

Sept. 24, 1940.

J. J. WILLIAMS ET AL

2,215,731

METHOD AND APPARATUS FOR FORMING METAL CLOSURES

Filed Sept. 28, 1937

2 Sheets-Sheet 1

Fig. 1.

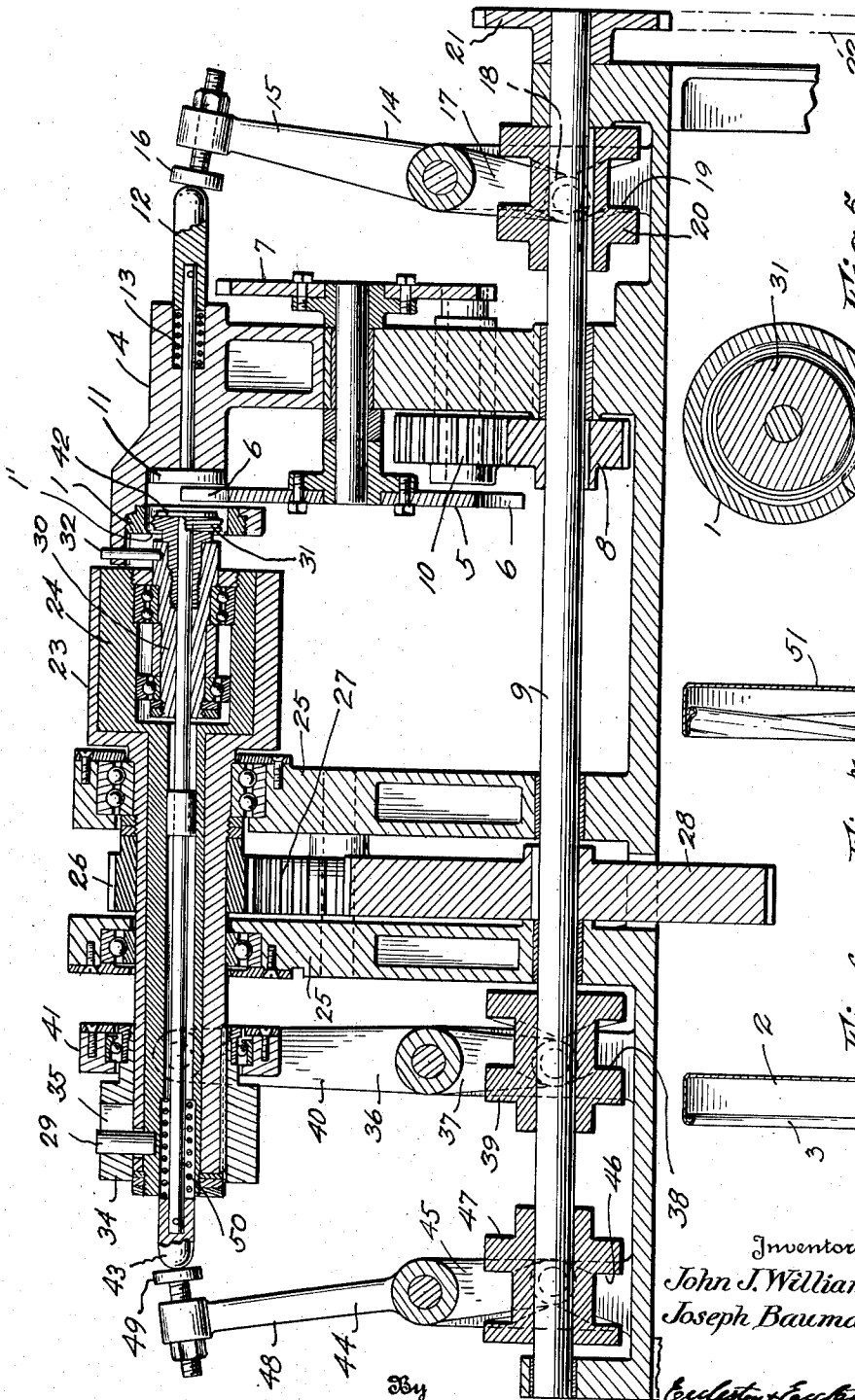


Fig. 5.

