Oct. 27, 1925. 1,558,804

E. L. GREENEWALD

METHOD OF AND APPARATUS FOR MAKING REENFORCED PRODUCTS

Filed Nov. 20, 1918 2 Sheets-Sheet 1

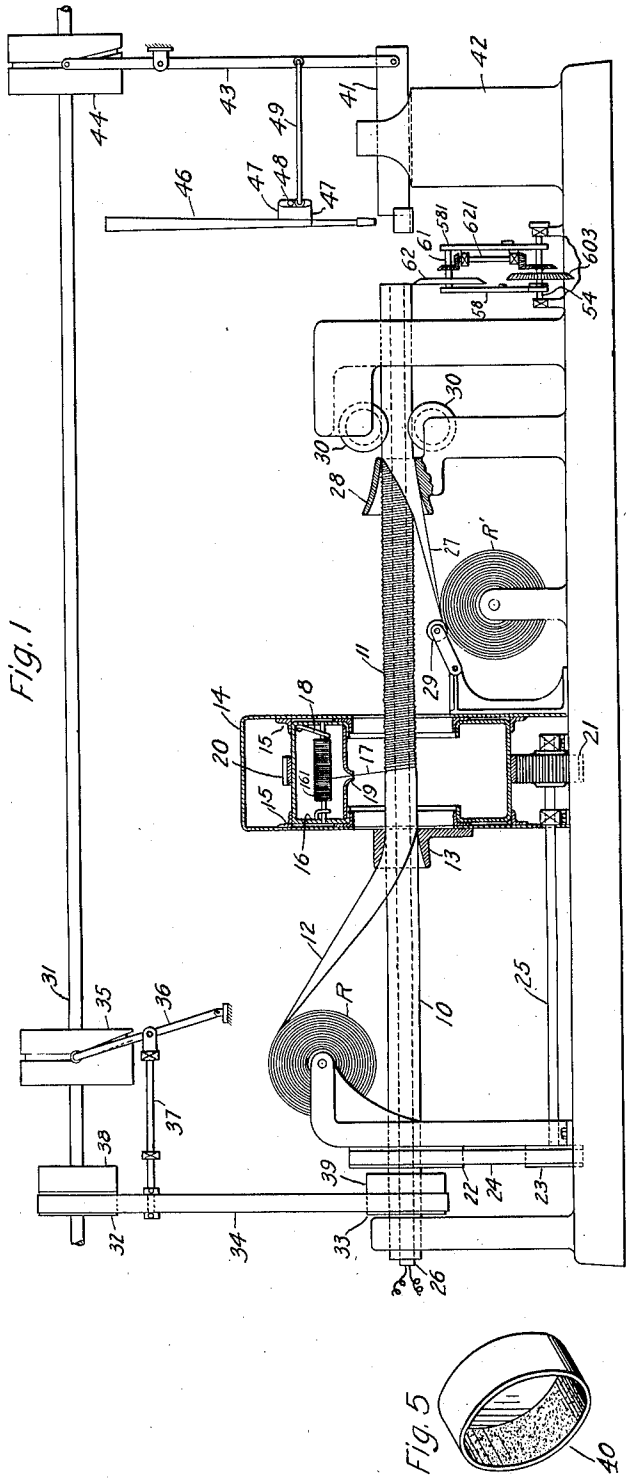


Fig. 1

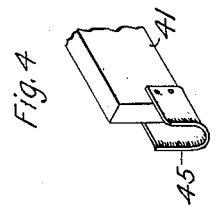


Fig. 4

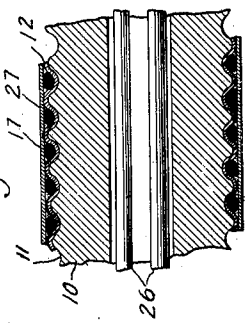


Fig. 3

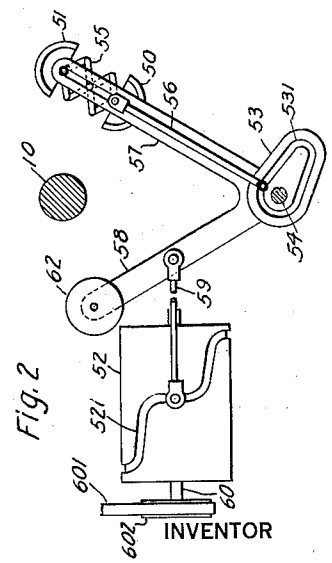


Fig. 2

Fig. 5

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Fig. 6

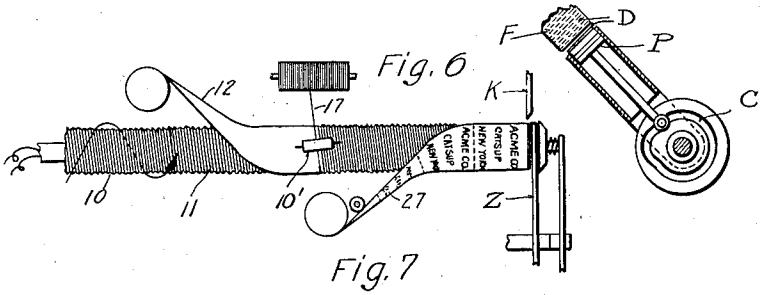


Fig. 7

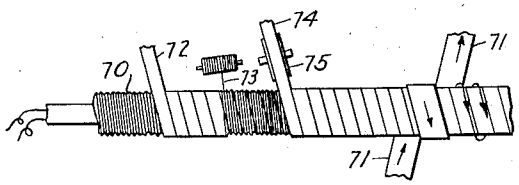


Fig. 8

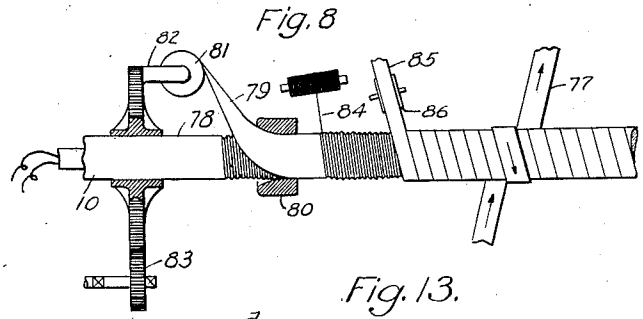


Fig. 12.

