

Oct. 15, 1940.

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2,218,102

METHOD AND APPARATUS FOR MAKING CONTAINER CAPS

Filed Oct. 21, 1937

3 Sheets-Sheet 1

Fig.1.

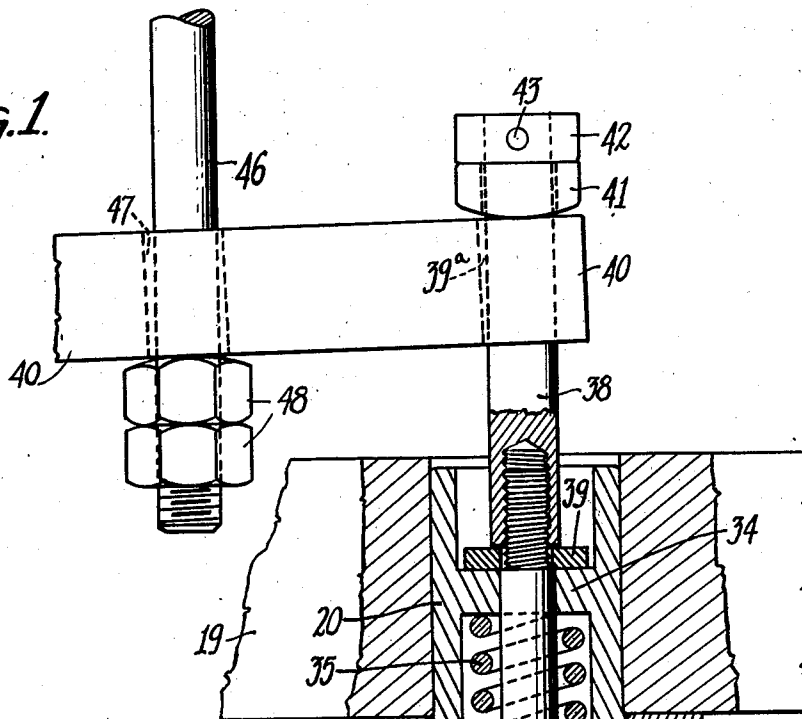
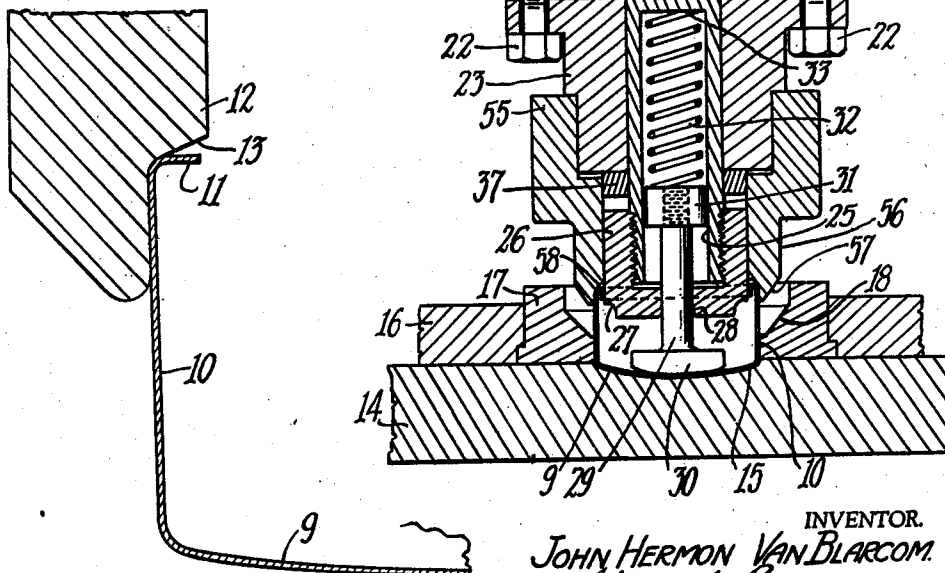


Fig. 4.



