March 30, 1937. W. H. WOODFORD 2,075,386

AMMUNITION

Filed May 10, 1933

Fig. 1

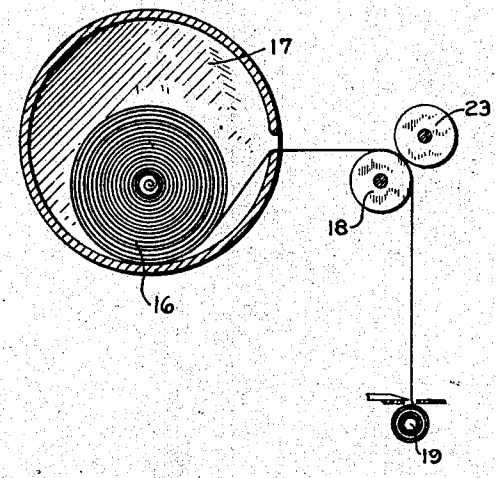


Fig. 2

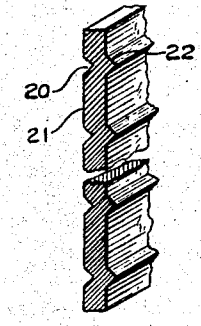


Fig. 3

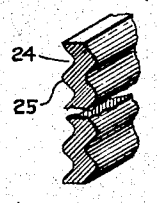


Fig. 4

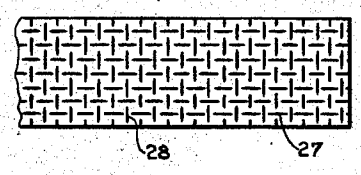


Fig. 6

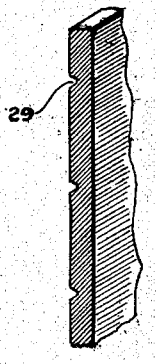


Fig. 7

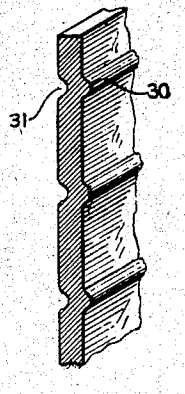


Fig. 9

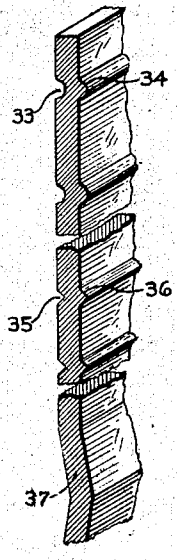


Fig. 8

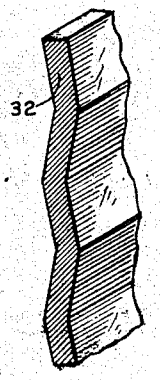
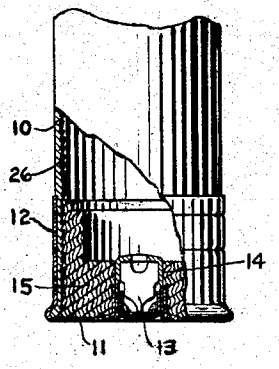


Fig. 5



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UNITED STATES PATENT OFFICE

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Application May 10, 1933, Serial No. 670,385

12 Claims. (Cl. 102—16)

This invention relates to the manufacture of articles comprising superposed layers or a sheet of strip material in which the superposed layers adhere to each other in such a manner as to form a substantially coherent article.

The invention will be described with particular reference to the manufacture of base wads of shot shells, although it is to be understood that its utility is not limited to this specialized field.

The base wad of a paper bodied shot shell has the function of filling the space surrounding the powder igniting means ordinarily contained in a battery cup projecting inwardly a substantial distance from the metal head, and the further function of forming a gas tight seal between the metal head and the paper body. In the firing of such shells, pressures of the order of 9,000 pounds per square inch are produced, and it is obviously of the utmost importance that the paper body and the metal head be sealed together with a gas tight joint. The securing of a proper joint has always been a difficult matter, and failures at this point are not uncommon. Base wads are ordinarily, if not universally, made from a rolled strip of paper of a suitable quality. Such a strip is rolled and inserted in the paper body, after which the metal head is placed on the body and the three parts joined together by the application to the rolled paper wad blank of a pressure of such magnitude as to very materially deform the paper, compacting it into a coherent wad and pressing it into firm and close engagement with the paper shell body. This construction of wads presents the disadvantage that in deforming the wad blank the paper is crushed and the fibers may be separated in such a manner as to produce a point or line of weakness. Such points of weakness in the interior of the wad body are in no way indicated on the exposed surfaces. When the shell is fired they are entered and further opened by the high pressure gases, frequently admitting these gases entirely through the wad to the paper body and thereby causing gas leaks and split and torn bodies.

It is an object of this invention to treat the paper or other strip material from which the wad blank is made in such a manner as to provide regular and definite points or lines of weakened resistance to deformation, so that when the wad forming pressure is applied to the blank it will be regularly and symmetrically deformed and its plies interlocked, instead of being torn or broken.

In the drawing:

Fig. 1 is a diagrammatic sectional elevation of one form of apparatus used in the practice of the invention.

