May 28, 1963 D. W. ROPER ETAL 3,091,153

APPARATUS FOR TREATING AND SEALING RELOADED SHOT SHELLS

Filed Oct. 7, 1960 2 Sheets-Sheet 1

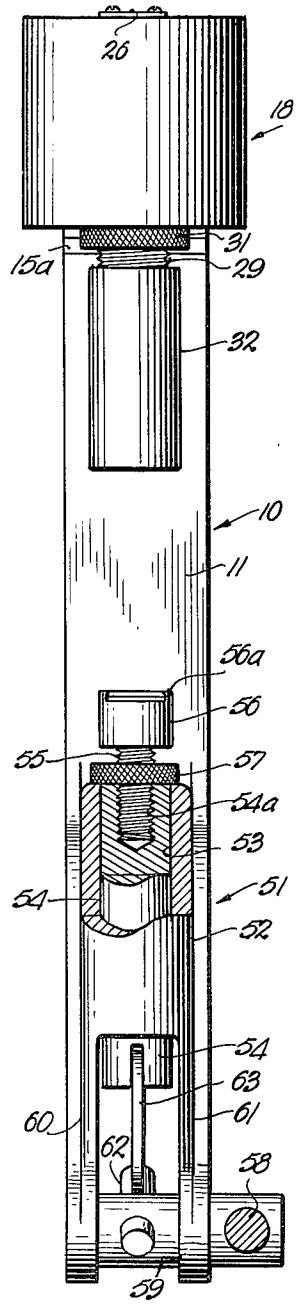


Fig. 1.