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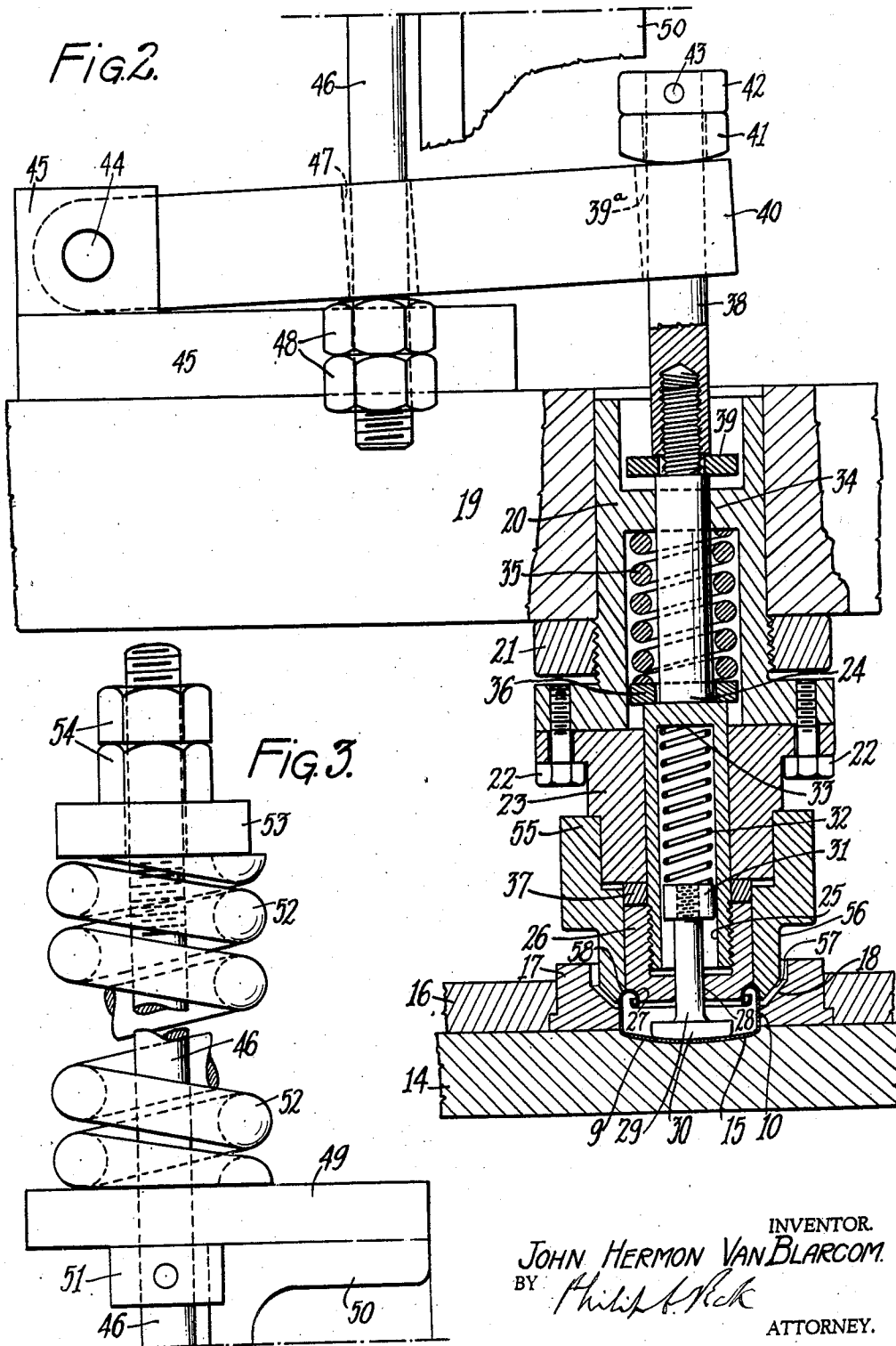
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METHOD AND APPARATUS FOR MAKING CONTAINER CAPS

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

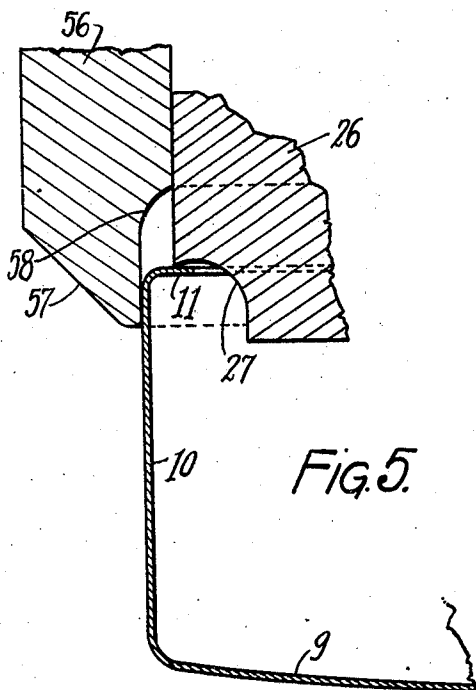


Fig. 5.

