June 27, 1944. C. R. JOHNSON ET AL 2,352,549

END CLOSURE FOR EXPLOSIVE CARTRIDGES

Original Filed March 9, 1939 2 Sheets-Sheet 1

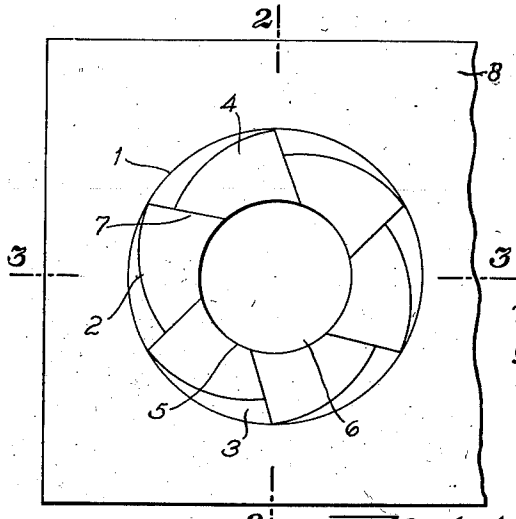


Fig. 1

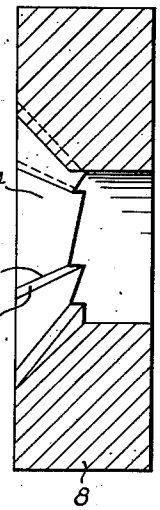


Fig. 2

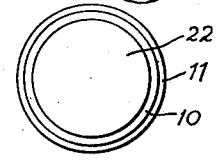


Fig. 5

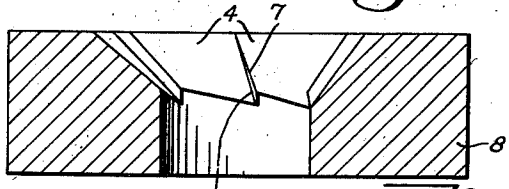


Fig. 3

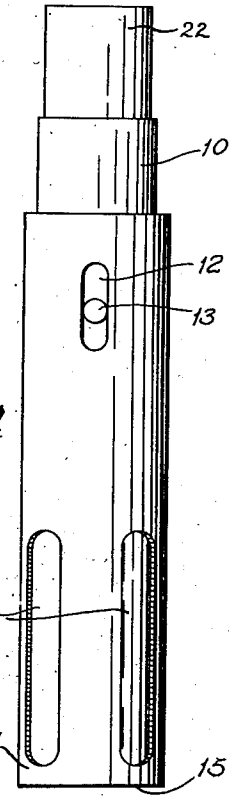


Fig. 4

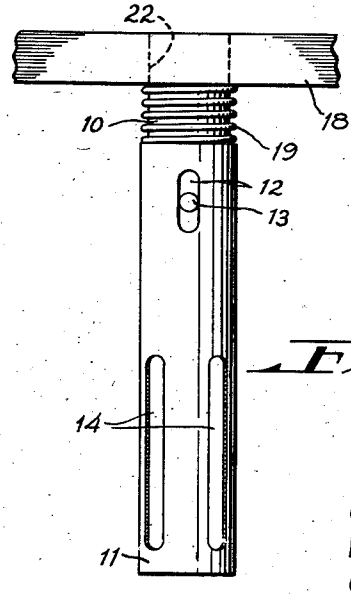


Fig. 6

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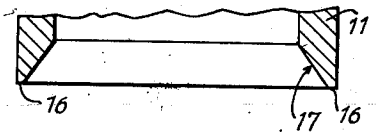
BY Thos. A. Wilson

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END CLOSURE FOR EXPLOSIVE CARTRIDGES

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Fig. 10



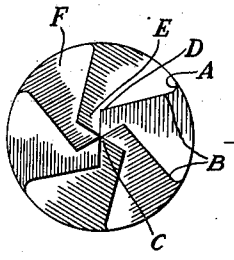
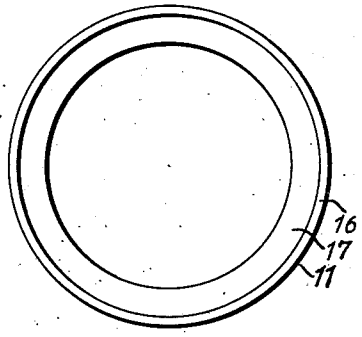


