

Sept. 28, 1937.

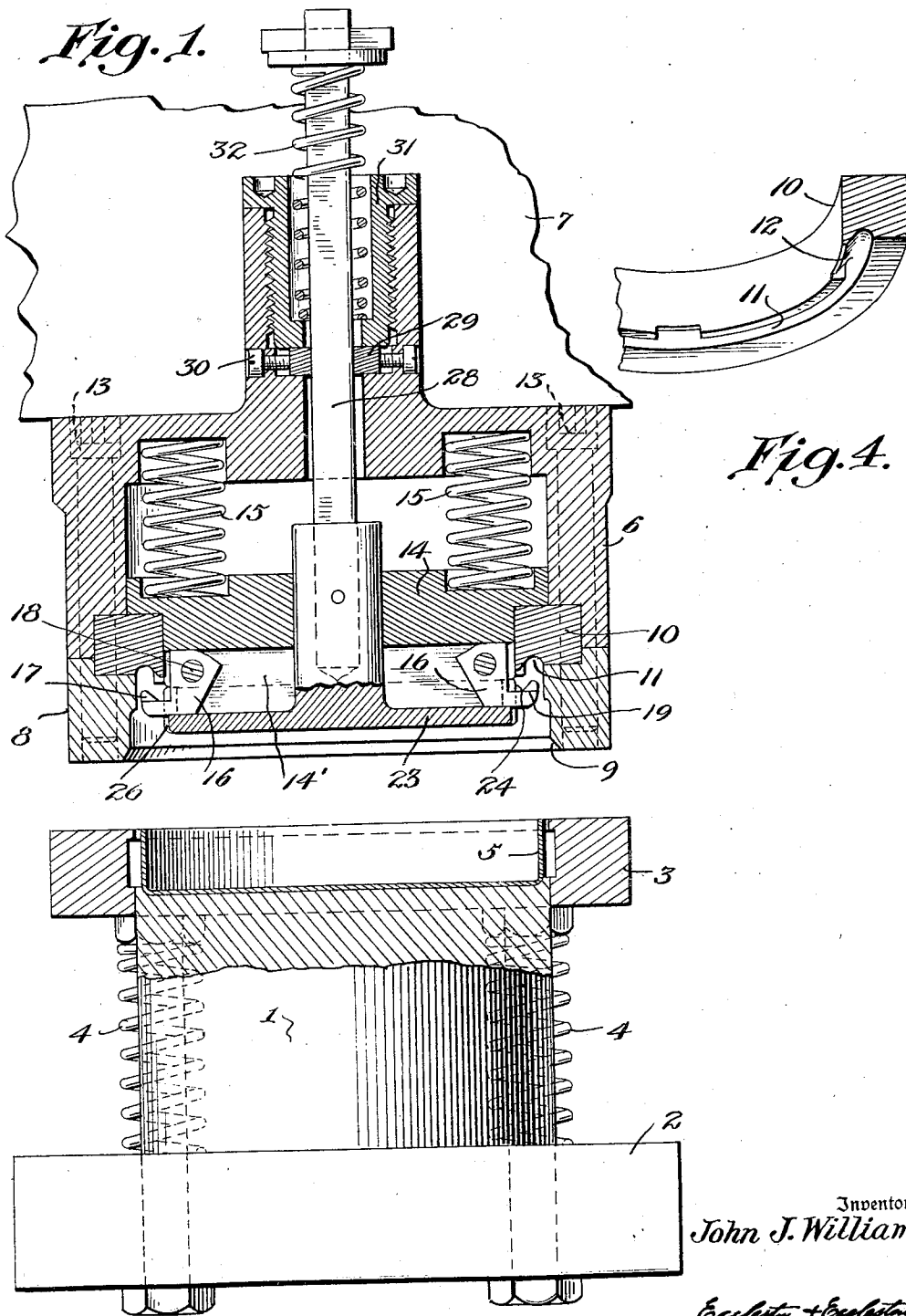
J. J. WILLIAMS

2,094,031

METHOD OF AND APPARATUS FOR MANUFACTURING METALLIC CLOSURES

Filed Dec. 4, 1933

3 Sheets-Sheet 1



Inventor
John J. Williams

Exelstin + Exelstin
Attorneys

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3 Sheets-Sheet 3

Fig. 6.

