MOLDING PROCESS AND MOLDED ARTICLE

Watson H. Woodford, Bridgeport, Conn., assignor to Remington Arms Company, Inc., a corporation of Delaware

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This invention relates to the molding of articles from fibrous pulp, and will be described with particular reference to wads for shot shells, although its novelty and utility are not limited to these particular articles.

Shot shell wads are of at least three distinct types, each type serving a particular purpose in the shot shell. The “base” wad, which is a wad of very substantial thickness in comparison with its diameter, is provided with a central aperture and pressed into the base of the shell opposite the metallic heads and therein and between such head and the battery cup. Its primary function is to effect a seal between the interior of the shell and the joint between shell body and head, thereby preventing the escape of powder gases. A suitable charge of powder is placed upon the base wad, and upon the powder is located an “overpowder” wad usually of a type of paper of a thickness of the order of 1/4" to 1/3". The overpowder wad is comparatively dense and non-resilient. Upon the overpowder wad are placed one or more “filler” wads usually of some type of hair felt. These wads are much more resilient than the overpowder wad and are designed to be pressed into close engagement with the bore of the shot gun, thereby effectually preventing the escape of powder gases around their peripheries into the shot charge. The edges of the filler wads are lubricated with such a substance as stearine, chiefly for the purpose of providing a lubricated surface on the gun bore and preventing abrasion of the shot and consequent “leading” of the bore. The lubricant must substantially penetrate the periphery of the wad, in order to prevent its complete removal in the cone of “choke bored” barrels, and consequent leading beyond this point.

The present invention is directed primarily to filler wads, although it likewise contemplates overpowder wads and base wads of essentially the same construction and made by processes substantially similar to those practiced in the production of filler wads.

One object of the present invention is to provide a process for the individual molding of shot shell wads from a suspension of the wad forming materials in a fluid medium.

A further object of the invention is to control the characteristics and quality of the wads by suitable regulation of the concentration of the wad forming materials in the fluid medium.

A further object contemplates the development of a process of wad forming which includes the utilization of large quantities of scrap material resulting from the manufacture of filler wads as hitherto practiced.

The invention further contemplates the accurate control of the density and other physical characteristics of wads by the accurate regulation of the quantity of material entering into each wad.

The invention further contemplates wads and other articles molded from materials of a fibrous character in such a manner as to prevent the laying of the fibres in plane substantially parallel to the wad surfaces and the consequent tendency of the wads to split into thin sheets.

The invention further contemplates wads having an improved capacity for absorbing a lubricant and retaining such lubricant under temperatures above its melting point.

With these and other objects in view the invention consists in the novel articles and methods of their production to be hereinafter more fully described.

In the drawing:

Fig. 1 is a fragmentary sectional elevation of one form of apparatus used in the practice of the novel processes of the present invention. This Fig. 1 showing of the apparatus is somewhat diagrammatic.

Fig. 2 is a fragmentary sectional elevation, partly in section, of a part of the apparatus shown in Fig. 1, positioned beneath the wad forming compression plungers.

Fig. 3 is a view similar to Fig. 2, showing the wad in the mold after compression by the plunger.

Fig. 4 is a fragmentary sectional elevation of a mold and plunger adapted to produce an apertured wad.

Fig. 5 is a perspective of a filler wad.

Fig. 6 is a perspective of an apertured wad as formed in the mold shown in Fig. 4.

Fig. 7 is a fragmentary side elevation of a slightly modified form of mold charging tube and adjacent part of the mold.

Fig. 8 is a sectional elevation of a wad produced by the apparatus of Fig. 7.

The wad forming materials utilized in the present invention may be any suitable granular or fibrous materials capable of suspension in water or other suitable fluid medium. Preferably, the wad forming composition is a mixture of a relatively coarse fibrous material, such as hair, with a relatively fine and partially hydrated material, preferably wood pulp, and a somewhat granular filler material, such as sawdust. Any of these materials, or mixtures of any two or all three of them, in varying percentages produce
wads of excellent properties for one or more of the three purposes hereinbefore mentioned. A suitable composition for filler wads comprises hair in proportions varying between 40% and
90%, sawdust in an amount of 10% to 25%, and wood pulp in an amount of 5% to 100%. The hair may be derived from scrap felt, a large amount of such scrap resulting from the cutting of hair felt wads for firing sheets. Approximately 35% of such sheets is scrap, and it has been impracticable to rework this scrap into other sheets. The wood pulp may be either sulphite pulp stock or scrap newsprint paper.