Fig. 7

Fig. 11



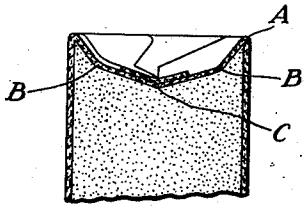


Fig. 8

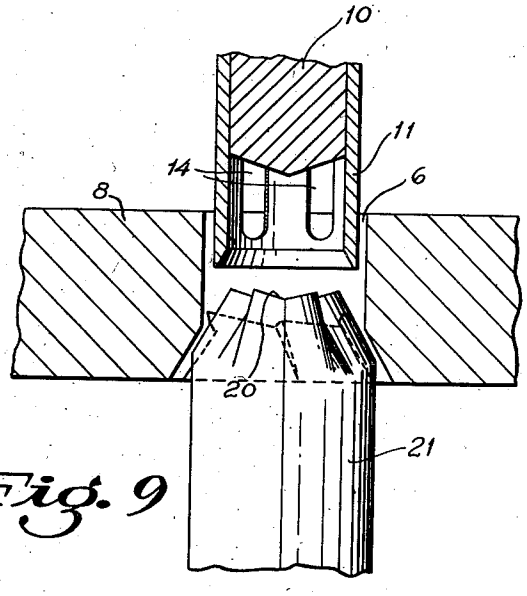


Fig. 9

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2,352,549

END CLOSURE FOR EXPLOSIVE CARTRIDGES

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Original application March 9, 1939, Serial No. 260,694. Divided and this application January 2, 1941, Serial No. 372,742

4 Claims. (Cl. 86—39)

The present invention relates to a new and improved end closure for explosive cartridges and to a method and apparatus for producing the same.

This application is a division of U. S. application Serial No. 260,694, filed March 9, 1939, now Patent Number 2,326,310, dated August 10, 1943.

The various types of end closures for dynamite cartridges and the like, known heretofore, have been characterized by numerous imperfections and disadvantages. No closure has been found to be satisfactory for all types of blasting explosives. In particular, conventional end closures have been found to be unsuitable for certain low density explosive compositions. Difficulty has been met in handling the loaded shells, because of the tendency of the loaded shell to spring open, permitting ingress of water and often occasioning a loss of some of the explosive charge.

The object of the present invention is the production of an improved shell closure by a facile method. Another object is a method and apparatus which permit efficient formation of a closure of increased mechanical strength. A further object is a device adapted to produce improved interlocking folds in the shell material. Additional objects will be disclosed as our invention is disclosed more fully hereinafter.

The foregoing objects are accomplished by the use of apparatus of novel design to produce an improved closure of depressed interlocking folds, in accordance with the method herein described. In order that the invention may be understood more clearly, reference is made to the accompanying drawings which illustrate a specific embodiment of our invention without limiting the scope thereof.

Referring generally to the various figures, Figure 1 is a plan view partly in perspective and partly in cross-section of a member adapted to restrict the shell wall and to form folds at spaced intervals therein. Figures 2 and 3 are vertical views in cross-section on the lines 3—3 and 2—2, respectively, of Figure 1. A vertical view in perspective of a tamping means adapted for use in conjunction with the folding member is shown in Figure 4, whereas Figure 5 is a plan view of the top of said tamping means. A preferred embodiment showing the tamping member in position is illustrated in Figure 6. Figure 7 is an end view of the closure. Figure 8 is a sectional view of the improved crimp or closure produced on the end of the shell. Figure 9 is a view of the device in operation on a dynamite shell. Figure 10 is an enlarged side view in cross-section of the base of the sleeve of the tamping member, while Figure 11 is a plan view of the base of said sleeve.

Similar numerals refer to similar parts throughout the several views.

Referring more specifically to Figure 1, which is a cross-sectional view from the side of the folder member 8 which first engages the dynamite shell, and to Figures 2 and 3, which are vertical views in cross-section on the lines 3—3 and 2—2, respectively, of Figure 1, the numeral 1 denotes the circumeference on which lie the outermost points of the working surface. Said folder device may be constructed of wood, synthetic resins, non-sparking metal, and the like. The surface 3 between said circumference and the curved lines 2 is flat or even and does not enter into the operation of folding the shell. Starting with the curved lines 2, the surfaces 4 slope downward and inward in the manner of the inner surface of a cone, viewed from its base toward the tip. The angle of inclination in the present embodiment is 45° with respect to the horizontal axis, and may be observed more readily by referring to Figures 2 and 3. The conical surfaces 4 extend to 5 the perimeter of the cylindrical portion of the folding device, said portion being designated by the numeral 6. Rather deep grooves 7 extend diagonally down through both the conical and cylindrical surfaces, in a manner somewhat similar to a spiral, said grooves being characterized by one wall which rises in a substantially vertical plane with respect to the surfaces 4, said wall being shown by the numeral 9 in Figures 2 and 3.