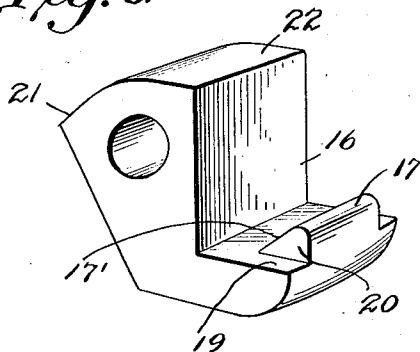


Fig. 9.

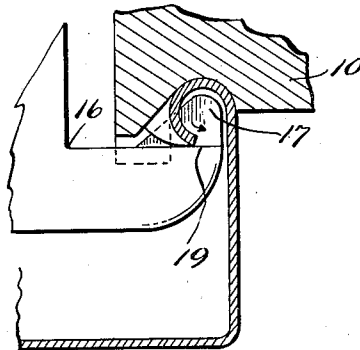


Fig. 7.

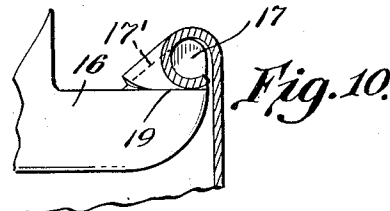
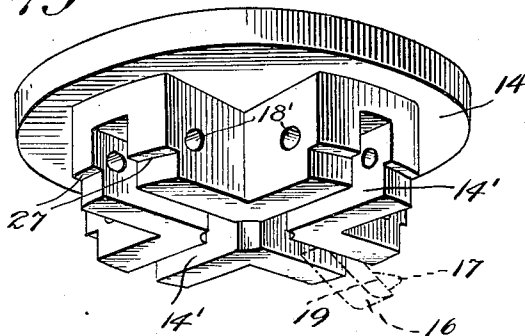


Fig. 8.

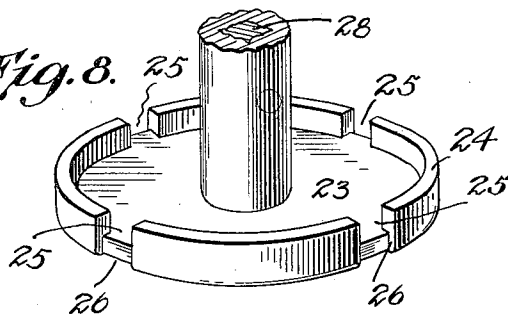


Fig. 11.

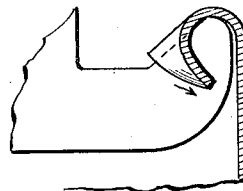


Fig. 12.

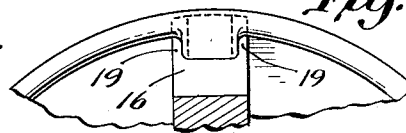


Fig. 14.

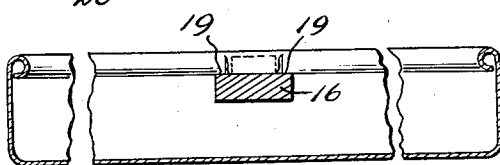
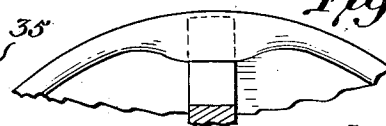


Fig. 13.

Inventor

John J. Williams

By

Beckwith & Beckwith
Attorneys

UNITED STATES PATENT OFFICE

2,094,031

METHOD OF AND APPARATUS FOR MANUFACTURING METALLIC CLOSURES

John J. Williams, Wheeling, W. Va., assignor to
Hazel-Atlas Glass Company, Wheeling, W. Va.,
a corporation of West Virginia

Application December 4, 1933, Serial No. 700,900

18 Claims. (Cl. 153—48)

The invention relates to an improved method and apparatus for manufacturing metallic closures having an incurled bead at the lower edge and having lugs extending inwardly from the incurled bead, and one of the objects of the invention is to greatly increase the speed of manufacturing these closures.