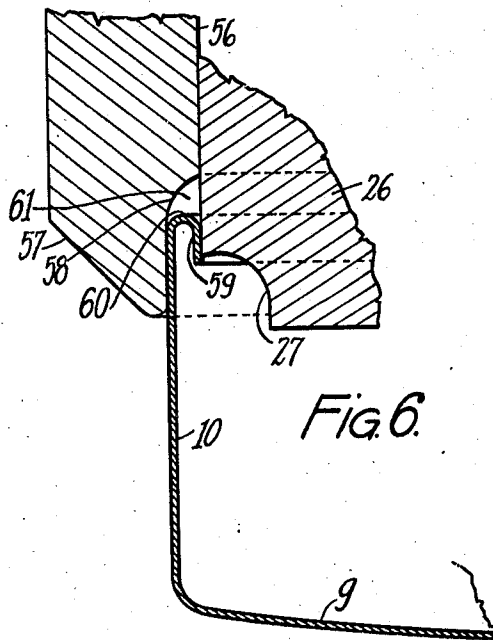


Fig. 6.

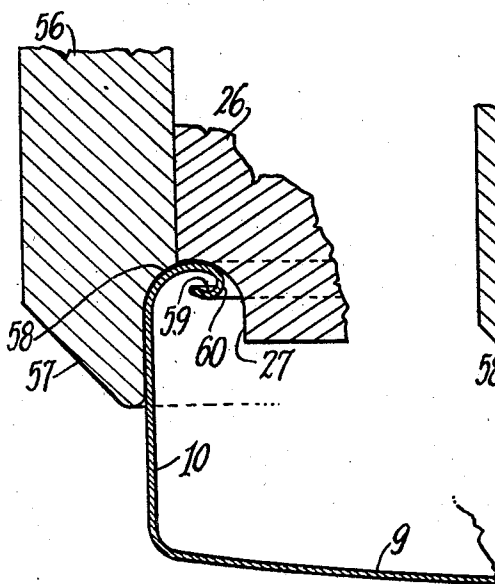


Fig. 7.

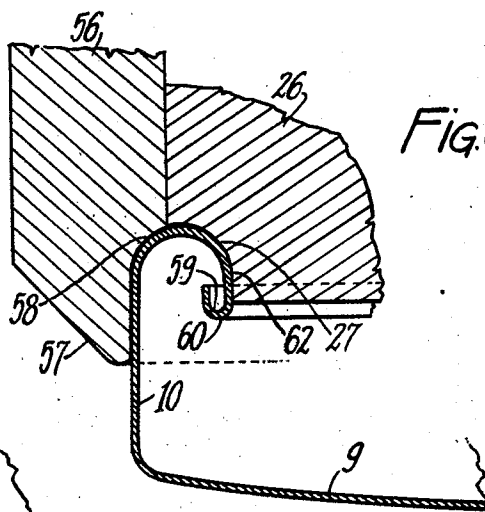


Fig. 8.

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METHOD AND APPARATUS FOR MAKING
CONTAINER CAPS

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Application October 21, 1937, Serial No. 170,202

8 Claims. (Cl. 153—2)

My invention relates particularly to improved methods and apparatus for making single-piece sheet-metal caps or closures used for sealing the openings in containers, jars, cans or bottles, in which the cap seals the container orifice when affixed in sealing position and is locked thereto by screw threads or lugs outside the contour of the nozzle or neck of the container. These screw-threads are preferably formed on the intumed inner shell integral with the cap skirt, and are adapted to engage suitable threads or lugs on the neck of the container. In container caps of the lug type, the lower edges of the skirt are preferably formed with an inwardly curled bead inside the peripheral zone of the skirt, which bead carries the intumed locking lips or lugs of the cap.