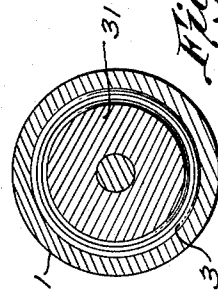


Fig. 7.

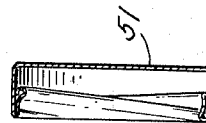
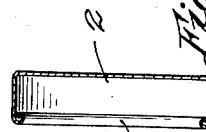


Fig. 6.



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2 Sheets-Sheet 2

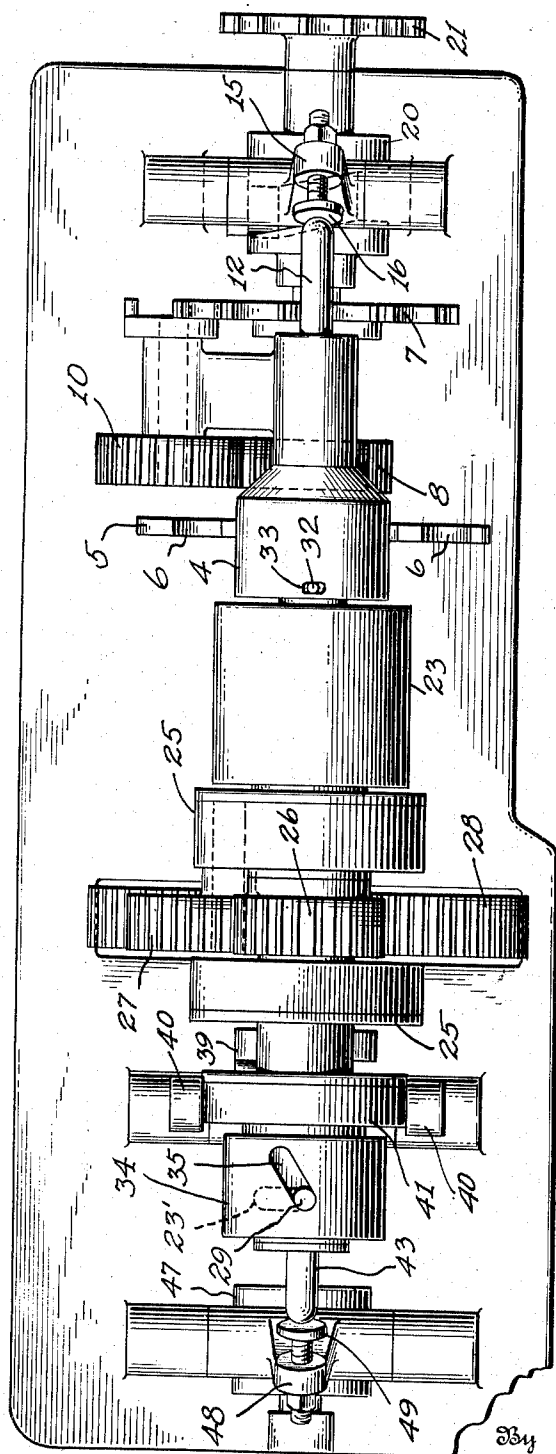


Fig. 2.

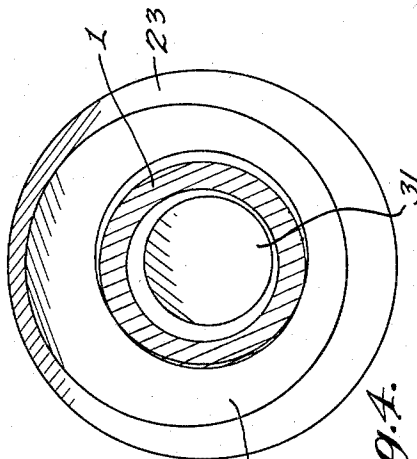


Fig. 4.

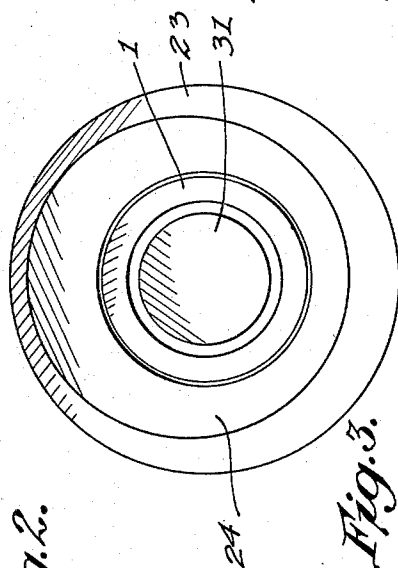


Fig. 3.

