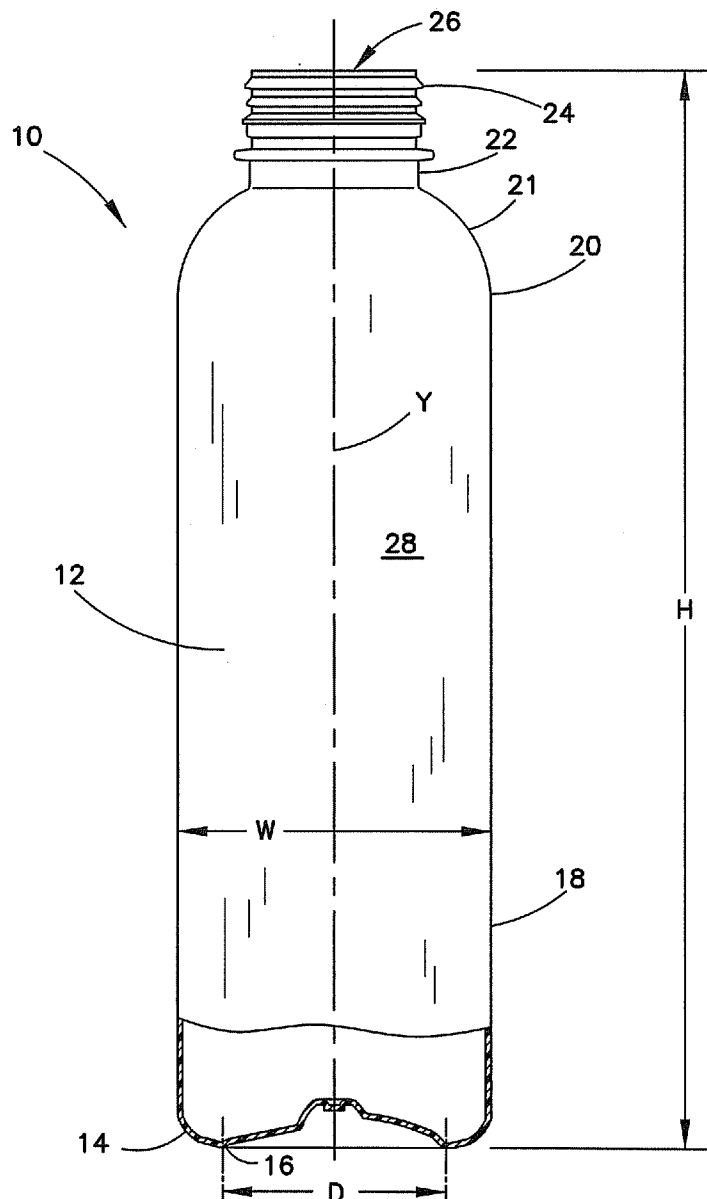




US 20110049083A1

(19) **United States**(12) **Patent Application Publication**
Scott et al.(10) **Pub. No.: US 2011/0049083 A1**(43) **Pub. Date: Mar. 3, 2011**(54) **BASE FOR PRESSURIZED BOTTLES**(57) **ABSTRACT**(76) Inventors: **Anthony J. Scott**, Westminster, CO (US); **John R. Ross**, Westminster, CO (US)(21) Appl. No.: **12/552,025**(22) Filed: **Sep. 1, 2009****Publication Classification**(51) **Int. Cl.**
B65D 90/02 (2006.01)(52) **U.S. Cl.** **215/371**

A plastic bottle with a base centered on a vertical axis, a continuous standing ring to support the bottle, a side wall formed unitarily with the base extending from the base upward to an upper side wall end, and a neck connected to the side wall upper end, the neck including a finish adapted to receive a cap to close an opening into the bottle interior. The bottle base standing ring is defined in vertical cross-section by a continuous curve bounded on a radial inside by an interior region that can include a plurality of concave domed wedge-shaped sections interspaced with buttress sections having substantially planar inclined outer portions. The bottle base standing ring has a diameter less than 80% of the maximum side wall width and is bounded on a radial outside by a conic section portion centered on the vertical axis having an apex angle of less than 1600 to improve the perpendicularity of the bottle.



