hold the charge with controlled confinement but also be adapted to open readily in a consistent manner when the powder is ignited to release the shot. Some shooters desire that the cartridge project the shot not only as a plurality of separated missiles, but also with a desirably tight pattern even at a long handicap range target. Some shooters then insist that the cartridges when spent be reloaded with components to the shooters own specifications. Each time such a shotgun cartridge is fired, it becomes desirable that the shot load continue to be projected with a desired pattern according to an acceptable degree of shot dispersion without too much lateral scattering of the shot and without too much longitudinal scattering to avoid giving too rarefied a string of shot. As a result, a shot shell is desirable wherein the fired case remains intact as long as possible and is reuseable as often as possible before any defect develops to prevent reuse.

The strength and flexibility inherent in laminated suitably treated paper for the cartridge side wall is promising for the purpose because it resists the tendency of the end of the shell being blown off, but the tendency of a paper tube to scuff and become internally frayed at the cartridge closure has been found to place considerable limitation on not only the reusability of the paper shell, but also on the pattern realized with each successive use of a shotshell.

Many factors bear upon durability and upon the kind of pattern given when a shotshell is fired. One factor is the hardness of the shot which produces an improvement in the pattern as the hardness increases. At the same time, increased hardness results in poorer durability. Another factor is the construction of the shotgun cartridge side wall made of a convolutely wound tube of paper impregnated and coated by a suitable material such as paraffin, microcrystalline wax and the like. The side wall thickness of such a tube is in the range of about 0.035 of an inch, and has the capacity to be folded to make a closure integral therewith and to unfold upon cartridge firing quite a number of times without the end at the closure being shot away. The paper side wall is firm enough to resist the tearing action of the shot much better than plastic can and is yieldable enough so as not to deform the shot excessively like metal.

Although an increase in the hardness of the shot has been found to affect the cartridge durability adversely despite a more effective improvement in pattern, and although inclusion of paper and fabric shot cups and bags of various types have been proposed in the past, but found ineffective for durability together with pattern improvement, it has been found according to this invention that the combination of a paper shotshell, shot and an intervening sleeve of special composition and construction results not only in the highest initial pattern improvement, but also in improvement in the durability of the shotgun cartridge case so that these can be reloaded and fired again and again and give a satisfactory pattern after the initial use. While this combination has been found to be generally effective, it is the particular combination of a certain type of sleeve forming a pad about the shot column that helps make the combination of advantage not only with standard soft shot but particularly with hard shot too and with other shell cases comparable to the paper case. In accordance with this invention, there is provided a shotgun cartridge having an axially or longitudinally slit fitted layer of shot-absorbing and self-lubricating material extending initially almost all the way axially down the length between the interior of the tubular side wall of the cartridge and the outer shot pellets of the load of shot. During shot acceleration and set-back, the layer is adapted to extend forwardly beyond the shot, but preferably not before firing.

The layer extends substantially over the shot column length in a single thickness of strip which is preferably press-fitted when loaded in the shot shell case to assume the form of a C-shaped band and thereby preferably prestressed to impart a bias giving the band a tendency to uncurl open out of its substantially closed ring shape as soon as it is free of the constraint of the shotgun bore. The band is a layer plastically deformable by shot indentation and formed from a strip of suitable synthetic plastic material of a sufficient length, thickness and stiffness for the purpose.

A layer of polyethylene or other similar olefinic polymer for the purpose is contemplated in the form of a band curled to a split-ring shape when constrained in combination with a shot shell case, especially of the type having an evanescent end closure and a self-sealing flanged gun wad as disclosed in United States Patent No. 2,582,124 and No. 2,582,125.

A suitably tough grade of polyethylene or any equivalent unctuous olefinic polymer or co-polymer is contemplated in a thickness of not much less than about the radius of the indentation of the smallest shot used, i.e., not much less than about 0.025 of an inch, but not more than about the thickness of the heaviest paper shell side wall i.e., not more than about 0.040 of an inch. This forms a plastically indentable pad movable with the shot and therefore forms part of the projectile load until ejection from the shotgun muzzle. During passage of the projectile load, the outer shot becomes absorbed partially by not only plastically indenting the layer but also by extruding parts of it up between them as the acceleration is applied to the load in the bore. Exteriorly of the barrel, the shot and the collar become free of each other.

The polyethylene should be at least 0.015 of an inch thick and preferably around 0.025 of an inch.

The plastic takes the form of a suitable length of a rectangular strip bent round and with its extremities in abutment in order to fit snugly within the standard cartridge cavity as a seamed collar, but having sufficient "memory" characteristics so as to tend gently to uncoil free from the shot column upon emergence from the muzzle. The extremities must neither overlap nor be joined. The length must not interfere with contiguity of the shot and the evanescent end closure.

