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(54) **CONTAINER BASE WITH RELEASED CORNER GEOMETRY**

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(57) **ABSTRACT**

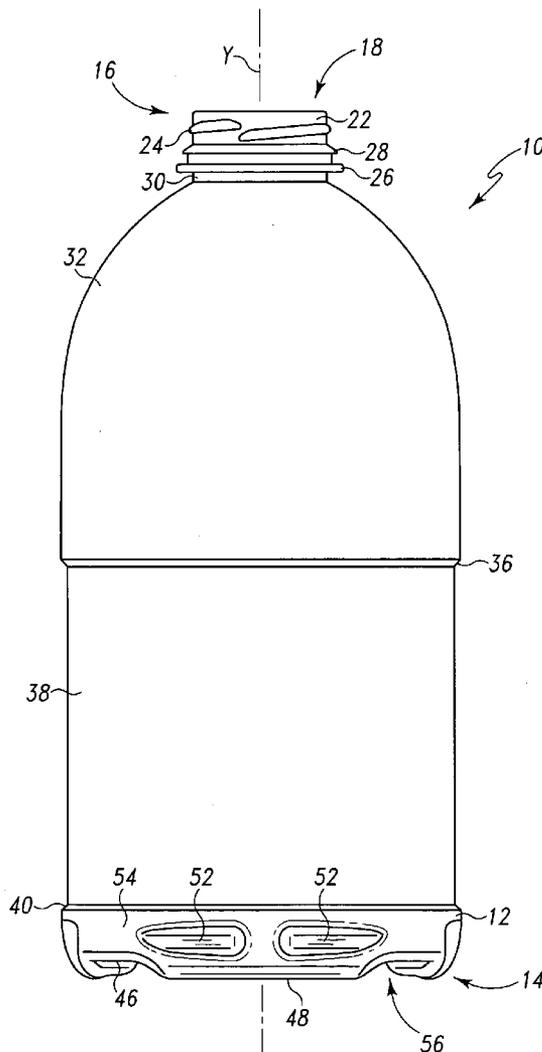
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A plastic container having a longitudinal axis, a finish adapted to receive a closure for sealing the container, a neck situated below and supporting the finish, a shoulder portion situated below the neck, a body portion extending downward from the shoulder portion, and a base. The base has a central portion and a plurality of edges and corners defining a generally polygonal base perimeter. Downwardly extending contact portions are located along the edges of the base perimeter, a lowermost surface of the contact portions defining a common plane perpendicular to the container longitudinal axis. Each of the corners of the base includes a channel upwardly offset with respect to the common plane, each channel extending between the base central portion and the base perimeter.

