Feb. 6, 1968 R. D. LURIE 3,367,554

DRAWN CONTAINERS

Original Filed Dec. 17, 1963

FIG. 1

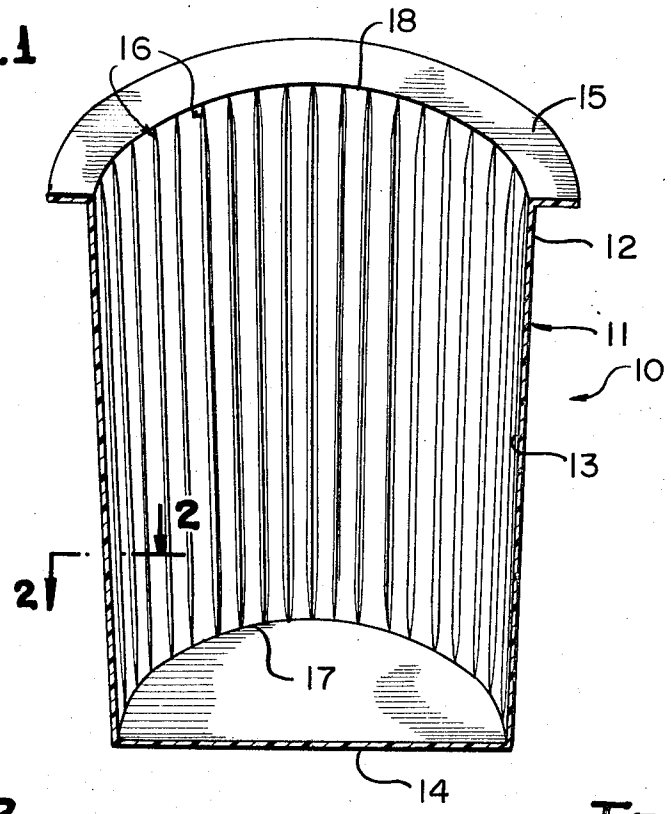


FIG. 2

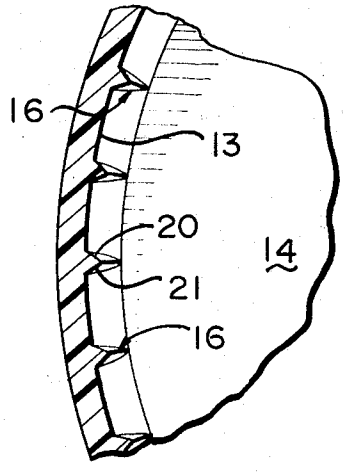
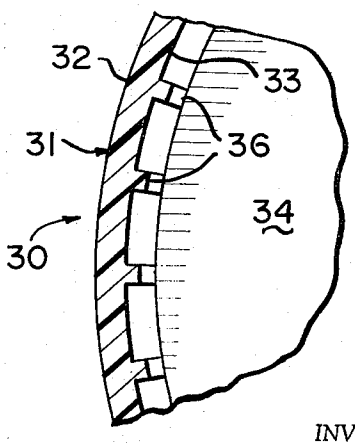


FIG. 3



INVENTOR

RANDOLPH D. LURIE

BY

Mason, Porter, Dibble & Brown

ATTORNEYS

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DRAWN CONTAINERS

Randolph D. Lurie, Park Forest, Ill., assignor to Continental Can Company, Inc., New York, N.Y., a corporation of New York

Original application Dec. 17, 1963, Ser. No. 331,249, now Patent No. 3,231,937, dated Feb. 1, 1966. Divided and this application Sept. 7, 1965, Ser. No. 485,443
14 Claims. (Cl. 229—2.5)

ABSTRACT OF THE DISCLOSURE

A drawn plastic article having a cup-shaped body with means forming integral portions in an interior peripheral surface for preventing the necking down of the body during the drawing thereof. The integral portions are a plurality of ribs extending from an upper edge and gradually merging into a smooth continuous unbroken surface adjacent a bottom wall. The ribs range in height upwardly from about .005 in., and in number between 5 to 110 for each inch of periphery of the body wall.

This application constitutes a divisional application of my copending commonly assigned application for U.S. Letters Patent, Ser. No. 331,249, filed Dec. 17, 1963, and now Patent No. 3,231,937.

This invention relates to a novel plastic article, and in particular, to a novel cold drawn plastic cup-shaped body having means forming integral portions of an interior peripheral surface of the body which prevent the body from "necking" or thinning during the formation thereof by a drawing operation.

