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(54) SHOTGUN SHELLS FROM NATURAL PLANT FIBERS

(57) Hulls for shotgun shells are formed of natural plant fibers such as from bagasse, bamboo, banana, and palm. Such hulls can be used in combination with conventional bases to form shotgun shells. The hulls of these shells, once used, will decompose to natural plant debris should they end up in a suitably moist environment. Some hulls are formed integral with the base, the entirety being made of natural plant fibers. Optionally, these include a brass band.

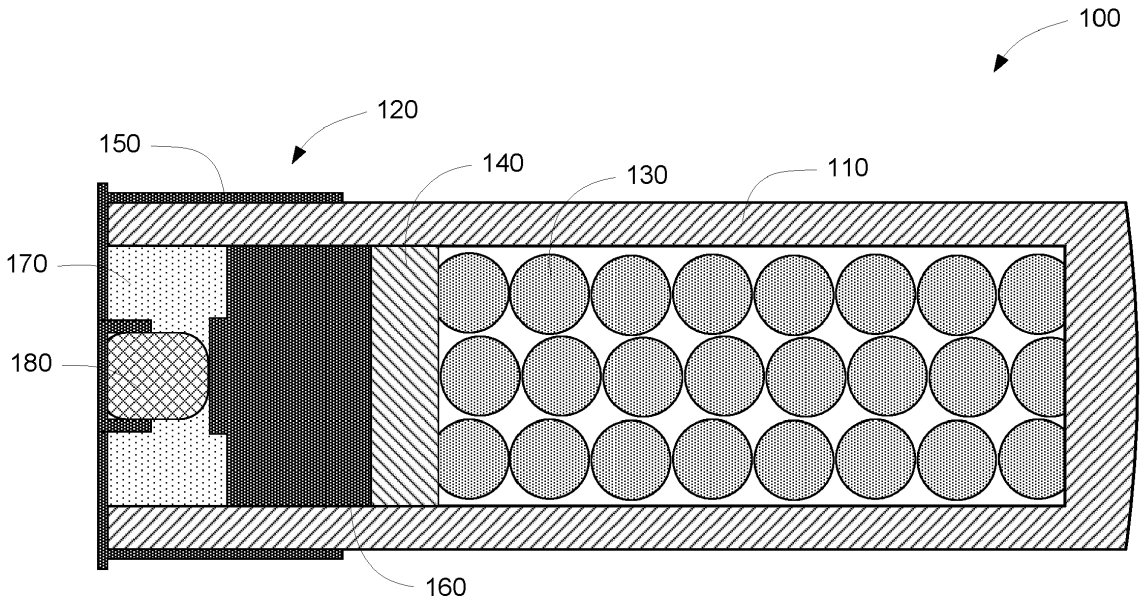

FIG. 1

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Description

BACKGROUND

Field of the Invention

[0001] The invention is in the field of firearms and more particularly in the field of shotgun ammunition.

Related Art

[0002] Shotgun shells (or shotshells or shotgun cartridges) hold a number of pellets, or shot, that are propelled from the barrel of a shotgun when fired. FIG. 1 illustrates an exemplary shotgun shell 100 in cross-section. The shotgun shell 100 comprises a cylindrical hull 110 joined to a cylindrical base 120. The hull 110 is loaded with shot 130 and a wad 140. The base 120 includes a head 150, propellant 160, a base wad 170, and a primer 180. The propellant 160 can also extend into the hull 110. The hull 110 and base 120 are both sized to fit within a particular shotgun chamber, that is, both have the same outside diameter which is slightly less than the inside diameter of the shotgun chamber into which they must fit easily but without much excess space.

[0003] The hull 110 is typically made from a petroleum-based plastic while the base 120 includes brass. In some designs, the hull 110 is manufactured from wood pulp-based paper that is coated with a wax coating to prevent the paper from absorbing moisture and swelling. The waxed paper is wound to form a cylinder. While paper hulls 110 are water resistant due to the wax, they are not waterproof. Accordingly, petroleum-based plastics generally have replaced paper as the preferred material for hulls 110 in order to avoid the problem of not being waterproof.

[0004] In some prior art shotgun shells 100, the head 150 is a short cylinder with a capped end, and the end with the cap includes a circumferential lip that retains the shotgun shell 100 at the end of the shotgun's chamber. The base wad 170 is a ringshaped component that holds the primer 180 in its center and fits into the head 150 such that the primer 180 is held in position. At one time base wads 170 were made from horsehair. The primer 180 is a pre-manufactured component comprising a small, cylindrical metal can filled with a shock-sensitive explosive. The primer 180 is press fit into a circular opening in the capped end of the head 150.

