Nov. 6, 1956 U. P. JENNINGS ET AL 2,769,377

EXPLOSIVE CARTRIDGE END CLOSURE APPARATUS

Filed Dec. 13, 1955 3 Sheets-Sheet 1

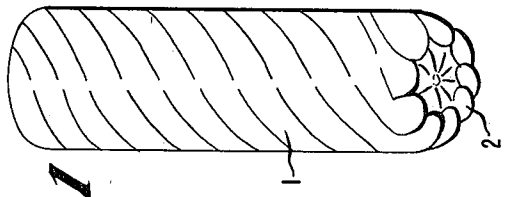


Fig. 1

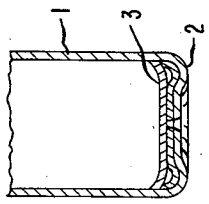


Fig. 2

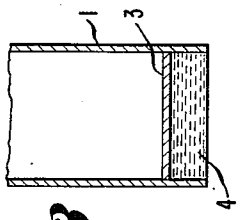


Fig. 3

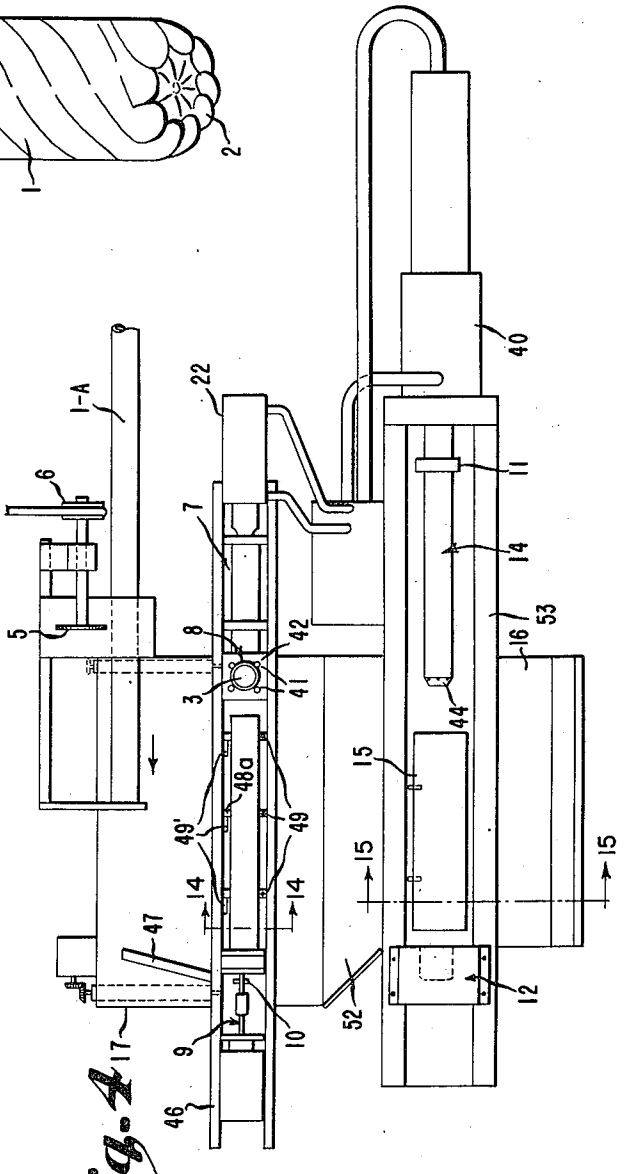


Fig. 4

INVENTORS
UEL P. JENNINGS &
EDWARD F. LEWIS

BY Jules H. Steinberg
ATTORNEY

Nov. 6, 1956 U. P. JENNINGS ET AL 2,769,377

EXPLOSIVE CARTRIDGE END CLOSURE APPARATUS

Filed Dec. 13, 1955 3 Sheets-Sheet 2

Fig. 5

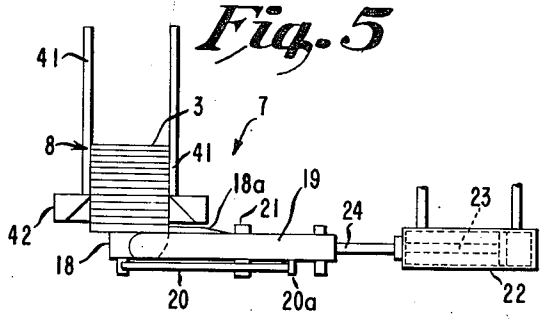


Fig. 6

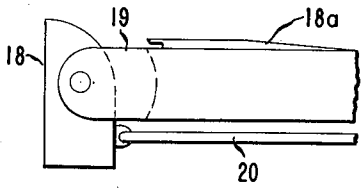


Fig. 10

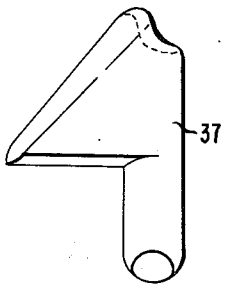


Fig. 8

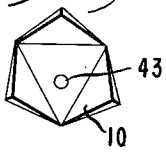


Fig. 7

Fig. 12

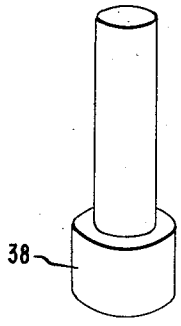
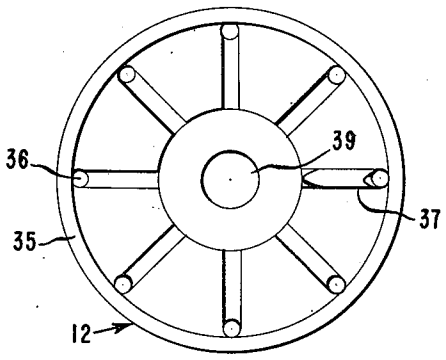


Fig. 11



INVENTORS
UEL P. JENNINGS &
EDWARD F. LEWIS