A typical composition for filler wads comprises 20% sawdust, 60% scrap felt, and 20% newsprint or sulphite pulp.

A typical composition for over-powder wads comprises 20% scrap felt or other fibre, such as jute fibre, 40% sawdust, and 40% newspaper.

A typical base wad comprises about 40% sawdust and 60% newspaper or sulphite pulp.

The process for forming wads from such materials as follows:

The scrap felt and news print paper or sulphite pulp or wood disintegrated, are introduced with the desired amount of sawdust into a suitable tank or container a part of which is identified by the numeral 10 in Fig. 1. The sulphite pulp or newspaper is disintegrated by mechanical working to a sufficient extent, but not to a point where it loses its fibrous character or the individual fibres become highly hydrated or gelatinous. It is essential that the fibrous character of the pulp be maintained in order to avoid such cohesion between the fibres as would result in a rigid, non-resilient article. The suspension of the wad materials in the tank is maintained at a fairly low concentration, and is agitated by suitable means to maintain all portions thereof at the desired concentration. Concentrations up to 10% are permissible, but a concentration of the order of 1% is preferable.

Suitable means are provided for withdrawing measured portions of the suspension of wad forming materials from the tank and introducing them into a wad forming mold. For this purpose, the tank may be provided with any desired number of tubes extending through the bottom of the tank and upward to a point well above the top of the pulp suspension, indicated by dotted line 12. Surrounding each tube 11 is a measuring cup 13 of suitable construction and connected with suitable devices for its elevation from the position within the pulp suspension, shown in full lines in Fig. 1, to a position adjacent the top of the tube 11, as shown in dotted lines in Fig. 1. As each cup 13 is elevated to the dotted line position its contents are discharged into the tube 11 and fall through said tube and a suitable connecting tube or sleeve 14 into a mold 15. Each mold 15 is fixed in a diam plate 16 supported above and closely adjacent to a fixed bed plate 17.

For the production of wads of the order of ½ʺ to ¾ʺ in thickness, mold 15 preferably has a height of about 3ʺ. Both ends of the mold wall are solid, while its intermediate portion is provided with suitably proportioned drainage perforations so that the slots 20 of the mold 15 are arranged to fit inside of its associated mold 15 and to be drawn slowly upwardly as the pulp suspension settles in the mold. The time occupied in withdrawing the sawdust 14 varies from 2 to 5 seconds, depending on the particular composition used.

Each mold 15 when in position to receive a charge of wad forming materials through the tube 11 is aligned with a perforated bushing 18 in the bed plate 17. The perforations 18 of said bushing provide a lumen for the pulp suspension fluid, while the slots 20 of the mold 15 provide a lateral drainage. The sleeve 14 is provided primarily for the purpose of preventing the escape of too large a quantity of wad forming materials all through the slots 20 before it has had an opportunity to settle, and said sleeve 14 is withdrawn at such a rate that only a very small quantity of the pulp escapes through or enters the slots 20.

The charge for a typical wad comprises 80 c.c. of the pulp suspension, which consists of substantially 70 c.c. of water and 1 c.c. of pulp. Before and during the withdrawal of the sleeve 14 about 10 c.c. of the fluid escapes through the bottom drainage perforations 19 and about 55 c.c. escapes through the lateral drainage perforations or slots 20. Of the remaining 10 c.c. of fluid, 9 c.c. is expelled in the pressing operation which will now described.

The molds 15 being thus charged with accurately measured quantities of wad forming pulp the dial plate 16 is indexed to a position in which the molds 15 are positioned beneath a set of wad forming plungers 21 (Fig. 2). The molds 15 are again aligned with perforated bushings in the bed plate 17, which bushings are substantially similar to the bushings already mentioned. The plungers 21 are now lowered, compressing the pulp and expelling about 90% of the remaining fluid through both the drainage slots 20 and the apertures 18, the downward movement of the plungers being stopped at a distance from the bottom of the molds corresponding to the desired thickness of the wad. If desired, an upward vertical drainage, as well as a downward vertical drainage, may be provided by the use of perforations 22 in the heads of plungers 21, as clearly shown in Fig. 3.