[0005] The shot 130 comprises a number of equally sized balls of a high-density material such as lead, tungsten, or bismuth. The wad 140 separates the shot 130 from the propellant 160 to prevent the shot 130 and propellant 160 from mixing, and keeps the propellant 160 packed tightly in place. The wad 140 also helps prevent the gas generated by the burning propellant 160 from blowing through the shot 140 rather than propelling it. It will be appreciated that shotgun shells 100 commonly include additional optional components, such as multiple wads, that have been omitted here for greater clarity.

[0006] The head 150 is typically made of brass, or steel that has been brass plated. For some shotgun shells 100, both the head 150 and the hull 110 are one integral brass piece, while the hull 110 and head 150 in other shotgun shells 100 are integrally made of plastic. In a variation of the all-plastic shell 100, a brass ring is cast into the head 150 to provide strength. The length of the head 150 along the length of the shotgun shell 100 can vary.

[0007] In a typical method of manufacturing a shotgun shell 100, the base 120 is partially assembled with the base wad 170 and primer 180 secured in the head 150. An end of the hull 110 is fit inside of the head 150 and the two are adhered together. With plastic or paper hulls 110, the overlapping region of the hull 110 and head 150 is heated to soften or melt the plastic or wax coating which then sticks to the inside of the head 150 upon cooling. Next, the propellant 160, wad 140, and shot 130 are added through the open end of the hull 110 and tamped down. Finally, the open end of the hull 110 is crimped to seal it.

SUMMARY

[0008] The invention is defined in claims 1, 5 and 10, respectively. Particular embodiments are set out in the dependent claims.

An exemplary shotgun shell hull of the present invention comprises a cylinder made of a natural plant fiber and sized to fit a shotgun chamber, the cylinder crimped at one end. Exemplary natural plant fibers include bagasse from the production of sugarcane, leaf fibers like banana and palm, and bamboo fibers. Exemplary shotgun shells of the present invention comprise a hull as just described adhered to a cylindrical head formed of brass or brass-coated steel and including a primer. When the shotgun shell is loaded, the head and hull includes a propellant and shot.

[0009] Other exemplary shotgun shells of the present invention comprise a cylindrical hull including a natural plant fiber and sized to fit a shotgun chamber, the hull crimped at one end, and a cylindrical head, integral with the hull and also including the natural plant fiber, the head including a primer. In various embodiments the head further comprises a brass or brass-coated steel band.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a cross-sectional view of a shotgun shell of the prior art and of embodiments of the present invention.

DETAILED DESCRIPTION

[0011] The present invention is directed to hulls 110 for shotgun shells 100, to shotgun shells 100 including such hulls 110, and to methods for manufacturing the same. Hulls 110 of the present invention are made of a natural plant fiber and optionally include some brass, but

do not include plastics, or do not include petroleum-based plastics, or do not include petroleum-based plastics or bioplastics. As such, shotgun shells of the present invention that might end up in ecologically sensitive areas like estuaries and marshes will degrade over time to natural organic debris, and optionally a small amount of brass. Shotgun shells 100 with hulls 110 made of petroleum-based plastics do not decay. Havens et al. (US 9,528,800) discloses a plastic wad made specifically of a bioplastic, polyhydroxyalkanoate, that decays to "benign monomers and oligomers." While these may be benign, they are still plastics, or the precursors thereof. Additionally, as a wad of polyhydroxyalkanoate begins to decay, the wad is first reduced to smaller pieces of plastic that can be consumed by wildlife.

[0012] Natural plant fibers, as used herein, expressly excludes plastics, including petroleumbased plastics and bioplastics, and also excludes papers made from wood pulp. Natural plant fibers are expressly limited to seed fibers, fruit fibers, stalk fibers, leaf fibers, and bast fibers. Particular examples of natural plant fibers include bagasse from the production of sugarcane, leaf fibers like banana and palm, and bamboo fibers.