Present commercial requirements for such screw-thread or lug cap closures formed of a single piece of sheet metal are (1) that the outer depending skirt shall be uniformly cylindrical and also present a smooth exterior surface throughout its entire area to allow for lacquering of the sheet metal without showing any indentations resulting from the embossing of the inner screw threads or formation of the lugs; (2) that the lower edge of the skirt be formed with a rounded bead that lies in the same horizontal plane throughout its circumference in mutual parallelism with the top or crown of the cap; (3) that the rounded screw threads be formed on an inner cylindrical shell integral with the cap skirt without any raw edges of the sheet material comprising this inner shell carrying the screw threads projecting anywhere inside the cap, and also without injuring the lacquer coating applied to the sheet metal before it is formed into the completed cap; and (4) that in the caps of the lug type the intumed locking lips integral with the inwardly rolled bead shall possess sufficient rigidity to form a tight seal, yet with enough flexibility in the cap as a whole when in coating engagement with the container lugs to allow for inevitable variations in the glass container nozzles.

The principal object of my invention is to provide a simple, effective and economical method and apparatus for the production of container caps either of the screw-thread type or of the lug type by bending inwardly the lower margin of the cylindrical skirt throughout its periphery into an inner cylindrical wall or shell spaced from the skirt, having its raw or free edge preferably formed with a folded hem within the contour of this inner wall. Thereafter such nov-

elly produced container cap may have the inner wall or shell suitably embossed with screw threads in the ordinary thread rolling machine or by other thread forming machines, or spaced-apart portions of this inner wall may be bent or pressed into locking lugs supported integrally by the inwardly curled bead along the rim of the cap skirt.

Further objects of my invention and advantages derived from utilizing my improved methods and apparatus for shaping and making these single-piece caps from sheet-metal blanks having a circular crown and cylindrical skirt will be hereinafter described in which by a single stroke of the curling tool, the cup-shaped blank is shaped along its lower rim with the intumed cylindrical wall or shell spaced from the skirt.

In the accompanying drawings,

Fig. 1 is a vertical sectional view of the apparatus or tool comprising the essential parts of the mechanism for forming the container cap, such mechanism being mounted on the ram of a stamping machine or press commonly used for bending or shaping the sheet-metal;

Fig. 2 is a sectional view somewhat similar to Fig. 1, but showing the apparatus or tool as arranged in a subsequent operation or stage of the press in forming the cap shell;

Fig. 3 is an elevation of part of the apparatus superposed upon that shown in Fig. 2;

Fig. 4 is an enlarged detail sectional view of the cup-shaped sheet-metal shell showing the curling die in the first curling operation to form a right-angled intumed flange on the rim of the cap skirt to prepare same for the next operation. This view illustrates a standard curling die having a circular beveled face that is commonly used and hence no detailed construction need be shown;

Fig. 5 is an enlarged detail sectional view of the cap shell shown in Fig. 4 about to be engaged by the external and internal curling dies shown in Figs. 1 and 2;

Fig. 6 is an enlarged detail sectional view of the cap shell showing the right angle flange of the shell shown in Fig. 4, which is bent downwardly substantially 90° by the heel of the internal curling die as shown in Fig. 1 in the next curling operation;

Fig. 7 is a sectional view on the same scale as Figs. 4-6, but illustrating the internal curling die raised to permit further inward curling of the lower margin of the skirt in the next curling operation succeeding that shown in Fig. 6 with

the folded hem of Fig. 6 starting to follow the course of the internal curling die; and

Fig. 8 shows the completion of the curling of the shell by the descent of the internal and external curling dies at the end of the stroke through the downward movement of the ram of the press.

Similar numerals refer to similar parts throughout the several figures.

Referring to the drawings, showing the successive curling or inward rolling action on the lower margin of the cap skirt, the container cap is initially stamped from sheet-metal into a cup-shaped blank by any well-known machine to comprise the top or crown 8 and depending cylindrical skirt 10 with its right-angled flange 11 along the skirt rim as shown in Fig. 4 by the use of the customary curling die 12 having the annular beveled face 13. Such sheet metal may be advantageously coated with lacquer or other similar materials for decorative purposes on the outside of the cap as well as on the inner shell before such blank is initially stamped to form the cup-shaped closure shown in Fig. 4.

