

FORMING CONTAINER END PANELS

5 This invention relates, in general, to forming end panels or closures for two piece or three piece containers from a blank of metal and relates in particular to a method and apparatus for forming such end panels in double acting presses with the resulting product having an improved strengthened chuckwall area formed without unacceptable thinning of the metal during forming.

10 End panels for two piece or, for that matter, three piece metal containers are well known in the art. Examples of various end panels of this general type and of methods for forming them can be seen in Hawkins U.S. Patent 3,537,291; Jordan U.S. Patent 4,031,837; Balocca U.S. Patent 15 4,054,228; Kraska U.S. Patent 4,093,102; Schultz U.S. Patent 4,109,599; Bulso U.S. Patent 4,516,420; and Bulso U.S. Patent 4,549,242.

20 Particularly in the beer and beverage industries where the contents are packaged under pressure, certain contours, commonly known as the chuckwall, are formed in these end panels to impart the strength necessary for them to withstand these internal pressures. It is of major importance in forming these end panels to control the thickness of the metal during the forming operation while providing adequate 25 strength in the critical chuckwall area of the panel.

30 In this industry, there is also constant stress on reducing starting metal thickness. Reduction of one thousandth of an inch in the gauge of the starting metal can produce phenomenal savings over the course of a production year in view of the tremendous quantities of these pieces produced.

35 Nevertheless, while it is, of course, desirable to achieve this metal reduction for economic reasons, certain problems are commonly encountered when this is attempted.

Specifically, as noted, these end panels are contoured and have what is usually called a chuckwall formed in them. These chuckwalls are essentially annular and include verti-

cal wall surfaces which extend downwardly from adjacent the peripheral edge of the panel and then upwardly to the main body portion of the panel with the walls being joined at the bottom by a radiused area. In essence, it can be said that the tighter the radius, the better the chuckwall and the stronger the end panel. However, with the constant pressure for reduction in starting gauge of the material, the material becomes harder and thinner and more and more difficult to draw in conventional draw and redraw equipment to the required or desired small radius without destruction of the article due to the stress created by drawing the metal about a sharply radiused tool.

The obvious solution to the problem created in the forming of such a tight radius is to start with thicker material so that, when the panel is thinned during forming, sufficient thickness remains in the finished product. Unfortunately, this defeats the object of achieving economy by reducing starting thickness and also results in too much or unnecessary thickness in some other areas where it is not needed.

Attempts to resolve this problem have been made in various ways, primarily by producing the end panel in a forming and reforming operation normally accomplished in successive stations in the press so as to avoid a single drastic draw over a sharp radius. Such a draw, with very thin, hard metal, can result in metal failure.

Therefore, it is felt that if this could be accomplished in a single station with a single hit or draw, considerable savings can be accomplished in the manufacturing operation while providing the desired stability and strength in the chuckwall area and achieving only the desired reduction in the thickness of the starting material.

It has been found that considerable reduction in material starting gauge without detracting from the strength of the finished product can be achieved by essentially drawing an overlength chuckwall with an oversized radius and

then reforming it at the same station without further drawing of the material in the final step.

5 To that end, it has been discovered that utilization of a punch having an oversized or overradiused blunt end can be employed to initially form the end panel with an oversized radius. It has then been found that the chuckwall, being
10 overlenth can be folded back into the material to reduce the radius, shorten the chuckwall and provide material for the center part of the end panel without damage to the material which is a common problem in small radius areas.

15 Accordingly, production of an improved method and apparatus for forming and reforming end panels of the character above-described becomes the principal object of this invention with other objects thereof becoming more apparent upon the reading of the following brief specification considered and interpreted in view of the accompanying drawings.

OF THE DRAWINGS:

20 FIGURE 1 is an elevational assembly view partially in section showing the apparatus at the end of the first step.

FIGURE 2 is a view similar to FIGURE 1 showing the apparatus at the final step of the operation.

25 FIGURE 3 is a schematic view showing the position of the relevant components of the tooling prior to blanking.

FIGURE 4 is a schematic view showing the relevant components of the tooling following blanking and drawing of a reverse end piece.

30 FIGURE 5 is a schematic view of the pertinent components of the tooling showing their position following inverting of the cup and forming of the wide radius.

FIGURE 6 is a schematic view showing the relevant components of the tooling following shortening of the chuckwall and tightening of the radius.

35 FIGURE 7 is a timing diagram.

Referring first to FIGURES 1 and 2 of the drawings, it will be seen that the tooling of the present method and apparatus is intended to be utilized in a double-acting press having an inner slide holder 10 and outer slide holder 20 which carry the various tooling components. A fixed base 30 is also employed with the arrangement being that the slides 10 and 20 are reciprocal toward and away from fixed base 30.