[0013] The natural plant fibers are molded into cylinders of appropriate wall thickness and diameter using sufficient heat and pressure. The hulls 110 are sized as appropriate for conventional shotgun shells 100 to fit conventional shotguns. A release agent, such as cotton oil or tung oil can be used. The resulting cylinders can be trimmed to the desired length for a hull 110, or continuous lengths can be produced and cut into segments of appropriate length. Hulls 110 are optionally formed by mixing the natural plant fibers with a biodegradable binder such as any commonly available plant-based starch or equivalents thereof as disclosed in Lehmann (US 2018/0014668 published on January 8, 2018) which is incorporated herein by reference. Finished hulls 110 can be coated with a biopolymer such as biopolyethylene, also known as renewable polyethylene, polyethylene (PE) or polylactide (PLA) or a waterproof coating such as PVB resin as disclosed in Jiang (WO 1999050151 A1 published on October 7, 1999) which is also incorporated herein by reference.

[0014] In some embodiments of the invention both the hull 110 and the head 150 are integral and therefore both formed as one piece from natural plant fibers. In embodiments made without brass, the head 150 is molded to include a circumferential lip that retains the shotgun shell 100 at the end of the shotgun's chamber. In those embodiments in which the hull 110 and head 150 are integral, the primer 180 will always include a small amount of metal so that the firing pin has something to strike. Other embodiments include a brass band, as generally illustrated by FIG. 1. In some of these embodiments, the brass band includes the circumferential lip, while in other embodiments the brass band is a simple cylinder and the circumferential lip is molded from the natural plant fiber as part of the head 150.

[0015] Hulls 110 of the present invention can be made, for example, by mixing a natural plant fiber, or a combination of natural plant fibers from different sources, with a binder. The mixture is injected into a mold around a mandrel and cured. After release from the mold the hulls 110 can be coated and dried. Shotgun shells 100 can be assembled from the hulls 110 in the manner described above. It will be appreciated that the finished hulls 110 of the present invention include actual fibers of the natural plant fibers, and this is distinguished from plastic hulls 110 made from a plastic derived from natural plant fiber through a process that eliminates those fibers to yield an anisotropic material.

[0016] The embodiments discussed herein are illustrative of the present invention. As these embodiments of the present invention are described with reference to illustrations, various modifications or adaptations of the methods and or specific structures described may become apparent to those skilled in the art. All such modifications, adaptations, or variations that rely upon the teachings of the present invention, and through which these teachings have advanced the art, are considered to be within the spirit and scope of the present invention. Hence, these descriptions and drawings should not be considered in a limiting sense, as it is understood that the present invention is in no way limited to only the embodiments illustrated.

Claims

1. A shotgun shell hull comprising:
   a cylinder comprising a natural plant fiber and sized to fit a shotgun chamber, the cylinder crimped at one end.

2. The shotgun shell hull of claim 1, wherein the natural plant fiber comprises bagasse.

3. The shotgun shell hull of claim 1, wherein the natural plant fiber comprises a leaf fiber.

4. The shotgun shell hull of claim 1, wherein the natural plant fiber comprises bamboo fiber.

5. A shotgun shell comprising:

   a cylindrical hull including a natural plant fiber and sized to fit a shotgun chamber, the hull crimped at one end; and
   a cylindrical head formed of brass or brass-coated steel and including a primer, the hull being adhered to the head.

6. The shotgun shell of claim 5, wherein the head and hull include a propellant and shot.

7. The shotgun shell of claim 5 or 6, wherein the natural

plant fiber comprises bagasse.

8. The shotgun shell of claim 5 or 6, wherein the natural plant fiber comprises a leaf fiber.

9. The shotgun shell of claim 5 or 6, wherein the natural plant fiber comprises bamboo fiber.

10. A shotgun shell comprising:

a cylindrical hull including a natural plant fiber and sized to fit a shotgun chamber, the hull crimped at one end; and
a cylindrical head, integral with the hull and also including the natural plant fiber, the head including a primer.