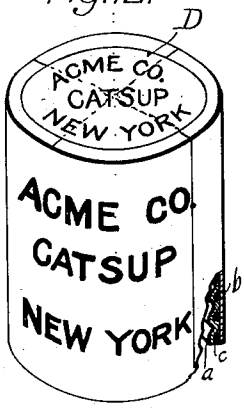


Fig. 13.

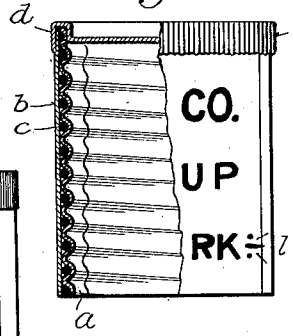


Fig. 9

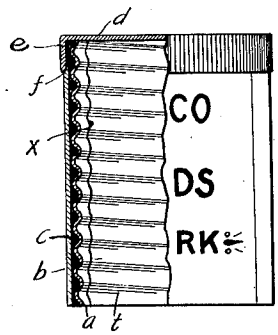


Fig. 10.

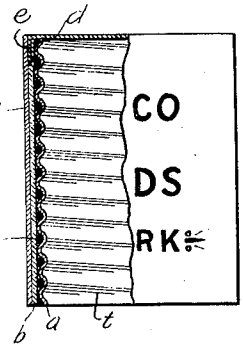
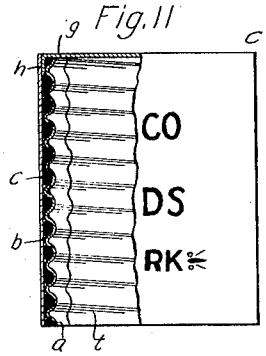


Fig. 11



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Patented Oct. 27, 1925. 1,558,804

UNITED STATES PATENT OFFICE

EUGENE L. GREENEWALD, OF WASHINGTON, DISTRICT OF COLUMBIA.

METHOD OF AND APPARATUS FOR MAKING REENFORCED PRODUCTS.

Application filed November 20, 1918. Serial No. 263,327.

To all whom it may concern:

Be it known that I, EUGENE L. GREENEWALD, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Methods of and Apparatus for Making Reenforced Products; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a bottle or jar cap or closure and the method and apparatus for making the same, but it is to be understood that certain features of the invention have a broader application, in that they may be employed in making containers, tubing and the like for various purposes.

One of the principal objects of the invention is to economically produce a satisfactory deep-skirt bottle cap made principally of paper that shall have a rigid interiorly threaded skirt or flange portion for engaging the usual thread on the neck of a bottle but that shall have a smooth or substantially smooth outer cylindrical surface to present a pleasing appearance and adapted to carry printing or advertising.

Another object of this invention is to produce a tubular structure that is circumferentially reenforced and adapted for use as a container body and for numerous other purposes.

Another object of the invention is to provide suitable methods and means for economically manufacturing such bottle caps, closures, containers, tubing, etc.

Heretofore, deep-skirt bottle caps or closures, such as those employed on catsup and similar bottles, have been drawn from a single metal blank or formed from two metal blanks, and the container-engaging means or thread thereof has been rolled in the skirt or flange, leaving an exterior groove, which is somewhat unsightly and precludes printing matter on the exterior wall of the cap or closure, such as the name of the manufacturing company, its trade mark, the name of the product and similar advertising. By the methods and mechanisms I disclose herein, comparatively inexpensive closures may be made in which such printing may be applied to and effectively displayed by the vertical outer surface of the closure. By the same methods and mechanisms, the tubular wall of the closure and the interior thread thereof are greatly reenforced so that cheaper material, such as paper and thinner sheet metal, may be employed in the manufacture of the closure body without detracting from its effectiveness. The same principles may of course be applied to reenforcing tubular bodies and sheet material generally, and may also be applied to the reenforcement of flexible material, such as paper or thin metal, to provide single or multiply corrugated material having a permanently incorporated reenforcement for a variety of purposes.

The above and other objects and the novel features of the invention will be apparent from the following description taken in connection with the drawing, in which Figure 1 is a side elevation of a machine for making a bottle cap embodying my invention; Fig. 2 is a view of the mechanisms for applying the top of the cap and for severing the tubular body; Fig. 3 is a longitudinal sectional view of a part of the mandrel upon which the tubular body is formed, showing a portion of a tube thereon; Fig. 4 is a perspective view of a portion of the mechanism for feeding the tops to the tubular bodies; Fig. 5 is a perspective view of a top; Fig. 6 is a more or less diagrammatic view illustrating another machine for making bottle caps; Figs. 7 and 8 are diagrammatic views illustrating several ways of reenforcing tubular bodies or making the threaded body part of a cap, Figs. 9, 10, 11, 12 and 13 are views, partly in section and partly in elevation of bottle caps embodying my invention.

Referring to Figure 1, the machine for making the caps comprises a rotatable mandrel 10 that is provided with an exterior helical groove 11 of the same pitch as the threads of the bottles for which the caps are intended.

The threaded tubular bodies of the caps are made on the mandrel 10 in the form of a continuous internally threaded tube. A paper web 12 is drawn longitudinally from the rotatable roll R through the stationary funnel-shape former 13 which surrounds the mandrel 10 and forms the web into a tube around the mandrel in a well known manner. The web 12 is of sufficient width to completely encircle the mandrel, thus forming a longitudinally-seamed inner wall for the cap body.

A housing 14 surrounds the mandrel be-

yond the former 13 and has ways 15 that support a carriage 16 upon which the spool 161 of flexible cord, wire or thread-forming member 17 is mounted. The cord is held at a proper tension by suitable devices 18 that frictionally engage the spool spindle and the cord feeds through a guide member 19 to the mandrel, the guide member 19 being preferably inclined at the pitch of the threads 11 on the mandrel.

