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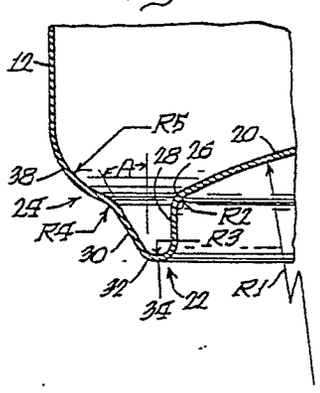
(54) Container.

(57) The invention relates to a drawn and ironed beer and beverage container (10) including a generally cylindrical side wall (12) having an inwardly-tapered reduced neck at one end with a reduced diameter end connected by a double seam to an open end of said reduced diameter neck, said double seam having an inner generally flat wall that extends generally parallel to the axis of said container with an upper arcuate exposed portion above said inner flat wall and an integral bottom wall characterized by said bottom wall including a fist lower convex annular arcuate portion (38) at the end of said cylindrical side wall (12), a concave annular second arcuate portion integral with a lower end of said first lower convex annular arcuate portion (38) and a generally U-shaped annular third portion (22), said second arcuate portion adapted to engage said arcuate exposed portion of double seam when stacking a lower portion of a container upon an upper portion of another container, said U-shaped annular third portion (22) having an outer annular flat wall (30) tapered inwardly and an inner substantially vertical flat wall (28) interconnected by a lower arcuate segment (32) that defines a reduced diameter lower annular support (34) for said container; and an inwardly-domed central panel (20) integral with said substantially vertical flat wall (28). The container can be formed using reduced thickness stock material without increasing the diameter of the disc-shaped stock material. The new container has excellent column strength, buckle strength and resistance to harsh handling, while at the same time incorporates a nesting feature for allowing the bottom profile wall to nest with the end attached to the reduced neck portion of the container.

Fig.3.



EP 0 337 500 A2

Container

The present invention relates generally to a drawn and ironed beer and beverage container according to the introductory portion of claim 1.

In an effort to reduce the cost of finished containers, manufacturers are constantly striving to reduce the thickness of the initial stock material, thereby decreasing the overall metal cost of each container. Since the end wall (bottom) of the container essentially represents the initial thickness of the can stock, new bottom profiles are required to maintain the pressure performance of thinner gauge of stock materials. Purchasers and users of such containers, particularly the beer and beverage industry, have very stringent requirements which require that the finished and filled container be capable of maintaining internal pressures above 7.03 kg cm^2 (100 psi) minimum without any significant distortion, and to provide such capability, rather elaborate dome or end configurations have been developed.

Another more recent requirement for such drawn and ironed containers is that the container must have a minimum resistance to the reversal of the end wall when the container is inadvertently dropped after it has been filled and is ready for sale and that the end wall have a buckle resistance of more than 7.03 kg/cm^2 (100 psi).

However, as the thickness of the stock material decreases, the problem of wrinkling the container shell wall becomes more acute, particularly when attempting to produce the more elaborate configurations in the end wall.

One problem that has recently received some attention is the handling of the containers, particularly during shipment, storage and display. With the increased use of the reduced end necked portion on the upper end of the container, allowing for the use of smaller ends as part of the package, one of the problems that has been encountered is stability of the containers, particularly when several six-packs of individual containers are stacked upon each other. This has created a problem in displaying the goods on shelves. While this has to some degree been a problem in the industry, no particular attention has been given to solutions for accomodating proper stacking and interlocking of a plurality of containers on a shelf.

According to the present invention, the container can be formed using reduced thickness stock material without increasing the diameter of the disc-shaped stock material. The new container has excellent column strength, buckle strength and resistance to harsh handling, while at the same time incorporates a nesting feature for allowing the bottom profile wall to nest with the end attached to the reduced neck portion of the container.

More specifically, the drawn and ironed beer and beverage container includes a cylindrical side wall having a reduced neck surrounding an upper open end with an outwardly-directed flange adapted to be seamed to a reduced diameter end. The bottom profile is designed to nest on the reduced diameter end to provide a peripheral support around the entire perimeter between the end and the bottom of two adjacent containers.