Fig. 2 is a fragmentary perspective, greatly enlarged, of the strip material treated in accordance with the present invention and prior to the application of deforming pressure.

Fig. 3 is a similar fragmentary perspective of the strip after the application of the wad forming pressure.

Fig. 4 is a side elevation of a section of strip treated in accordance with a slight modification of the invention.

Fig. 5 is an enlarged fragmentary elevation, partly in section, of a shot shell comprising a base wad made in accordance with the invention.

Figs. 6, 7, 8 and 9, are respectively fragmentary perspectives of paper strip treated in accordance with different methods of practicing the invention.

Referring first to Fig. 5, numeral 10 identifies the paper body of a shot shell provided with a head 11 of brass or other suitable metal, which head comprises a cylindrical flange 12 surrounding the end section of the paper body 10. Numeral 13 indicates generally the powder ignition means, contained in a battery cup 14. Numeral 15 is applied to the base wad, which has a gas tight engagement with the battery cup, head and shell body. The contour of the upper surface of the wad may vary greatly, the contour shown being merely a typical one. In the making of the blank from which the wad 15 is to be formed, a roll 16 of suitable paper may be supported in a container 17 from which it passes over a guide roll 18 and is wound on a mandrel 19.

As heretofore stated, the present invention contemplates forming in the paper strip, prior or as an incident to the winding operation, a series of definite points or lines of weakened resistance to deformation. In the preferred form of the invention the sections of weakened resistance are a series of lines parallel to the edges of the strip. These lines may be formed by the displacement of a comparatively small fraction of the stock of the strip, or may include substantially the entire stock. A fragmentary section on one form of strip is shown in Fig. 2. A series of slight indentations 20 separated by relatively wide undeformed spaces 21 have been made in one face of the strip. Opposite the indentations 20 the strip presents slight projections 22. Such indentations may be formed in a variety of ways, the preferred method comprising the use of a roll 23, which roll is provided with a series of V-shaped ridges. The strip, while suitably supported, is caused to pass this roll at

any convenient stage in the manufacture of the strip itself or in the feeding of the strip to the winding mandrel 19. When a strip comprising such indentations 20 and projections 22 is wound, the projections 22 of one layer are opposite the indentations 20 of the adjacent layer and tend to interlock therewith.

In the pressing of a wad from such a blank the depth of the blank is greatly reduced, the greatest depth of the wad being of the order of two-thirds of the depth of the blank. In the deformation of a wad blank wound from paper strip marked as shown in Fig. 2, there are formed from the indentations 20 a regular series of grooves 24 separated by ridges 25, as illustrated in Fig. 3. The flat spaces between adjacent indentations have disappeared and the entire lateral surface of the wad and each convolution of the strip forming the wad is a series of alternate grooves and ridges. The grooves and ridges of each convolution interlock with those of adjacent convolutions, forming a gas tight article, as shown in Fig. 5. Similarly, the ridges of the outer wrap or convolution of the wad interlock with the paper of the shell body, actually deforming the shell body to a certain extent and forming a tight joint therewith. By thus providing for a regular and controlled deformation of the blank under the wad forming pressure the tearing and fiber separation, occurring when the blank consists of a plain sheet, is eliminated, and an impervious and gas tight article is formed. The sealing of the wad to the shell body is enhanced by the provision on the inner wall of the shell body of a surface comprising grooves or alternating ridges and grooves. As illustrated in Fig. 5, said surface is formed into a series of angularly disposed teeth 26, such teeth sloping away from the shell head. Under the wad forming pressure the outer portion of the wad material is pressed into interlocking engagement with these teeth, its deformation into contact with the teeth being facilitated by the simultaneous formation of ridges and grooves on the wad and following the lines of weakened resistance heretofore described.

Any desirable arrangement of the lines or points of weakened resistance to deformation may be used, the particular arrangement of parallel lines shown in Fig. 2 being merely typical. Thus, Fig. 4 illustrates a section of a strip in which the points of weakened resistance to deformation are sections 27 and 28 of longitudinal and transverse lines. Such a pattern may be formed by pressing the strip, prior to winding, against a wire screen of suitable mesh. Wads formed from a strip thus marked have shown very desirable interlocking between adjacent layers of paper and a substantial elimination of fiber separation under the wad forming pressure.

Other arrangements of parallel lines are shown in Figs. 6, 7 and 8. Fig. 6 illustrates a strip comprising indentations 29 which are deeper and more widely spaced than those shown in Fig. 2. During the forming of these indentations the strip is supported against a hard surface so that the side opposite the indentations remains flat. A similar strip supported upon a grooved surface during the making of the indentations is shown in Fig. 7. The stock is projected outwardly at 30 opposite each indentation 31 in the same manner as in Fig. 2 but the indentations are deeper and more widely spaced. Fig. 8 illustrates a strip 32 which has been treated by applying to its opposite faces rollers comprising relatively staggered ridges. Substantially the entire stock of the strip is displaced, forming a series of undulations or corrugations. It is obvious that numerous other patterns may be used.