The carriage 16 has a peripheral rack 20 meshing with a pinion 21 driven from the mandrel 10 by the pulleys 22 and 23, belt 24 and shaft 25. As the carriage 16 rotates, the spool 161 revolves around the axis of the mandrel, and the cord 17, being held at the proper tension and applied transversely of the web, forces portions of the tube formed from the web 12 into the helical thread-groove on the mandrel. Since the mandrel is also rotating at about the same speed, the threaded tube is fed toward the right in Fig. 1. To prevent the tendency of the tube to rotate with the mandrel, the strip or web 12 may be of paraffin paper, or the inner face thereof coated with paraffin, the mandrel being heated by some suitable means such as an electric heating member 26 that extends from end to end through the mandrel. The heat softens the paraffin, which forms a lubricant between the mandrel and the tube to prevent excessive friction and rupture of the tube when it is advanced. The mandrel is also tapered slightly toward the discharge end to lessen the tendency of the tube to stick to the mandrel.

A paper web 27 form the rotatable roll R′ passes through the stationary funnel-shape former 28 and is formed into a tube to surround and conceal the inner tube formed from the web 12 and also conceals the exterior threads and the cord lying therein. It will be seen that the cord 17 thus performs several functions since it initially forms the thread in the inner tube or wall and then by being permanently confined between the inner and an outer wall it reenforces the multiple wall and also serves as a means to reenforce and sustain the interior threads of the tube and make them more rigid and durable.

A suitable device 29 applies suitable adhesive material to the inner surface of the web 27 which will unite the inner and outer tubular walls and may be also in sufficient quantity to fill the portions of the exterior groove not occupied by the cord 17. A suitable number of rollers 30 having curved faces support the mandrel and press the inner and outer walls of the tube in intimate contact. The longitudinal seam of the web 27 will be disposed opposite to the one of the web 12. The web 27 furnishes a smooth outer surface for the interiorly-threaded body and carries printing or other decorating to enhance the appearance of the tube or cap. The roll of paper R′ may be lithographed as desired before being applied to the inner wall 12.

The mandrel is driven from a suitable shaft 31 by the fast pulleys 32 and 33 and belt 34, the mechanism being so timed that when the end of the internally-threaded finished tube reaches the discharge end of the mandrel, the cam 35 secured to the shaft 31 operates a lever 36 and shifter 37 to throw the belt 34 to the loose pulleys 38 and 39, thus periodically stopping the feeding of the tube and the operation of the thread-forming mechanism.

A paper top or cover part 40, such as the one shown in Fig. 5 is stamped separately and forced on to the end of the tube on the mandrel at the proper time by a plunger 41 slidable on the pedestal 42 by a lever 43 rocked by the cam 44 on the shaft 31. The plunger 41 has a curve trough 45 at its front end, the edge thereof being bent out. The trough 45 fits around the mandrel and is designed to receive a top part 40 and place it upon the tube on the end of the mandrel at the proper time in the cycle of operations. Top parts are dropped, one at a time with their open ends to the left, into the trough from the chute 46 by some suitable well known mechanism such as the slides 47 and lever 48, operated from the lever 43 by the link 49. Any suitable mechanism may be employed for properly feeding the tops to the chute 46.

The interiors of the flanges of the top parts are prepared with adhesive that will soften and adhere quickly when heated. After one of the top parts has been placed on the end of the tubular body, the clamping members 50, 51 are thrown in position on opposite sides of the top of the cap by the cam 52, and then the members 50, 51 are brought together and, by this pressure and the heat of the tube and the mandrel, the top part is secured to the end of the tube. The cam 53 is rotatable by the shaft 54 and connected to the lazy tongs device 55 by the link 56 having a follower in the cam groove 531 that causes the operation of the members 50 and 51, which are slidable on the arm 57 toward and away from each other.

The arm 57 is secured to, or integral with, an arm 58 that is connected by the link 59 and a follower to the groove 521 in the cam 52. The groove in the cam 52 has the proper dwells to hold the device consisting of the arms 57 and 58, stationary for the proper periods for the plunger 41 to apply the top and for the members 50, 51 to secure it in place, and said groove also has the properly timed inclined portions to rock the double-arm device 57, 58 on the shaft 54. The

cam 52 is mounted on the shaft 60 that is driven by a belt 601 and pulley 602, or other suitable means, from the countershaft 31. The shaft 60 also carries a gear, not shown, that meshes with the gear 603 on the shaft 54 and rotates the latter.

The cam 52 is carried by the shaft 60 mounted in suitable bearings on the machine frame and disposed transversely of the shaft 54.

A standard 581, rockable on the shaft 54 and disposed opposite the arm 58, forms a frame with the latter for supporting the shaft 61 carrying the cutter or saw 62 and the gearing 621 by means of which said cutter is continuously rotated from the shaft 54. The cutter is adapted to be moved across the end of the mandrel to cut a cap off the end of the threaded tube formed on the mandrel, after a cover part has been applied to the end of the body.

Assuming that a cap has just been cut from the end of the tube, the next cycle of operations in order is as follows: The mandrel is stationary and the double arm device is in mid-position with the arms 57 and 58 on opposite sides of the mandrel. The plunger moves to the end of the mandrel 10 and slips the flanged top part on to the end of the tube and immediately withdraws. The arm 57 is then moved to bring clamping members 50, 51 opposite the mandrel, whereupon said clamping members are closed and opened to press the flange of the top and cement the same to the tube. The clamping members and arm 57 being restored to their initial position, the mandrel rotates for a sufficient period to feed the tube the necessary distance to provide the desired depth of flange for the cap, whereupon the mandrel ceases rotating and the cutter 62 is rocked so as to cut off a complete cap. In the meantime, a top part has been deposited in the trough 45 on the plunger 41 and the cycle is repeated.

Of course, if interiorly threaded tubes are desired, without tops, it is obvious that the top applying mechanism and clamping mechanism may be omitted. The product then obtained will be interiorly-threaded paper bodies having the threads thereof reenforced.

In Figure 6, I have illustrated another apparatus for making interiorly threaded and reenforced bottle caps, containers and the like, the parts being more or less diagrammatically illustrated for the sake of clearness. The mandrel 10, which may be of metal or other suitable rigid material such as bakelite or a composition thereof, corresponds to the mandrel 10 of Figure 1 and is rotated in the same manner. A plain paper strip 12 is fed to the mandrel to form a tube about which the cord or wire 17 is wound at a sufficient tension to force the paper or sheet material 12 into the helical groove 11 of the mandrel. A suitable pressure roller 10′ may be mounted on the carriage 16 and held against the cord or wire 17 with sufficient pressure to force such cord or wire and a helical portion of the paper or metal tube beneath it into the groove 11 in the mandrel to form an interior thread or bead in the tube.