Carried on the inner slide holder 10 is a punch center post 11, which has secured to it a punch core 12. This punch core 12 has a bottom surface which is contoured so as to impart the desired preliminary configuration to the end panel, as will be described more fully below.

To that end, it will be noted that the punch core 12 tapers to an annular nose 13 which has a rather large radius relative to the final radius to be formed in the chuckwall area of the end panel. One example would be wherein the radius on the annular nose 13 is on the order of .030 inches^(0.076 cm) while the end product has a desired chuckwall radius of .020.^(0.051 cm)

Carried by the outer slide holder 20 is an upper fluid actuated piston 21 and an upper pressure sleeve 22 which is disposed beneath and acted on by the piston 21 for holding purposes as will be described.

Also carried by the outer slide holder 20 is a punch shell 23 which is held in place by the punch shell clamp 24 and suitable screws 24a and which is disposed in concentric relationship with punch core 12.

Carried on fixed base 30, which is disposed opposite slide holders 10 and 20, is a cut-edge 31 which is held on the cut edge retainer 32 by one or more screws 32a.

Also received in the base 30 is a fixed die core pad 33 and a concentric knockout piston 34. This knockout piston 34 is actuated by suitable fluid pressure through the bore 34a and functions to return the finished product to the die line.

Also received in concentric relationship with and outboard of the knockout piston 34 and the die core pad 33 is a lower pressure sleeve 35 actuated again by suitable fluid pressure.

5 Between the lower pressure sleeve 35 and the knockout sleeve 34 and concentric therewith is a die core ring 36.

10 The die core ring 36 is supported on one or more posts 37, which are in turn supported on stacked pistons 38 and 39 so that the die core ring 36 is movable within base 30 and toward and away from the inner and outer slide holders 10 and 20.

15 Turning to FIGURES 3 through 6 for a description of the operation of the improved apparatus, it will be seen that in FIGURE 3 the punch shell 23 has been advanced by movement of outer slide holder 20 to trap the material M against the top of the lower pressure sleeve 35. The upper pressure sleeve 22 and the punch 12 are elevated at this point and the top of the die core ring 36 is disposed beneath the bottom surface of the material M.

20 Further downward movement of the inner and outer slide holders 10 and 20 will move the tooling components from the position of FIGURE 3 to that of FIGURE 4. At that time the punch shell 23 will have blanked the material M against the cut edge 31 and will have forced the lower pressure sleeve 25 35 down by overcoming the fluid pressure which normally supports it. At the same time, the periphery of the blank will have been wiped around the radius 36a of the die core ring 36 so as to form the metal into the shape of an inverted cup still designated by the letter M.

30 Also, at this time, the upper pressure sleeve 22 will have advanced so as to trap an inboard area of the material M against the top of the die core ring 36 and the punch 12 will have just come into contact with the top surface of the material M.

35 Further downward movement of the slide holders 10 and 20 will move the tooling from the position of FIGURE 4 to the position of FIGURE 5. At this time, it will be noted

that upper pressure sleeve 22 will continue to clamp the peripheral flange area of the end piece against the top of die core ring 36. However, the further downward movement of the inner slide 10 will force the punch 12 below the die line and at this point the previously formed inverted cup will be re-inverted by pulling the material over the top of die core ring 36 so as to form a chuckwall portion CW and a center bottom portion CD interconnected by a radiused area R. It will be noted that this radiused area R is formed by the annular nose 13 on the punch 12 and, as previously noted, the radius on the annular nose 13 is oversized with regard to the desired final radius.

At this time, further action of the press will move the tooling components from the position of FIGURE 5 to the position of FIGURE 6. In that regard, it will be noted that the upper pressure sleeve 22 will continue its downward movement having bottomed piston 21 against the fixed structure of the outer slide holder 20 and this continued downward movement will overcome the fluid supporting the die core ring 36 so that it will move downward as indicated by the arrows in FIGURE 6.

At the same time, the punch 12 will have lifted off and be out of engagement with the material M. However, the downward movement of the pressure sleeve 22 and die core ring 36 will push some of the material from the chuckwall area CW down into the space X between the inner periphery of the die core ring 36 and the outer periphery of the die core 33 so as to shorten the length of the chuckwall and tighten the radius R.

Activation of knockout sleeve 34 will then raise the finished product to the die line upon retraction of slides 10 and 20.