Another object of the invention is to provide a method and apparatus by which the bead will be completely curled inwardly right up to the lug, as distinguished from a construction in which the bead is gradually uncurled up to the lug.

Another object of the invention is to provide means by which the cap will be positively and automatically ejected after its formation.

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

Figure 1 is a vertical sectional view of the apparatus; the parts being shown in the positions they assume in their downward movement, but prior to reaching the metallic blank.

Figure 2 is a view similar to Figure 1, but showing the parts in the positions they assume after engaging the blank, and with certain parts omitted.

Figure 3 is a similar view, but showing the parts in the positions they assume during their upward movement; the completed cap having been ejected. In this figure certain parts are broken away and other parts are omitted.

Figure 4 is a fragmentary perspective view of the curling ring.

Figure 5 is an enlarged detail view of one of the lug forming fingers and associated parts.

Figure 6 is a perspective view of one of the lug forming fingers.

Figure 7 is a detail perspective view of the finger holder.

Figure 8 is a detail perspective view of the knockout pad.

Figures 9 and 10 are detail views illustrating the manner in which the bead is completely curled right up to the lugs.

Figure 11 is a similar view illustrating how, in the formation of a cap without the use of the improved lug forming fingers, the bead would be gradually uncurled up to the lugs.

Figures 12 and 13 are a detail plan and vertical sectional view, respectively, of a portion of the cap and one of the lug forming fingers, and illustrating how the bead is completely curled up to the lugs; and

Figure 14 is a view similar to Figure 12, but illustrating how the bead is gradually uncurled up to the lugs when the improved lug forming finger of the present invention is not employed.

Referring to the drawings in more detail, numeral 1 indicates a supporting plug which is solidly bolted to a plate 2; the plate being fastened to the bolster plate of the press. Numeral 3 refers to a locating ring slidably mounted on the plug 1, and normally held in its elevated position by the springs 4. When the ring is in its elevated position it assists in properly positioning the cap blank 5 on the supporting plug, and when the shaping mechanism descends to form the cap it pushes the locating ring downwardly out of the way.

Numeral 6 refers to the die holder which is clamped or otherwise secured to the crosshead 7 of the press. The crosshead is illustrated diagrammatically, and the mechanism of the press for raising and lowering the crosshead is not illustrated, as such mechanism is old and well-known.

A centering ring 8 is mounted on the lower end of the die holder, and this ring is preferably beveled as indicated by numeral 9. The centering ring performs the function of accurately centering the blank 5 on the supporting plug, and also forces the locating ring 3 downwardly as the parts come into position to form the cap.

Also mounted in the holder, and above the centering ring, is the curling die 10. The lower side of the curling ring is provided with an annular groove 11 which causes the skirt of the blank to be curled inwardly; and at intervals the inner side of the groove is cut away at whatever may be the desired angle of the lug, as best shown in Figure 4 and referred to by numeral 12. Of course the number of these angular portions in the curling die depends upon the number of lugs to be formed. In the form illustrated four lugs are formed but the number of lugs varies with the size of the cap. Any desired means may be employed for securing the centering ring 8 and the curling die 10 to the die holder 6, but the preferred arrangement is best illustrated in Figure 1, which shows in dotted lines bolts 13 for securing these three parts together.

Numeral 14 refers to the holder for the lugging members, and this holder is normally held downward against the curling die by the springs 15. These springs permit relative movement between the holder 14 and the curling ring 10, as will appear hereinafter. The lugging members, referred to by numeral 16, are pivotally mounted

in the holder 14. The specific design of the holder is best illustrated in Figure 7, but it is to be understood that the invention is in no manner limited to this specific form. By reference to Figure 7 it will be noted that the holder is provided with channels 14' in which the lugging members are pivotally mounted by pins 18 carried in openings 18' provided in the walls of the channels.

