

METHOD AND APPARATUS FOR FORMING CONTAINER WITH PROFILED
BOTTOM

This invention is concerned in general with the art of forming containers and it relates to a method and apparatus for forming a container body. A particular application of the invention is to the forming of bottom profiles on two-piece containers.

In the container industry in general, and in the food container industry in particular, it is often desired to impart a bottom profile to the container for purposes of strength. These profiles include one or more annular rings or recesses in the bottom which, of course, improve the buckle strength of the end.

Some examples of representative profiles can be seen in Jones U.S. Patent 4,010,867; Saunders U.S. Patent 4,120,419 and Holk U.S. Patent 4,439,081.

In the prior art, it has generally been known to form two-piece containers to essentially their final cylindrical configuration having a sidewall and bottom and then to impart a "preform" profile to the bottom at a first station. This is accomplished by utilizing a suitable die core and die with a profile pad inserted therein.

The container is then moved to a second station either in the same press or in another press wherein the bottom will be hit again to "reform" or deepen the profile to its final depth. The primary purpose of transferring the container and utilizing a two station operation is to relieve the back tension on the sidewalls during the reform operation. In other words, during the reforming or resetting of the bottom profile, it is desirable to minimise the distance which the metal has to be pulled from the sidewall to finally form the bottom profile so as to avoid damage to the container which can be so severe as to tear the bottom out of the container.

This is because it is extremely difficult to pull around the sharp edges of the forming tools and impart a deep profile, particularly if the material has to be

pulled any distance down the sidewall area of the container. Therefore, the two station approach results in pulling the material a lesser distance in any single operation. The obvious disadvantage, however, is that
5 this approach requires handling the container twice and also requires the provision and utilisation of transfer equipment.

It has been discovered, therefore, that these disadvantages can be eliminated and the entire profiling
10 operation can be performed at a single station without risking damage or even destruction of the container.

In furtherance of that goal, it has been found that an effective, relatively deep profile can be formed in the bottom of a two-piece container by first providing
15 an inverted cup and then reverse drawing the cup to a slightly overlength condition while setting the preliminary or "preform" profile, following which the bottom profile is finally set by folding the excess material up into the bottom. It has been found that this
20 can be accomplished in one continuous operation at one station without the need to transfer the container.

Elimination of the back tension on the material is achieved primarily by the utilisation of a two piston support for the profile pad wherein one piston supports
25 during the initial forming and the second piston picks up during the reforming.

It has been found that, in this fashion, the entire profiling operation can be accomplished in one station without the risk of damaging or destroying the container
30 and, of course, without the difficulty and expense of transferring the container from one station to another in order to accomplish the complete profiling operation.

Broadly stated the present invention provides in one aspect a method of forming a container body from a
35 supply of material, comprising the steps of: forming a blank from the supply of material; forming an inverted cup from said blank; reversing said inverted cup and forming a preliminary profile in the bottom of said

inverted cup during the reversal; and reforming the preliminary profile to a final profile.

In another aspect the invention provides apparatus for forming a container body in a double acting press
5 having inner and outer slides and a fixed base, comprising: a punch carried by the inner slide; a die cut edge carried by the outer slide; a profile pad carried by the base; first and second fluidly actuated pistons carried by the base for selectively supporting
10 said profile pad; a redraw die fixed to said base and disposed concentrically with respect to said profile pad; said die cut edge being movable toward said base to form an inverted cup by wiping a blank of material over said redraw die; said punch being movable toward said base a
15 predetermined distance to force the bottom of the inverted cup against said profile pad with said first piston supporting said profile pad; and said punch being further movable toward said base a further distance to reverse said inverted cup by drawing over said redraw die with
20 said profile pad being supported by said first and second pistons.

The invention and its practice will be further described with reference to the apparatus embodying the invention illustrated in the accompanying drawings in
25 which:

FIGURE 1 is an elevational assembly view, partially in section, showing the position of the apparatus just prior to final forming.

FIGURE 2 is an elevational assembly view, partially in section, showing the position of the apparatus at the conclusion of the forming operation.

5 FIGURE 3 is an enlarged sectional elevational view showing the position of the apparatus just prior to the blanking operation.

FIGURE 4 is an enlarged sectional elevational view showing the position of the apparatus following formation of an inverted cup.

10 FIGURE 5 is an enlarged sectional elevational view showing the position of the apparatus at the beginning of the reverse draw.

FIGURE 5A is an enlarged sectional elevational view showing the position of the apparatus during the reverse draw and bottom profiling.

15 FIGURE 6 is an enlarged sectional elevational view showing the position of the apparatus following reverse drawing and preliminary bottom profiling of the container.

FIGURE 7 is an enlarged sectional view showing the position of the apparatus during reforming of the bottom profile.

20 FIGURE 8 is an enlarged sectional elevational view showing the position of the apparatus following completion of the container.

25 FIGURE 9 is a timing diagram indicating the phase angles of the press at various stages of the operation.

Referring first to FIGURE 1 of the drawings, it will be noted that the apparatus of this invention and the method of operating that apparatus is intended to be practiced in conjunction with a double acting press of the type generally shown in Ridgway U.S. Patent 3,902,347. That patent discloses, in some detail, a press of the general type intended to be employed and, generally speaking, it can be said that such a press has inner and outer slides to which tooling can be attached and which are capable of reciprocating with

respect to a fixed base and which are also capable of being independently controlled as to phase angle and shut height.