The strip 27 of metal or paper carrying printing, lithographing or decorating on its outer surface is fed to the mandrel to completely cover the grooved strip 12 and the cord or wire 17 embedded in the exterior surface thereof, the abutting portions of the two strips being united at suitable points by adhesive, welding or otherwise. The points of union are at the tops of the outer corrugations, see Figure 3, thus forming a wall consisting of a reenforced truss structure of great strength, additionally reenforced by a reenforcement confined between two plies of the multiply wall.

In order to close the end of the threaded tube thus formed, a suitable mechanism Z may be employed, such for example as the folding and closing mechanism shown in Patent No. 1,127,718, Feb. 9, 1915, to Auchu. After the end of the tube has been closed a suitable printed or decorated adhesive label or disk D may be secured over the folded end by suitable mechanism. In Fig. 6 I have illustrated a plunger P that receives the adhesive disks D, one at a time, from the feeder F, and is rotated into position opposite the folded end of the tube to which it is applied when the cam C forcss the plunger outwardly against the end of the tube.

The knife K is operated to cut off the cap after the tube has been fed outwardly a distance equal to the length of the skirt of the cap. The operations are timed by suitable mechanism so the cycle is performed in the proper order. Figure 12 illustrates the form of cap made by the machine of Figure 6. It will be obvious that the disk D may be omitted, in which case an interiorly threaded cap will be formed with an end similar to that on the device of Figure 12 of Patent 1,127,718, in which the folds overlap but are adhesively secured together, in a suitable manner.

It will be understood that the principles of the invention may be applied to spirally wound tubing as shown in Fig. 7, where a similarly threaded and heated mandrel 70 is employed but in this apparatus the mandrel is stationary and the tube is rotated by a belt 71 so as to screw the tube off of the mandrel. An inside paraffined paper strip 72 is wound upon the mandrel helically and the cord or wire 73 is wound upon the strip 72 in the direction of the pitch of the thread groove on the mandrel and at a sufficient tension to press a helical thread inwardly

into the groove of the mandrel. The cord or wire 73 is left in the exterior groove that corresponds to the interior rib or thread, thus reenforcing the latter. The exterior strip 74 that passes over the glue wheel 75 is then wound upon the inner tube, preferably overlapping the seam of the inner tube. The strip 74, which may be lithographed, covers the exterior groove and cord 73 in the inner tube and presents a smooth exterior wall for the tubular body similar to the strip 27 of Fig. 1. Of course, more than one inner strip or wall 72 may be employed if desired, before applying the cord or wire 73. The other parts of this machine for making caps are the same as those of Fig. 1.

In Fig. 8, I have diagrammatically illustrated still another method and apparatus for making the internally threaded tubular body—being the equivalent, in all essentials, of the method and apparatus shown in Figs. 1, 6 and 7. A belt 77, wound around the tube and driven in the direction of the arrows rotates the tube on the stationary threaded, heated mandrel 78, the tube being rotated in the proper direction to screw it off of the mandrel. The paper strip 79 that forms the inner wall of the tube is fed longitudinally to a funnel-shape former 80 from a roll 81 that is mounted on a carrier 82 rotated around the axis of the mandrel in the same direction, and at the same speed, as the rotation of the tube, by suitable driving means 83. The paraffined strip 79 forms an inner wall having a longitudinal seam and upon the same I wind the cord or wire 84 in a direction corresponding to the thread groove of the mandrel and at a sufficient tension to force a helical portion of the inner wall into the thread groove of the mandrel. The spool from which the cord 84 is drawn is maintained stationary. To provide a smooth exterior surface and conceal the threaded inner wall and the cord thereon, an outer paper strip 85, that passes over the glue wheel 86, is wound helically on to the inner wall. The final outside strip may be lithographed, and the inner and outer walls may consist of more than one layer and of different materials, such as fibrous material and metal, if desired for rigidity or other reasons. Such walls, or the paper or metal from which they are made, may be coated or impregnated on either side or throughout with suitable waterproofing, acid proofing or other substance to render the same impervious to the contents of the container upon which they are placed.

A finished paper cap is illustrated in Fig. 9. The inner wall *a* has a longitudinal seam *x* and is threaded as at *t*. The cord or wire *c* lies in the exterior groove of the wall *a* and between the latter and the exterior wall *b* which is plane and smooth and lithographed to advertise the goods, as shown. The top *d* closes one end and has a depending flange *e* that is slightly knurled and inserted or squeezed into the outer wall *b* as at *f*. Sufficient pressure may be applied against the flange *e* to force it flush with the outer wall *b*.

The paper cap shown in Fig. 10 is similar in all essential respects to the one shown in Fig. 9, except that the strip forming the wall *b* is not lithographed but instead a lithographed or printed label *l* of the same height as the cap is pasted on the outside thereof to conceal the flange *e* of the cover part and increase the thickness of the flange of the cap. The printing on the caps will, of course, face the same direction as the labels on the bottles to which the caps are fitted.

Figure 11 illustrates still another cap embodying my invention in which the flange *h* of the top *g* is disposed between the inside and outside walls *a* and *b*, thereby forming a multiple-wall cap having a smooth exterior surface. Otherwise, this cap is similar to those shown in Figs. 9 and 10. In each of the caps the groove containing the cord is bridged by the wall adjacent thereto, thereby reenforcing the thread *t* in the inner wall. The cord *c* may also be of slightly greater diameter than the groove and sufficiently soft to be flattened out by the wall surrounding the same to more completely fill said groove.