The lugging members 16 are of very material importance in the present invention as they are so designed as to accomplish an entirely new and most desirable function. The construction of the lugging members is best illustrated in Figure 6, which shows one of the members in perspective and on an enlarged scale. By reference to that figure it will be noted that an upwardly extending finger or protuberance 17 is provided at the end of the member. This finger is curved at its top to substantially the curvature of the bead, and its rear face, indicated by numeral 17', is inclined at the angle of the lug to be formed. Of course the size and particular shape of the finger 17 may be varied according to the size of the cap and according to the particular inclination desired in the lug. Particular attention is called to the fact that the finger 17 is arranged centrally of the lug member, so that a flange or shoulder 19 is provided on either side of the finger; and that the sides 20 of the finger extend upwardly abruptly from these shoulders. The manner in which these shoulder cause the bead to be completely curled right up to the lugs will be described hereinafter. The lugging members 16 are, as previously stated, pivotally mounted upon pins 18, and it will be noted that the tops of these members are provided two inclined faces 21 and 22 which in cooperation with the bottom of the holder 14 limit the outward and inward swinging movement of the lug members.

Numeral 23 refers to the knock-out pad which strikes against the bottom of the blank and holds it firmly on the plug 1 during the forming operation, and which subsequently ejects the cap, as will be described hereinafter. In the specific mechanism illustrated the knock-out pad is provided with an annular upstanding flange 24, which is best illustrated in Figure 8. This flange is interrupted at intervals to form openings 25 through which the lugging fingers pass; and at these points the pad is slightly recessed as indicated by numeral 26, so that there will be no possibility of the lugs catching on the pad when the caps are ejected. By reference to Fig. 7 it will be noted that the ends of the walls forming the channels 14' are cut away at 27 to an extent equal to the thickness of the flange 24, so that the lug holder will have a neat fit with the pad when these parts are in cooperating positions. It will of course be understood that this specific construction, which is merely the preferred form, may be modified in any respect desired.

The knock-out pad 23 is mounted on a stem 28 which is angular in cross-section. This stem passes through a similar angular opening in a ring 29; the ring being held against rotation by pins 30. This ring prevents the pad from rotating and holds it in correct position relative to the lugging members. A key (not shown) prevents rotary movement of the lug holding member 14 and the curling die; and thus the lugging members, the curling die and the knock-out pad are all maintained in proper alignment. The ring 29 is held against vertical movement by the nut 31.

The knock-out pad is normally held in elevated

position with respect to the other moving parts by the spring 32, so that when the die is moving downward, as shown in Fig. 1, the holder 14, the curling die, the lugging fingers, and the knock-out pad are all held together in proper position to act upon the blank or shell 5. When the knock-out pad strikes the bottom of the shell no further downward movement of the pad, lugging members and the holder 14 is possible, but the die holder 6 and the curling die continue the downward movement to form the blank into a finished cap, so that the curling die becomes spaced from the holder for the lugging members, as indicated in Figure 2, and referred to by numeral 33. When the cap is formed and the die moved upwardly the parts resume the positions shown in Figure 1, but the upward movement continues and finally the stem strikes the knock-out bar 34 (Fig. 3), which stops the upward movement of the knock-out pad while the other parts continue the upward movement. This relative downward movement of the knock-out pad ejects the finished cap 35.

The complete operation in forming a cap will now be described, and this description will bring out more clearly how the present method and apparatus overcome various difficulties with respect to the cap itself as well as to the formation thereof.

While the crosshead of the press is at the upper end of its stroke a blank or shell 5 is placed on the operating plug 1, either automatically or by hand; the blank being centered by the ring 3. The positions of the parts when at the upper end of the stroke are shown in Fig. 3. The clutch of the press being now tripped the crosshead descends and carries with it the die holder 6, the curling ring 10, the holder 14 for the lugging members and the lugging members 16; it being understood of course that the springs 15 normally maintain the holder 14 in a downward position against the curling ring. While these parts descend the spring 32 holds the knock-out pad upward, so that this pad is, in effect, drawn upwardly, until it engages the holder 14 and the lugging members 16. The parts have now been brought to the position shown in Fig. 1; and while the downward movement has not been sufficient to bring the die into contact with the blank, yet it will be noted that all of the parts are in position ready to enter the blank and shape it into a completed cap. The holder 14 is held down against the curling die by the springs 15, and the knock-out pad is held upwardly against the lugging members and the holder by the spring 32. The flat bottom faces of the lugging members cooperate with the flat upper face of the knock-out pad, and a portion of the top face of the lugging members cooperates with the flat bottom face of the holder, so that the lugging members are firmly held in the exact operative position desired. Thus positive means is provided by which the lugging fingers 17 and the shoulders 19 are always forced to assume the same position. This is of importance because these fingers and shoulders perform important functions in the formation of the cap, and any variance in their positions will cause undesirable variations in the finished cap.