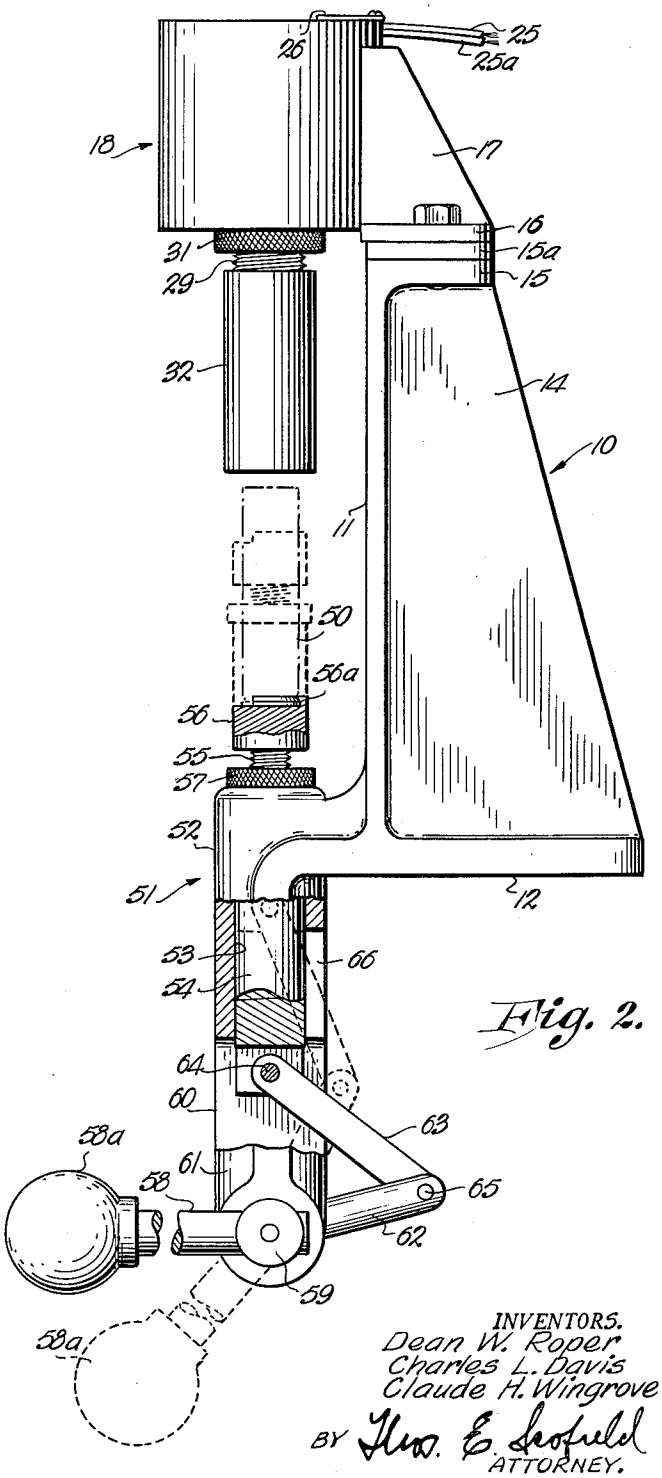


Fig. 2.

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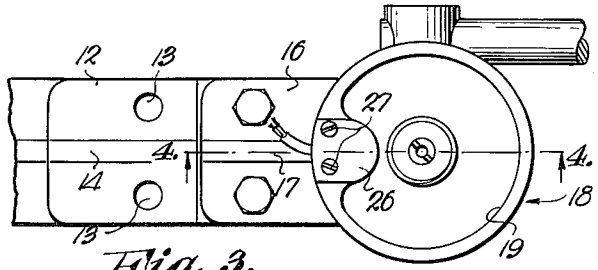


Fig. 3.

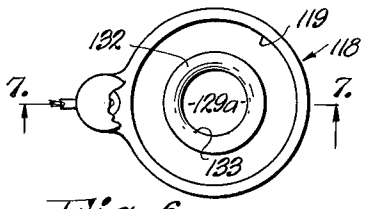


Fig. 6.

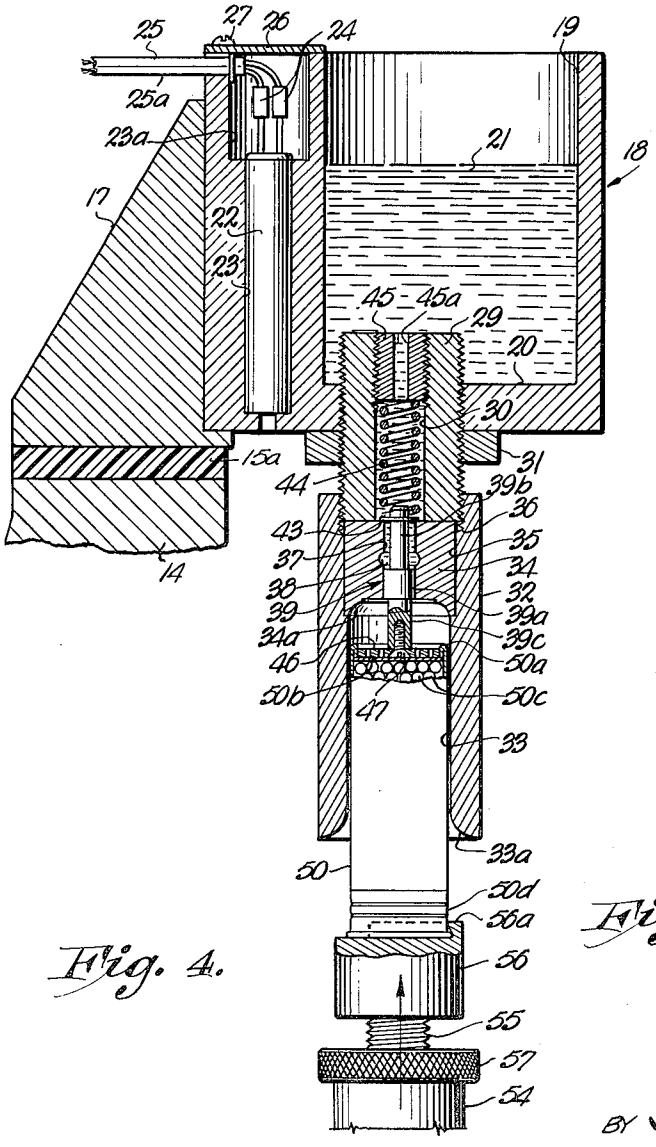


Fig. 4.