11. The shotgun shell of claim 10, wherein the head and hull include a propellant and shot.

12. The shotgun shell of claim 10 or 11, wherein the natural plant fiber comprises bagasse.

13. The shotgun shell of claim 10 or 11, wherein the natural plant fiber comprises a leaf fiber.

14. The shotgun shell of claim 10 or 11, wherein the natural plant fiber comprises bamboo fiber.

15. The shotgun shell of any of claims 10 to 14, wherein the head further comprises a brass or brass-coated steel band.

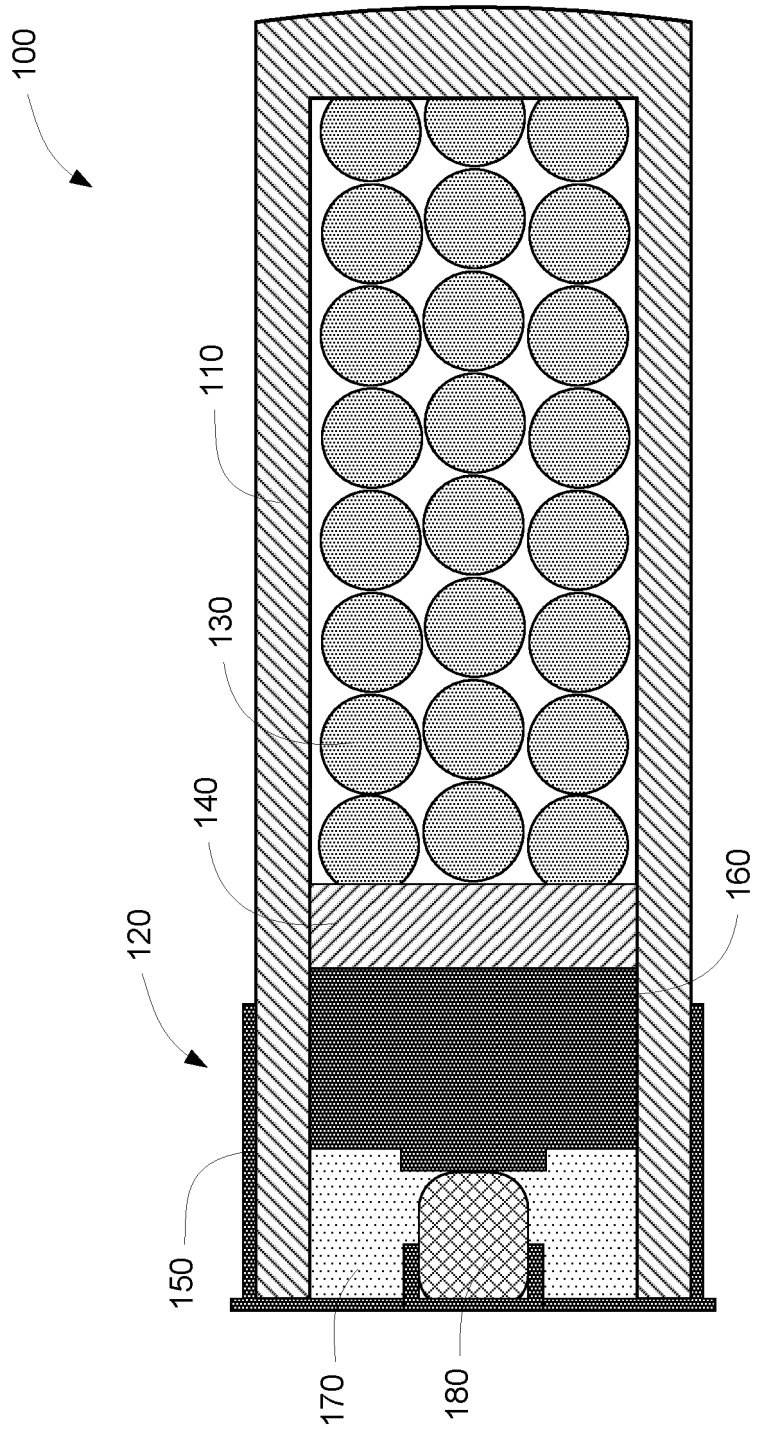

FIG. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 20 17 2878

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 144 008 A5 (GEVELOT SA) 9 February 1973 (1973-02-09) * page 3, line 15; claim 1; figure 1 *	1-9	INV. F42B5/26
Y	GB 751 686 A (GEVELOT S A) 4 July 1956 (1956-07-04) * page 1, line 56; claim 1; figure 2 *	10-15	
Y	EP 2 078 921 A2 (FRANCE CHEDDITE [FR]) 15 July 2009 (2009-07-15) * claim 4 *	10-15	
Y	US 2014/060372 A1 (PADGETT CHARLES [US]) 6 March 2014 (2014-03-06) * paragraphs [0142], [0146]; figure 18 *	15	
X	DE 35 535 C (MARIE PAUL EMILE GERARD) 6 October 1885 (1885-10-06) * claim 1 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

F42B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 September 2020	Beaufumé, Cédric

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 17 2878

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- US 20180014668 A, Lehmann **[0013]**
- WO 1999050151 A1, Jiang **[0013]**