(73) Assignee: **Ball Corporation**

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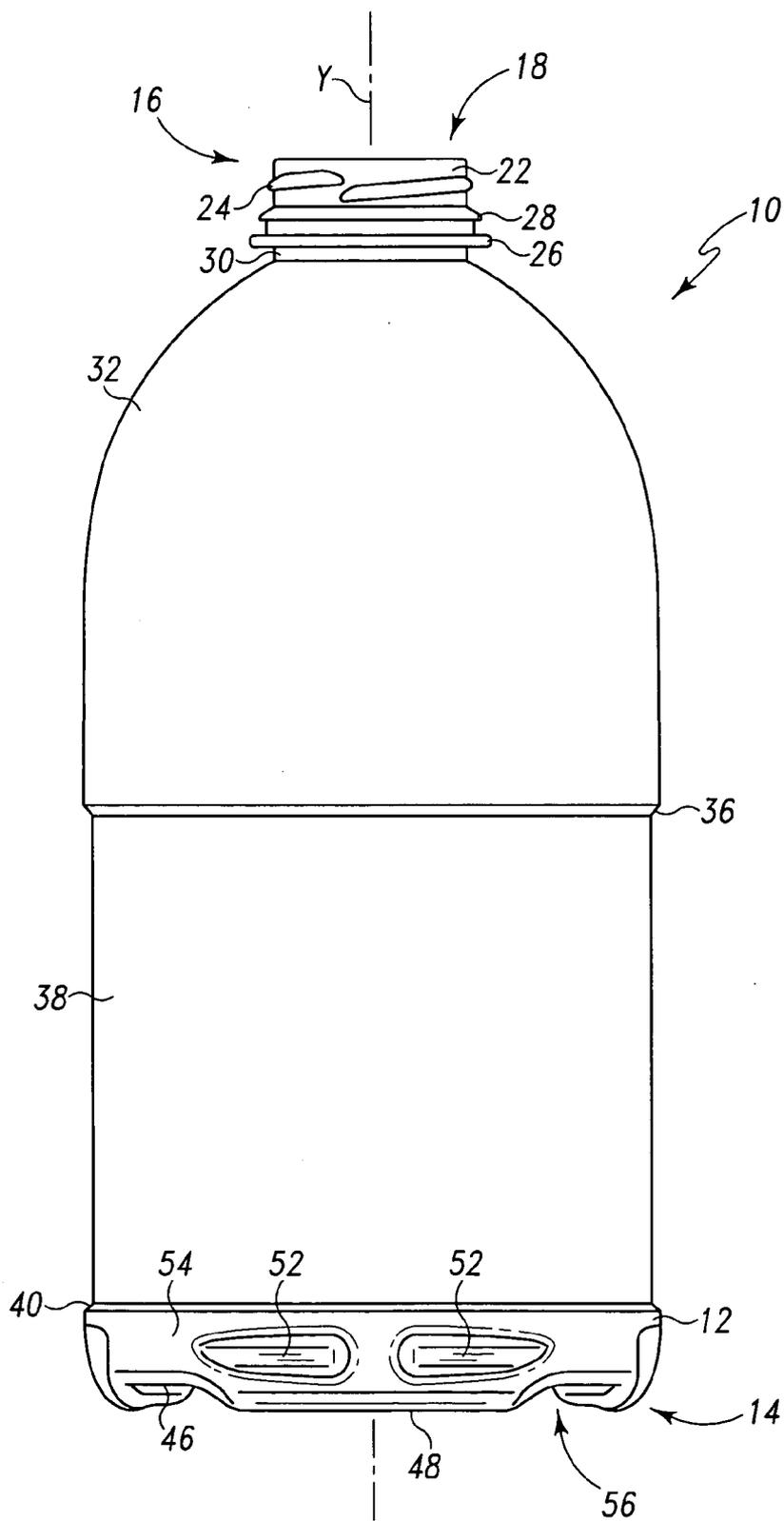