The bottom profile includes a spherically, inwardly-domed portion surrounded by a generally U-shaped annular segment defining a lower support for the container with the annular segment having a diameter of about 80% of the diameter of the side wall. A specifically configured annular joining segment is integral with the side wall and the U-shaped annular segment with the joining segment including a first annular arcuate portion having an interior radius and a second annular arcuate portion having an exterior radius to produce an annular support point for nesting with an end on an adjacent container.

The particular domed profile is configured to eliminate the need of any metal reversal during the formation of the bottom profile at the end of a drawing and ironing operation, and the profile incorporates specifically, dimensioned radii and segments that simplify the metal-deforming process so that the containers can be manufactured at acceptable production rates.

Brief Description of Drawing

Fig. 1 is a fragmentary cross-sectional view of the container having the present invention incorporated therein;

Fig. 2 is an enlarged fragmentary cross-sectional view of the container shown in Fig. 1, along with the tooling for forming the bottom profile;

Fig. 3 is an enlarged fragmentary segment of the container bottom profile;

Fig. 4 is a perspective view of a container having an end seamed thereto;

Fig. 5 is a fragmentary cross-sectional view showing two containers in nesting relation to each other.

Detailed Description

Fig. 1 of the drawings discloses a fragmentary portion of a container, generally designated by

reference numeral 10, having a generally cylindrical side wall 12 and an integral end wall 14. Container 10 is what is commonly known as a "drawn and ironed container" wherein a flat circular metal disc is converted into a shallow cup in a press, commonly referred to as a "cupper". The shallow cup is then delivered to a drawing and ironing machine, commonly referred to as a "bodymaker" wherein the cup is reformed to reduce the diameter thereof and increase the height by reducing the thickness of the side wall. The end wall is subsequently reformed at the end of the stroke of the punch that forms part of the press or bodymaker. After the end wall or bottom has been reformed to the particular bottom profile, the container has a reduced neck 16 formed around the open end and an outwardly-directed flange 18 with the flange being utilized for double-seaming an end thereto.

With the increased attention in reduction of metal costs, many manufacturers are now utilizing what is referrred in the industry as a "206 End" rather than the prior most common "209 End", the numerical values indicating the effective diameter of the end, which also dictates the amount of metal required for forming the end. With the use of the "206 End" and a substantially reduced neck on the upper end of the container, the problem of stacking several groups of containers upon each other has become more acute. Most commercially-available containers use a bottom profile having an outwardly-convex peripheral annular segment surrounding a reduced diameter lower support surface and an inwardly-domed central portion inside the annular support surface.

According to the present invention, the bottom profile of the drawn and ironed container is configured such that the bottom of one container will nest within the end of an adjacent container attached to the reduced neck and the container is still capable of withstanding internal pressures in the order of 7.03 kg/cm^2 (100 psi) and also has a column strength of approximately 159 kg (350 pounds) or greater. Moreover, the present container has exhibited excellent results in drop-tests that have recently become a criteria in the beer and beverage industry.

According to the present invention, the lower end 14 of the container 10 includes a center domed portion 20 (Fig. 3) surrounded by an annular U-shaped portion 22 and an annular joining segment 24 integral with the side wall 12 and the U-shaped portion 22.

As shown in Fig. 3, the center domed portion 20 has a spherical radius R1 and is joined to the U-shaped portion by an arcuate segment 26 having a radius R2. The U-shaped portion 22 includes an annular, substantially vertical wall 28 and an outer annular wall 30 interconnected by an annular arcuate lower segment 32 having an interior radius R3. The lower segment 32 defines an annular support surface 34 for the container 10. The inner annular wall 28 is substantially vertical and defines an included angle with respect to a vertical axis (not shown) through the container which is as close to zero as possible, while the outer annular wall 30 defines an angle A.

The joining segment 24 includes a first annular arcuate portion 36 having an exterior radius R4 and a second annular arcuate portion 38 having an interior radius R5.

The particular radii and dimensions of the various parts that form the integral lower end 14 of the container are important to the overall performance of the container when filled with pressurized contents and also incorporates a nesting feature which will preclude "wobbling" when two filled containers are stacked on each other.

A specific set of parameters will now be described with the understanding that some of these parameters may be varied without departing from the spirit of the present invention.