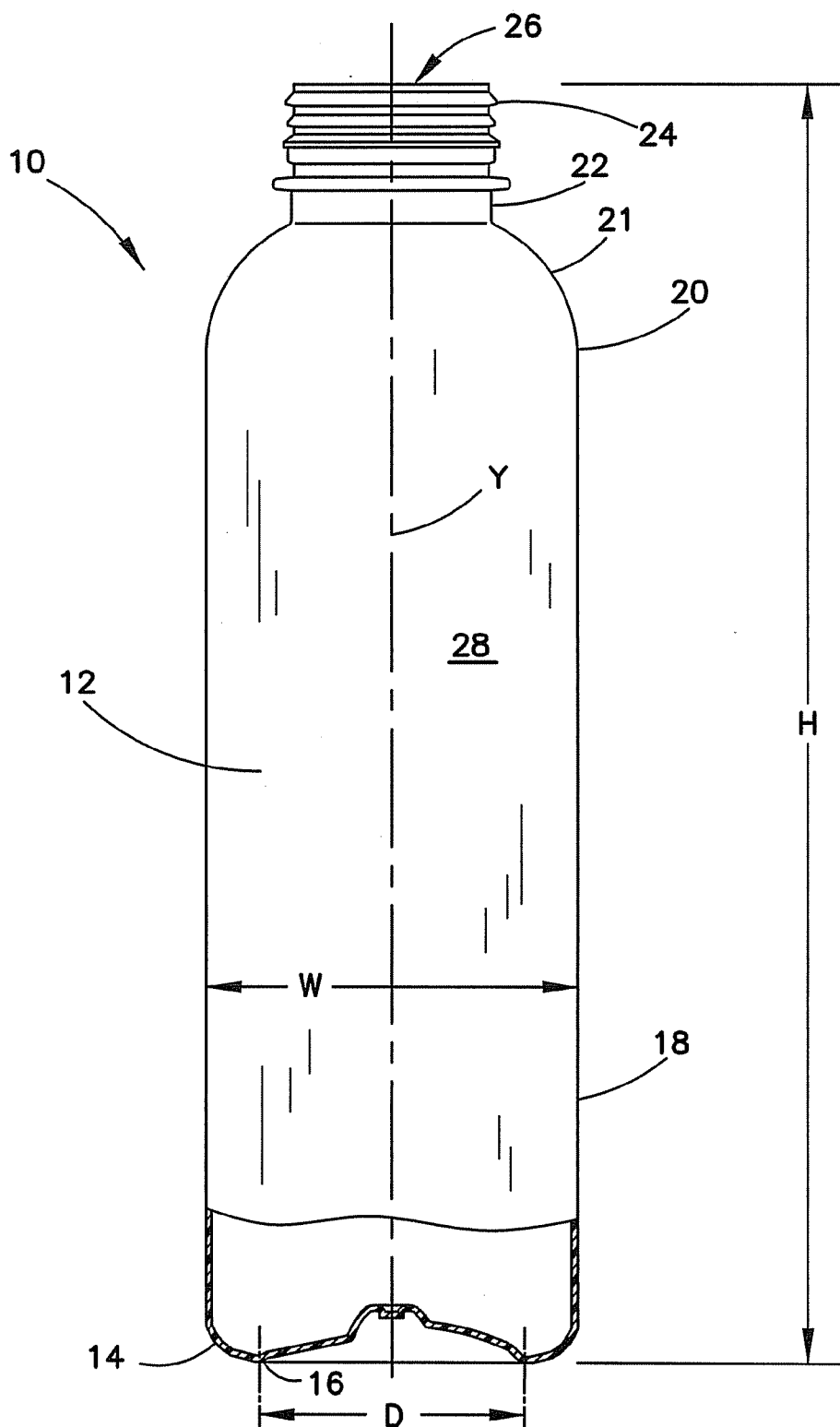


FIG. 1