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2,215,731

METHOD AND APPARATUS FOR FORMING
METAL CLOSURES

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Application September 28, 1937, Serial No. 166,166

26 Claims. (Cl. 153—7)

The invention relates to a method and apparatus for forming metallic screw caps for containers, particularly caps in which the screw threads are hidden from exterior view. Caps of this general type are old, as shown by the patent to Kempien No. 725,970, April 21, 1903, and one of the objects of this invention is to provide a new method and apparatus by which concealed-thread screw caps can be manufactured at a high rate of speed, and by which the cap produced will be efficient in operation as closures for containers.

A further object of the invention is to provide a method and apparatus for producing this type of cap, in which the blank holder is stationary, thereby avoiding the marring or disfiguring of the cap coating, which often occurs during the insertion of blanks in spinning blank holders.

A further object of the invention is to provide a method and apparatus by which the forming tool, which may be of different types, is given a bodily revolving motion, in connection with a stationary cap blank, whereby the threads are formed by a pressing action, as distinguished from a rolling or spinning action.

Various other objects and advantages of the invention will be apparent to those skilled in the art, from the following detailed description, when taken in connection with the accompanying drawings; in which,

Figure 1 is a vertical longitudinal sectional view of the apparatus.

Figure 2 is a plan view thereof.

Figure 3 is a diagrammatic view illustrating the positions of certain parts, before the forming tool is moved laterally into engagement with the cap blank.

Figure 4 is a similar view showing the positions of the same parts, after the forming tool has been moved laterally into engagement with the cap blank.

Figure 5 is a sectional view through the blank holder and forming tool.

Figure 6 is a sectional view of a cap blank prior to being threaded; and

Figure 7 is a sectional view of a completed cap.

Referring to the drawings in more detail, numeral 1 indicates a cap blank or shell holder. The blanks or shells introduced into the holder 1 are preferably in substantially the form shown in Figure 6, where the blank 2 is provided with an incurled bead 3. This incurled bead may be formed by engaging the edge of the blank skirt with a die having an annular curling groove, or other means may be employed for forming the

incurled bead. The bead is shown as substantially circular in cross-section, though it may be of greater depth than its thickness, or of other form.

The shell holder 1 is stationary, and is suitably mounted in a frame 4. It has heretofore been the practice in the manufacture of any kind of a screw cap, to have the cap shell rotate, but in accordance with the present invention the shell holder and the shell remain stationary, as will be described in more detail hereinafter.

The cap shells or blanks may be periodically delivered to the shell holder, by any desired means. In the present form there is shown a feed wheel 5 provided with a series of pockets 6. Plates (not shown), or other suitable means, are provided for holding the blanks in the pockets. This feed wheel is rotated step-by-step by a Geneva wheel 7. For operating the Geneva movement a gear 8 keyed to the main drive shaft 9, meshes with a gear 10. The ratio of these gears is such that the feed wheel will move one step for each complete rotation of the main drive shaft. This brings a pocket 6 into alignment with the shell holder 1. The feed wheel now remains stationary and a plunger 11 is operated to deliver the shell from the pocket to the holder. The plunger 11 has a shank provided with an outwardly projecting portion 12, and a spring 13 normally holds the plunger in its retracted position.

Numeral 14 refers to a lever, the upper arm 15 of which is provided with an adjustable lug 16, for engagement with the projecting portion 12 of the plunger 11. The lower arm 17 of the lever carries a roller 18 which rides in the groove 19 of a cam 20 keyed to the main drive shaft 9. Thus the rotation of the drive shaft causes the plunger, at the proper moment, to move to the left (Fig. 1) and deliver a cap shell from a pocket 6 of the feed wheel to the shell holder 1. The forward movement of the shell in the holder is limited by a shoulder 1'. The plunger remains in its advanced position until the cap is completed, and the cam then permits the spring 13 to return the plunger to its normal or inactive position. This forward and backward movement of the plunger occurs once for each cycle of operation of the machine, i. e., once for each rotation of the main drive shaft. The main drive shaft is continuously rotated by any desired means, as by sprocket wheel 21 driven by a sprocket chain 22, leading from any desired source of power. After the cap has been completed it will be returned to the pocket of the feed wheel, by a

knock-out pad to be hereinafter described; and the wheel is then rotated one step to carry off the completed cap and to bring another shell into position for delivery to the shell holder 1.