A container having a cylindrical side wall diameter D1 of 64.93 mm (2.597 inches) was formed from a flat circular disc having a diameter of 137.38 mm (5.495 inches) and a thickness of 0.32 mm (0.0128 inch). The disc was first converted into a cup and then converted to a finished drawn and ironed container using tooling shown in Fig. 2, to be described later.

The container center dome 20 has a spherical radius R1 of 53.85 mm (2.120 inches) with the radius R2 of segment 26 being 1.25 mm (0.050 inch).

The lower annular arcuate support had a radius R3 of 1.00 mm (0.040 inch) and the angle A for wall segment 30 was 27° 30′ and the angle for wall segment 28 was less than 5°, preferably as close to vertical as possible. The exterior radius R4 was 2.80 mm (0.100 inch), while the interior radius R5 was 5.00 mm (0.200 inch).

The support diameter D2 for the container was 50.00 mm (2.000 inches), while the diameter D3 for the center of the radius R4 was 59.13 mm (2.365 inches) and the diameter D4 for the center of the radius R5 was 54.68 mm (2.187 inches).

This type of container was then filled with beverage and an end 40 was seamed to the reduced neck portion 16 by a double seam 42 (Fig. 4). The end was a standard commercial 206 End.

This container was tested extensively and was found to meet or exceed all minimum requirements for the beer and beverage industry. Furthermore, filled containers, when stacked upon each other, had a good snug fit with continuous contact around the entire periphery.

Actual tests were conducted on this and it was found that the bottom profile nested snuggly into a "206 End" double seamed to the opposite end of the container after it was filled with a product and did not "rock". Dome reversal tests were then conducted using a bottom profile having a dome height of 0.9906 cm (0.390 inch), measured from the lower center of the dome to the bottom edge of the container, and it was determined that it withstood pressures of 6.995 kg/cm^2 (99.5 psi) before dome reversal occured. This figure is well above the minimum requirements for this container.

Fig. 5 of the drawings shows the nesting relation between two containers stacked upon each other. It should be noted that the annular arcuate segment 36 has continuous extended contact with the double seam 42 and the U-shaped annular segment 22 is partially wedged into the double seam to prevent tilting of the upper container with respect to the lower container.

While the relative dimensions and their relation have not been fully explored, it is believed that some of the relationships are critical to the overall success in performance of the container. For example, in the specific container described, the diameter D2 was less than 80% of the diameter D1 of the container. The relationship between the diameter of the support surface 34 and the spherical radius R1 of dome 20, along with the vertical annular wall 28, is believed to add strength characteristics. Also, the fact that the joining segment has two arcuate segments 36 and 38 having significantly different radii, with radius R5 being about twice the radius R4, provides excellent internal pressure resistance.

Fig. 2 of the drawings shows the tooling used for forming the bottom profile of the present invention. The tooling includes a center dome pad 50, an outer annular forming element 52 and a punch 54. The center dome pad 50 has an upper spherical surface 56 having a radius R1 and a peripheral edge having a radius R2, along with a peripheral vertical surface 58. The outer annular forming element 52 has an inclined flat surface 60, a convex annular surface 62 having a radius R4, and a concave annular surface 64 having a radius R5. The punch 54 has a lower nose 70 configured to produce the U-shaped portion 22 and an outer surface 72 conforming to the surfaces 62 and 64.

Containers constructed in accordance with the present invention exhibited more than adequate resistance to buckling, internal pressure and column strength. It has also been noted that the stock material thickness could be reduced to 0.03175 cm ((0.0125 inch), and possibly as low as 0.03048 cm (0.0120 inch), which significantly reduces the raw material cost for these containers.

It should also be noted that the tapered upper end 16 of the container is a constantly-reducing taper from the cylindrical sidewall to the upper flange 18. This constantly-reducing tapered smooth neck is produced in a spin-necking operation and tests have shown that this results in significantly increased crush strength for the container. In fact, these tests show that the upper edge of the neck will actually curl rather than having the tapered portion wrinkle.

As indicated above, one of the problems encountered in forming container shells from reduced thicknesses of aluminum stock material and reforming the end wall of the configuration described above is that the metal has a tendency to wrinkle, particularly in the reformed juncture area, which renders the finished container unacceptable. According to the present invention, the domer 50 and annular forming element 52 are biased with unique biasing means that produce greater pressure in a confined space to insure that the container shell is accurately reformed around the punch 54 without wrinkling of the very ductile aluminum.