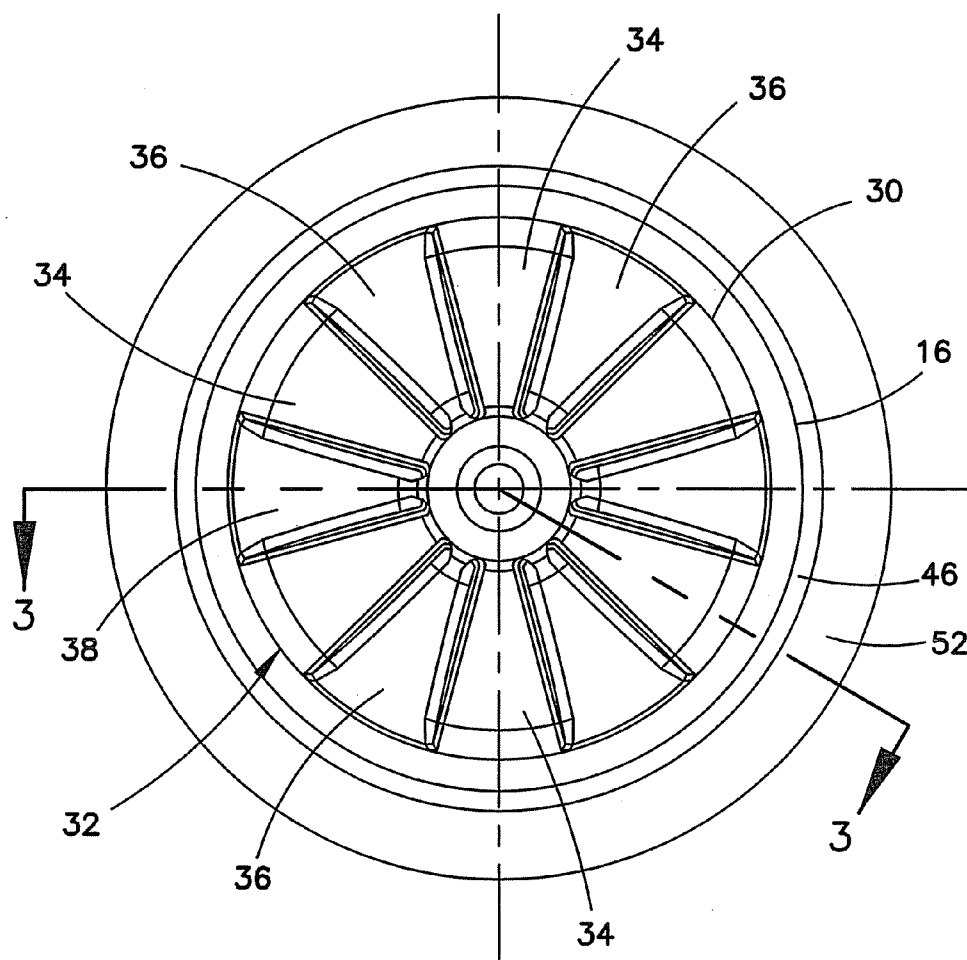
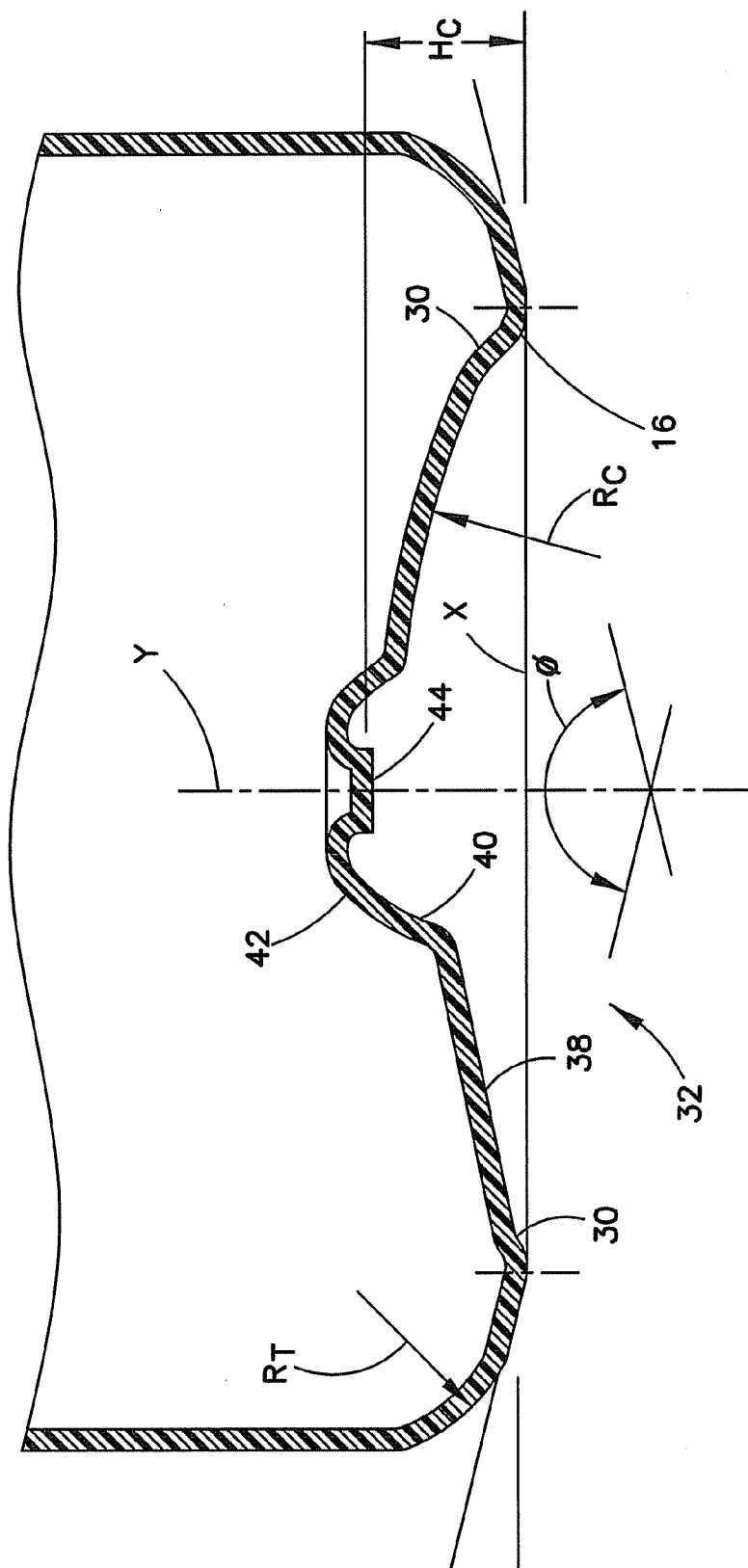