Fig. 1

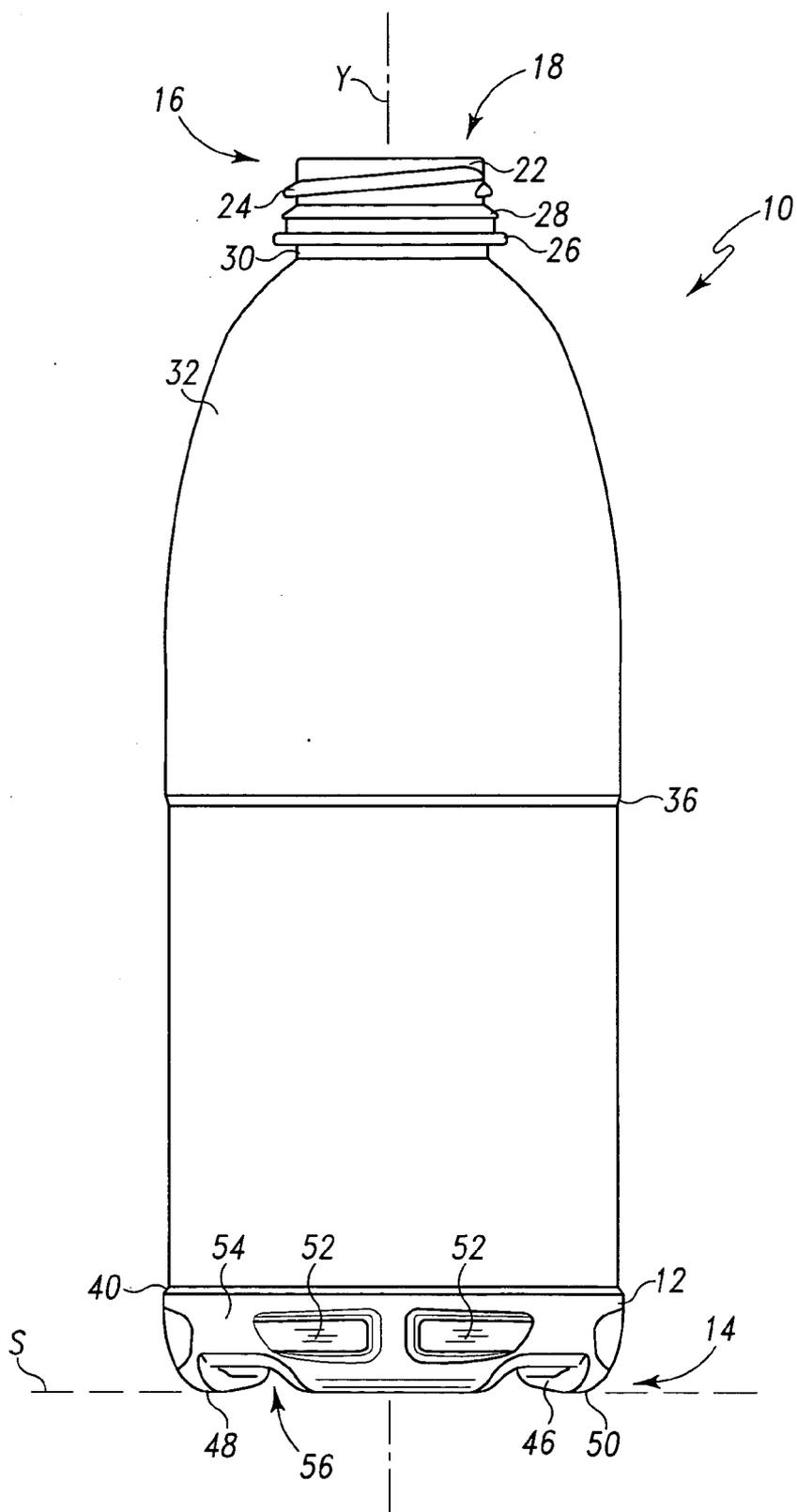


Fig. 2

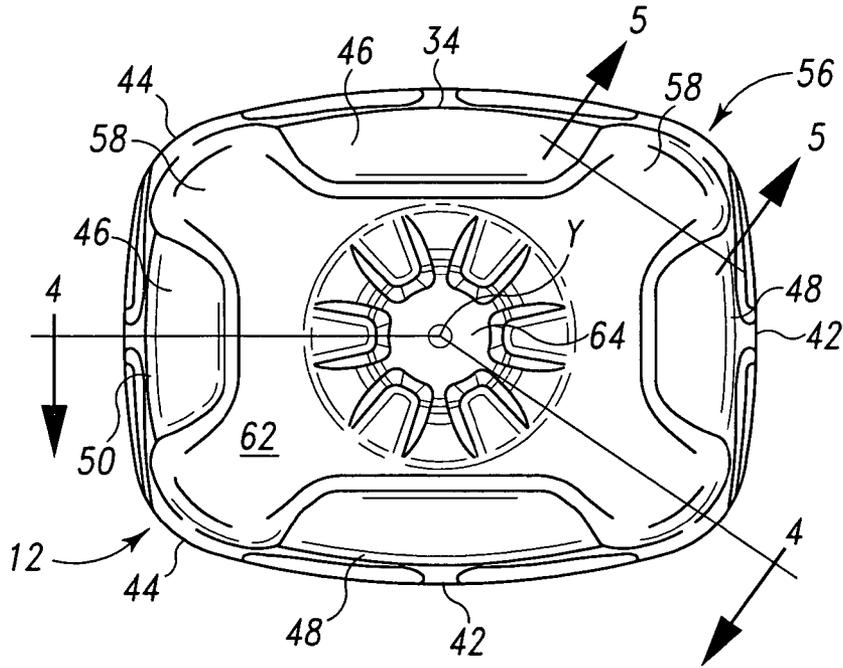


Fig. 3

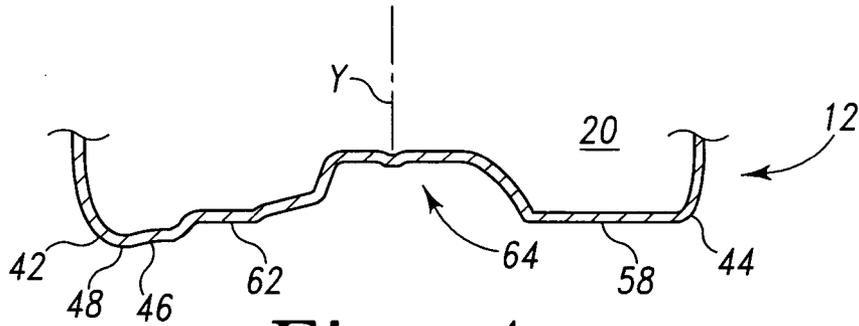


Fig. 4

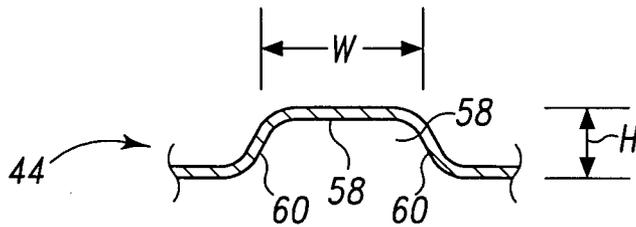


Fig. 5

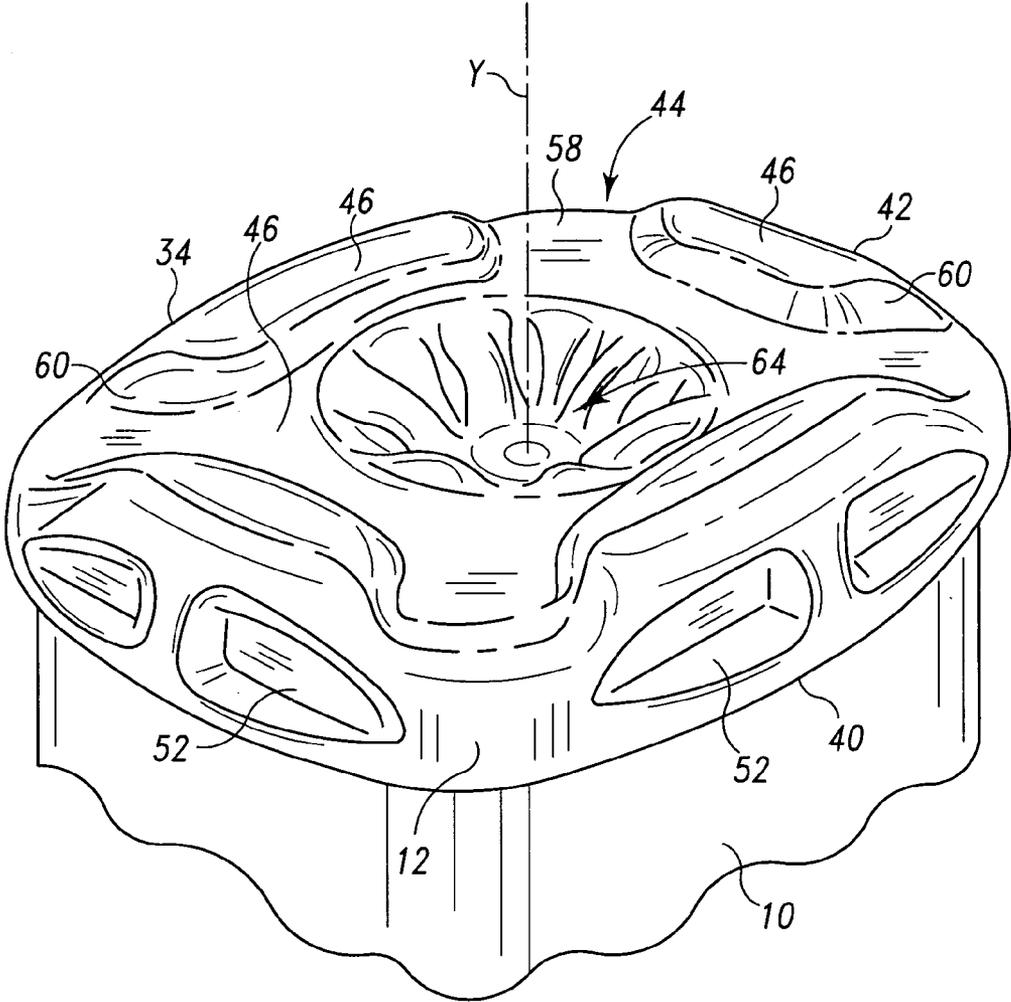


Fig. 6

CONTAINER BASE WITH RELEAVED CORNER GEOMETRY

BACKGROUND OF THE INVENTION

[0001] The present invention relates to blow-molded containers of thermoplastic materials, which are generally biaxially oriented, such as polyethylene terephthalate. The invention particularly relates to improvements in container design to achieve a stable container that accurately reflects the desired container geometry, preferably using less polymer than other containers of similar overall geometry. The invention more particularly relates to containers having bases that are polygonal rather than circular when viewed in plan view. Polygonal as used herein can mean triangular, rectangular including square, pentagonal, hexagonal, octagonal, etc., unless the context of the use of the term prevents such scope.