With that in mind and referring still to FIGURE 1 of the drawings, it will be noted that the FIGURE 1 position of the tooling is just prior to preliminary forming of the bottom profile of the container, while the FIGURE 2 position of the tooling illustrates the position of the tooling following such forming. FIGURES 3 through 8 are enlarged views which illustrate the positions of the tooling at various stages of the forming operation.

Reference will then be had to FIGURES 1 or 2 for a general description of the apparatus and, in that regard, it will be noted that the inner ram of the press carries a inner slide holder 10 to which is attached a riser 11 by suitable screws 11a. The projecting end of the riser 11 carries a punch 12 secured thereto by screw 12a and which has a profiled bottom surface, for reasons which will become more apparent subsequently.

The outer ram of the press carries an outer slide holder 20 which is arranged generally in concentric relationship with respect to the riser 11 carried by the inner slide holder 10. Thus, surrounding the riser 11 is a pressure sleeve 21 which is reciprocal within the outer slide holder 20 and which is disposed beneath an upper piston 22 which is also reciprocal under fluid pressure through the bore 22a so that pressure acting on the piston 22 will act also on the sleeve 21 for purposes which will be described below.

Also carried on the outer slide holder 20 is a die cut edge 23 and a cut edge retainer 24 secured to the slide holder by means of suitable screws 24a.

Disposed in opposed relationship to the inner and outer slide holders 10 and 20 of the press is the fixed base or platen 30 which also carries a number of tooling components.

First, a cut edge 31 is secured to the base 30 by means of suitable screws 31a and cooperates with the die cut edge 23 for blanking the material, as will be described.

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Inboard of the cut edge 31 is a profile pad 32 which is located centrally in the die cavity in the fixed base 30. This profile pad 32 is fixed to a die core riser 33 which is actuated by pistons 38 and 39 and can reciprocate with respect to the fixed base 30. Profile pad 32 also has a through vent passage 32b permitting venting to the atmosphere for purposes which will be described below.

Outboard of the profile pad 32 and die core riser 33 and inboard of the cut edge 31 is a knockout 34 which is supported by one or more springs 34a received in a fixed seat in the fixed base 30 so that, in effect, the knockout 34 is spring-loaded, again for purposes which will be described in detail below.

Also arranged concentrically about the profile pad 32 and die core riser 33 is a redraw die 35 which is fixed to the fixed base or platen 30 by one or more screws 35a. Concentric with the redraw die 35 and inboard radially of the cut edge 31 is a lower piston 36 which is actuated by a source of high fluid pressure through the bore 36a. Supported on the top of the lower piston 36 is a draw pad 37 which cooperates with the die cut edge 23, as again will be described below in greater detail.

Turning next then to FIGURES 3 through 8, wherein enlarged elevational views are presented, for a description of the operation of the apparatus, and referring first to FIGURE 3, it will be noted that the material M has been fed into the opening of the press in the form of either sheet or coil stock and is in position in FIGURE 3 for the blanking operation.

At this time, both the inner and outer slide holders 10 and 20 are descending toward the base 30, and the die cut edge 23 has come in contact with the material M, as has the pressure sleeve 21, under the force of the piston 22. At this point, it will be noted that the lower piston 36 is in an elevated position such that the draw pad 37 is supporting the material M beneath the die cut edge 23. Additionally,

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the fixed redraw die 35 supports the material beneath the pressure sleeve 21.

Further downward movement of the slide holders 10 and 20 moving the tooling from the position of FIGURE 3 to
5 FIGURE 4 will accomplish two purposes.

First, the die cut edge 23 will sever the material M against the cut edge 31 so as to effectively blank the material. Second, continued downward movement of the die cut edge 23 will wipe the periphery of the blank thus formed
10 about the top of the redraw die 35 to form an inverted cup IC from the blank, as can further be seen in FIGURE 4 of the drawings. It will be noted at this point that the profile pad 32 is disposed beneath the central part of the inverted cup thus formed and is supported by air pressure under
15 piston 39. Any air trapped beneath the material M will be exhausted through vent passage 32b. Furthermore, the punch 12 will have just come into engagement with the top of the material M at this stage.

Continued downward movement of the slides 10 and 20
20 will move the tooling from the position of FIGURE 4 to the position of FIGURE 5 and will accomplish the object of initiating the redraw and inversion of the cup IC. It will be understood that the fluid pressure on profile pad 32 exerted by piston 39 is such that no profiling will initially
25 take place. The high points on the bottom of punch 12 and top of profile pad 32 will contact the material and the punch will force the profile pad down and begin the reverse draw of the cup, as can be seen in FIGURE 5.

Continued downward movement of punch 12 eventually
30 causes piston 39 to "pick up" piston 38 (See FIGURE 2). At this time, the high pressure on piston 38 will create sufficient resistance to cause the bottom to be initially profiled by punch 12 and profile pad 32, as can be seen in FIGURE 5A.