As the crosshead further descends from the position shown in Figure 1 the centering ring 8 strikes the locating ring 3 and forces it downward out of the way, and the edge of the shell 5 enters the centering ring, which is preferably beveled at its lower edge to aid in receiving the shell. Upon continued downward movement the knock-

out pad 23 strikes against the bottom of the shell and holds it firmly while the cap is being formed; thus preventing any buckling in this part of the cap.

When the knock-out pad strikes the shell no further downward movement of the pad, the lugging fingers or their holder is possible, but the die holder 6 continues to descend, thereby compressing the springs 15 and increasing the pressure of the pad against the bottom of the shell. The curling die now comes into contact with the upper edge of the shell and as the die descends the edge is forced to curl inwardly uniformly throughout its entire extent. This continues until a completely curled bead is formed entirely around the cap, except at those points where the lugs are to be formed. At these points the edge curls freely until it comes into contact with the face 17' of the lugging fingers 17, and as the die continues its downward movement the metal is forced to follow the contour of the lugging fingers, thereby positively shaping the metal to give the lugs the exact angle desired. It is important, in the manufacture of the specific cap illustrated, that these lugging fingers be of such design that the curling metal edge will strike them at the proper instant. For instance, if the plane of the inclined faces 17' should be too low the metal will start to curl outwardly before contacting with the faces, with the result that the metal will double upon itself, thereby deforming the single sheet lugs illustrated and rendering the cap useless. It will therefore be understood that in the manufacture of caps with single sheet lugs the lugging fingers must be so positioned that the incurling metal will strike them before the curling operation has continued to such an extent that the metal is moving outward.

If the lugging members included only the fingers 17 the metal on either side of the fingers would be prevented from becoming completely curled, due to the strains set up in the metal by the lugging fingers. That is, in the completed cap the metal would remain largely uncurled immediately adjacent the lugs and would gradually taper off away from the lugs to a complete curl. This is illustrated in Figs. 11 and 14, and in practice it produces the most serious difficulties, just a few of which will be briefly mentioned here, before continuing the description of the operation. In the manufacture of glass containers there is always a slight variance in the finish. These variations are kept within fixed limits, termed the tolerance. In lug caps the lugs must project inwardly clear of other parts of the cap a sufficient distance to properly engage the threads of the finish whether the container happens to have a maximum finish, a minimum finish, or a finish anywhere between a maximum and minimum. If the bead remains partly uncurled adjacent the lugs then that portion of the lug which is free to engage the finish of the container is necessarily measured from the end of the lug to the outermost uncurled portion. It is apparent that in such a construction the lug is too shallow to take care of the tolerance, so that in minimum finishes or finishes near the minimum the lug might fail to engage the threads of the finish. In some instances instead of the lugs engaging the threads the uncurled portion adjacent the lugs will engage, and this not only improperly positions the cap on the container but also the edge of this uncurled portion is likely to become bent when pressure is applied in turning the cap to sealing position. In general, the

construction described above may result in the cap being totally unfit for use, or it may be positioned off center of the container, or it may assume a lopsided position on the container, etc. A poor seal is the result. These most serious difficulties and various other difficulties are entirely overcome by the present invention, as will be made clear below.

In the operation thus far described the die has descended far enough to curl the entire bead inward, and at the points where the lugs are to be formed the metal has engaged the inclined faces of the lugging fingers and is following the contour of the lugs. The fingers 17 are arranged centrally of the lugging members, so that shoulders 19 are formed on each side of the fingers. The metal immediately adjacent the lug now engages these shoulders and is forced to the same complete curl it would have assumed if the lugs were not formed. In other words the incurled bead of the cap leads directly up to the lugs in a uniform curl. The shoulders 19 cause this complete curling up to the lugs, and the abrupt ends 20 of the fingers permit it. The accomplishment of this most desirable result will perhaps be better understood by reference to Figs. 9, 10, 12 and 13. By reference to these figures it will be noted that in Fig. 9 the metal directly adjacent the finger has just engaged the shoulder 19, and further downward movement of the die causes it to curl completely; the shoulder preventing the metal from passing below its plane and causing it to curl upwardly. Fig. 11 makes clear what happens when the shoulders 19 are not present. Also, Figs. 12 and 13 illustrate how the curled bead is completed directly up to the lugs when the shoulders are employed, and Fig. 14 illustrates how the portions adjacent the lugs remain partly uncurled when the shoulders are not employed. It should be mentioned that the position of the shoulders is also of importance. If the shoulders are too high the metal will engage too soon and will be forced toward the center of the cap instead of outwardly; and if it is too low it will not cause the metal to be curled sufficiently. The best position is approximately as illustrated in Fig. 9; i. e., the shoulder is preferably so positioned that it will be engaged by the metal just about the time the metal is starting to curve outwardly.