The method of operations is as follows: A cartridge 21 loaded with a dynamic composition, but having one end open, is brought into contact with a folding member 8 of proper size. The circumference of the dynamite shell in such case is approximately intermediate in size between the circumference 1 of the cone, and the circumference 5 of the cylinder. Due to the fact that the surfaces 4 are in different planes, the shell wall contacts the aforementioned vertical walls 9 of the grooves 7 at a point inside the outer extremities of said grooves, without touching the remainder of the surfaces 4. Upon the application of further pressure, said vertical walls having a rather sharp edge cause the shell material to crease, whereas contact of the remainder of the surface of the shell with the remainder of surfaces 4, forces the top of the resulting folds or pleats into the groove 7. In this manner the open end of the shell is restricted to a cross-

section corresponding to that of the cylinder 6, and is characterized by a number of folds corresponding to the number of grooves, said folds inclining toward the center and lying at an angle of about 45° with respect to the longitudinal axis of the shell, so that a spiral effect is produced. Due to the aforementioned inclination, the uppermost tips of the folder shell are closely grouped.

At this stage of the operation, the tamping pin is brought into play. This member has a diameter slightly less than that of the cylindrical aperture 6, through which it is pressed onto the gathered folds, with sufficient force to crimp said folds against the body of the explosive within the shell. A preferred embodiment of the tamping pin is illustrated in Figures 4 and 5. The construction shown therein involves a rod 10 acting within a sleeve 11, said sleeve being provided with slots 14, which permit the escape of excessive moisture-proofing agent, as paraffin, for example. The slot 12 permits an original engagement of the base of the sleeve 15 which is independent of the enclosed rod, the pin 13 acting as a stop as well as a means of retention of the sleeve during operation. As illustrated in Figures 4, 5 and 6, the upper portion 22 of the rod 10 is of reduced cross-section, thus permitting the placing of said rod in a fixed position by inserting portion 22 thereof into a carrying member 18 having an aperture adapted to retain the same.

The details of the base of the tamping member are shown in Figures 10 and 11. It will be noted that the flat surface 16 of the sleeve 11 is quite small in cross-section, the remainder of the sleeve wall 17 having a receding surface which slopes inward. This particular design is well adapted to prevent slippage of the folds of the cartridge during the tamping operation.

During said operation said folds first engage the flat surface 16. Said surface 16 must be a flat surface; if it were a sharp edge it would tend to cut said folds. However, said flat surface is quite small in cross-section; if it were large in cross-section it would be apt to cause slippage of said folds. The folds of the cartridge, which first engage the flat surface 16, are directed thereby against the receding surface 17 and thence against the bottom of the rod 10, whereby a uniform, conical crimp of interlocking folds is had.

In actual operation, a spring 19 or other suitable tension member is slipped over the top part of the tamping pin which is then placed in a fixed position by inserting that portion 22 of the rod 10 having a reduced cross-section into a carrying member 18 having an aperture adapted to retain the same. Such arrangement is illustrated in Figure 6. The spring 19 then rests snugly between the sleeve 11 and the carrying member 18, and exerts sufficient pressure to cause the base of the sleeve to extend beyond that of the rod 10. Thus, when the tamping operation commences, only the retaining base of the sleeve engages the shell folds at first, the sleeve then being forced upward against the tension of the spring as the pressure increases, the rod being contacted only after said spring has been compressed a predetermined degree. In this manner a uniform, conical crimp of interlocking folds is formed. The sleeve, which of course contacts the wrapper material in advance of the pin, may be brought forward to strike the material directly, or may be brought forward with a twisting motion by rotating the same about its axis at the time of contact with the wrapper. The latter is preferable.

In Figure 9 the entire assembly is depicted partly in perspective and partly in cross-section, showing the relative position of the various parts at one point in the operation of crimping the end of a charged dynamite shell. Thus, the open end 20 of the shell 21 is shown folded inwards toward the cylinder 6 by contact with the various elements of the folder device 8 which are illustrated by dotted lines in Figure 9 and are shown in detail in Figures 1, 2 and 3. The tamping pin is depicted as disposed within the cylinder 6 and approaching the gathered folds, showing the sleeve 11 in advance of the pin 10.