Claims

1. A drawn and ironed beer and beverage container (10) including a generally cylindrical side wall (12) having an inwardly-tapered reduced neck (16) at one end with a reduced diameter end (40) connected by a double seam (42) to an open end of said reduced diameter neck (16), said double seam (42) having an inner generally flat wall that extends generally parallel to the axis of said container (10) with an upper arcuate exposed portion above said inner flat wall and an integral bottom wall characterized by said bottom wall including a fist lower convex annular arcuate portion (38) at the end of said cylindrical side wall (12), a concave annular second arcuate portion (36) integral with a lower end of said first lower convex annular arcuate portion (38) and a generally U-shaped annular third portion (22), said second arcuate portion (36) adapted to engage said arcuate exposed portion of double seam (42) when stacking a lower portion of a container (10) upon an upper portion of another container (10), said U-shaped annular third portion (22) having an outer annular flat wall (30) tapered inwardly and an inner substantially vertical flat wall (28) interconnected by a lower arcuate segment (32) that defines a reduced diameter lower annular support (34) for said container (10); and an inwardly-domed central panel (20) integral with said substantially vertical flat wall (28).

2. A drawn and ironed beverage container as defined in claim 1 characterized by said first arcuate portion (38) having a radius which is about twice the radius of said second arcuate portion (36).

3. A drawn and ironed beverage container as defined in claim 1 or 2, characterized by said inwardly-tapered neck (16) being generally smooth and continuous between said side wall (12) and said double seam (42).

4. A drawn and ironed beverage container as defined in claim 1, 2 or 3, characterized by the radius of said first arcuate portion (38) being about one-tenth the diameter of said lower support (34) and the radius of said second arcuate portion (36) being about one-half the radius of said first arcuate portion (38).

5. A drawn and ironed beverage container as defined in claim 1 or 2 in which the diameter of said lower annular support is 5.08 cm (2.00 inches) and is about 80% of the diameter of said side wall (12).

Fig. 1.