5 The mechanism for operating the forming tool, will now be described. Numeral 23 refers to an outer cylindrical spindle which is eccentrically bored, and numeral 24 refers to an inner cylindrical spindle which is also eccentrically bored.

10 The outer spindle is appropriately mounted for rotation in standards 25. Keyed to the outer spindle is a gear 26, which meshes with an intermediate gear 27. The intermediate gear meshes with a gear 28 keyed to the main drive shaft 9. Thus the outer spindle is continuously rotated. The gear ratio between the drive shaft and the spindle may be as desired, usually such that the spindle will make about six revolutions for one revolution of the drive shaft, though no attempt has been made to show any particular gear ratio in the drawings.

20 The inner spindle 24 continuously rotates with the outer spindle 23, by reason of a pin 29 which is attached to the inner spindle and projects through a suitable opening in the outer spindle and into a slot provided in a collar slidably keyed to the outer spindle, as will appear more fully hereinafter.

30 As mentioned hereinbefore, both the outer spindle and the inner spindle are eccentrically bored, and mounted within the eccentric bore of the inner spindle is the shank 30 of the threading tool 31. It is to be particularly noted that the threading tool does not rotate about its own axis, and to prevent such rotation a pin 32, mounted in the shank of the threading tool, passes through an opening 33 in the frame of the shell holder. The opening 33 is slightly elongated to permit the hereinafter described bodily revolving movement of the threading tool, but prevents any rotation of the threading tool about its own axis.

40 The arrangement is such that when the axis of the threading tool is central of the blank holder, such axis coincides with the center of the outside diameter of the outer spindle, as illustrated diagrammatically in Figure 3. When the parts are in such positions, it will be noted, particularly by reference to Figure 5, that the threading tool is only slightly spaced from the incurled bead 3 of the cap blank; and of course this slight spacing is uniform throughout the entire circumference. And it will also be apparent, with the parts in the positions described, that the continuous rotation of the inner and outer spindles will impart no movement whatever to the threading tool, for the inner and outer spindles are in a neutral position.

50 To start forming the thread in the cap blank, the forming tool must be moved laterally to bring the tool into engagement with the incurled bead of the cap blank; and when the cap is completed the tool must be moved back to its original position to free the cap. Any desired means may be employed for periodically effecting this lateral movement of the threading tool. In the particular embodiment illustrated, a collar 34 is slidably keyed to the outer spindle so that it may be moved axially of the spindle, but cannot rotate relative thereto. The pin 29, which is carried by the inner spindle, extends into a slot 35 provided in the collar. Thus the two spindles and the collar will rotate in unison. By reference to Fig. 2 it will be noted that the slot is diagonal of the collar, so that as the collar is moved backward or forward, the inner spindle will be ro-

tated relative to the outer spindle. The outer spindle is provided with a slot 23' in which the pin 29 rides, which slot permits the relative rotation between the two spindles.

For moving the collar back and forth periodically, a lever 36 is provided adjacent the collar. The lower arm 37 of the lever carries a roller which rides in a groove 38 of a cam 39 keyed to the main drive shaft 9. The upper arm 40 of the lever is forked, and the prongs are connected with a ring 41 associated with the collar 34.

For each completed rotation of the drive shaft, the collar will be moved in one direction to rotate the inner spindle in one direction relative to the outer spindle, to bring the thread forming member into operative engagement with the incurled bead of the cap blank, and after the cap is formed the collar will be moved in the opposite direction to rotate the inner spindle back to its original position relative to the outer spindle, to free the tool from the completed cap. The distance that the thread forming tool is thrown off center determines the pressure the tool will exert on the incurled bead, and of course any desired means may be employed for varying the extent the tool is thrown off center.