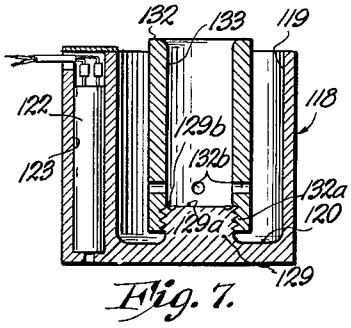


Fig. 7.

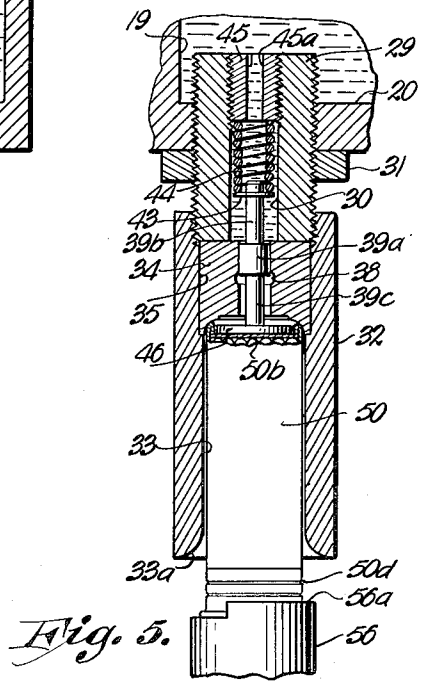


Fig. 5.

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3,091,153

APPARATUS FOR TREATING AND SEALING RELOADED SHOT SHELLS

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11 Claims. (Cl. 86—17)

This invention relates generally to the conditioning of reloaded shot shells, for example, those fired in shotguns, in order to produce a more perfect reloaded shell and so treat the shell casing as to lengthen its useful life for successive reloadings, and to novel apparatus for quickly and easily accomplishing the above results.

In the shooting of shotgun shells (which, as is known, include a brass base and a paperboard or plastic casing) it is a known fact that the base and casing expand as much as the gun chamber will allow. For many shooters it is a common practice to reload used casings rather than purchase new ammunition. In reloading the previously fired casing it is not only desirable but also necessary to return the casings to as near the original or specified size as possible. While most shotgun shell reloaders of which we are aware do this to a certain degree, nevertheless the lack of complete accuracy in sizing and increased dryness of the casing makes reloaded shells unreliable performers in certain types of guns, especially automatics.

In addition to the problems noted above there are others. It is often difficult to maintain a good crimp on the crimped end of the reloaded shell, particularly after two or more firings, and no effective means of sealing around the crimp has been found. The successive firing of the same casing also tends to weaken and dry out the casing, rendering it susceptible to undesirable moisture absorption, or in the alternative, subject to damaging, cracking and fraying at the edges. As the casing dries out it also becomes more susceptible to being burned as the powder burns, which tends to reduce the number of times the shell cases can be reloaded.

It is the principal object of the present invention to provide apparatus which, when used in conjunction with the reloading of shotgun and like shells, overcomes the problems outlined above as well as several others and which produces a reloaded shotgun shell which meets the most stringent requirements in handling, loading and firing, even in the most sophisticated weapons. Through the use of our invention not only is the reloaded shell sized to a proper diameter, but also it is sized in a fashion which produces in the casing a permanent set at the proper diameter and at the same time the casing is reconditioned to waterproof and protect the surface with a coating of lubricating medium, assisting in loading the shell into the chamber of the gun. Moreover, the shell is provided with a sealed and tightly crimped end which will preserve the shell in operative condition under all circumstances of normal handling and the crimped portion of the shell is preserved and its strength protected to the extent that the shell case may be used many times over which satisfactory results.