This Fig. 4 cap is then brought into position in the stamping machine or press shown in Figs. 1-3 with the right-angled flange 11 of the cap skirt 10 in contact with the external and internal curling dies of the press as shown in Fig. 5.

Referring more particularly to Figs. 1-3, the stamping machine or press comprises the bed-plate 14 having the cylindrical hollowed-out pocket 15 to enclose the cap crown 8, which bed-plate 14 supports the dial ring 16 enclosing the dial bushing 17 having the upwardly presented beveled face 18. The ram 19 of the ordinary punch press (not shown) is raised and lowered by any suitable mechanism (not shown) to impart the usual vertically reciprocable movement to the ram 19.

Mounted on the ram 19 is the curling tool shank 20 held thereto by the adjusting nut 21, and secured to the shank 20 by screw bolts 22 is the curling tool holder 23 within which is slidably secured the internal curling punch plunger 24 having its lower ends in the form of an open tube 25 and externally threaded to carry the internal curling die 26 with its lower end formed with the inwardly cut curved face 27 extending circumferentially around the bottom of the die 26 (Figs. 1 and 2). The bottom of the die 26 is formed with the hole 28 through which slides the stem 29 of the clamping and ejector member 30 that in its Figs. 1 and 2 position firmly holds the cap crown 9 in the pocket 15. The upper end of stem 29 has fastened thereto the cylindrical washer 31 that slides within the tube 25 and supports the lower end of the coil spring 32, the upper end of which bears against the top 33 of the plunger tube 25 (Figs. 1 and 2). The plunger 24 is slidably supported in the ring 34 integral with the curling shank 20 below which is the spring 35 coiled about the plunger 24 with the lower end of the spring 35 resting on the washer 36 carried by the plunger tube 25, while the upper end of the spring 35 bears against the ring 34. The lower end of the holder 23 carries the thrust washer 37 encircling the tube 25 as shown in Figs. 1 and 2, which washer is adapted to engage the top of the internal curling die 26.

The lower end of the internal die lift shank 38 is interiorly screw-threaded to hold the upper screw-threaded end of the plunger 24 which is encircled by the stop washer 39 that bears on the ring 34 of the shank 20. The lift shank 38

projects upwardly through the slot 39^a in the lift lever 40 for the die 26 and is held thereto by the washer 41 and collar 42 secured to the shank 38 by the friction pin 43. The lever 40 is fulcrumed on the pin 44 secured in the upturned bracket 45 carried by the ram 19 (Fig. 2), and such lever 40 is a 2 to 1 ratio and is actuated by the return rod 46 passing through the hole 47 of the lever 40 to which it is held by the nuts 48.

As shown in Fig. 3 the return rod 46 passes slidably through the mounting plate 49 of the angle bracket 50 fastened to the side of the press (not shown), such rod 46 having pinned thereto below the plate 49 the stop collar 51. Coiled about the upper end of the return rod 46 is the heavy spring 52, the lower end of which rests on the plate 49 while the upper end of the spring 52 bears against the washer 53 adjustably secured on the return rod 46 by the nuts 54. The mechanism hereinbefore described is provided to actuate the internal curling die 26 in timed relation with the external curling die as illustrated in successive curling operations shown in Figs. 4-8.

The external curling die 55 is secured around the lower end of the holder 23 as shown in Figs. 1 and 2 to provide a slight clearance so that the thrust washer 37 may receive the impact of the die 26 when raised from its Fig. 1 position to that shown in Fig. 2. The lower end 56 of the die 55 surrounds the internal die 26, and has its outer circular face 57 beveled in substantial parallelism with the beveled face 18 of the dial bushing 17. The inner circular face 58 of the die 55 is curved as a circular groove shown in Figs. 5-8 to provide in conjunction with the curved face 27 of the die 26 the continuous conjoint curved groove shown in Figs. 2, 7 and 8 when the two dies 26 and 55 are locked together as an operating unit in the final curling operation on the cap shell.

My invention in respect to the operation of the parts of my apparatus (Figs. 1-3) will be more fully described by setting forth not only the successive operations of the apparatus as a whole, but also the particular effects or results of such operations upon the cup-shaped cap shell as more particularly shown in Figs. 4-8, all of which are produced by a single stroke of the curling punch carrying the coaxial internal die 26 and the external die 55.