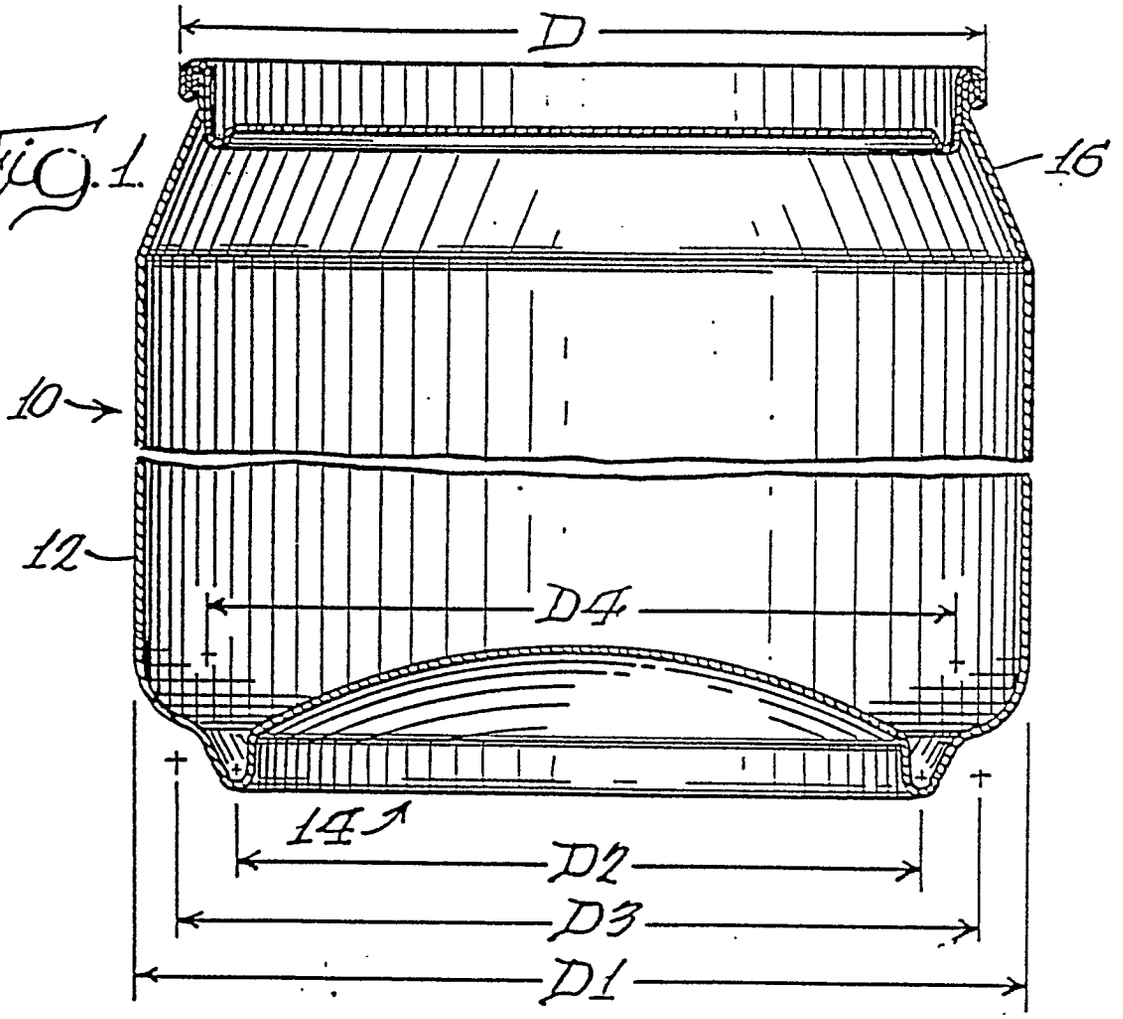


Fig. 2.