Other objects of the invention are to provide means for regenerating, sizing and sealing shotgun and like shells which produces a rounded end edge on the shell assisting in loading and repeating an automatic weapon; which, in one embodiment is operable automatically to deliver to and coat the critical portions of the shell casing with a measured charge of a liquified coating and sealing material which reverts to the solid state under normal temperature conditions when the shell is removed

from the apparatus; which is simple to operate; and can be produced at relatively low cost.

Other and further objects of the invention together with the features of novelty appurtenant thereto will appear in the course of the following description.

In the accompanying drawings, which form a part of the specification and are to be read in conjunction therewith, and in which like reference numerals indicate like parts in the various views;

FIG. 1 is a front elevational view of a preferred form of apparatus incorporating the invention, parts being broken away and in section for purposes of illustration;

FIG. 2 is a side elevational view of the device parts again being broken away and shown in section for purposes of illustration;

FIG. 3 is a top plan view on a reduced scale of the device of FIG. 1, the operating handle not being shown;

FIG. 4 is an enlarged fragmentary cross section taken generally along the line 4—4 of FIG. 3 in the direction of the arrows, a shell being shown in position in the holding and inserting plunger and partly inserted into the forming die;

FIG. 5 is a fragmentary section similar to FIG. 4 but showing the shell in fully inserted position;

FIG. 6 is a top plan view of a modified form of apparatus embodying features of the invention; and

FIG. 7 is an enlarged cross section taken along the line 7—7 of FIG. 6 in the direction of the arrows.

Referring now to the drawings and initially to FIGS. 1 and 2, reference numeral **10** indicates an upright frame having the upright forward edge **11** and horizontal base portion **12**. As is best seen in FIG. 3, base portion **12** is provided with apertures **13** by which the unit can be secured in upright fashion on any suitable mounting surface such as a bench top (not shown) with the use of suitable bolts (also not shown). The edge **11** and base portion **12** are joined by a vertical web or gusset **14**. An upper flange **15** extends rearwardly from edge **11** and is connected to and supported by web **14**. A member of T-shape cross section having the base **16** and vertical web **17** provides a support for a relatively large cylindrical body **18** having its vertical center line spaced forwardly of frame edge **11**. For reasons which will subsequently appear, a spacer **15***a* of thermal insulating material is interposed between flange **15** and base **16**.

The body **18**, as may best be appreciated from FIGS. 3 and 4, is hollowed out to provide a receptacle or reservoir **19** having the bottom **20**. Reservoir **19** contains a supply of a melted waxlike substance **21** which, as will subsequently be made clear, is applied to the reloaded shell case to seal and properly condition it. The substance **21** may be paraffin or the like. We have had good results with paraffin although like materials having the general properties of paraffin may also be used.

The body **18** is constructed of metal or other material being a good conductor of heat. To maintain the surfaces of the reservoir in heated condition and thus maintain the substance **21** in melted and readily flowable state, an electric heating element **22** is located in a pocket **23** formed in the body **18**. In the preferred embodiment of the invention the pocket **23** and heating element **22** are cylindrical. Pocket **23** is provided with an enlarged bore **23***a* at its upper end which forms a space for containing the splices or couplings **24** which serve to join the electrical lines **25** and **25***a* with the leads of the heating element. The cover **26** serves as a closure for the bore **23***a*, being secured to the body **18** for removal when desired by screws **27**.

It will be understood that the heating element **22** may be controlled through the medium of a thermostat (not

shown) operable to obtain the desired temperature in the chamber in known fashion.

Threadedly inserted through a suitable aperture in the bottom 20 of reservoir 19 is an annular tube 29 having the central bore 30. A knurled lock nut 31 is threaded on the exterior of tube 29 to a point where it tightly engages the bottom of body 18 to secure the tube in place. Threaded onto the lower end of tube 29 is the upper end of the casing forming die 32.