[0002] U.S. Pat. No. 5,064,081 discloses a pressure resistant polygonal bottle-shaped container having a polygonal bottom. The center of the bottom wall of the container is inversely bent inwardly of the container, and reinforcing ribs are formed in the inversely bent portions. With this shape, the orientation of the bottom wall is increased, and the bottom wall of the container is strengthened by virtue of the well-known properties of polymer, such as polyethylene terephthalate, to increase the mechanical strength and the heat resistance by orientation. The number and the shape of the reinforcing ribs are not particularly limited, but suitably selected to perform the objects of providing sufficient mechanical strength and heat resistance to the bottom wall. The perimeter of the bottom surface has a planar seating ring that is formed in a polygonal shape related to the number of sides of the container. The polygonal shape is an integer number times of the number of the side surfaces, the integer preferably being at least 2. In order to have the bottom surface approach as near to a true circle as possible, it is preferable to form the sides to have equal lengths, thus allowing the bottom to have a regular polygonal shape as this will result in more uniform orientation during blow-molding of the container. When approaching to the circular shape, the orientation of the bottom wall becomes uniform, so that no permanent deformation or distortion is feasibly produced due to irregular remaining stress at the time of heat setting or after completing the bottle-shaped container. There is no disclosure of any indentations in the seating ring surrounding the center of the bottom wall.

[0003] U.S. Pat. 5,222,615 discloses a polygonal container that can be octagonal or hexagonal, but is preferably rectangular or square. The bottom wall of the container includes a center portion is similar to that disclosed in U.S. Pat. 5,064,081, the center portion being surrounded by an annular ring inside a seating ring. The outer periphery of the seating ring is disclosed to be polygonal. In containers with sides of unequal character or dimension, e.g., rectangular containers, it is said to be desirable to ensure regularity of the seating ring by providing further indentations on or adjacent the seating ring itself. For example, indentations can be provided on the portions of the seating ring opposite the shorter sides of the container. Further indentations can be provided radially inwardly of and adjacent to the portions of the seating ring opposite the longer sides of the container on the radially inward annular ring. This construction is said to result in a particularly stable seating ring in spite of significant differences in degree of stretch of the sidewalls of the

rectangular container. There is no discussion of any problem related to the filling of the corners of a polygonal base.

[0004] It has been observed, however, that the corners of polygonal bases, being situated farthest from the axis of the container, experience higher residual stress due to the significant differences in the stretch that the polymer experiences during blow molding of the container. This residual stress can cause warping of the seating ring and other structural problems, particularly when the weight of polymer used to form the container is reduced. What is needed is a polygonal container that can provide a satisfactory seating surface that experiences minimal distortion or mechanical failure, while at the same time allows for the possibility of weight reduction in the container as compared to prior polygonal container designs.

SUMMARY OF THE INVENTION

[0005] These several needs are satisfied by a container of the present invention, which has longitudinal axis, a finish adapted to receive a closure for sealing the container, a neck situated below and supporting the finish, a shoulder portion situated below the neck, a body portion extending downward from the shoulder portion, and a base, the base having a plurality of substantially linear edges and corners that together define a generally polygonal base perimeter. Downwardly extending contact portions are located substantially continuously along the substantially linear edges of the base perimeter, with a lowermost surface of the contact portions defining a common plane perpendicular to the container longitudinal axis. Each of the corners includes a channel upwardly offset with respect to the common plane defined by the lowermost surfaces of the contact portions.

[0006] The channel in each corner of the base can have a generally planar upper surface. The upper surface of each corner can extend laterally by a distance that is greater than the vertical offset of the upper surface from the common plane defined by the lowermost surfaces of the contact portions. The corner channels can have vertically tapered side edges joining the upper surface to the adjacent lowermost surfaces of the contact portions. The upper surfaces of the corner channels can be joined together by a single surface inside the downwardly extending contact portions, which can also be generally planar. A central portion can be vertically offset even further than the corner channels, and the vertically offset central portion can be centered on the vertical axis of the container. When viewed from the bottom of the container, the contact portions can have a generally trapezoidal shape, with the lowermost contact portions being situated along an outermost edge of each contact portion. The contact portions can also include inwardly indented outside surfaces. The polygonal base perimeter can be equilateral, e.g., square, or non-equilateral, e.g., rectangular.