Figure 12 illustrates a form of cap made by the mechanism disclosed in Figure 6. The body of this cap consists of two walls of paper, having non-coincident longitudinal seams, the inner wall having an interior thread reenforced by a cord or wire that is confined between the two walls. The exterior wall is adhesively or otherwise secured to the inner wall and is substantially cylindrical and smooth and its outer surface carries printing or other suitable decoration. The end of the cap or container is closed by the folded portions at the ends of the tubular body. The overlapping folded portions may be adhesively or otherwise secured together or they may be covered by an adhesively coated disk that has printing or decorating thereon for advertising. The end of the tube may also be closed by securing or crimping a metal top part to the interiorly threaded tubular paper or metal body part. In this manner a cap or container of the same type may be constructed having a rigid metal head that is formed with a depressed center and a knurled or corrugated gripping edge, as shown in Fig. 13, thereby providing a more rigid cylindrical structure.

It will be understood that the thread or bead may be rolled in the inner tubular body *a*, in the known manner of rolling threads in metal tubes. The cord, wire or other

reenforcement may then be wound or inserted in the exterior groove, after which the outer surface and reenforcement may be covered by another layer of paper, fibrous or other material, which may be secured to said outer surface adhesively or otherwise. For some purposes, the reenforcement may be omitted entirely, and after the thread has been formed or rolled in the tubular body, the outer wall may be cemented or otherwise secured to the apexes of the exterior threads on the inner wall, thereby bridging the helical exterior groove that corresponds to the interior helical thread, thus forming struts which reenforce the multi-ply wall of the tubular body.

I have also shown how tubular bodies may be helically corrugated or threaded and reenforced by flexible strip or device such as a fibrous cord or metal wire wound helically around one wall and completely confined between two walls or plies of the tube. Circular beads may be similarly formed in tubes and the like and reenforced by the bead-forming member that may be embedded or confined in the body coextensive with the bead. In the manufacture of bottle caps and similar articles, the materials used for the plies and top may preferably be paper or any suitable fibrous material, and, for some purposes, thin metal may be employed. However, heavier tubing of metal and other materials may be reenforced by winding wire or cable of any suitable size, helically around the outside thereof at a sufficient tension to force such wire or cable into the exterior surface of the tube while the same is supported on and moving along an exteriorly threaded mandrel. Such wire or cable may be forced into the exterior wall of the tube by a pressure roller acting alone, or by both pressure roller and tension on the cable or wire, as indicated in Fig. 6. Such circumferentially reenforced metal tubing is useful in the manufacture of piles of concrete, and has various other uses. The methods and means herein disclosed may likewise be employed for threading or beading tubes and rods, and, in its broader aspects, the threading or beading may be accomplished by moving said flexible cord or wire and the tube or rod relatively to one another, either being stationary or both being movable.

In its broader sense also, the principles of this invention may be applied to the manufacture of composite reenforced material generally, in which sheet material such as the paper web is fed over a stationary or movable corrugating support; whereupon the paper is corrugated and reenforced by disposing a cord-like reenforcing means in the corrugations formed in the outer face of the paper; and thereupon a paper or other covering is united to the said face to conceal said reenforcing means, further reenforce said material as a whole, and provide a substantially plain exterior surface thereon.

While I have shown and described the method, apparatus and product as applied to the manufacture of tubes, bottle caps, containers and like articles, I consider certain sub-combinations, elements, steps and features novel in themselves, and therefore do not wish to be limited to the exact features disclosed nor merely to the machine, process or product in its entirety. Furthermore, although I have shown and described in detail several methods of making reenforced plain and threaded tubular bodies, and machines for carrying out such methods, together with articles made thereby, it will be understood that, without departing from the scope of this invention, other methods and machines may be devised which involve the principles of my invention, and which will produce the articles herein disclosed or equivalents thereof, also tubes, containers and bottle caps having interior threads reenforced by a member embedded or confined within the wall of the tubular parts of the articles, but formed by moulding or deposition processes, or otherwise.

The improved articles and composite reenforced material disclosed herein are shown, described and claimed in another application copending herewith.

What I claim is:

1. The method of corrugating and reenforcing a rod or tube that comprises applying corrugating means to the outer surface of a rod or tube while said rod or tube is moved in the direction of its axis and retaining said corrugating means in place on the rod or tube to reenforce the same.

2. The method of forming a helically corrugated or threaded tube that comprises supporting a plain tube on a grooved or exteriorly-threaded mandrel, winding a flexible member around the tube at a tension that is sufficient to force portions of said tube into the groove or thread of the mandrel and retaining said flexible member in the groove formed by such inwardly forced portions of the tube.

3. The method of making an interiorly-threaded tube or the like that comprises supporting a tube on an exteriorly-threaded mandrel, causing the tube to move longitudinally of the mandrel, and applying a flexible cord, wire or similar means to the exterior of the tube with sufficient force to press portions of said tube into the thread-groove of the mandrel while said tube is moved at a velocity that is constantly proportional to the rate of application of such flexible means.

4. The method of making a tube having an interior bead or thread and a plain exterior surface that comprises supporting a

plain tube on an exteriorly-threaded mandrel, applying a flexible cord or wire to the outside of the tube with a force that is sufficient to press a helical portion of said tube into the thread-groove of the mandrel to form an interior thread, and applying means to the exterior of said tube and about said cord or wire and the exterior thread formed by it to form a plain outer surface for the tube.

5. The method of making a reenforced tube that comprises supporting a tube on an exteriorly-threaded and grooved mandrel, applying a flexible reenforcing member to the exterior of said tube by winding said member around said tube and therewith forcing a helical portion of the tube into the groove of the mandrel, and causing said tube to move axially of the mandrel while said flexible member is being applied thereto.

6. The method of making a receptacle or the like having a reenforced wall that comprises forming a tubular body, applying a flexible reenforcing device to the exterior of said body, and closing one end of said body.

7. The method of making a receptacle or the like having an interiorly-threaded reenforced wall which comprises forming a tubular body, winding a flexible strip around the outside of said body under sufficient tension to force inwardly a helical portion of the body to form an interior thread, covering said strip, and closing one end of said body.

8. The method of making a bottle cap or closure that comprises forming a tubular body, providing the same with container-engaging means, and then closing one end of said body.

9. The method of making bottle caps and the like that comprises forming a threaded tubular body from a continuous strip of suitable material, closing one end of said body, and thereafter severing a portion of the body, including such closed end.

10. The method of making a reenforced receptacle, bottle cap and the like that comprises forming a tubular body, embedding a reenforcing member in said body, and closing said body at one end.