BY Jules H. Heuberg

ATTORNEY

Nov. 6, 1956 U. P. JENNINGS ET AL 2,769,377

EXPLOSIVE CARTRIDGE END CLOSURE APPARATUS

Filed Dec. 13, 1955 3 Sheets-Sheet 3

Fig. 9

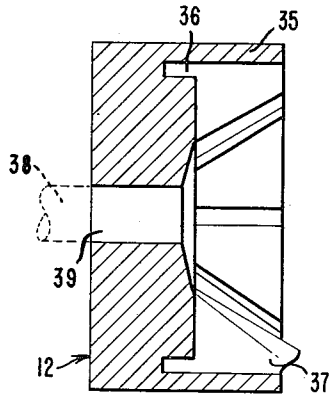


Fig. 13

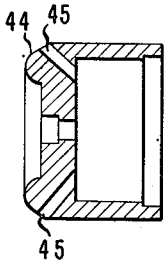


Fig. 14

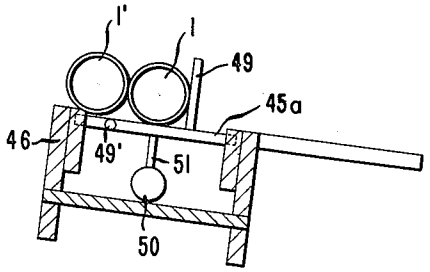
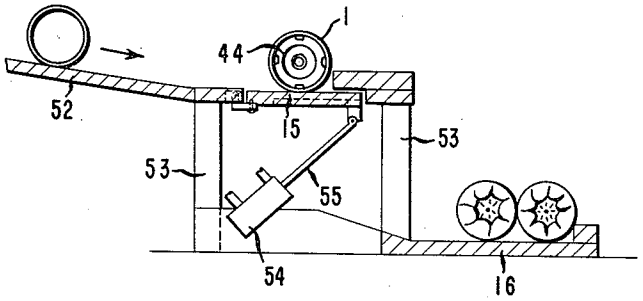


Fig. 15



INVENTORS
UEL. P. JENNINGS &
EDWARD F. LEWIS

BY Jules W. Steinberg
ATTORNEY

United States Patent Office 2,769,377 Patented Nov. 6, 1956

2,769,377

EXPLOSIVE CARTRIDGE END CLOSURE APPARATUS

Uel P. Jennings, Wilmington, Del., and Edward F. Lewis, Martinsburg, W. Va., assignors to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Application December 13, 1955, Serial No. 552,851

4 Claims. (Cl. 93—55.1)

This application is a continuation-in-part of our prior application Serial Number 208,622 filed January 30, 1951, now abandoned.