When the tool is thrown off center into engagement with the incurled bead, by the relative rotation of the two spindles, the tool then travels around the interior of the blank, but without any rotation of the tool about its own axis. The result is that the thread is formed in the blank by a sort of pressing action as distinguished from a rolling or spinning action, as will be made more clear hereinafter. Figure 4 illustrates diagrammatically the relation of the inner and outer spindles, the blank holder, and the thread forming tool, when the tool is in operative position.

After the cap has been completed, and the threading tool is moved to its inoperative or neutral position, the cap is moved from the holder into the pocket 6 from which the blank was originally delivered to the holder, by a knock-out pad 42. This pad is provided with a shank which extends through the inner spindle, and has an outwardly extending projection 43.

For operating the knock-out pad at the desired instant a lever 44 is provided. The lower arm 45 of this lever carries a roller which rides in a groove 46 of a cam 47 keyed to the main drive shaft; and the upper arm 48 carries an adjustable lug 49 positioned to engage the outwardly projecting portion 43 of the pad shank. Thus every time the main shaft makes a complete rotation, the knock-out pad is moved to the right (Fig. 1) to eject a completed cap. A spring 50 returns the pad to its normal position. The completed cap is illustrated in Figure 7, and is referred to by numeral 51. At the instant the knock-out pad is operated to eject a completed cap, the plunger 11 is moved to inoperative position.

The operation will now be described. The blanks with the incurled bead are carried step-by-step into alignment with the blank holder by the feed wheel 5, and at the proper instant the plunger 11 is operated to push a blank from a pocket 6 into the blank holder. The blank holder and blank remain stationary.

When the blank is delivered to the holder, the axis of the threading tool is central of the blank holder, and coincides with the center of the outer diameter of the outer spindle 23. That is, the parts are in the positions shown in Figures 3 and 5. When in this position, the threading tool

is preferably spaced only slightly from the incurled bead on the cap blank.

As stated above the cap blank does not rotate, and the threading tool also does not rotate, but has a bodily revolving movement.

The inner and outer spindles, which are in effect a single spindle with relatively movable parts, are rotating continuously, but no movement is imparted to the threading tool, for the inner and outer spindles are in neutral position. The blank having been delivered to the holder, the cam 39 now throws the lever 36 and thereby moves the collar 34 longitudinally of the spindles. Upon such movement of the collar, the diagonal slot 35 therein, and the cooperating pin 29, cause the inner spindle to be rotated relatively to the outer spindle; the outer spindle being provided with the slot 23' to permit the relative rotation.

This relative rotation of the spindles throws the threading tool off center, and into operative engagement with the incurled bead of the cap blank. The extent the tool is moved off center determines the pressure exerted on the incurled bead, and of course the extent it is moved off center can be varied by any desired means.

When the tool is moved off center to bring it into engagement with the incurled bead, a thread portion is formed at the point where the tool is forced into the bead. And it is to be noted that as neither the blank nor the tool is rotating, the thread portion at that point is formed by substantially a pressing action. And that is true of the whole operation, as will now appear.

Let it be assumed, merely for purposes of explanation, that a north point of the threading tool coincides with a north point of the cap blank, when they are originally brought into operating thread-forming relation, and a thread portion is thereby pressed at the north point. The outer and inner spindles are of course continuously rotating, and the pin 32 prevents any rotation of the threading tool. But the threading tool has been moved to an off-center position, and hence it will have a bodily revolving movement around the incurled bead, in thread-forming relation therewith. During this bodily movement, the above-mentioned north point of the threading tool remains substantially aligned with the north point of the cap blank, so it will be apparent that the whole thread-forming operation is substantially a pressing operation, rather than a rolling or spinning operation. Such a method and apparatus for forming screw caps, either of the continuous thread or interrupted thread type, are believed to be broadly new. It is true that the Douglas Patent No. 1,010,740, granted Dec. 5, 1911, shows a tool which is intended to form threads, and which tool is given a bodily revolving movement. But in Douglas the tool not only has a bodily revolving movement, but also rotates about its own axis, and the blank rotates about its own axis. And in Douglas the thread-forming tool does not operate upon an incurled bead of a blank, but rather upon the blank skirt, and in some manner is intended to spin portions of the skirt metal into threads. The present method and apparatus bear no relation to the Douglas disclosure.