11. The method of making a reenforced threaded bottle cap that comprises forming a tubular body, applying a member on said body to form a helical thread thereon and to reenforce said body, and closing one end of said body.

12. The method of making a bottle cap that comprises forming a tubular body of fibrous material having interior container-engaging means and a substantially plain or smooth exterior surface, and closing one end of said body.

13. The method of making bottle caps that comprises forming a tubular body, reenforcing said body and providing the same with a thread, and closing one end of the body.

14. The method of making a bottle cap that comprises forming a threaded tubular body of paper or fibrous material, and closing one end of said body.

15. The method of making a threaded bottle cap that comprises forming a multiple-wall body having a thread on the interior wall only, and closing one end of said body.

16. The method of making bottle caps that comprises forming a tubular body, providing the same with an interior thread by winding a cord or wire helically around the same, and securing a top part to one end of the body.

17. The method of making a bottle cap that comprises forming a tubular paper body, providing the body with an interior thread by winding a cord or wire helically around the same at a sufficient tension to force inwardly a helical portion of the tubular body, closing one end of the body and also securing an outer wall to the exterior of said body to conceal the outside of the latter and the cord wound around the same and to reenforce the body and provide a smooth outside surface therefor.

18. The method of making a receptacle, bottle cap or the like that comprises supporting a tubular body part on a helically-grooved mandrel and intermittently feeding said body part lengthwise of the mandrel, applying a flexible cord or wire to said tubular part while the latter is moving and therewith forcing a helical portion of said tubular part into the groove of the mandrel to form a thread on said body, closing the end of the tubular part each time the tubular part ceases feeding along the mandrel, and, during each cessation of movement of said tubular part, severing the same at a predetermined distance from the closed end thereof.

19. The combination with a helically grooved mandrel for supporting a tubular body, of means for applying a flexible member to said body in such manner as to force a portion of said body into said groove, and means whereby said body is moved axially of said mandrel.

20. The combination with a supporting mandrel for a tubular body, of means for forming an exterior groove in said body and applying a reenforcing member to said groove.

21. The combination with an externally-grooved mandrel for supporting a tubular body, of means for applying a device to said body so as to force a portion of the body into the groove in the mandrel, and means for closing one end of said body.

22. The combination with means for forming a tubular body having an interior

thread and a substantially plain exterior surface, of means for closing one end of said body.

23. The combination with mechanism for forming a tubular body, of mechanism for internally threading said body and mechanism for severing said body at intervals in its length.

24. The combination with mechanism for forming, threading, and advancing a tubular member, of means for interrupting said mechanism, and means for severing said member at intervals in its length during the interruptions of said mechanism.

25. The combination with means for supporting a tubular body, of means for winding a flexible member around the same, and means for closing one end of said body.

26. The combination with means for forming a tubular body, of means for winding a flexible cord or wire around the body to form a thread thereon, means for applying a top part to one end of said body, and means for cutting off a portion of the threaded body after a top part has been applied thereto.

27. The combination with means for forming a tubular body including a helically-grooved mandrel for supporting said body, means for winding a cord or wire around said body at a sufficient tension to force a helical portion of said body into the groove in the mandrel, means for applying a covering to the tubular body and the cord surrounding the same, and means for closing one end of the body.

28. In a receptacle or closure making machine, the combination with mechanism for forming a reenforced threaded tube comprising fibrous material, of means for closing one end of said tube.

29. In a machine of the class described, the combination with mechanism for forming a threaded tube, of means for folding inwardly portions of one end of said tube.

30. The combination with mechanism for forming a corrugated tube, of means for closing one end of said tube, and means for applying a member to the closed end of the tube.

31. The combination with means for forming a tubular body, of means for winding a cord around the same, means for applying a covering to the cord and the outside of said body, means for securing a cover part to one end of said body, and means for severing a portion of said body including the part to which said cover has been secured.

32. The combination with mechanism for forming, beading and feeding a tubular member, of means for interrupting said mechanism periodically, and mechanism for severing said tubular member during such interruptions.

33. The combination with mechanism for forming, beading and feeding a tubular member, of means for interrupting said mechanism periodically, and mechanism for severing said tubular member during such interruptions, comprising a rockable frame and a rotatable cutter mounted on said frame.

34. In a tube making machine, a mandrel arranged to support a tube and having a tapering part provided with a helical groove arranged to receive a portion of the tube adapted to be forced thereinto.

35. In a tube making and threading machine, the combination with an exteriorly-threaded mandrel, of heating means therefor and means adapted to cooperate with said mandrel to form a threaded tube.

36. In a tube making and threading machine, the combination with a tapering, exteriorly-threaded mandrel, of means for heating the same.

37. Beading mechanism comprising means for supporting the article to be beaded, flexible beading means arranged to engage the article to be beaded, and means for moving said supporting means and beading means relatively to one another to bead said article.

38. Threading mechanism comprising a threaded mandrel for supporting the article to be threaded, flexible cord-like or wire-like threading means arranged to engage the article to be threaded, and means for moving said mandrel and threading means relatively to one another so as to thread said article.

39. In a machine for threading closure bodies and the like, the combination of closure-body supporting means threaded to correspond to the thread of a vessel to which the closure is to be applied, flexible wire means cooperating with said supporting means to thread a body on such supporting means, and means for operating said wire means and said supporting means.

40. The method of making reenforced material that comprises corrugating flexible material and permanently inserting flexible reenforcing means wholly within groove means formed in one face of such material.

41. The method of making reenforced material that comprises transversely corrugating a web of flexible sheet material and permanently disposing cord-like reenforcing means wholly within groove means formed in one face of such material.

42. The method of making multi-ply reenforced material that comprises corrugating a member of flexible material and disposing reenforcing means in groove means thus formed, and applying a substantially plain covering to said member to conceal such corrugations and the reenforcing means therein and to provide a substantially plain surface on such corrugated member.

43. The method of making reenforced material that comprises corrugating flexible material and permanently disposing cord-like reenforcing means in corrugations formed in one face of such material, and uniting a substantially plain covering to such face to further reenforce said material and conceal such reenforcing means and to provide a substantially plain uncorrugated surface on one side of said material.