Explosive compositions for industrial uses are packaged in a variety of forms, the most general being in a cylindrical container of some sort. The container for an explosive composition must provide adequate moisture protection, must have reasonable resistance to tear and collapse, and must prevent leakage of the explosive composition. The containers are preferably made from inexpensive materials which are light in weight and are safe to use with the explosive composition. To facilitate the preparation of the industrial charge, the container must be easily loaded, and for subsequent handling in the field, should be constructed so as to offer the least resistance to insertion into the blast area.

In the case of large diameter charges, i. e., 2 in. to 9 in. diameter, it has long been the practice to use heavy paper-board materials for the containers.

The paper-board, frequently produced by a spiral wrapping operation, is prepared in tubular form, and the ends thereof closed to seal the contents. A number of end-closures for this type of cartridge are known to the art, and have been used with varying degrees of success for many years. Typical end closures include flat crimped ends, cup-shaped inserts positioned by rolling the edges, adhesive bonded caps, bag-tie, and the like.

In the manufacture of explosive cartridges, it is generally the practice to close one end prior to loading the explosive composition, and the other end after the cartridge has been filled. The present invention is directed to the closure of the end performed prior to filling the cartridge.

An object of the present invention is to provide a completely automatic apparatus for closing one end of a tube to form an explosive cartridge. A further object of the present invention is to provide an apparatus adapted to provide a strong, simple end closure for explosive cartridges. Additional objects will become apparent as the invention is further described.

We have found that the foregoing objects may be attained by providing a means for positioning a severed length of tubing at a disc-inserting station, mechanically inserting a disc into the tube, mechanically applying glue to the inside edge at one end, and, with the disc held perpendicular to the axis of the tube, crimping the glue-wetted end against the said disc.

The present invention is illustrated by the accompanying drawings, in which

Figure 1 represents a perspective view of a shell prepared in accordance with the invention, and;

Figure 2 represents a sectional view of the end-closure of such a shell, while;

Figure 3 represents a view of the end to be closed immediately before the crimping operation.

Figure 4 represents a plan view of an apparatus for forming tapered-crimp shell;

Figures 5 and 6 represent detail views of the disc inserting mechanism;

Figures 7 and 8 represent detail views of the glue applying arrangement;

Figures 9, 10, 11 and 12 all represent detail views of the crimping head; and

Figure 13 represents a detail sectional view of the crimping and disc positioning mandrel.

Figure 14 is a view taken along the line 14—14 of Figure 4 showing details of a typical stop mechanism for the disc inserting station.

Figure 15 is a view taken along the line 15—15 of Figure 4 showing details of a typical mechanism for operating a trap under the crimping mechanism.

Referring to the figures in greater detail, 1 is a spirally wound tube, 2 is a tapered crimp closing one end of the tube 1, 3 is a disc inserted in tube 1, and 4 is a layer of glue. On the finished closure, as shown in Figures 1 and 2, the disc 3 and the folded edges of tube 1 forming the tapered crimp are all firmly bonded to each other by the glue 4, thus forming a rigid, strong seal.

1–A is a rotating continuously-fed spirally-wound paper tube, 5 is a revolving circular saw adapted to be moved perpendicularly to the tube 1–A and also laterally at the same speed as tube 1–A, and is driven through belt and pulley 6 by a motor 45. 17 is a sloped receiving table consisting of a traversing belt 48 which feeds severed lengths 1 of tube 1–A onto rocker bars 48*a*, as will be later described. 8 is a stack of discs 3 mounted over the insert mechanism 7, and 9 is the glue applying mechanism having a projecting paddle 10. 12 is the crimper head assembly and 14 is the horizontally reciprocating mandrel operated by the hydraulically actuated unit 40, and containing a shoulder 11 adapted to engage the end of the tube 1. 16 is a receiving platform beneath the crimping assembly 12, 14 on which the crimped tubes 1 fall when the trap 15 is mechanically tilted downward.