It has been found that the combination of lateral drainage through the slots 20 with downward vertical drainage through the bottom apertures 18 and, if desired, an upward vertical drainage through the apertures 22, is effective to prevent the laying of the fibres in planes parallel to the wad surfaces, and the resultant lamination or cleavage along such planes which characterizes practically all products hitherto made from molded fibrous pulp. The paper wads hitherto used, particularly as over-powder wads, are very highly laminated and upon firing of the shell they split into thin sheets which scatter about, obscuring the shooter's view of the results of the shot. A similar characteristic is possessed by all prior articles of molded fibrous pulp. While solid articles have been molded from pulp which has been beaten and hydrated to such an extent that the fibres are disintegrated or gelatinized until their fibrous character is lost and under compression they adhere and form a substantially rigid, non-resilient and non-fibrous article, the present invention is believed to constitute the first process of molding fibrous articles of substantial thickness showing no cleavage. This result is moreover achieved without binder whatever. Ordinary hair felt wads contain a very substantial percentage of a binder, yet the wads of this invention, with no binder at all, show a far greater resistance to tearing parallel to their faces than hair felt wads containing large quantities of binder.

Apparently three factors are involved in the
securing of wads of substantial thickness which are resilient, porous enough to take a lubricant, and show no clearance which is liable to be a cause of leakage. The first factor is the presence of a substantial amount of granular material, of which sawdust has been given as an example. It is a familiar fact in the manufacture of paper and pulp articles generally that in the formation of sheets, a fluid suspension of fibrous material is made. Further, all the fibres are laid in planes perpendicular to the direction of drainage. Due to the presence of numerous granules, the regular laying of the fibres is broken up, and a substantial portion of the fibres assume irregular, transverse or diagonal positions, in which they serve to bind the sheet transversely.

The second factor in preventing the parallel laying of the fibres which results in transverse cleavage is the large and controlled lateral drainage. Only about 35% of the fluid escapes through the face of the wad, and of this about half is pressed out after the wad material has become so concentrated as to prevent free movement of the fibres. The remaining 75% or more of the fluid escapes through the lateral drainage apertures. Thus, each wad may be considered as a fluid suspension that is agitated and compressed. The third factor is the application of pressure to the wad faces. A large portion of the fibres being arranged substantially perpendicular to the wad faces, this pressure is applied to them endwise, and results in diagonal displacement, curling and crinkling, which completes their felting into such a tangled mass as to prevent any tendency to cleavage.

A wad having concave faces, as illustrated in Fig. 5, may be formed by introducing the charge of pulp suspension into the mold 15 in such a way that it acquires a whirling motion, and removing the sleeve 14 while the suspension is still in motion. One means of accomplishing this result is illustrated in Fig. 5 in which the opening 12 of the tube 11 and sleeve 14 is adjacent one wall of said sleeve. The pulp of the suspension settles while it is being urged outwardly by the centrifugal action of the whirling suspension, and a wad with concave faces results even though a more or less uniform suspension of material is pressed into a predetermined thickness. Greater uniformity in ballistics of shells, as well as superior lubrication and the absence of deterioration due to the escape of lubricant, are thus secured.

The embodiments of the invention and the processes herein are typical and illustrative only, the invention being susceptible to practice in other ways and by means of other apparatus, all falling within the scope of the appended claims.

What is claimed is:

1. The method of making a shot shell wad which comprises the placing of a measured quantity of a fluid suspension of wad forming material in a tubular mold provided with lateral drainage perforations and an imperforate sleeve, and the removal of said sleeve at a rate determined by the rate of settling of said wad material in said mold.

2. The method of making shot shell wads from a suitable mixture of fibrous and granular materials which comprises forming suitably sized pieces of the said materials in a fluid of low concentration, the charging of measured quantities of said suspension into a mold provided with vertical drainage apertures and lateral drainage apertures shielded by an imperforate sleeve during charging, the withdrawal of said sleeve as the wad forming material settles in said mold, and the subsequent compression of said material to form a wad.