As is best seen in FIG. 4 the forming die 32 comprises a cylindrical member containing a downwardly open longitudinal recess 33 of cylindrical cross section. The lower end of the recess is defined by the flared of bell-like entrance 33*a*. The upper end of the recess is formed by the lower end of a plug 34 which fits into a corresponding counterbore 35 formed in the upper portion of the die. Plug 34 has threaded engagement as at 36 with a correspondingly threaded section of the counterbore 35.

The upper end of plug 34 abuts and tightly engages against the lower end of tube 29 to form a seal therebetween. Provided centrally in the plug and running axially therethrough is a cylindrical passageway 37 having intermediate its ends a circumferential groove 38.

Extending centrally through the passageway 37 and movable vertically therein is a plunger 39 having the enlarged cylindrical portion 39*a* which, as will subsequently be explained, functions as a valving member during operation of the invention. In the normal position of the plunger the enlarged portion 39*a* lies entirely below the annular groove 38. Extending upwardly from the portion 39*a* is reduced diameter extension 39*b* which extends for a short distance upwardly into the bore 30 of tube 29. A retainer ring 43 is secured to the extension 39*b* so as to limit downward movement of the plunger in passageway 37 by engagement with the upper end of plug 34.

The plunger 39 is resiliently biased toward its downward or normal position illustrated in FIG. 4 through the medium of a compression spring 44 contained in bore 30. The lower end of spring 44 engages the retainer ring 43 while the upper end bears against a threaded insert 45 screwed into the similarly threaded upper portion of bore 30. Insert 45 is provided with a central passageway 45*a* through which the liquid 21 can flow by gravity into the bore 30 and downwardly into passageway 37 and annular groove 38.

Extending axially below the enlarged valving portion 39*a* of the plunger and forming a downward continuation of the plunger is a second reduced diameter portion 39*c*. The lower end of the downward extension 39*c* has secured thereto a circular platelike member 46. The member 46 is secured to extension 39*c* by any suitable means such as the countersunk machine screw 47. As is shown the plate 46 is provided with a plurality of spaced perforations parallel with the axis thereof and providing flow paths through the plate.

The diameter of passageway 33 closely conforms to the desired final diameter for the shell casing 50 which is shown in partly inserted position in FIG. 4. The outside diameter of plate 46 is less than the inside diameter of passageway 33 providing a clearance space between the periphery of the plate and the wall of the passageway. The clearance space is such as to permit the annular crimp 50*a* formed by folding over the end of the casing to be received therein so that the lower surface of the plate will be engaged by the closure disk 50*b* which is held against the shot 50*c* by the crimp 50*a*.

To facilitate insertion of the shell casing into the recess of the die 32 a reciprocable shell lifter mechanism 51 is provided on the lower portion of frame 10. The lift mechanism includes the stationary guide 52 vertically bored from above to provide a cylindrical bore 53 open at its upper and lower ends. Slidably fitted within bore 53 is a cylindrical plunger 54. The top of the plunger 54 is provided with an axially tapped recess 54*a* in which is threaded the screw member 55. The screw member 55

terminates at its upper end in a head 56 which serves to support and carry the brass base 50*d* of the shell. A knurled lock nut 57 is threaded on screw 55 to provide means for locking the screw in any desired elevation relative plunger 54.

The upper surface of the head 56 is provided with an undercut upstanding flange 56*a* which extends part way around the margin of the upper surface and defines between its ends an opening through which the rim of the base 50*d* of the shell can be inserted when the shell is held in the vertical position. The rim fits into the undercut of flange 56*a* and the shell is thereby supported on the head in axial alignment with the recess 33 in the forming die.

The lifting mechanism includes means for impelling plunger 54 upwardly and thereby causing the shell to enter the forming die to the full depth permitted thereby. Such means includes the pivotal hand lever 58 having the hand knob 58*a* at its distal end and which is connected through a linkage, to be subsequently described, to the lower end of plunger 54.