44. The method of making reenforced material that comprises continuously supplying a web of sheet material onto a corrugated surface, corrugating both faces of such web while it is moving along said surface and disposing reenforcing means in certain groove means thus formed, and supplying a substantially plain web of sheet material and uniting the same to such corrugated web.

45. The method of making reenforced material that comprises continuously supplying a web of sheet material onto a corrugated surface; corrugating both faces of such material while it is moving along said surface and permanently disposing flexible reenforcing means substantially wholly within groove means in one face of such material; and applying a separate substantially plain covering to the apexes of the corrugations of such face to conceal said reenforcing means and further reenforce said material and to provide a substantially plain uncorrugated surface on one side of said material.

46. The method of making reenforced multi-ply material that comprises supplying a web of paper onto a corrugated surface; corrugating both faces of said paper while it is moving along said surface and permanently disposing cord-like reenforcing means in groove means formed in one face of said paper; and supplying another web of paper and uniting it to such face to conceal said reenforcing means, further reenforce said material, and provide a substantially smooth exterior surface therefor.

47. The method of reenforcing paper that comprises corrugating both faces of paper sheet material and permanently disposing cord-like reenforcing means in groove means formed in one face of such material.

48. The method of making reenforced material that comprises corrugating sheet material and permanently disposing reenforcing means in groove means thus formed, and uniting a covering to a corrugated face of such material to further reenforce the same and provide a substantially plain exterior surface thereon.

49. The method of reenforcing paper that comprises corrugating paper sheet material and permanently disposing cord-like reenforcing means in groove means formed in one face of such material, and uniting a covering to such face to conceal such reenforcing means also to further reenforce said material and provide a substantially plain exterior surface therefor.

50. The method of making reenforced material that comprises delivering a web of material onto a corrugated surface, operating on such material while it is on such surface to simultaneously corrugate it and dispose reenforcing means in groove means formed in one face of such material, and uniting another web to said face to further reenforce said material and conceal said reenforcing means.

51. Apparatus for making reenforced material comprising the combination of corrugated means for supporting flexible material, and means cooperating with such supporting means to corrugate flexible material thereon and apply reenforcing means thereon.

52. Apparatus for making reenforced material comprising the combination of corrugated means for supporting flexible material, means cooperating with such supporting means to simultaneously corrugate flexible material thereon and apply reenforcing means thereto, and means for supplying and applying a covering to conceal said reenforcing means.

53. Apparatus for making reenforced material comprising the combination of corrugated means for supporting flexible material, and means for permanently applying tensioned reenforcing means onto material on such supporting means to simultaneously corrugate such material.

54. Apparatus for making reenforced material comprising the combination of means adapted to continuously supply a web of flexible material, corrugated means for supporting such flexible material, means cooperating with said supporting means to corrugate both faces of said material and to permanently apply flexible reenforcing means to one corrugated face of said material, and means adapted to continuously apply a covering of substantially plain material to the reenforced face of such corrugated material.

55. Apparatus for making reenforced material comprising the combination of means for continuously supplying flexible sheet material, corrugated means for supporting flexible sheet material, and means cooperating with said supporting means to corrugate both faces of said material and to permanently apply cord-like reenforcing means substantially wholly within the groove means in one face of said material.

56. Apparatus for making reenforced material comprising the combination of corrugated means for supporting flexible web material, means cooperating with said supporting means to corrugate both faces of said flexible material transversely of its

length and also permanently apply reenforcing means into the groove means in one face of said material, and means supplying a substantially plain covering material to conceal said reenforcing means and to provide a plain surface on such corrugated material.

57. The method of producing a reenforced corrugated product that comprises applying a flexible reenforcing cord or the like to one side of a wall with sufficient pressure to produce a corrugation in said wall, leaving said cord or the like in the corrugation formed thereby, and applying a covering to said wall to conceal said cord or the like and further reenforce said product.

58. The method of making reenforced interiorly threaded tubing that comprises forming a tubular body from a continuous strip of suitable material, forming an interior thread and corresponding exterior groove in the wall of said body and applying reenforcing means to such exterior groove, and applying means to the outside of said body to retain said reenforcing means in said exterior groove.

59. The method of making reenforced interiorly threaded tubing that comprises forming a tubular body from a continuous strip of suitable material, forming an interior thread and corresponding exterior groove in the wall of said body and applying reenforcing means to such exterior groove, and applying means to the outside of said body to cover said reenforcing means and said exterior groove and to provide a smooth exterior surface for said tubing.

60. The method of making a tube having an interior thread and a plain or smooth substantially cylindrical exterior surface that comprises supporting a plain tube on an exteriorly-threaded mandrel, pressing a helical portion of said tube into the thread groove of the mandrel to form an interior thread on said tube, and applying means to cover the entire exterior of said tube to provide a plain or smooth exterior surface for the tube.

61. The method of making a receptacle, closure or the like that comprises forming a tubular body from a continuous strip of suitable material, forcing inwardly portions of said body to provide attaching means thereon, applying a covering to the exterior of said body, closing one end of said body, and severing a portion of the body, including such closed end.

62. The method of making closures, receptacles and the like that comprises interiorly threading a tubular body, applying reenforcing means to the exterior of said body and closing one end of said body.

63. The method of making closures, receptacles and the like that comprises interiorly threading a tubular body, laying a cordlike or wire-like reenforcing member in the exterior groove corresponding to the interior thread formed in said body, applying a covering to said body to conceal said member and exterior groove, and closing one end of said body.

64. In a machine for making closures, receptacles and the like, in combination, supporting means for a hollow tubular body, flexible means cooperating with said supporting means, means for moving such supporting means and flexible means to bead a body on said supporting means, and means for closing one end of said body.

65. In a machine for making closures, receptacles and the like, in combination, a threaded mandrel for supporting a hollow tubular body, flexible cord-like or wire-like means cooperating with said mandrel, means for moving said mandrel and flexible means relatively to one another to thread a body on said mandrel, and means for closing one end of said body.

66. In a machine for threading tubing, the combination of a rotatable threaded mandrel for supporting tubing, flexible cord-like or wire-like means cooperating with said mandrel and tubing, and means for rotating said mandrel to cause said flexible means to thread said tubing and to cause said tubing to be fed axially of the mandrel.