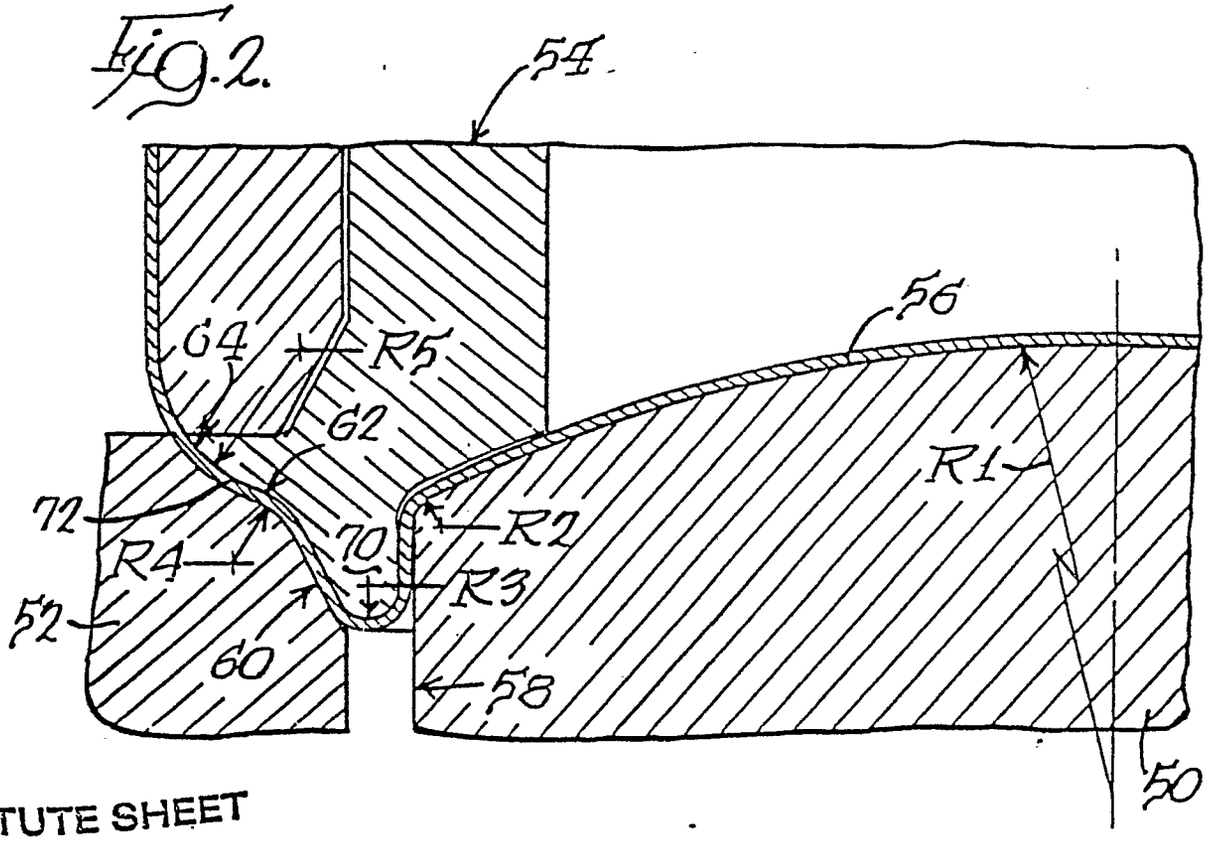


Fig.4.

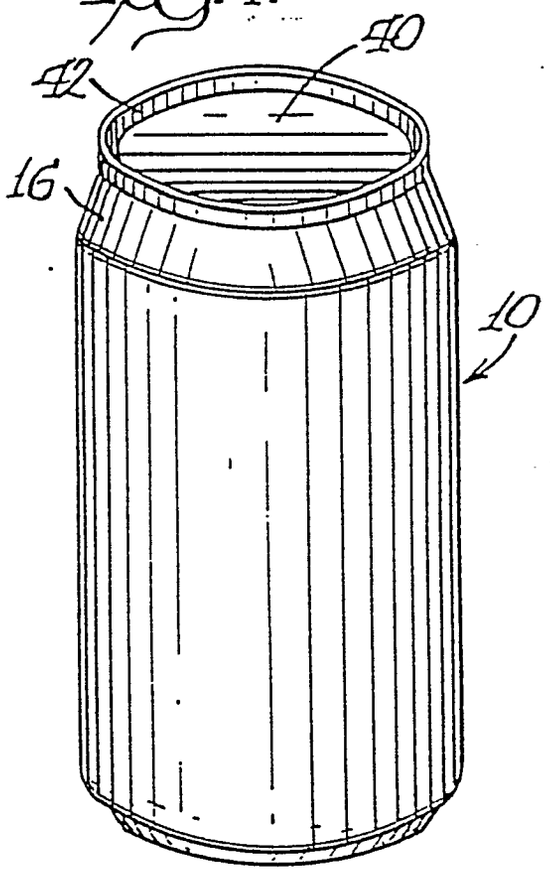


Fig.3.

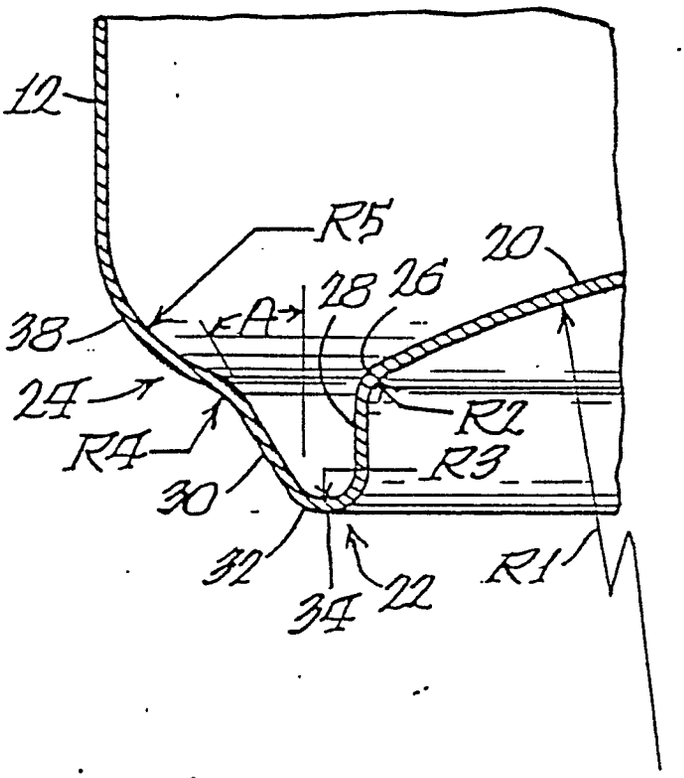


Fig.5.