Other suitable resinous materials are compounds of polyvinyl chloride, ethyl cellulose, cellulose acetate, polyethylene terephthalate and the like, if lubricated and if of a suitable grade for the purpose. At the aforenoted thickness, a collar of solid polyethylene having a sufficient Shore durometer hardness of from about 50 to about 75 and preferably about 65, measured on the "C"

scale, is contemplated to offer the necessary degree of deformability, lubricity, and curlback without having undesired resilience.

By this invention, paper shot shells are provided with a shot collar to advantage as compared to prior shot "containers."

Therefore, one object of this invention is to provide a novel shotgun cartridge which gives an excellent shot pattern and the case of which lasts such a long time so that it can be reused as many as five or more times.

Another object is to provide a paper cartridge case arrangement which will better resist side wall deterioration and tube wash adjacent the shot column and end closure without adversely affecting the pattern. Still another object is to provide a shot shell having a novel shot band in combination with other features of the shell. These and other objects may be more completely understood from the following description of specific embodiments of the invention when taken with the accompanying drawing in which:

FIGURE 1 is an elevational view in longitudinal cross section of one embodiment of a shell according to one embodiment of the invention;

FIGURE 2 is a perspective view of the shot encircling member of FIGURE 1 before assembly in the cartridge;

FIGURE 3 is a cross-sectional view taken transversely of the cartridge of FIGURE 1 through its shot column;

FIGURE 4 is a longitudinal cross-sectional view of the cartridge of FIGURE 1 shown firing in a typical shotgun barrel;

FIGURE 5 is an enlarged fragmentary view in cross-section taken through part of a collar member retrieved after firing showing what has happened;

FIGURE 6 is a front end view of the whole cartridge showing how the view of FIGURE 1 was taken particularly through the evanescent end closure on line I—I; and

FIGURE 7 is an elevational view partly in cross section of another embodiment of the invention using another type of evanescent end closure in a cartridge like that disclosed in U.S. Patent No. 2,582,125.

In FIGURE 1, a laminated paper tube **10** is staked in a cup-shaped metallic head **12** with the aid of base wad **14** compressed into the head sufficiently to press the end **11** of the side wall into extractor rim **24** of the head. Head **12** and wad **24** are orificed for the reception of the primer **13** for the charge of powder **16** disposed between the flanged overlay wad **15** and the over-powder wad **17**. The cavity of the cartridge case is charged next to wad **17** with one or more compressible occupying wads **18** compressed snugly against the tubular side wall **10**. Against the peripheral edge of wad **18**, there is forcefully inserted a strip **29** of the type shown in FIGURE 2 after being coiled up. This is stress-fitted against tube **10** to form preshaped band **30** as shown in FIGURE 3 with a pair of opposite extremities **31** and **32** in coplanar juxtaposition or abutment as shown at **41**.

The dimension of strip **29** between the leading and trailing edges **33** and **34** is sufficient to extend over nearly all of the length or height of the shot column **19**.

At the end of the tube opposite the head **12**, there is an evanescent closure **20** formed of contiguous circular sectors folded in pie-cut crimps **21** forming tapering reentrant folds all folded in around the shell at **22**.

When the cartridge is fired in the chamber **51** of a shotgun barrel **50** shown in FIGURE 4, collar **30** acts as a tubular pad or mat **35** upon and in which the column of shot **19** slides out of the shot shell and the barrel. At the shell, interference is avoided with the opened closure **25** with its trailing edge **26** protruding inwardly from the forcing cone **52**, the constrictions of the closure edge **26** and the cone **52**; it is also avoided with the whole length of the barrel bore **53**, and finally the choke constriction **54**. The shot impressed mat **35** also blocks the shot pellets in place in the moving column while minimizing impact.

The greatest impact occurs during acceleration shown in FIGURE 4 and when the shot **19**, still encircled by the band to form the impressed mat **35**, and the driving wads **17** and **18** are encountering the constrictions. As a result of the axial setback in the shot column, mat **35** is subjected to great pressure acting radially between it and the outer shot, and to a pressure acting axially between the shot bearing on the mat and the wad **18** bearing on the edge **33** of the mat. Because of this action during acceleration, mat **35**, axially foreshortened a bit originally, projects in front of the column and is permanently indented by the outer shot of the column **19** as shown in FIGURE 5 and as evidenced by the occurrence of the depressions **36** and the extruded peaks **37**. It is believed the plastic deformation produced creates a much smaller inward residual pressure on the shot column radially than that produced by the elastic action coming from pure resilience of an elastic band such as a mere rubber band. The resulting forward projection is evanescent but occurs at the right time and helps make for a further reduction of disrupting forces on the column during interior ballistics. Forward projection either in the shell before firing or during exterior ballistics is not desired.