As best shown in FIGS. 1 and 2 the handle is secured to and extends radially from a roll pin 59 which is journaled for rotation with respect to and supported by the spaced legs 60 and 61 which form a yoke integral with and extending downwardly from the guide 51. The lower portions of legs 60 and 61 are provided with aligned bearing apertures through which pin 59 extends in a rotatable fit. The handle is located to the outside of leg 61, being inserted through a suitable diametral aperture provided in the sidewise extending portion of the pin. Between the legs 60 and 61 the pin is provided with a radially extending arm 62 which conveniently can be press fitted into a suitable opening provided in the pin.

Arm 62 provides one link of a toggle having a second link 63 which is pivotally connected with the distal end of arm 62 at one end and at the other end with the lower end of plunger 54. The link 63 conveniently is in the form of a flat bar. The ends of the bar are received respectively in cross slots cut into the corresponding ends of the arm 62 and plunger 54 and are pinned therein by parallel pivot pins 64 and 65. In order to accommodate the necessary movement of link 63 required to move head 56 to the upper position shown in broken lines in FIG. 2 and solid lines in FIG. 5, the rear wall of guide 51 is cut away in the path of movement of the link to provide slot 66, one side of which is seen in FIG. 2.

In the operation of the invention as thus far described, the reservoir 19 is supplied with a quantity of the coating and sealing substance 21, paraffin being used as an example, and the heating element 22 is connected with a source of electrical power. Enough heat is supplied to melt the paraffin and render it completely liquid and at the same time to heat the forming die 32, through conduction, to a temperature which will soften and melt any wax in the shell casing and also maintain the paraffin delivered from the reservoir 19 in melted condition while in the forming die. It will be understood in this connection that the tube 29, die 32 and end plug 34 are all composed of material having good heat conductivity, for example, steel.

With the lift mechanism in the position illustrated in FIGS. 1 and 2 (the solid lines of the latter) the reloaded shell 50 is mounted on the head 56 in the manner previously described. The head carrying the shell on it is then elevated by depressing hand lever 58, the pivotal movement of the handle 58 being translated into longitudinal movement of the plunger 54 by the toggle linkage 63 and 62.

The shell proceeds upwardly in the passageway 33 and eventually engages the plate 46. The crimp 50*a* on the shell surrounds the plate as previously described and is confined between the plate and the wall of the recess. As upward movement continues the plate is displaced up-

wardly by the shell thereby causing corresponding axial movement of the upper plunger **39**.

Since the spring **44** normally holds the upper plunger **39** in its lowermost position (as shown in FIG. 4) the paraffin is prevented from entry into recess **33** until the valving member **39***a* is shifted upwardly to the point where its lower edge is located above the lower edge of the annular groove **38**. Once the valving member **39***a* reaches this position, the liquid contained in groove **38** is free to flow on down into the recess and to distribute itself over the upper surface of plate **46** into the perforations thereof and down around the exterior of the shell casing. It will be evident that the amount of paraffin delivered to the recess **33** is that amount stored in the annular groove **38**. As the plunger or valving member **39** moves above the groove **38** the groove is sealed from communication with the paraffin thereabove. Thus a measured charge of paraffin is obtained.

The thickness of plate **46** in relation to the depth of the crimp **50***a* and open volume provided by the perforations in the plate are both so related to the volume of the groove **38** as to cause a portion of the coating and sealing material to spill over the upper end of the crimp thus to flow down the side of the casing. Moreover the axial position of the valving portion **39***a* of valve plunger **39** is so located as to cause the coating material to flow down into the recess before the end edge of the crimp **50***a* makes contact with the curved forming portion **34***a*, thus to insure that the coating material is distributed over all exterior surfaces of the crimp. The pressure exerted by spring **44** on the end of the shell during the forming can be varied by adjustment of the insert **45** in the upper end of tube **29**.