As previously noted, in one example, wherein the annular nose 13 forms an initial radius R in the order of .030 inches ^(0.076 cm), the movement from the position of the components from FIGURE 5 to FIGURE 6 will reduce that radius to approximately .020 inches ^(0.051 cm) which is, in this example, its final

desired dimension. This is accomplished by pushing the metal out of the chuckwall area CW down through the radiused area R without actually drawing the material about a sharply radiused tool. In effect, the material is simply guided
5 into the desired area.

The result is a tight radius and a strong chuckwall without unacceptable metal thinning since the metal is never really drawn about a sharp radius.

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CLAIMS

1. A method of forming a container end piece from a sheet of material at one station in a press having a fixed base and a movable platen comprising the steps of: forming an inverted cup by wiping a peripheral edge portion over a die core ring carried by the fixed base; inverting the cup by advancing a punch core carried by the movable platen and forming a flange area and a central bottom area interconnected by a chuckwall area and forming an enlarged radiused portion between the chuckwall and the central bottom area by said punch core with said central bottom area supported on a fixed die core; and retracting said punch core and exerting force toward the fixed base on said flange area to shorten said chuckwall area and reduce said radiused area while holding the workpiece against a fluidly supported die core ring and supporting said central bottom portion on said fixed die core.

2. The method of Claim 1 wherein said die core is carried by the fixed base concentrically with respect to said die core ring and spaced radially inwardly therefrom; material from said chuckwall area being forced into the space therebetween as said chuckwall is shortened and said radiused area is reduced.

3. A method of forming a container end piece at a single station in a press having a fixed base and a movable platen, comprising the steps of: blanking a work piece; holding said work piece between a pressure sleeve carried by the movable platen and a fluidly supported die core ring carried by the base; forming said work piece into an inverted cup over said die core ring by advancing a punch shell carried by the movable platen toward the base; advancing a punch with a radiused annular nose and carried by the movable platen radially inwardly of the punch shell to reverse said inverted cup and form an end piece having a chuckwall joined to a central bottom portion by an enlarged radiused portion with said central bottom portion supported on a die core fixed to the base with said chuckwall being formed between complementary surfaces of said punch and said die core ring; shortening said sidewall and reducing the radius of said enlarged radiused portion by advancing the pressure sleeve further while holding the work piece against said die core ring and supporting said central bottom portion on said fixed die core.

4. Apparatus for forming a container end piece from a sheet of material at a single station in a press having a fixed base and a movable platen, comprising: a die



core ring fluidly supported on the fixed base; a punch shell carried by the movable platen; said punch shell telescoping over said die core ring upon movement of the movable platen toward the fixed base to form an inverted cup; a punch core carried by the movable platen and telescoping with said die core ring upon movement toward the fixed base to invert the cup and form a flange area, a central bottom area and a chuckwall interconnecting them; said punch core having a radiused nose area whereby a radiused area of a given dimension is formed between said chuckwall and said central bottom portion and a chuckwall is formed between the external surface of said punch core and the inner surface of said die core ring; a die core fixed to the base and spaced radially inwardly from said die core ring and supporting said central bottom portion; means carried by the movable platen for exerting pressure on said flange area to force said chuckwall area and said radiused area into the space between said die core ring and said die core to shorten said chuckwall and reduce said radius.

5. The apparatus of Claim 4 wherein said last mentioned means include a pressure sleeve carried by the movable platen in opposed relationship with said die core ring and movable toward the fixed base.

6. Apparatus for forming a container end piece from a work piece at a single station in a double acting press having a fixed base and inner and outer slides movable toward and away from the base, comprising: a die core fixed to the base; a die core ring fluidly supported on the base in concentric, spaced relationship with said die core; a lower pressure sleeve fluidly supported on the base in concentric relationship with said die core ring; a punch core carried by the inner slide in opposed relationship with said die core and having a radius imparting distal end; an upper pressure sleeve carried by the outer slide in opposed relationship with said die core ring; a punch shell carried by the outer slide in opposed relationship with said lower pressure sleeve; said upper pressure sleeve being movable toward the base to hold the work piece against said die core ring; said punch shell being movable toward the base to form an inverted cup by bending the periphery of the work piece about said die core ring; said punch core being movable toward the base to reverse said inverted cup and form a chuckwall and a radiused area between the chuckwall and bottom thereof; said upper pressure sleeve being further movable toward the base by movement of the outer slide to overcome the pressure supporting said die core ring and forcing metal from the chuckwall into the area between said die core and said die core ring; whereby the sidewall is shortened and the radius of the radiused area is reduced.



7. A method of forming a container end piece from a sheet of material substantially as hereinbefore described with reference to the accompanying drawings.

8. Apparatus for forming a container end piece from a sheet of material substantially as hereinbefore described with reference to the accompanying drawings.



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