Since different parts of the wad blank are deformed to different extents, the wad shown in Fig. 5 comprising a center section which is pressed to approximately one-half the depth of the circumferential section, it may be desirable to provide different types and/or arrangements of lines or points of weakened resistance at different transverse sections of the wad forming strip. Any desirable combination of the methods of treating the strip may be used, in accordance with the particular contour of the wad which is desired. An illustrative arrangement is shown in Fig. 9, in which the part of the strip adjacent one edge is provided with lines of weakness comprising indentations 33 and oppositely extending projections 34 of substantially the same character and spacing as those shown in Fig. 7. The central section of the strip comprises indentations 35 and opposite projections 36 generally similar in character and spacing to those illustrated in Fig. 2; while the third section 37 of the strip is corrugated in a manner similar to the strip shown in Fig. 8. It is obviously practicable to provide other types of lines or points of weakness and to combine these in many ways for the purpose of adapting them to stock of different character to be formed into wads of varying contour.

In actual practice the wads constructed in accordance with this invention have been found to be much more impervious to the powder gases and to substantially eliminate shell failures due to cracks in the wad or failure of the wad to seal properly with the shell body.

Since the present invention comprises the first discovery both of the advantages of providing base wad forming material with lines or points of reduced resistance to deformation and of interlocking any base wad with the shell body by providing such body with a roughened surface, the appended claims are to be broadly construed.

What is claimed is:

1. In the manufacture of articles comprising a plurality of superposed layers of sheet or strip material, the method which comprises forming on the sheet or strip a series of shallow indentations, superposing sections of the sheet or strip with the indentations of each section substantially registering with the indentations of adjacent sections, and applying deforming pressure to the surface formed by the edges of the superposed sections while the article is confined; whereby at the indentations there are formed a series of grooves separated by ridges, the grooves and ridges of adjacent layers interlocking to form a substantially coherent article.

2. In the manufacture of articles comprising a plurality of superposed layers of sheet or strip material, the method which comprises initiating the deformation of localized areas on the sheet or strip, superposing sections of the sheet or strip with the lines of deformation of each section substantially registering with the lines of deformation of adjacent sections, and applying deforming pressure to the surface formed by the edges of the superposed sections while the article is confined; thereby forming symmetrical surfaces which interlock to form a substantially coherent article.

3. In the manufacture of articles comprising wound sheet or strip material, the method which comprises initiating the deformation of localized areas on the sheet or strip, winding the sheet

or strip with the lines of deformation of each wrap substantially registering with the lines of deformation of adjacent wraps, and applying deforming pressure to the edges of the wraps while the article is confined, thereby forming on each wrap a symmetrical pattern of surfaces which interlock with the surfaces of adjacent wraps to form a substantially coherent article.

4. In the manufacture of shot shells, the method of making a base wad which comprises the formation of a symmetrical pattern of lines or points of deformation on a strip material, winding wad blanks from said strip material, inserting said blanks in shell bodies, and applying deforming pressure to said wad blanks, whereby interlocking surfaces are formed from said lines or points of deformation, said interlocking surfaces forming a coherent wad and sealing said wad to the shell body.

5. A shot shell comprising a paper body provided on its inner surface with a series of ridges and grooves, said ridges being inclined away from the head of said shot shell.

6. A shot shell comprising a paper body provided on its inner surface with a series of ridges and grooves, and a base wad comprising a regular series of ridges and grooves adapted to interlock with the ridges and grooves of said shell body.

7. In the manufacture of shot shell base wads from rolled strip material, the method which comprises forming on the strip a plurality of shallow indentations, and subsequently forming a series of grooves from said indentations by applying deforming pressure to the edges of the strip.

8. In the manufacture of shot shell base wads by compressing a blank rolled from strip material, the method which comprises forming on the strip material a plurality of points of reduced resistance to deformation, the spacing of said points varying in different transverse sections of said strip, and subsequently deforming said strip material in a pattern determined by said points by applying pressure to the edges thereof.

9. In the manufacture of shot shells, the method which comprises forming on the inside surface of the shell body a plurality of indentations, forming a base wad blank adapted to be deformed by pressure, and pressing the peripheral portion of said base wad blank into interlocking engagement with the indentations on said shell body.

10. In the manufacture of shot shell base wads, the method which comprises forming on strip material a symmetrical pattern of points of reduced resistance to deformation, superposing portions of the strip thus prepared to form a wad blank, and subsequently deforming said wad blank by applying pressure to the faces thereof formed by the edges of said strip.

11. In the manufacture of shot shell base wads by compressing a blank rolled from strip material, the method which comprises initiating the deformation of localized areas of the strip, superposing portions of the strip thus prepared to form a blank, and subsequently deforming said blank in a pattern determined by the initial deformation of the strip by applying pressure to the edges thereof.

12. In the manufacture of shot shells, the method which comprises the formation on a strip of wad forming material of localized areas of reduced resistance to deformation, winding a wad blank from the strip thus prepared, roughening the inside surface of the shell body by forming thereon a plurality of spaced projections separated by indentations, inserting said wad blank into said shell body, and deforming said wad blank at said points of reduced resistance to form projections interlocking with the indentations on said shell body.

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