35 Thus, continued movement of the slide 10 toward the fixed base or platen 30 will force the riser 11 and the punch 12 downward against the material in the bottom of

inverted cup IC and will impart the desired contour to the bottom, as can clearly be seen in FIGURE 5A. It will be understood that this profile will be dictated by the complementary configuration of punch 12 and profile pad 32.

5 This movement will also force knockout ring 34 downward against the force of the spring 34a, compressing it. Movement of the slide 20 downwardly will also cause the die cut edge 23 to force the draw pad 37 and piston 36 downwardly, overcoming the fluid pressure beneath the piston 36. At
10 this point, an inverted cup has been formed and the preliminary bottom profile has essentially been imparted to the container.

Comparing the position of the tooling in FIGURES 5 and 6 (FIGURES 1 and 2, respectively), it will be noted that
15 between those two positions, the outer slide holder 20 will have reached bottom dead center and will have begun to retract. It will then be noted that the die cut edge 23 will begin to pull away from the fixed base or platen 30. However, the inner slide 10 continues downward movement against
20 the fluid pressure on piston 39 which now is picked up by piston 38 (See FIGURE 2) thereby increasing resistance and will complete reverse of the container without disturbing the bottom profile established at the FIGURE 5A position, pulling the material over the top of the die core ring 35 so
25 as to effectively turn the previously formed cup IC inside out and form cup C.

As the inner slide 11 and punch 12 begins to pull away from base 30, the profile will be finally set, as can be seen in FIGURE 7. Thus, since the flange of the container
30 is still clamped by sleeve 21, and the profile pad 32 is under the influence of pistons 38 and 39 and it will move up with the punch 12 and will roll material up into the bottom of the container and finally set the profile.

Once piston 38 engages the bottom of base 30, the
35 profile will be finally set. Following this, piston 39 has sufficient pressure beneath it to lift the container back to the die line.

The result of this action can be seen in FIGURE 7 of the drawings wherein the die core riser 33 will have lifted the profile pad 32 back up to the die line and, of course, pulling the punch 12 away from the fixed platen will permit the spring 34a to raise the knockout 34 back up to die line, while piston 39 lifts profile pad 32 thereby assisting in removal of the container from the die cavity. It will be noted that profile pad 32 stops short of the die line and the action of springs 34a on knockout 34 is required to lift the finished container off the top of profile pad 32. Removal from punch 11 can then be accomplished by air pressure through passages 11b and 12b or by other means if desired.

It will thus be seen that the method and apparatus just described is capable of forming a deep bottom profile at a single station and with a relatively tight radius and deep countersink.



Claims:

1. A method of forming a container body from a supply of material, comprising the steps of: forming a blank from the supply of material (M); forming an inverted cup
5 (IC) from said blank; reversing said inverted cup and forming a preliminary profile in the bottom of said inverted cup during the reversal; and reforming the preliminary profile to a final profile.
2. The method of Claim 1 wherein the step of reversing
10 and preliminary profiling is accomplished by advancing a profiled punch (12) into engagement with the bottom of said inverted cup (IC) and urging the bottom against a profile pad (32) supported for a period by a first fluidly supported piston (39) and subsequently by a second fluidly
15 supported piston (38).
3. The method of Claim 2 wherein the reforming step is accomplished by exerting force on said profile pad (32) by said first piston (39) and said second piston (38) while holding pressure on the flange by sleeve (21) as punch
20 (12) withdraws.
4. Apparatus for forming a container body in a double acting press having inner and outer slides and a fixed base, comprising: a punch (12) carried by the inner slide (10); a die cut edge (23) carried by the outer
25 slide (20); a profile pad (32) carried by the base (30); first and second fluidly actuated pistons (39, 38) carried by the base for selectively supporting said profile pad; a redraw die (35) fixed to said base and disposed concentrically with respect to said profile pad; said die
30 cut edge (23) being movable toward said base to form an inverted cup (IC) by wiping a blank of material over said redraw die (35); said punch being movable toward said base a predetermined distance to force the bottom of the inverted cup against said profile pad with said first
35 piston supporting said profile pad; and said punch being further movable toward said base a further distance to reverse said inverted cup by drawing over said redraw die with said profile pad being supported by said first and



second pistons.

5. The apparatus of Claim 4 wherein a knockout piston (34) is concentrically disposed between said profile pad and said redraw die; and said knockout piston is
5 resiliently mounted on said base.

6. The apparatus of Claim 4 or 5 wherein said first and second pistons are mounted beneath said profile pad; said first piston being movable into engagement with said second piston upon said further movement of said punch.

10 7. The apparatus of Claim 4, 5 or 6 wherein a draw pad (37) is fluidly supported on said base in concentric relationship with said redraw die.

8. The apparatus of Claim 4, 5, 6 or 7 wherein a third fluidly actuated pressure sleeve (21) is carried by the
15 outer slide in opposed relationship with said redraw die.

9. The method of forming container bodies substantially as hereinbefore described with reference being had to the accompanying drawings.

10. The apparatus for forming container bodies
20 substantially as hereinbefore described with reference being had to the accompanying drawings.