[0007] The vertical offset of the upper surface of each corner can reduce the residual stress in that area of the container. The reduction in residual stress is manifest by improved corner definition and reduced warping of the container, particularly in hot-fill containers. Other features of containers of the present invention and the corresponding advantages of those features will be come apparent from the following discussion of a preferred embodiment of the present invention, exemplifying the best mode of practicing the present invention, which is illustrated in the accompa-

nying drawings. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. Moreover, in the figures, like referenced numerals designate corresponding parts throughout the different views.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a side elevation of a container including a base of the present invention.

[0009] FIG. 2 is an end elevation of a container including a base of the present invention.

[0010] FIG. 3 is a bottom plan view of a container base of the present invention.

[0011] FIG. 4 is a dead sectional view taken along line 4-4 of FIG. 3.

[0012] FIG. 5 is a dead sectional view taken along line 5-5 of FIG. 3.

[0013] FIG. 6 is a perspective view of a container base of the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0014] A container 10 of the present invention is shown in the several Figures to include a base 12 on a lower end 14 for generally supporting the container 10 on any underlying substrate such as a shelf or table. An upper end 16 of the container 10 includes an open mouth 18 leading to the interior 20 of the container 10. The mouth 18 is surrounded by a finish 22 that is shown to include a thread 24 for receiving a threaded cap, not shown. A support ring 26 is located at a lower margin of the finish 22, and a pilfer-indicating band engagement ring 28 is located just above the support ring 26 to engage a pilfer-indicating ring, not shown, on a lower margin of the cap. Other finish conformations designed to engage other caps could be used in a container 10 of the present invention.

[0015] A neck portion 30 is located immediately below the support ring 26. A shoulder portion 32 is unitarily joined to the neck portion 30. The shoulder portion 32 is joined by margin 36 to a side wall portion 38 that extends from the shoulder portion 32 down to another margin 40 joining the side wall portion 38 to the base 12. The neck portion 30 and elements of the finish 22 are generally rotationally symmetric about the axis Y extending vertically through the center of the container 10. The perimeter 34 of the base 12 is generally polygonal, as shown in FIGS. 3 and 6, having nearly linear edges 42 joined by corners 44 that occupy a smaller portion of the base perimeter 34 than do the edges 42. The base 12 is shown in FIGS. 3 and 6 to be rectangular, with the horizontal linear dimension of the side shown in FIG. 1 being greater than the horizontal linear dimension of the end shown in FIG. 2, but the sides could all have equal horizontal linear dimensions. The base 12 can also have polygonal shapes other than rectangular including triangular, pentagonal, hexagonal, etc. The portions of the container between the base 12 and the neck portion 30 can reflect the geometry of the base 12, or can be generally symmetric about the axis Y, or any blend or combination thereof. Additional surface features that, for example, improve con-

tainer performance, appearance, and ease of handling can be incorporated into the container 10 between the base 12 and the neck portion 30.

[0016] The base 12 includes downwardly extending contact portions 46 that are located substantially continuously along the substantially linear edges 42 of the base perimeter 34. A lowermost surface 48 on each of the contact portions 46 defines a common plane of support S for the container 10 that is generally perpendicular to the container longitudinal axis Y. When viewed from the bottom of the container 10 as in FIG. 3, the contact portions 46 can have a generally trapezoidal shape. The lowermost surfaces 48 can be situated along an outermost edge 50 of each contact portion 46. The contact portions 46 can also include inward indentions 52 on the outside surfaces 54 or other equivalent features that will enhance the strength of the contact portions 46.

[0017] Each of the corners 44 includes a channel 56 that is upwardly offset with respect to the common plane of support S defined by the lowermost surfaces 48 of the contact portions 46. The channel 56 in each corner 44 of the base 12 can have a generally planar upper surface 58. The upper surface 58 of each corner 44 can extend laterally by a distance W that is greater than the vertical offset H of the upper surface 58 from the common plane of support S. The corner channels 56 can have vertically tapered side edges 60 joining the upper surface 58 to the adjacent lowermost surfaces 48 of the contact portions 46. The upper surfaces 58 of the corner channels 56 can be joined together by a single surface 62 inside the downwardly extending contact portions 46, which can also be generally planar. A central portion 64 of the single surface 62 can be vertically offset even further to form an upwardly domed area that can be centered on the vertical axis Y of the container 10.