In these operations the tool is vertically moved by having secured to the press ram 19 the tool shank 20 suitably adjusted by the nut 21 to the ram.

In released position, the internal curling die 26 extends below the external curling die 55 (Fig. 5). The top or margin of the skirt 10 has already been bent inwardly 90° to form the right-angled flange 11. As the ram 19 descends with the thereby supported tool, the ejector 30 first contacts the cap crown 9 to nest the cup-shaped shell in the pocket 15 to hold the shell properly in position while the tool performs its successive curling operations on the lower margin of the skirt 10. The ejector spring 32 compresses to permit the further lowering of the tool.

As shown in Fig. 5, the heel of the internal curling die 26 strikes the right-angled flange 11 and bends the latter back along the skirt to form the folded hem 59 shown in Figs. 1 and 6 with top edge 60 of such hem passing upwardly into the groove 61 formed between the two dies 26 and 55 (Fig. 6). When the folding of this hem is completed, and before the top 60 reaches the top of the groove 61 between the dies 26 and 55, the internal curling die 26 is raised to its closed posi-

tion as shown in Figs. 2, 7 and 8 by the lever 40 acting on the lift shank 38 to compress the spring 35 and pull the die 26 upwardly against the thrust washer 37 (Fig. 2). At this stage of the operation the curling radius 58 of the external die 55 coincides with the curling radius 27 of the internal curling die 26, and from this point to completion of the stroke of the tool, the two curling dies 26 and 55 act as a unit to complete the curling of the shell as shown in Fig. 8.

The lever 40 fulcrumed at 44 on the ram 19 is a 2 to 1 ratio and is actuated by the return rod 46 that has the heavy compensating spring 52 to permit further downward movement of the ram 19 when the internal die 26 strikes the thrust washer 37. As shown the spring 52 is of greater strength than the spring 35 and the latter is compressed thereby. When the internal die 26 strikes the thrust washer 37, the further upward movement of the lift shank 38 is stopped and because both ends of the lever 40 are fixed at that moment, the return rod 46 must continue to descend and so compress the spring 52 with the further downward movement of the ram 19.

This downward movement is so timed that it actuates the internal die 26 just as the folded hem 59 as shown in Fig. 6 is completed and before the top edge 60 of this hem reaches the top of the curved groove 61 between the dies 26 and 55 (Fig. 1). At this point while the external die 55 continues its downward movement and the folded hem 59 continues to pass up into the groove 61 between the dies, the internal die 26 has not only halted its downward movement but has begun its upward movement twice as fast as its descent because of the 2 to 1 ratio of the lever 40 until the die 26 engages the thrust washer 37.

Since this upward movement of the die 26 is faster than the downward movement of the die 55, no obstruction to the top edge 60 of the folded hem 59 is caused by the face 27 of the die 26 as the latter travels from its Fig. 6 to its Fig. 7 position. The tool as a whole is now in its Fig. 7 position with the dies 26 and 55 acting as a unit because the internal die 26 is held in its raised position by the lever 40 and because the return rod 46 with its compensating spring 52 permits a further lowering of the ram 19 with attached curling tool. As the ram and tool descend the top of the folded hem 59 continues to flow around the curling radius of the two dies 26 and 55 (Figs. 7 and 8) until it is positioned and bent as shown in Figs. 2 and 8 at the end of the downward stroke or movement of the ram 19.

When the ram 19 and tool begin their upward return movement, the cap shell as shown in Fig. 2 is firmly held in the nest or pocket 15 by the ejector 30 under pressure of the spring 32 until the dies 26 and 55 leave the completed cap shell and the ejector 30 breaks contact with such shell. When the return rod 46 lifts to completely release the tension on the spring 52, the spring 35 returns the internal die 26 to its released position that is controlled by the plunger stop washer 39 to complete the cycle, and the tool as a whole is again in raised position ready for the next stroke in curling the skirt margin of the next cap shell.

The cap shell when completed as shown in Figs. 2 and 8 presents the cylindrical wall 62 spaced from the skirt 10 with the folded hem 59 avoiding any visible raw edge inside the cap, and such wall 62 may then be embossed with

inclined screw threads by any suitable thread-rolling machine to form a screw cap, or spaced portions of the wall may be uncurled to produce spaced lugs to engage projections on the neck of the container.