The disc inserting mechanism includes a stack 8 of discs 3, supported radially by four pins 41 over base plate 42; a pivotable disc hand 18 supported by the arm 19 and controlled by shaft 20 and stop 21. Shaft 24 couples the arm 19 to the piston 23 of the hydraulic cylinder 22.

The gluing mechanism includes a three bladed paddle 10 mounted on shaft 43 rotated by a high speed motor; a tubing 34 connects check valve 33 to the paddle 10, the check valve 33 permitting only outward flow from glue pump 30; a glue reservoir 31 is connected through a check valve 32 to the pump 30, the check valve 32 permitting flow to the pump 30 only; and hydraulic cylinder 25 containing piston and shaft 26 which is coupled to shaft 29 of pump 30 by means of couplings 27 and 28.

The crimping head assembly 12 includes a base 35 having a number of pin positions 36, and a central opening 39; a plurality of crimping pins 37; and a plunger 38.

The mandrel assembly contains the mandrel 14, which includes a head 44 having a plurality of air ports 45; and the motive mechanism 40.

In operation, tube 1–A is continuously fed into the present apparatus directly from a conventional tube winding machine positioned adjacent to the present apparatus, and is thus rotating as well as moving forwardly. When a predetermined length has passed the blade of saw 5, the saw mechanism is actuated, for example, by a microswitch, and the rotating blade moves into sufficient engagement with the tube 1–A so that the teeth of the saw penetrate the thickness of the tube. The saw unit 5 moves forward at the same speed as the

tube 1–A for a distance sufficient for the tube 1–A to make a complete revolution. This completely severs a predetermined length of tube, and the saw unit 5 then withdraws and moves laterally into its original position. The movable cut-off saw assembly unit is conventional equipment and forms no part of the present invention. If desired, previously severed lengths of tubing may be hand or machine fed into the instant apparatus and the cut-off saw 5 dispensed with.

Meanwhile, the severed tube 1 is carried forward by the traversing belt 48 to a stop 47 and rollls down the inclined table 17 to the frame 46, where it is positioned by stops 49, 49'. The stops 49, 49' are positioned in pairs, 90 degrees out of phase, on a series of parallel rocker bars 48*a* journalled in the frame 46. The rocker bars are oscillated by an hydraulic ram 50 or other suitable motive means positioned beneath the frame 46 through links 51. As can be seen particularly in Figure 14, stops 49 hold tube length 1 in position on frame 36 while a disc is inserted and glue is applied. When tops 49 are in the upright position, stops 49' are 90 degrees out of phase and lie flat in the plane of rocker bars 48*a*. The next tube length 1' rests against tube 1 ready to roll into the disc inserting station as soon as it is permitted to do so. The retraction stroke in a single push-pull cycle of the piston rod of ram 50 will, through links 51, rotate stops 49 downward into the plane of rocker bars 48*a*, while elevating stops 49' to the upright position. The latter will hold tube length 1' while tube 1 rolls out of the disc inserting station and down toward trap 15. The extension stroke of the piston rod will re-depress stops 49' to the position shown in Figure 14 while at the same time re-elevating stops 49 to the upright in which position they will hold new tube length 1' momentarily in the disc inserting station. The stops 49, 49' may be set to oscillate at regular time intervals or may oscillate in response to a predetermined signal as, for example, an air valve or microswitch which is triggered by depression of the saw 5 or withdrawal of the glue paddle 10 to actuate a suitable control mechanism. The particular control means selected is not critical and may be varied to suit the requirements of the situation.