3. The method of making a wad having a thick peripheral flange and a thin center which comprises charging a measured quantity of a suspension of wad forming materials into a mold in such a manner as to cause the suspension to revolve in said mold.

4. The method of making a wad having a thick peripheral flange and a thin center which comprises charging a measured quantity of a suspension of wad forming materials into a mold in such a manner as to cause the suspension to revolve in said mold, and subsequently compressing said material under a die.
ing of said shield at a rate determined by the rate of settling of the wad forming materials in the suspension.

6. In the molding of fibrous pulp, the method of controlling the laying of the pulp fibres to form a non-laminated article of substantial thickness which comprises the charging of a measured quantity of a pulp suspension into a mold provided with lateral and vertical drainage apertures, and the shielding of the vertical drainage apertures during the charging operation.

7. In the manufacture of shot shell wads, the method which comprises molding from a fluid suspension of a mixture of fibrous and granular materials, and varying the amount of lateral drainage during the molding operation.

8. In the manufacture of shot shell wads, the method which comprises molding from a fluid suspension of fibre containing material under fixed axial drainage and variable lateral drainage.

9. In the manufacture of shot shell wads, the method which comprises molding from a fluid suspension of a mixture of long fibres, short fibres, and a granular material, under fixed drainage in one direction and variable drainage in another direction.

10. In the manufacture of shot shell wads, the method which comprises molding from a fluid suspension of a mixture of fibrous materials and a granular filler material under conditions of fixed axial drainage and a lateral drainage controlled to enable partial settling of the suspended materials prior to exposure to lateral drainage.

11. In the manufacture of shot shell wads comprising fibrous materials, the method of felting the fibres into a resilient, coherent, un laminated structure which comprises molding a fluid suspension of said fibrous materials and a granular material while providing a fixed drainage in one direction and controlling drainage in another direction so as to permit partial settling of the suspended materials before draining in said second direction.

12. In the manufacture of shot shell wads comprising fibrous materials, the method of felting the fibres into a resilient, coherent, un laminated structure which comprises molding a fluid suspension of said fibrous materials and a granular material while providing a fixed drainage in one direction and controlling drainage in another direction so as to permit partial settling of the suspended materials before draining in said second direction, the amount of controlled drainage substantially exceeding the amount of fixed drainage.

13. In the manufacture of shot shell wads comprising fibrous materials, the method of felting the fibres into a resilient, coherent, un laminated structure which comprises molding a fluid suspension of said fibrous materials while providing a limited fixed axial drainage and a substantially greater variable lateral drainage, and subsequently compacting and additionally felting said materials by axial pressure.

14. In the manufacture of shot shell wads, the method which comprises introducing into a mold a charge of a fluid suspension of fibrous materials, draining a portion of the fluid axially from said mold during the settling of the charge, releasing the supernatant liquid laterally from said mold, and compressing the charge.

15. In the manufacture of shot shell wads, the method which comprises introducing into a mold a charge of a fluid suspension of fibrous materials, a mixture of fibrous and granular materials, allowing a settling of said charge in said mold, releasing the supernatant liquid laterally from said mold, and compressing the charge.

16. In the individual molding of shot shell wads, the method which comprises the addition to a fluid suspension of fibres of from 10% to 40% of sawdust, and the molding of the fiber sawdust mixture into shot shell wads which are coherent in use.

17. A coherent gun wad molded from a water-laid mass of a fibrous mixture including hair, wood pulp and sawdust, the sawdust constituting 10% to 40% of the wad according to its intended use.

18. A coherent gun wad molded from a water-laid mass of a fiber mixture including hair, wood pulp and sawdust, wherein the fibrous content varies from 45% upward and the sawdust content varies from 10% to 40% according to the intended use of the wad.

19. A coherent gun wad molded from a water-laid mass of a fiber mixture including hair, wood pulp and sawdust, in the following proportions: hair, 20% to 90%; wood pulp, 10% to 60%; sawdust, 10% to 40%.

20. A coherent gun wad molded from a water-laid mass of a mixture of a fibrous material and sawdust, the sawdust being present in an amount between 10% and 40% depending upon the intended use of the wad.

WATSON H. WOODFORD.