Independent of the final shape or contour of a drawn or redrawn plastic article, such as a container, by a conventional deep drawing process, the container tends to "neck down" or thin in a peripheral area of the container body adjacent the juncture of the body and bottom walls thereof. This "necking" or thinning of the material adjacent the bottom wall can occur during any one of several drawing operations, but is most prevalent during the second or redrawing operation. As a result of the formation of this conventional "neck" of thin material, one of three things may happen to the redrawn container.

First, the material of the container may strain harden enough to cause a brittle break in the material. This may easily cause the bottom wall of the container body to be punched out during the redrawing operation. If the break in the material is minute and remains undetected a perishable product packaged in the container could spoil or the shelf-life thereof could be materially lessened due to atmosphere entering the container through the break in effecting the product.

Secondly, the "neck" of thin material may propagate further along the container body or wall and/or the bottom wall of the container, thus rendering the container commercially useless due to the differential wall thickness.

Finally, the material of the container may strain harden in this "neck" region but the tensile forces may be too weak to tear the material thus forming an objectionable thin but relatively strong and highly oriented band around the container body.

In accordance with this invention, it has been found that the elongation to yield (the additional length to which a ductile plastic material may be stretched before the onset of unstable viscous or plastic flow) of a tensile specimen, such as a plastic container during a drawing operation, goes through a minimum value of some relatively low value of strain rate i.e., the velocity at which a specimen is being strained divided by the original length of specimen being strained. It has been found in accordance with this invention that the provision of a plurality of closely spaced relieved areas in the form of elongated parallel, shallow grooves in the periphery of a die center pad of a die assembly prevents undesired elongation during a drawing or a redrawing operation and prevents the above-noted conventional thinning or "necking" of container bodies during conventional drawing methods performed by conventional die apparatuses, and produces containers of a generally uniform wall thickness and strength, and high esthetic characteristics.

It is, therefore, an object of this invention to provide a novel drawn plastic article including a generally cup-shaped body having interior and exterior peripheral surfaces, means forming integral portions of only one of the peripheral surfaces for preventing the necking down of the body during the drawing thereof whereby the body is of a generally uniform wall thickness and the integral portions are of a size which are generally indiscernible to the naked eye and insufficient to materially disfigure the body.

A further object of this invention is to provide a novel drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, one of the peripheral surfaces being smooth and unbroken, and the other of the peripheral surfaces having a plurality of parallel ribs ranging in height upwardly from about .0005 inch to a height sufficient to prevent necking down but insufficient to materially disfigure the drawn article.

Still another object of this invention is to provide a novel drawn plastic article of the type described in which the number of ribs range between five to one-hundred ten for each inch of periphery of the cup-shaped body.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

FIGURE 1 is an axial sectional view through a redrawn plastic cup-shaped article, and illustrates the generally uniform wall thickness of the article and numerous raised areas or ribs formed in the internal surface thereof, the size of the ribs being highly exaggerated.

FIGURE 2 is a highly enlarged fragmentary sectional view taken along line 2—2 of FIGURE 1 and more clearly illustrates the plurality of raised areas in the interior surface of the article.

FIGURE 3 is a highly enlarged fragmentary transverse sectional view taken through another article of this invention on a line substantially identical to the line 2—2 of FIGURE 1, and illustrates a plurality of closely spaced parallel generally U-shaped areas or ribs in an interior peripheral surface of the article.

A novel cup-shaped article or container formed by the redrawing process heretofore described is generally designated by the reference numeral **10**. The drawn or redrawn container **10** comprises a container body **11** defined between an exterior peripheral surface **12** and an interior peripheral surface **13**. The body or wall **11** tapers slightly upwardly from a bottom wall **14** toward an upper end portion (unnumbered) terminating at a radially outwardly directed flange **15**.

The inner peripheral surface **13** of the body **11** is provided with a plurality of identical elongated closely spaced raised areas or ribs **16** (FIGURE 2). The raised ribs extend from a radius portion **17** joining the bottom wall **14** to the body wall **11** and terminate at a radius portion **18** joining the wall **10** to the radially outwardly directed flange **15**.