The cap having been completed, the cam 39 now moves the collar 34 in the opposite direction, to turn the inner spindle back to its original position relative to the outer spindle. This relative movement of the inner spindle positions the forming tool centrally of the blank holder, so that the completed cap is free of the forming

tool; and as the inner and outer spindles have been returned to neutral position, no further motion is imparted to the forming tool, by the continuous rotation of the inner and outer spindles.

The cap having been completed, cam 47 now operates the knock-out pad 42, to remove the cap from its holder and place it in the pocket 6 of the feed wheel, from which it was originally delivered to the holder. At the same time the plunger 11 is withdrawn to its inactive position. A cycle of the machine is thus completed, and each time the main drive shaft makes a rotation, a cap is formed.

While the method and apparatus have been shown and described as producing concealed thread caps by the bodily revolving movement of a thread-forming tool, yet a modified form of the invention produces such caps by a chasing action. The claims presented are broad enough to cover either, but no claim is presented in this application specific to a chasing method or apparatus.

Having fully described the invention, what we claim is:

1. The method of forming concealed thread single-shell metallic closures, which comprises first forming an incurled bead on a blank skirt, and then causing a substantially non-rotating threaded tool to move bodily around the interior of the non-rotating blank in pressing engagement with the incurled bead.

2. The method of forming concealed thread single-shell metallic closures, which comprises first forming an incurled bead on a blank skirt, and then causing a substantially non-rotating threaded tool to move bodily around the interior of the blank skirt in pressing engagement with the incurled bead, while the blank is held stationary.

3. The method of forming concealed thread single-shell metallic closures, which comprises forming an incurled bead on a blank skirt, and then by relative movement between the blank and a substantially non-rotating threaded tool, causing the threaded tool to be brought into pressing engagement with the incurled bead throughout its circumference, to press the threads of the tool into the incurled bead, while the exterior of the blank is maintained undeformed.

4. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder, said holder having a plain interior surface in contact with the blank, a non-rotating threaded tool, and means for moving the non-rotating threaded tool bodily about the interior of a blank in the blank holder.

5. An apparatus for manufacturing concealed thread single-shell metallic closures, including a non-rotating blank holder, a substantially non-rotating threaded tool, and means for moving the substantially non-rotating threaded tool bodily about the interior of a blank in the blank holder.

6. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder, a substantially non-rotating threaded tool, and means for moving the tool bodily about the interior of a stationary blank in the blank holder.

7. An apparatus for manufacturing concealed thread single-shell metallic closures, including a non-rotating blank holder, a threaded tool, means for preventing substantial rotation of the tool, and means for imparting a bodily revolving movement to the tool.

8. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder, a threaded tool, means for preventing substantial rotation of the tool, and means for imparting a bodily revolving movement to the tool.
9. An apparatus for manufacturing concealed thread single-shell metallic closures, including a non-rotating blank holder, a threaded tool, means for preventing substantial rotation of the tool, means for moving the tool into and out of engagement with a blank in the blank holder, and means for imparting a bodily revolving movement to the tool.
10. An apparatus for manufacturing concealed thread single-shell metallic closures, including a non-rotating blank holder, a threaded tool, means for preventing substantial rotation of the tool, means for moving the tool into and out of engagement with a blank in the blank holder, means imparting a bodily revolving movement to the tool while in operative relation with the blank, and means for discontinuing the bodily movement of the tool holder when it is moved to a position central of the blank holder.
11. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder adapted to receive a blank having an incurled bead, said blank holder having a plain interior surface in contact with the blank, a non-rotating threaded tool, the non-rotating threaded tool having a diameter slightly less than the inner diameter of the incurled bead, and means for moving the thread-forming tool bodily about the interior of the blank in pressing engagement with the incurled bead.
12. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder adapted to receive a blank having an incurled bead, a non-rotating threaded tool having a diameter slightly less than the inner diameter of the incurled bead, and means for imparting a bodily revolving movement to the thread-forming tool.
13. An apparatus for manufacturing concealed thread single-shell metallic closures, including a blank holder fixed against movement longitudinally of its axis, a thread forming tool fixed against movement longitudinally of its axis, means for delivering a cap blank to the holder, and means for ejecting a completed cap from the holder.
14. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder having a smooth cylindrical interior, said blank holder adapted to receive a blank having an incurled bead, a non-rotating threaded tool, and means for moving the tool around the interior of the blank in pressing engagement with the incurled bead.
15. An apparatus for manufacturing concealed thread single-shell metallic closures, including a non-rotating blank holder having a smooth cylindrical interior, said blank holder adapted to receive a blank having an incurled bead, a substantially non-rotating threaded tool, and means for moving the tool around the interior of the blank in pressing engagement with the incurled bead.
16. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder having a smooth cylindrical interior, said blank holder adapted to receive a blank having an incurled bead, a substantially non-rotating threaded tool, and means for moving the tool around the interior of the blank in pressing engagement with the incurled bead.
17. An apparatus for manufacturing concealed thread single-shell metallic closures, including a non-rotating blank holder having a smooth cylindrical interior, said blank holder adapted to receive a blank having an incurled bead, a substantially non-rotating threaded tool, said tool having a diameter only slightly less than the inner diameter of the incurled bead, and means for causing relative movement between the holder and tool to bring the tool into pressing engagement with the incurled bead throughout the entire circumference of the bead.
18. An apparatus for manufacturing concealed thread single-shell metallic closures, including a blank holder having a smooth cylindrical interior, the front and rear ends of said holder being open, an incurled shoulder at the forward end of the holder, means for feeding a blank with an incurled bead through the rear end of the holder into engagement with the incurled shoulder, and a thread-forming tool for forming threads in said incurled bead, said tool extending through the front end of the holder.
19. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder having a smooth cylindrical interior, an inwardly extending shoulder at the front end of the holder, means for feeding a blank with an incurled bead through the rear end of the holder and a thread-forming tool for forming threads in said incurled bead, said tool extending through the front end of the holder.
20. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder having a smooth cylindrical interior, means for feeding a blank with an incurled bead through the rear end of the holder, and a thread-forming tool for forming threads in said incurled bead, said tool extending through the front end of the holder.
21. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder having a smooth cylindrical interior, said blank holder being open at its front and rear ends, means for feeding through the rear end thereof a blank having an incurled bead, a threaded tool extending through the front end of the holder, said tool being substantially non-rotating, and means for moving the tool around the interior of the blank in pressing engagement with said incurled bead.
22. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder having a smooth cylindrical interior, said blank holder being open at its front and rear ends, an inwardly extending shoulder around the front end thereof, means for feeding a blank with an incurled bead through the rear end of the holder into engagement with said shoulder, a threaded tool extending through the front end of the holder, said tool being substantially non-rotating, and means for moving the tool around the interior of the blank in pressing engagement with said incurled bead.
23. An apparatus for manufacturing concealed thread single-shell metallic closures, including a blank holder having a smooth cylindrical interior, said blank holder being open at its front and rear ends, a feeding device for aligning with the rear end of the holder blanks having an incurled

bead, means for delivering the blanks to the holder through the rear end thereof, and a thread-forming tool for forming threads in said incurled bead, said tool extending through the front end of the holder.

- 5 24. An apparatus for manufacturing concealed thread single-shell metallic closures, including a blank holder having a smooth cylindrical interior, said blank holder being open at its front and rear ends, a feeding device for aligning with the rear end of the holder blanks having an incurled bead, means for delivering the blanks through the rear end thereof, a thread-forming tool for forming threads in said incurled bead, said tool extending through the front end of the holder, and means for discharging the completed closure through the rear end of the holder.

- 10 25. An apparatus for manufacturing concealed thread single-shell metallic closures, including a stationary blank holder having a smooth cylindrical interior, said blank holder being open

at its front and rear ends, a feeding device for aligning with the rear end of the holder blanks having an incurled bead, means for delivering the blanks to the holder through the rear end thereof, a threaded tool extending through the front end of the holder, said tool being substantially non-rotating, and means for moving the tool around the interior of the blank in pressing engagement with said incurled bead.

- 15 26. An apparatus for manufacturing concealed thread single-shell metallic closures, including a non-rotating blank holder having a cylindrical interior, said blank holder adapted to hold a blank having an incurled bead, a non-rotating threaded tool, and means for relatively moving the non-rotating tool and the non-rotating blank holder so that the tool is brought into pressing engagement with the incurled bead throughout the circumference of the incurled bead.

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