By this invention it is possible to raise the average pattern level at the 30-inch test circle by a figure of 5% and even as much as about 10% at a range of both 40 and 60 yards using extra hard shot. Where at 40 yards paper shells of the aforenoted patents have given improved average patterns as high as from about 67%–74%, the present shells give average patterns as high as about 73.4%–78%. Because the mat **35** stays with the column of shot during interior ballistics, a general reduction in leading of the barrel is observed. The improved results are also noted with the laminated paper tube case, the polyethylene shot band and extra hard shot (lead with 6% antimony) assembled as shown in FIGURE 1, giving average patterns as high as 80%–82%.

The recovery character of strip **29** may be varied in the band **30** by providing it in the form of a flat piece or one with a natural curvature as shown in FIGURE 2. A further adjustment may be made by curling the strip either in the direction of curvature as shown at **70** or away from it as shown at **71**. In any event, only enough restoration is desired to give the band a tendency to open outwardly and avoid fluttering against the shot column or excessive spring snap.

Compression and distribution of the mat **35** creates shot sockets **36** and also extensive bearing areas **38** on the outer side of the mat at each shot instead of mere points of extremely high pressure. At these areas, the surface of the mat becomes heated during passage of the load to enhance the unctuous character of the plastic. Because plastic rather than elastic deformation is relied upon, the peak force at the areas **38** is high, but because of the increased areas of contact, the pressure reacting on the shot is reduced and the tendency to snap the outer shot inwardly to cause disruption of the shot in the column is greatly avoided. As shown in FIGURE 5, the spent mat has assumed the more flattened shape of the indented and sprung strip **40**. In this condition it is unlike strip **29** of FIGURE 2 by the presence of indentations **36**, the extruded peaks **37**, and the occasional occurrence of a pin hole **39**, the latter being indicative of utilization of the ultimate plastic deformation available through the thickness of the strip and avoidance of the band **35** acting as a foreign body disruptive to the shot arrangement.

The combination described herein has been found to be particularly advantageous in combination with the shotshell arrangement having end closures of the folded-in integral type shown and the self-sealing flanged wad. Advantages are realized, however, with this arrangement having other types of evanescent closures (FIGURE 7) such as where the edge of sidewall **60** is rolled in to form

a crimp 62 holding a top wad 61 of the readily frangible type.

It will be understood by those skilled in the art that the foregoing is a description of embodiments now being preferred but that further changes and modifications may be made without departing from the spirit and scope of this invention as is set forth in the appended claims.

What is claimed is:

1. A shotshell comprising in combination a paper tube, a metallic head secured to said paper tube, a column of shot and a powder charge disposed within the tube, an over-powder wad arrangement including a filler wad and a flanged wad positioned between the powder charge and the column of shot, a normally flat, resinous, plastic strip disposed in said tube to form a substantially annular open-ended collar having opposed unjoined extremities defining a parting slit, said collar being constrained by said tube to develop a spring action, said slit extending from edge to edge of said collar, said collar being curled immediately adjacent the interior of the tube about the shot column and in frictional contact with the interior of the tube and having a tendency to uncurl by virtue of said spring action, and a closure for said shotshell integral with said tube in overlaying contiguity with said column and overlaying said collar, said flanged wad being effective in response to activation of the powder charge to drive said shot column and said collar with obturation as a package through said closure, said package being effective to open said closure whereby the shot column and collar package are operative to proceed along and emerge from a shotgun barrel as a unit, said collar by virtue of said slit and said tendency to uncurl, being further operative to separate from said column without disruption of said column after emergence from said barrel.

2. A shotshell comprising in combination a paper tube having an integral closure, a metallic head secured to said paper tube, a column of shot and a powder charge disposed within the tube, an over-powder wad means including a filler wad portion and a flanged wad portion positioned between the powder charge and the column of shot, a polyolefinic collar disposed in said tube to create a substantially annular portion terminating in a leading edge defining a collar opening at said closure and having opposed unjoined extremities defining a slit, said collar being constrained by said tube to develop a spring action, said slit extending from edge to edge of said collar, said collar being curled immediately adjacent the interior of the tube about the shot column and in frictional contact with the interior of the tube and having a tendency to uncurl by virtue of said spring action, said integral closure overlaying said column of shot and said collar, said flanged wad portion being effective in response to activation of the powder charge to drive said column and said collar with obturation as a package through said closure, said package being effective to open said closure whereby the shot column and collar package are operative to proceed along and emerge from a shotgun barrel as a unit, said collar by virtue of said slit and said tendency to uncurl, being further operative to separate from said column without disruption of said column after emergence from said barrel.

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UNITED STATES PATENTS

2,759,420	Schultz	Aug. 21, 1956
2,897,758	Miller et al.	Aug. 4, 1959