[0018] The vertical offset H of the upper surface 58 of each corner channel 56 can act to reduce the residual stress in the container 10. The amount of residual stress reduction is believed to be directly related to the vertical offset H. The amount of residual stress reduction is also believed to be directly related to the width W of the corner channel 56 such that little or no stress reduction may be achieved if the corner channel width is less than the vertical offset H. The reduction in residual stress is manifest by improved corner definition and reduced warping of the container 10, particularly in hot-fill situations.

[0019] While these features have been disclosed in connection with the illustrated preferred embodiment, other embodiments of the invention will be apparent to those skilled in the art that come within the spirit of the invention as defined in the following claims.

What is claimed is:

1. A plastic container for containing a beverage or food, the container having a longitudinal axis, a finish adapted to receive a closure for sealing the container, a neck situated below and supporting the finish, a shoulder portion situated below the neck, a body portion extending downward from the shoulder portion, and a base, the base comprising a plurality of substantially linear edges and corners defining a generally polygonal base perimeter, downwardly extending contact portions located substantially continuously along the substantially linear edges of the base perimeter, a lowermost surface of the contact portions defining a common plane

perpendicular to the container longitudinal axis, each of the comers including a channel upwardly offset with respect to the common plane.

2. The plastic container of claim 1 wherein the channel in each corner is larger horizontally than vertically.

3. The plastic container of claim 1 wherein the polygonal base is generally rectangular.

4. The plastic container of claim 1 wherein the base includes a central portion that is upwardly offset further than the corner channels.

5. The plastic container of claim 1 wherein the contact portions are generally trapezoidal.

6. The plastic container of claim 5 wherein the lowermost surfaces are located on the outer edges of the contact portions.

7. The plastic container of claim 1 wherein the contact portions include laterally inwardly indented outside surfaces.

8. A plastic container for containing a beverage or food, the container having a longitudinal axis, a finish adapted to receive a closure for sealing the container, a neck situated below and supporting the finish, a shoulder portion situated below the neck, a body portion extending downward from the shoulder portion, and a base, the base comprising a central portion and a plurality of edges and corners defining a generally polygonal base perimeter, downwardly extending contact portions located along the edges of the base perimeter, a lowermost surface of the contact portions defining a common plane perpendicular to the container longitudinal axis, each of the corners including a channel upwardly offset with respect to the common plane, each channel extending between the base central portion and the base perimeter.

9. The plastic container of claim 8 wherein the channel in each corner includes a generally planar upper surface lying parallel to said common plane.

10. The plastic container of claim 9 wherein the upper surface of each corner extends laterally by a distance that is greater than the vertical offset of the upper surface from said common plane.

11. The plastic container of claim 10 wherein the base includes a center portion that is upwardly offset further than the upper surfaces of the corner channels.

12. The plastic container of claim 11 wherein the polygonal base is generally rectangular and the contact portions are generally trapezoidal.

13. The plastic container of claim 12 wherein the lowermost surfaces are located on the outer edges of the contact portions and the contact portions include laterally inwardly indented outside surfaces.

14. A plastic container for containing a beverage or food, the container having a longitudinal axis, a finish adapted to receive a closure for sealing the container, a neck situated below and supporting the finish, a shoulder portion situated below the neck, a body portion extending downward from the shoulder portion, and a base, the base comprising a central portion and a plurality of edges and corners defining a generally polygonal base perimeter, downwardly extending contact portions located along the edges of the base perimeter, a lowermost surface of the contact portions defining a common plane perpendicular to the container longitudinal axis, each of the corners including a channel extending between the base central portion and the base perimeter, each channel being of substantially constant width and having a planar upper surface upwardly offset with respect to the common plane.

15. The plastic container of claim 14 wherein the planar upper surfaces of the corners are joined together inside the contact portions to form a single surface perpendicular to the container longitudinal axis.

16. The plastic container of claim 15 wherein the corner channels have vertically tapered side edges joining the planar upper surface to the adjacent lowermost surfaces of the contact portions.

17. The plastic container of claim 15 wherein the single surface includes a center portion that is upwardly offset further than the upper surfaces of the corner channels, the center portion being centered on the longitudinal axis.

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