Since the dimensions of the annular groove **38** determine the volume of the charge of coating and sealing material delivered into the recess, it will be evident that should it be desired to change this volume, it is necessary only to replace the plug **34** with one having a larger or smaller groove, whichever is desired. The volume of the charge which is required depends on the condition of the shells being treated, the worse the condition the more volume necessary.

The extreme upper position for the upper plunger **39** is illustrated in FIG. 5. It will be noted that at this point the crimp **50***a* is in engagement with the rounded marginal portion **34***a* of the lower end of plug **34**. This rounded, crimp receiving guide serves to form a corresponding rounded end edge on the crimp **50***a* and improves its facility for insertion in the chamber of the gun.

The die **32** is maintained at a temperature which will sustain the paraffin in liquid condition. By the same token, as the shell is inserted the heated die serves to soften any wax which is in the shell casing. The stresses in the casing are relieved upon the liquification of the wax therein permitting the casing to return more closely to its original manufactured shape.

As the lift mechanism is again lowered the upper plunger **39** is returned toward its normal downward position through the medium of spring **44**. Once the retaining ring **43** strikes the top of plug **34** the shell will begin to separate from plate **46**. Any wax still present on top of the plate **46** and contained in the perforations therein will then flow over the entire surface of closure disk or wad **50***b* and fill in the corner between the closure and downturned end of the crimp **50***a*. The end of the shell is thus sealed with the paraffin and the crimped portion is coated therewith. Continued downward movement of the head **56** serves to progressively remove the casing from the forming die. Once the shell is exposed to the atmosphere the paraffin will set.

The shell can now be removed from the head and an untreated one substituted therein after which the process is repeated.

We have shown in FIGS. 6 and 7 a less complex apparatus embodying certain features of the invention and which provides an alternate means of hot sizing and coating and sealing the shell. In the arrangement of FIGS. 6 and 7 the main body is indicated at **118**. As in the previous embodiment this is provided with the reservoir **119** having the bottom **120**. The side of body **118** is provided with the pocket **123** to receive the heating element **122**.

Rising centrally from the bottom **120** is a threaded boss **129**. The shell forming die **132** is a tubular member having the inside cylindrical surface **133** and terminating at its lower end in internal threads **132***a* which are engaged with the threads on the boss. The forming die **132** is provided with a plurality of lateral ports **132***b* near its lower end, these ports communicating between the interior of the die and the annular space between the wall of the reservoir **119** and the die.

The top **129***a* of the boss is provided with a flat central portion surrounded by the marginal depression **129***b* which serves to receive and form the crimped end of the shell.

In utilizing the apparatus shown in FIGS. 6 and 7 the annular chamber surrounding the die is supplied with a quantity of the coating and sealing material and is maintained in melted condition therein by the heating element **122**. By virtue of the ports **132***b* the same level of melted coating material will obtain in the recess **133** in the die. The shell (not shown in these figures) is inserted from above, the crimped end of the shell being inserted foremost in the recess. As the shell descends in the die liquid will be displaced outwardly through the ports **132***b* but a thin film will remain between the wall **133** of the recess and the exterior surface of the casing. The crimped end of the shell will be in contact with the wax or coating material.

As in the case of the preceding embodiment the die **132** is heated through conductivity and performs the same forming operation upon the shell as the die in the preceding embodiment.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, we claim:

1. In apparatus for properly sizing, conditioning and sealing the casing and end crimp of reloaded shot shells, the combination with such a shell of a support member composed of heat conducting material and having a solid base and upstanding side walls forming a hollow space therein, a boss extending upwardly centrally of said base, a central tube member also of heat conductive material and having a cylindrical inside surface and connected with said boss whereby to stand upright between the side walls of said support member and define therewith a chamber surrounding the tube member, said tube having an inside diameter closely conforming to that of the casing but permitting insertion of the end of the casing therein and a length less than the length of said shell, ports in said tube communicating between said chamber and the interior of the tube, a melted coating and sealing material in said chamber, and heat supplying means connected with said support means whereby to heat the walls of said support means and tube member sufficiently to maintain said coating and sealing material in flowable condition.