67. In a machine for making closures, receptacles, and the like, the combination of supporting means for a tubular body, means whereby said body is threaded interiorly and whereby a reenforcing member is applied thereto, and means for closing one end of said body.

68. In a machine for making closures, receptacles, and the like, the combination of a threaded mandrel for supporting a tubular body, means whereby a body on said mandrel is threaded interiorly and whereby a cord-like or wire-like reenforcing member is laid in the exterior groove corresponding to such interior thread, means for applying a covering to the exterior of said body, and means for closing one end of said body.

69. The method of making tubing having a reenforced wall which comprises supporting a tube on an exteriorly-threaded or grooved mandrel, winding a flexible reenforcing member around the outside of said tube under sufficient tension to force a portion of said tube inwardly into the groove of said mandrel, and retaining said reenforcing member in the groove in said tube formed by said inwardly forced portion.

70. The method of making tubing which comprises supporting a paper tube on an exteriorly-threaded or grooved mandrel, winding a flexible reenforcing cord around the outside of said tube under sufficient ten-

sion to force a portion of said tube inwardly into the groove of said mandrel, causing said tube to move axially of the mandrel while said cord is being wound thereon, and applying a covering to the exterior of said tube to reenforce the same and to retain and conceal said cord in the exterior groove formed in said tube.

71. The method of making a receptacle, closure and the like having a reenforced wall which comprises supporting a tube on an exteriorly-threaded or grooved mandrel, winding a flexible reenforcing member around the outside of said tube under a tension that forces a portion of said tube inwardly into the groove of said mandrel and retaining said reenforcing member in the groove in said tube formed by said inwardly forced portion, and closing one end of said tube.

72. The method of making a receptacle, closure or the like having a reenforced wall which comprises supporting a paper tube on an exteriorly-threaded or grooved mandrel, winding a flexible reenforcing cord around the outside of said tube under a tension that forces a portion of said tube inwardly into the groove of said mandrel, causing said tube to move axially of the mandrel while said cord is being wound thereon, applying a covering to the exterior of said tube to reenforce the same and to retain and conceal said cord in the exterior groove formed in said tube, and closing one end of said tube.

73. The method of making reenforced interiorly corrugated tubing that comprises forming a tubular body, and forming an exterior groove and a corresponding interior corrugation in the wall of said body and applying reenforcing means to such exterior groove.

74. The method of making reenforced interiorly corrugated tubing that comprises forming a tubular body, forming an exterior helical groove and a corresponding helical interior corrugation in the wall of said body and applying reenforcing means to such exterior groove, and applying means to the outside of said body to retain said reenforcing means in said exterior groove.

75. The method of making reenforced interiorly corrugated tubing that comprises forming a tubular body, forming an exterior groove and a corresponding interior corrugation in the wall of said body, and applying means to said body to cover said exterior groove.

76. The method of making reenforced interiorly corrugated tubing that comprises forming a tubular body, forming a helical exterior groove and a corresponding helical interior corrugation in the wall of said body, and uniting means to the exterior of said body to close said exterior groove.

77. The combination with threaded supporting means for a tubular body, of flexible means cooperating with said supporting means to thread a body on said supporting means.

78. In a closure or receptacle machine, the combination with threaded supporting means for the tubular body of a closure or receptacle, of a wire-like means cooperating with said supporting means to thread a closure or receptacle body on said supporting means.

79. In a closure machine, the combination of a threaded support fitting the tubular body of a closure, of a flexible strip cooperating with said support, and means adapted to draw and tension said strip about a body on said support to force a helical portion of said body inwardly against said support, whereby said body is threaded.

80. The method of threading the body of a closure or receptacle that comprises drawing a flexible device against the exterior of said body under sufficient tension to force a portion of said body inwardly.

81. The method of threading the body of a closure, receptacle or the like that comprises supporting said body on a member having a helical groove, and drawing a flexible strip against the exterior of said body under sufficient tension to force a helical portion of said body inwardly into said groove.

82. The method of threading the sheet metal body of a closure that comprises supporting said body on a member having a helical exterior groove, and winding a wire about the exterior of said body under sufficient tension to force a helical portion of said body inwardly into said groove.

83. The method that comprises corrugating a layer of sheet material and disposing wire means in groove means thus formed, and uniting another layer of sheet material only to apexes of corrugations of such corrugated layer to provide a substantially plain or smooth surface on the latter.

84. The method that comprises corrugating a layer of flexible material and disposing wire means wholly within groove means in one face of such corrugated layer, and uniting a layer of plain flexible material to the apexes only of the corrugations of such face to provide a substantially plain or smooth surface on the latter.

85. The method of making a reenforced receptacle or the like that comprises forming a tubular body from a continuous strip of material, applying a continuous reenforcement to said body, and closing one end of such reenforced body.

86. The method of making reenforced receptacles or the like that comprises forming a tubular body from a continuous strip of material, applying a continuous reenforcing

strip to the exterior of said body, closing one end of such reenforced body, and severing a portion of such reenforced body including such closed end.

87. The method of making reenforced receptacles or the like that comprises applying a continuous strip of material to a mandrel to continuously form tubular body means, continuously applying reenforcement to such body means while feeding the same lengthwise of said mandrel, at intervals closing the end of such reenforced body means, and at intervals severing a portion of such reenforced body means including a closed end.

88. The method of making a reenforced tube that comprises supporting a substantially plain tube on an exteriorly threaded mandrel, forming an interior helical corrugation and a corresponding exterior groove in the wall of said tube and applying reenforcing means wholly within such exterior groove, and uniting a substantially plain covering to such corrugated tube at the apexes of the exterior corrugations thereof.

89. In a machine for making receptacles, closures and the like, the combination of a horizontal support for tubular bodies, a cap support horizontally in line with such body support, such caps having flanges adapted to telescopically fit such bodies, a chute adapted to deliver flanged caps to said cap support, means whereby said supports are relatively movable to telescopically apply such caps to said bodies, and means operative to apply pressure to cause cementitious substance between said flange and body to unite said cap and body.

In testimony whereof I hereunto affix my signature.

EUGENE L. GREENEWALD.