The cap is now completed and the die starts its upward movement. If this upward movement left the cap on the plug the speed of production would be considerably reduced for the cap would then have to be removed from the plug by hand or by some other means which would slow down production and cause complications. In accordance with the present invention the finished cap is automatically removed. As the die first starts upward the springs 15 maintain the holder 14, the lugging fingers and the knock-out pad in their lowermost position, while the die holder and the curling die 10 move upward. But when the curling die strikes the holder 14 then all of the parts move upward together; and as the spring 32 is maintaining the knock-out pad upwardly against the holder 14 and thereby keeping the lugging fingers in their extended or operative positions, it follows that the completed cap must be lifted from the forming plug 1, for the lugs of the cap are positioned over these fingers.

The cap 35 has now been lifted from the plug 1, the locating ring 3 has been moved to its elevated position by the springs 4 in place to receive

the next blank, and all of the parts associated with the curling die are moving upwardly together, carrying the cap on the lugging fingers. When the crosshead approaches the upper limit of its stroke the stem 28 strikes the knock-out bar 34 (Fig. 3) which prevents further upward movement of the knock-out pad. The other parts continue their upward movement and thus the pad is separated from the holder 14. This relative downward movement of the knock-out pad forcibly ejects the completed cap, and the lugging members are thrown to their inoperative position, all of which is illustrated in Figure 3. The caps fall by gravity, or may be blown by compressed air, into a container suitably placed to receive them.

It should be noted that the lugging fingers are pivoted in such manner that they will swing downward and inward away from the cap lugs at a rate of speed relative to the downward speed of the knock-out pad that will permit them to clear these lugs without distorting them. Also, the cut-out portions 26 of the knock-out pad prevent the lugs from catching on the pad while being ejected. The inclined face 21 at the top of the lugging members limits the inward movement of these members so that they will be properly positioned to be again moved into operative position.

When the crosshead of the press reaches the top of the stroke the clutch of the press is released and a cycle of operation is completed. A repetition of the cycle is started by the tripping of the clutch.

While the preferred apparatus has been described in detail it is to be understood that the present invention in both the method and apparatus is in no manner limited to the specific disclosure. In other words, the particular apparatus shown and described is to be considered as illustrative rather than in any limiting sense.

What I claim is:

1. The method of forming metallic lug caps which consists of forming a blank having a uniform depth, forming an incurled bead about the edge of the blank, while the metal is curling inward forming lugs at the desired points by causing the raw edge of the metal to extend inwardly beyond the curled portions, and simultaneously with the formation of the lugs causing the metal immediately adjacent the lugs to be curled into a bead substantially uniform with the remainder of the incurled bead.

2. The method of forming metallic lug caps which consists of forming a blank having a uniform depth, forming an incurled bead about the edge of the blank, while the metal is curling inward forming lugs at the desired points by causing the raw edge of the metal to extend inwardly beyond the curled portions, and during the formation of the lugs causing the metal immediately adjacent the lugs to be so curled that the portion thereof nearest the top of the cap will be in substantially the same plane as the similar portion of the remainder of the bead.

3. The method of forming metallic lug caps which consists of forming a blank having a uniform depth, forming an incurled bead about the edge of the blank, while the metal is curling inward forming lugs at the desired points by causing the raw edge of the metal to extend inwardly beyond the curled portions, and while the lugs are being formed causing the metal immediately adjacent the lugs to curl in substantially the same path as the remainder of the bead.