2. In apparatus for properly sizing, conditioning and sealing the casing and end crimp of reloaded shot shells,

the combination of a casing forming die including a recess open at one end and adapted for insertion therein of the shell with the end crimp foremost, said recess dimensioned to conform the casing to the proper outside diameter and having shell contacting means within and at the other end of the recess supported for movement with the shell as the shell is inserted into the recess and engages said contacting means, a chamber containing a supply of coating and sealing material in liquid state, a conduit containing a normally closed valve between said chamber and said recess, and means connecting said contacting means with said valve whereby to cause said valve to open and delivery of said material to said recess as said contacting member is engaged and displaced by the entering shell.

3. The combination as in claim 2 including means resiliently biasing said contacting member toward the open end of said recess.

4. The combination as in claim 2 wherein said contacting means comprises a perforated plate permitting contact between said material and the inserted end of the shell.

5. In a device for properly sizing, conditioning and sealing the casing and end crimp of reloaded shot shells, the combination of a body having a reservoir containing a supply of molten waxlike material, the reservoir provided with a discharge conduit at the base thereof for gravity flow of said material from said reservoir, a casing forming die depending below said body and having a downwardly open cylindrical recess therein with the axis of the recess substantially vertical, said recess dimensioned to conform the casing to the proper outside diameter when the casing is inserted longitudinally therein through said open end with the end crimp foremost, means connecting said recess with said conduit and including a normally closed valve preventing flow of said material into said recess, and means within the recess connected with said valve and operable to open same to cause delivery of said material through said aperture to the recess in response to the insertion of the shell into the recess.

6. The combination as in claim 5 wherein said last mentioned means includes a pressure plate located within said recess and positioned to be engaged and displaced by the inserted end of the shell.

7. The combination as in claim 6 wherein said pressure plate is perforated to permit contact of the molten material with the inserted end of the shell.

8. The combination as in claim 6 including means resiliently biasing said pressure plate downwardly toward the open end of the recess.

9. The combination as in claim 5 including means for maintaining the inside surfaces of said recess at a temperature sufficient to maintain any of said material adjacent thereto and contained in the shell casing in molten state.

10. In apparatus for properly sizing, conditioning and sealing the casing and end crimp of reloaded shot shells, the combination of a casing forming die having a cylindrical recess conforming substantially in diameter with the outside diameter of the shell casing and dimensioned to receive the casing longitudinally therein with the end crimp foremost, a displaceable valve operating member associated with said die and positioned to be contacted by a portion of the advancing shell and displaced thereby, a source of liquid coating and sealing material, and means connecting said source with said recess and including a valve controlled by said operating member and operable in response to said displacement of said operating member to deliver a measured charge of coating and sealing material to said recess for contact with said casing and end crimp.

11. In apparatus for properly sizing, conditioning and sealing the casing and end crimp of reloaded shot shells, the combination with such a shell of a heat conducting die having a cylindrical passageway therein open at one end and adapted for insertion therein of the shell with the end crimp foremost, said passageway dimensioned to conform the casing to its proper outside diameter, shell contacting means within and at the other end of said passageway disposed to be engaged by and forming a support for the end of the shell when the shell is inserted to full depth in the passageway, support means directly connected with said die and providing a storage chamber for melted coating and sealing material, said support means also constructed of heat conductive material, heater means carried by said support means and operable to supply sufficient heat to said support means and through said support means to said die as to maintain said coating and sealing material in flowable state both in said chamber and said passageway, and means between said chamber and die operable to communicate said material between said chamber and passageway whereby to cause said shell casing and end crimp to be contacted with said material responsive to insertion of the shell into said passageway.

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