The disc insertion mechanism 7 is then automatically actuated, pressure being applied to hydraulic cylinder 22 on piston 23 from a conventional hydraulic pump, thereby moving arm 19 and hand 18 under the stack 8 of discs 3. One disc is trapped by a sharp jaw or projection 18*a* on arm 19 and carried forward in a horizontal position to the interior of tube 1. As the forward motion nears the end of the stroke, shaft 20 is stopped by engagement of lug 20*a*, riding in a lost-motion cam tract, with stop 21, causing the hand 18 to pivot to a vertical position, thereby tilting the disc to a position perpendicular to the longitudinal axis of the tube 1, and releasing it from the jaw on arm 19. The assembly then reverses and the arm 19 and the hand 18 are withdrawn to the original position.

During the time the disc 3 is being inserted, a layer of glue 4 is being applied at the opposite end of tube 1. This is accomplished by an inward movement of the gluing mechanism 9 until the paddle 10 is completely inside the tube 1, at which time piston 26 is reciprocated within the hydraulic cylinder 25, pumping glue 4 from the reservoir 31 through the pump 30 and the line 34 to the paddle 10. The glue is hurled from paddle 10 by centrifugal force to form an even layer at the inside edge of the tube 1. After a predetermined period of operation, the pumping is stopped and the mechanism 9 retracted.

Upon completion of both the gluing and disc inserting operations, the tube 1 is mechanically released, by retraction of stops 49, as described above, and rolls to trap 15. Mandrel 14 is moved laterally toward crimper head 12 by hydraulic pressure in unit 40, and forces the disc 3 toward the end to be crimped until the tube 1 abuts collar 11 on mandrel 14. Further motion of mandrel 14 completes the initial fold and applies pressure to the end. Plunger 38 in head 12 is thrust against the center of the partially folded end 2 of tube 1 to complete the folding and effects a seal. The mandrel then backs off, and by means of air through port 45 of the head 44, releases the completed cartridge. Trap 15 is then automatically swung open to drop the cartridge to the receiving platform 16. A typical mechanism for swinging open trap 15 is illustrated in Figure 15 wherein tube length 1 is shown resting on the hinged trap 15 to which it has rolled from the incline 52. A fluid motor 54 is secured beneath the trap. The upwardly extensible piston rod 55 is pivotally connected to the trap in a manner which will cause the trap to swing down when the rod 55 is retracted. The crimped tube may then fall to the receiving platform 16. The motor 54 may be actuated by any suitable means, as for example, horizontal movement of the mandrel 14 or contact of the latter with the crimping head 12. The particular control means selected forms no part of the present invention.

The various elements 17, 48, 46, 52, 53, etc., from a continuous inclined support structure, which is disposed at an acute angle to the horizontal, down which the tube length 1 may roll from the top of the device to the receiving platform 16 except when it is momentarily held at a work station.

In the apparatus described, alternative motive means may be used to actuate the various mechanisms, such as air units, electric motors, etc., and the particular motive means selected is not a part of this invention. Similarly, the tube may be severed by a means other than the rotating saw mentioned, or the tube may be cut or formed in predetermined lengths on a separate apparatus and then fed to the remainder of the assembly, as noted above. Various tube aligning means may be used to position the tubes properly for the successive operations, and the tubes may be mechanically conveyed from one station to the next without departure from the scope of the present invention.

The number of blades on the glue paddle is not particularly important in the distribution of the glue, a three-blade paddle being preferred because it is more rugged and cheaper to construct. The angle at which the blades are bent should be between 30° and 45° measured from the shaft. The glue is applied on the inside surface of the tube about 1 to 2 inches in from the end, depending upon the diameter. In the particular embodiment disclosed, all the glue required for one tube is provided by on stroke of the plunger 29 of the pump 30, the length of that stroke being determined by adjustment of the couplings 27 and 28.

The crimper head 12 is designed for simple replacement of those parts most apt to become worn or broken, e. g., the projecting edges which start the crease in the end of the tube resulting in a crimp, and for this reason the pins 37, one of which is illustrated in Figures 9, 10, and 11, are made removable. If desired or necessary, the head could be provided with means for heating the contacting surface.