4. The method of forming metallic lug caps which consists of curling portions of the blank over protuberances to form lugs, and while the metal is following the contour of the protuberances intercepting the curling metal immediately adjacent the lugs and causing it to curl outwardly.

5. The method of forming metallic lug caps which consists of curling portions of the blank over protuberances to form lugs, and while the metal is following the contour of the protuberances intercepting the curling metal immediately adjacent the lugs and preventing it from passing below a predetermined plane.

6. The method of forming metallic lug caps which consists of forming an incurled bead about the edge of the blank, at the points where lugs are to be formed engaging the incurling metal to form lugs after the metal has curled the desired extent, and engaging the incurling metal adjacent the lug forming portions and preventing it from passing below a predetermined plane.

7. Apparatus for forming metallic lug caps including a curling die, means for moving said curling die to cause the edge of the cap blank to curl inwardly, lug forming fingers for shaping portions of the incurling metal into lugs, and means adjacent the fingers for limiting the downward movement of the metal adjacent the lugs.

8. Apparatus for forming metallic lug caps including means for curling inwardly the edge of the cap blank, means for forming inwardly projecting lugs from the incurling metal, and means for fixing the lowest plane of the incurled metal immediately adjacent the lugs.

9. Apparatus for forming metallic lug caps including means for curling inwardly the edge of the cap blank, means for forming inwardly projecting lugs from the incurling metal, and means engaged by the curling metal adjacent the lugs, the last-mentioned means preventing further downward movement of the metal.

10. Apparatus for forming metallic lug caps including means for curling the edge of a cap blank into a substantially completely curled bead except at intervals, means for forming inwardly projecting lugs at said intervals, and means for forcing the incurled metal immediately adjacent the lugs into a substantially completely curled bead.

11. Apparatus for forming metallic lug caps including a curling die for inwardly curling the edge of a cap blank, a lug-forming finger movable into the path of the curling die, and shoulders on both sides of said finger to engage the incurling metal immediately adjacent to said finger.

12. Apparatus for forming metallic lug caps including a curling die for inwardly curling the edge of a cap blank, a lug-forming finger movable into the path of the curling die, and means adjacent to and below the top of said finger for limiting the downward movement of the metal at the sides of the lug-forming finger.

13. Apparatus for forming metallic lug caps including a forming plug to receive a cap blank, a plurality of lugging fingers, a curling die, means for moving the lugging fingers into the path of said die, said lugging fingers lifting the completed cap from said forming plug.

14. Apparatus for forming metallic lug caps including a forming plug to receive a cap blank, a plurality of lugging fingers, a curling die curling the edge of the blank inwardly and forming lugs over said lugging fingers, said lugging fingers

lifting the completed cap from said forming plug, and means for positively ejecting the cap after it has been lifted from the forming plug.

5 15. Apparatus for forming metallic lug caps including a forming plug to receive a cap blank, a curling die, a holder for said curling die, lug-
ging members, a holder for said lugging members, a knock-out pad, a spring normally maintaining
10 the holder for the lugging members downward against the curling die, and a spring normally
maintaining the knock-out pad upward against the lugging members.

15 16. Apparatus for forming metallic lug caps including a forming plug to receive a cap blank, a
curling die, lugging members, said curling die forming lugs in the blank over said lugging mem-
bers, said lugging members lifting the completed
20 cap from the forming plug, a knock-out pad, and means for causing relative movement between the
lugging members and the knock-out pad to eject the cap.

17. Apparatus for forming metallic lug caps including a forming plug to receive a cap blank, a curling die, a holder for the curling die, lugging members, a holder for the lugging members, said curling die and lugging members cooperating to
5 form the cap, a knock-out pad below the lugging members, means normally holding together the knock-out pad and the holder for the lugging
members, and means for separating the knock-
10 out pad and the holder for the lugging members to eject the cap.

18. The method of forming metallic lug caps which consists of forming a blank having a uni-
form depth, forming an incurled bead about the
15 edge of the blank, forming lugs projecting inwardly from the bead at the desired points, and
while the lugs are being formed causing the metal immediately adjacent the lugs to curl in substan-
tially the same path as the remainder of the
bead.

JOHN J. WILLIAMS. 20