Each of the ribs **16** is substantially V-shaped in trans-

verse section (FIGURE 2) and converging wall surfaces **20**, **21** thereof enclose an angle of approximately ninety degrees. The height of each of the ribs **16** is approximately 0.0005 inch and the number of the ribs varies in accordance with the diameter and circumference of the body wall **11**. There are preferably approximately between five to one-hundred ten ribs **16** for each inch of periphery or circumference of the body wall **11**. While this number of ribs per each inch of circumference is preferred, the maximum number of ribs is limited only by the maximum number of grooves which can be accurately machined or formed in a die center pad, as described, in the commonly assigned application heretofore noted. The minimum number of ribs per each inch of circuference is similarly limited only by the minimum number of ribs necessary to achieve the object of this invention, and five such ribs in each inch of circumference have been found satisfactory to preclude the formation of a "neck" of thin material adjacent the bottom wall **14** and maintain the thickness of the body wall **11** substantially uniform thoughout. While the ribs **16** are quite numerous, they are of a height which is generally insufficient to materially disfigure the container **10** and are substantially undiscernible to the naked eye.

Working embodiments of the container **10** have been manufactured and tested, and one such container was formed by employing a die center pad having a length of approximately five and one-half inches, a diameter of 1.8410 inches and a circumference of approximately 5.786 inches. The body of the die center pad was provided with 720 V-shaped grooves arranged in parallel relationship to each other and to the axis of the die center pad. Each of the grooves was approximately four inches in length and adjacent grooves were spaced from each other a center-to-center distance of approximately .00803 inch or approximately one-half degree of arc between adjacent grooves or approximately 107.2 grooves per each inch of circumference of the body. The converging wall portions defining each of the grooves set off an angle of approximately ninety degrees and the depth of each groove was 0.0005 inch. The maximum width of the grooves was 0.001 inch. The working embodiment of the container **10** was, of course, provided with ribs corresponding to the size, shape and number of grooves of the die center pad.

Many containers were redrawn from polycarbonate material having a nominal 0.012 inch thickness which previously could not be drawn because the container body and/or bottom always tore and/or thinned or necked down markedly. Further containers were drawn from acrylonitrile-butadiene-styrene terpolymer.

Referring to FIGURE 3 of the drawing, another cup-shaped article or container constructed in accordance with this invention is referred to by the reference numeral **30** and comprises a generally cylindrical body **31** having an exterior peripheral surface **32** and an interior peripheral surface **33**. The container **30** is substantially identical to the container **10** and includes a bottom wall **34** and a flange (not shown) corresponding to the flange **15** of the container **10**.

The interior peripheral surface **33** on the body **31** is provided with a plurality of closely spaced parallel raised areas or ribs **36**. Each of the ribs **36** is substantially U-shaped in transverse section and is approximately 0.0005 inch in height. The container **30** preferably includes one such rib for each ten degrees of arc of the body **31**, and the maximum width of each of the U-shaped ribs is approximately 0.010 inch.

Containers corresponding to the containers **30** have been drawn in the manner disclosed in the above-noted application by employing a die center pad having a body of approximately five and one-half inches in length. Thirty-six identical U-shaped grooves were formed in the exterior peripheral surface of the die center pad body with each groove being approximately four inches long. The diameter of the body was 2.041 inches with a circumference of approximately 6.408 inches. The U-shaped grooves were spaced apart a center-to-center distance of ten degrees of arc or approximately 5.62 grooves in each inch of circumference of the body. The depth of each groove was approximately 0.0005 inch and the width of each groove was 0.010 inch. The drawn containers include correspondingly sized and shaped ribs.

It will be apparent from the foregoing that there has been provided various forms of a novel cold-drawn plastic container wherein a plurality of closely spaced ribs in an interior surface thereof prevents the formation of a "neck" of thin material in the container wall just slightly removed from the radius portion which joins the body wall to the bottom wall thereof. While this problem of thinning or "necking" has been solved by the provision of a plurality of such ribs, other rib configurations are considered to be within the scope of this invention. For example, serpentine or spiral-like ribs might also be formed in the interior surface of the container body by forming corresponding ribs in the exterior surface of a die center pad.

Thus, while preferred forms and arrangements have been shown to illustrate this invention, it is to be understood that various changes in details and arrangements may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A cold-drawn plastic container comprising a body wall terminating in a bottom wall, said body wall including an interior peripheral surface and an exterior peripheral surface, a plurality of closely spaced elongated raised areas extending substantially the length of said body wall upon the interior peripheral surface thereof, and each of said raised portions being of a height which is insufficient to materially disfigure the container and being generally undiscernible to the naked eye.

2. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, means forming integral portions of said body for preventing the necking down of said body during the drawing thereof whereby said body is of a generally uniform wall thickness, and said means being generally insufficient to materially disfigure the body and being generally indiscernible to the naked eye.

3. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, means forming integral portions of only one of said peripheral surfaces for preventing the necking-down of said body during the drawing thereof whereby said body is of a generally uniform wall thickness, and the other of said peripheral surfaces being absolutely smooth and unbroken.

4. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, said body having an upper peripheral end portion and a bottom wall portion, means forming integral portions of one of said peripheral surfaces for preventing the necking-down of said body during the drawing thereof whereby said body is of a generally uniform wall thickness and is devoid of a necked-down portion adjacent the bottom wall portion thereof, said means extending from the peripheral end portion of said body to the bottom wall poriton thereof, and said integral portions being a plurality of ribs which gradually merge into a smooth continuous unbroken surface adjacent said bottom wall portion.

5. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, said body having an upper peripheral end portion and a bottom wall portion, means forming integral portions of only one of said peripheral surfaces for preventing the necking-down of said body during the drawing thereof whereby said body is of a generally uniform wall thickness and is devoid of a necked-down portion adjacent the bottom wall portion thereof, said means extend-

ing from the peripheral end portion of said body to the bottom wall portion thereof, and said integral portions being a plurality of ribs which gradually merge into a smooth continuous unbroken surface adjacent said bottom wall portion.

6. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, one of said peripheral surfaces being smooth and unbroken, a plurality of elongated raised ribs in the other of said peripheral surfaces, each of said raised ribs ranging in height upwardly from about .0005 inch to a height sufficient to prevent necking-down but insufficient to materially disfigure the drawn article.

7. A drawn plastic article comprising a generally cylindrical cup-shaped body having interior and exterior peripheral surfaces, one of said peripheral surfaces including a plurality of means for preventing the necking-down of said article during the drawing thereof, and said means ranging in number between five to one-hundred ten for each inch of circumference of said cylindrical body wall.

8. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, said body being of a generally uniform thickness, said body having a body wall defined by said interior and exterior peripheral surfaces, said body wall having upper and lower end portions, said exterior peripheral surface being absolutely smooth and unbroken, a plurality of means forming integral portions of said interior peripheral surface for preventing the necking down of said body during the drawing thereof, said means being insufficient to materially disfigure the interior peripheral surfaces of the body and being generally indiscernible to the naked eye, said plurality of means being a plurality of parallel ribs extending between said upper and lower end portions, and each of said ribs ranging in height upwardly from .0005 inch.

9. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, said body being of a generally uniform thickness, said body having a body wall defined by said interior and exterior peripheral surfaces, said body wall having upper and lower end portions, said exterior peripheral surface being absolutely smooth and unbroken, a plurality of means forming integral portions of said interior peripheral surface for preventing the necking down of said body during the drawing thereof, said means being insufficient to materially disfigure the interior peripheral surfaces of the body and being generally indiscernible to the naked eye, said plurality of means being a plurality of parallel ribs extending between said upper and lower end portions, and said ribs ranging in number between five to one-hundred ten for each inch of periphery of said body wall.

10. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, said body being of a generally uniform thickness, said body having a body wall defined by said interior and exterior peripheral surfaces, said body wall having upper and lower end portions, said exterior peripheral surface being absolutely smooth and unbroken, a plurality of means forming integral portions of said interior peripheral surface for preventing the necking down of said body during the drawing thereof, said means being insufficient to materially disfigure the interior peripheral surfaces of the body and being generally indiscernible to the naked eye, said plurality of means being a plurality of parallel ribs extending between said upper and lower end portions, and each of said ribs ranging in height upwardly from .0005 inch, and said ribs ranging in number between five to one-hundred ten for each inch of periphery of said body wall.

11. The drawn plastic article as defined in claim 8 wherein said ribs are of a generally V-shaped cross-sectional configuration.

12. The drawn plastic article as defined in claim 10 wherein said ribs are of a generally V-shaped cross-sectional configuration.

13. A drawn plastic article comprising a generally cup-shaped body having interior and exterior peripheral surfaces, said body being of a generally uniform thickness, said body having a body wall defined by said interior and exterior peripheral surfaces, said body wall having upper and lower end portions, said exterior peripheral surface being absolutely smooth and unbroken, a plurality of means forming integral portions of said interior peripheral surface for preventing the necking down of said body during the drawing thereof, said means being insufficient to materially disfigure the interior peripheral surface of the body and being generally indiscernible to the naked eye, and said plurality of means being a plurality of parallel ribs extending between said upper and lower end portions.

14. The drawn plastic article as defined in claim 13 wherein said ribs gradually merge into a smooth continuous unbroken surface adjacent said lower end portion.

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DAVID M. BOCKENEK, *Primary Examiner.*