Figure 8 depicts the resulting crimp which is conical in shape, uniform in structure and comprises interlocking folds of shell material so that springing open of the crimp is avoided. A is a round bead or reversed fold in the paper side walls of the cartridge. B is a sharp bend in the wrapper material. C is the point at which the raw edges of the fold meet. D is the point at which the raw edges of the material double back on themselves. In producing said improved end closure with depressed interlocking folds, displaying increased strength, the following factors should be considered. The reverse bend A should be as sharp as practicable. The smaller the radius at A, the greater is the tendency of the closure to stay in place. The folding pin should be shaped to produce a sharp break at B, effecting a line or bead approximately concentric with the cartridge wall. The end of the folding pin 10 (as illustrated in Figure 9) should bulge to produce a depression in the central portion of the fold at C, which extends deeper into the powder than at B, thus effecting a somewhat conical structure and adding strength to the fold. Each fold or flute of paper D should overlap the adjacent fold E, and so on around, forming a regular figure about the center. Preferably, the line of the fold determined generally by the points A, B, and D, should be as near a radial line as is practicable, for the purpose of adding structural strength. The degree with which this fold approaches a radial line is determined by the number of flutes or folds around the center and by the shape of the tool causing the fold to be formed.

The apparatus described in the foregoing is particularly well adapted to machines employed for loading simultaneously a plurality of dynamite shells, because the folding members as well as the tamping pins may be provided readily in series in such manner that they coincide with the spacing of the cartridges during the loading operation. Hence, after the explosive has been charged into the shells, it is a simple matter to engage the top of said shells with a member provided with the folding and tamping members in the requisite position.

In operating in accordance with our invention, it is not necessary to restrict the grooves in the folding member to a definite number, because the number most advantageous for the operation is influenced by various factors, among which may be mentioned the physical characteristics of the flexible shell material and the physical properties of the explosive charged into the shell. Nor need the grooves be maintained at a definite depth, it being possible to obtain satisfactory results with variations in depth, depending on the diameter of the shell, and the stiffness and weight of the material, of which said shell

is constructed. These possible variations in design, however, can be determined by experiment.

Likewise, the extension of the shell wall beyond the level of the explosive charge depends on the size of the shell being closed. For example, where it is desirable to close a shell 1½ inches in diameter, we have found that a very satisfactory end closure may be obtained if the level of the explosive charge be ⅞ of an inch below the edge of the shell wall. For a shell having a diameter of 1¼ inches, ¾ of an inch has proved satisfactory.

In operating in accordance with our invention, a uniform crimp, characterized by interlocking folds, is obtained. Such closure possesses a mechanical strength materially greater than closures of similar class which were known heretofore, and hence permits enclosure of the various dynamite compositions currently manufactured, without danger of loss of the explosive charge because of accidental opening of the shell.

Furthermore, the end closure produced by the method and apparatus of our invention offers the additional advantages that it displays an increased water resistance, and enhanced imperviousness to moisture over closures of the art. In addition this closure lends itself more readily to the various water-proofing and moisture-proofing methods such as the operations of end spraying, coating or dipping with water-proofing or sealing compositions.

As is evident to those skilled in the art, our invention permits of various modifications without departing from the spirit or scope thereof. We intend therefore to be limited only in accordance with the following claims:

We claim:

1. In an apparatus for enclosing an explosive charge within a flexible wrapper, the combination comprising a folding member and a tamping member, said folding member being provided with an inner surface substantially the shape of a truncated cone, and having a predetermined number of grooves extending upward from the base in spiral fashion to form interlocking folds in said wrapper upon being compressed thereon, said tamping member including a sleeve and a tamping pin movable within said sleeve, said sleeve being adapted to being advanced and twisted against said folds followed by said pin to compress said folds against the explosive charge while maintaining said folds in interlocking relationship.

2. In an apparatus for enclosing an explosive charge within a flexible wrapper, the combination comprising a folding member and a tamping member, said folding member being provided with an inner surface substantially the shape of a truncated cone, and having a predetermined number of grooves extending upward from the base in spiral fashion to form interlocking folds in said wrapper upon being compressed thereon, said tamping member including a sleeve and a tamping pin movable within said sleeve, at least a portion of the wall of which has a receding surface which slopes inward, said sleeve being adapted to being advanced and twisted against said folds followed by said pin to compress said folds against the explosive charge while maintaining said folds in interlocking relationship.

3. In an apparatus for enclosing an explosive charge within a flexible wrapper, a folding member having an inner surface substantially the shape of a truncated cone provided with a predetermined number of grooves extending upward from the base in spiral fashion to form interlocking folds in said wrapper upon being compressed thereon.

4. A method of enclosing a substantially cylindrical explosive charge in a flexible wrapper, which comprises simultaneously exerting downward and inward pressures on the overhanging cylindrical portion of the wrapper along lines inclined with respect to the axis of the wrapper, thereby starting a formation of folds in said wrapper, continuing said pressure over the entire edge of the charge while causing all of the resulting folds to incline at an angle from the longitudinal axis of said charge and to incline at an angle from lines radial from the longitudinal axis of said charge, and compressing said folds against the end of said explosive charge while maintaining said folds in interlocking relationship.

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