My invention as shown and described is not to be limited to the structural details set forth, but relates broadly to a method and apparatus for producing sheet metal caps in which the lower margin of the skirt is progressively inwardly curled to produce a uniformly curled bead that merges with a cylindrical wall having its raw edge in the form of a folded hem, such wall being spaced from the cap skirt, such form of cap as shown in Figs. 2 and 8 being produced from a 15 cup-shaped sheet-metal blank by a single stroke or pressing operation as I have hereinbefore set forth in detail and illustrated in Figs. 4-8.

I claim as my invention:

1. A method of forming a sheet-metal cap from a cup-shaped blank having a flange extending inwardly at right angles to the skirt in a single stroke of a pair of curling dies having coacting annular grooves, which comprises bending the said flange inwardly into a folded hem by the pressure of the dies, and then further bending the folded hem with adjacent portions of the skirt inwardly during a successive movement of the dies to form a cylindrical wall inside the cap and concentrically spaced from the skirt.

2. A method of forming a sheet-metal cap from a cup-shaped blank having a flange extending inwardly at right angles to the skirt in a single stroke of a pair of mutually reciprocable curling dies having coacting annular grooves, which comprises bending the said flange inwardly into a folded hem by the pressure of the dies, and then further bending the folded hem with adjacent portions of the skirt inwardly during a successive movement of the dies when locked as a unit to form a cylindrical wall inside the cap and concentrically spaced from the skirt.

3. An apparatus for forming a sheet-metal cap from a cup-shaped blank having a flange extending inwardly at right angles to the blank skirt comprising in combination means for converting said flange into an incurled folded hem, and means for further curling said hem and adjacent portions of the skirt to form a smooth inwardly presented cylindrical wall of less diameter than, and spaced from, the skirt.

4. An apparatus for forming a sheet-metal cap from a cup-shaped blank having a flange extending inwardly at right angles to the blank skirt comprising in combination means for converting said flange into an incurled folded hem, and means for further curling said hem and adjacent portions of the skirt to form a smooth inwardly presented cylindrical wall connected by a radially curved portion to the skirt and of less diameter than, and spaced from, the skirt with the hem curled within the contour of the cylindrical wall.

5. An apparatus for forming a sheet-metal cap from a cup-shaped blank having a flange extending inwardly at right angles to the blank skirt comprising a pair of coacting mutually reciprocable dies having means thereon for converting said flange into an incurled folded hem, and means operative in another position during a successive movement of the dies for curling the portion of the skirt adjacent said hem inwardly and substantially concentrically with said skirt to form a cylindrical wall spaced from the skirt.

6. An apparatus for forming a sheet-metal cap

from a cup-shaped blank having a flange extending inwardly at right angles to the blank skirt comprising a pair of coacting mutually reciprocable dies having means thereon for converting said flange into an incurled folded hem, and means operative in another position during a successive movement of the dies when locked as a unit for curling the portion of the skirt adjacent said hem inwardly and substantially concentrically with said skirt to form a cylindrical wall spaced from the skirt.

7. An apparatus for forming a sheet-metal cap from a cup-shaped blank having a flange extending inwardly at right angles to the blank skirt comprising a pair of curling dies having coacting annular grooves, means for moving said dies in timed relation for bending the flange to form an incurled folded hem, means for moving and locking said dies as a unit with their annular grooves positioned to provide a curling surface of uniform radius, and means for moving said

dies when so locked to curl said hem and adjacent portions of the skirt inwardly and substantially concentrically with the skirt to form a cylindrical wall spaced from the skirt.

8. An apparatus for forming a sheet-metal cap from a cup-shaped blank having a flange extending inwardly at right angles to the blank skirt comprising a pair of curling dies having coacting annular grooves, means for moving said dies in timed relation for bending the flange to form an incurled folded hem, means for moving and locking said dies as a unit with their annular grooves positioned to provide a curling surface of uniform radius, and means for moving said dies when so locked to curl said hem and adjacent portions of the skirt inwardly and substantially concentrically with the skirt to form a cylindrical wall spaced from the skirt, said dies also curling said hem within the contour of said cylindrical wall.

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