The apparatus described is adaptable for the production of end-closures of various contours, including concave as well as the convex closure illustrated in the drawing. The particular closure shown herein is not a part of the present invention, and is separately described and claimed in copending application Serial No. 208,262, filed January 29, 1951, by Edward F. Lewis.

The foregoing description fully illustrates the present invention, but is not intended as limiting the scope thereof to the exact embodiments shown. We intend to be limited only by the following claims.

We claim:

1. In an apparatus for producing tubular explosive cartridge shells by closing one end of a tube, the combination

comprising a continuous inclined support structure for pre-cut lengths of tube, said support structure being disposed from beginning to end at an acute angle to the horizontal whereby said pre-cut lengths of tube may roll downward along the length of the upper side of said support structure, a mechanical disc inserting mechanism at one side of said support structure adapted to insert a disc into one end of a length of tube while said tube is momentarily held stationary, a glue distributing mechanism opposite said disc inserting mechanism adapted to apply glue on the inside edge of the other end of said tube during the disc insertion, movable stop means for intermittently arresting the downward roll of said lengths of tube to momentarily hold them stationary while the disc is being inserted in and the glue is being applied to the ends of the tube, a horizontally reciprocatable mandrel adjacent to said disc inserting mechanism adapted to press said inserted disc to the glue containing end of the tube after the tube has rolled down the inclined support structure past the disc inserting and glue applying mechanisms, a crimping head opposite said mandrel and mating therewith when the mandrel is at its innermost position, and motive means for operating said disc inserting mechanism, said glue distributing mechanism, and said mandrel.

2. In an apparatus for producing tubular explosive cartridge shells having one end thereof closed, the combination comprising a continuous inclined support structure for pre-cut lengths of tube, said support structure being disposed from beginning to end at an acute angle to the horizontal whereby said pre-cut lengths of tube may roll downward along the length of the upper side of said support structure, a disc inserting device at one side of said support structure comprising essentially a holder for a stack of discs, an arm positioned under said holder, said arm having a projection on its upper side of a height not exceeding the thickness of a single disc and said arm carrying a pivotal hand on its front end of a length not exceeding the diameter of a disc, motive means for reciprocating said arm and hand horizontally into one end of a length of tube which is momentarily held stationary for this purpose on the inclined support structure, and means for pivoting said hand to a vertical position within said tube, a glue distributing mechanism opposite said disc inserting mechanism adapted to apply glue to the inside

edge of the tube opposite the disc inserting device during the time a disc is being inserted, comprising essentially a rotatable paddle, a glue reservoir, a pump, tubing from said reservoir to said pump and from said pump to said paddle, and means for horizontally reciprocating said paddle, rotating said paddle, and operating said pump, movable stop means for intermittently arresting the downward roll of said lengths of tube to momentarily hold them stationary while the disc is being inserted in and the glue is being applied to the ends of the tube, a crimping head adjacent to said glue distributing mechanism, and a horizontally reciprocatable mandrel opposite said crimping head adapted to press an inserted disc to the glue-containing end of said tube and to press said glue-containing end of said tube and to press said glue-containing end into said crimping head after the tube has rolled down the inclined support structure past the disc inserting and glue applying mechanisms, and motive means for actuating said mandrel.

3. An apparatus for producing tubular explosive cartridge shells with one closed end as claimed in claim 1, wherein said glue distributing mechanism comprises a rotatable paddle, a reservoir containing glue, a tubing from said reservoir to said paddle, a pump interposed in said tubing between said reservoir and said paddle, and wherein said motive means for operating said glue distributing mechanism comprises means for moving said paddle horizontally and means for simultaneously operating said pump and rotating said paddle.

4. An apparatus for producing tubular explosive cartridge shells with one closed end as claimed in claim 1, wherein the disc inserting device comprises a holder for a stack of discs, an arm positioned under said holder, said arm having a projection on its upper side of a height not exceeding the thickness of a single disc and said arm carrying a pivotal hand on its front end of a length not exceeding the diameter of the disc, and wherein the motive means for operating said disc inserting device comprises means for reciprocating said hand horizontally, and means for pivoting said hand to a vertical position when said hand is at an extended position.

No references cited.