FIG. 2



3
G
F

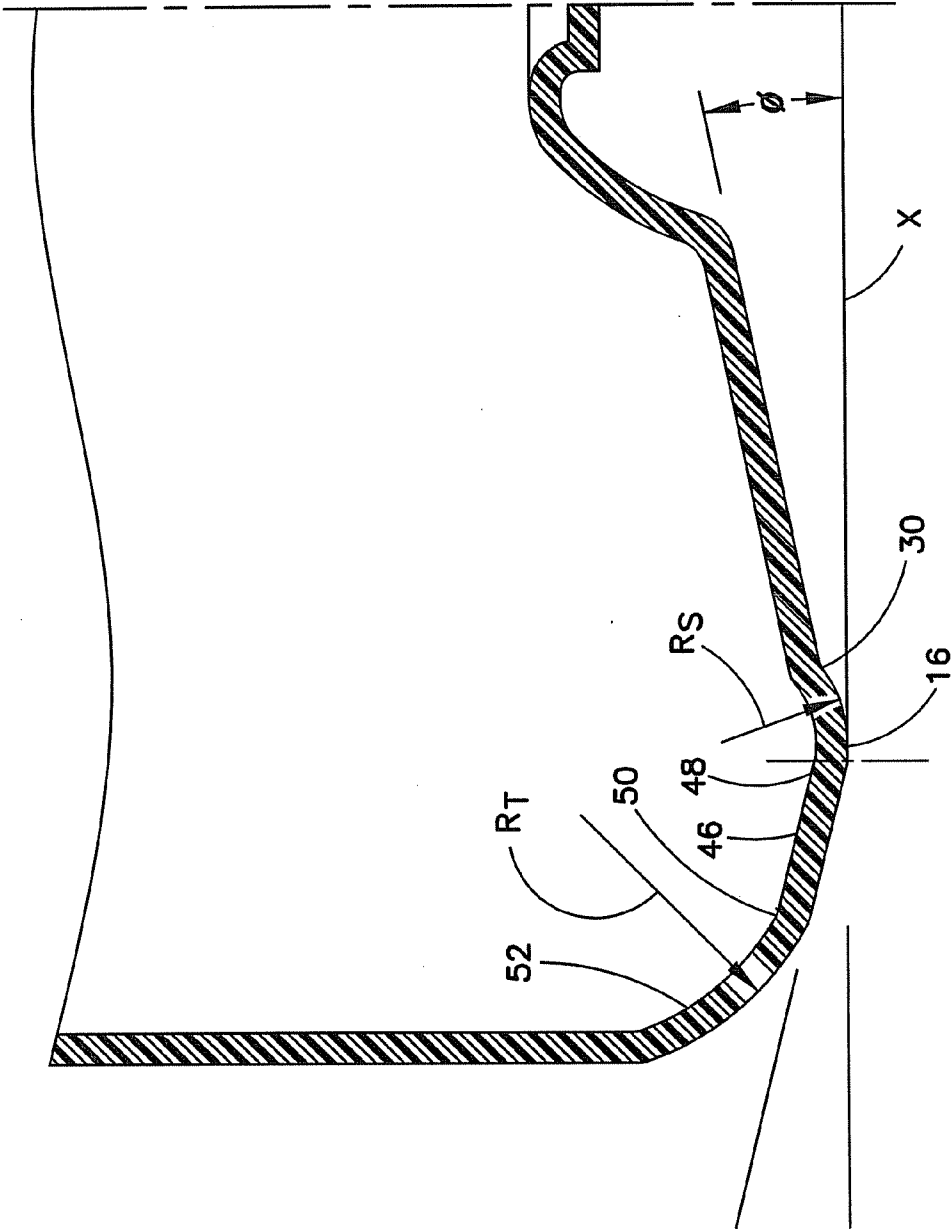
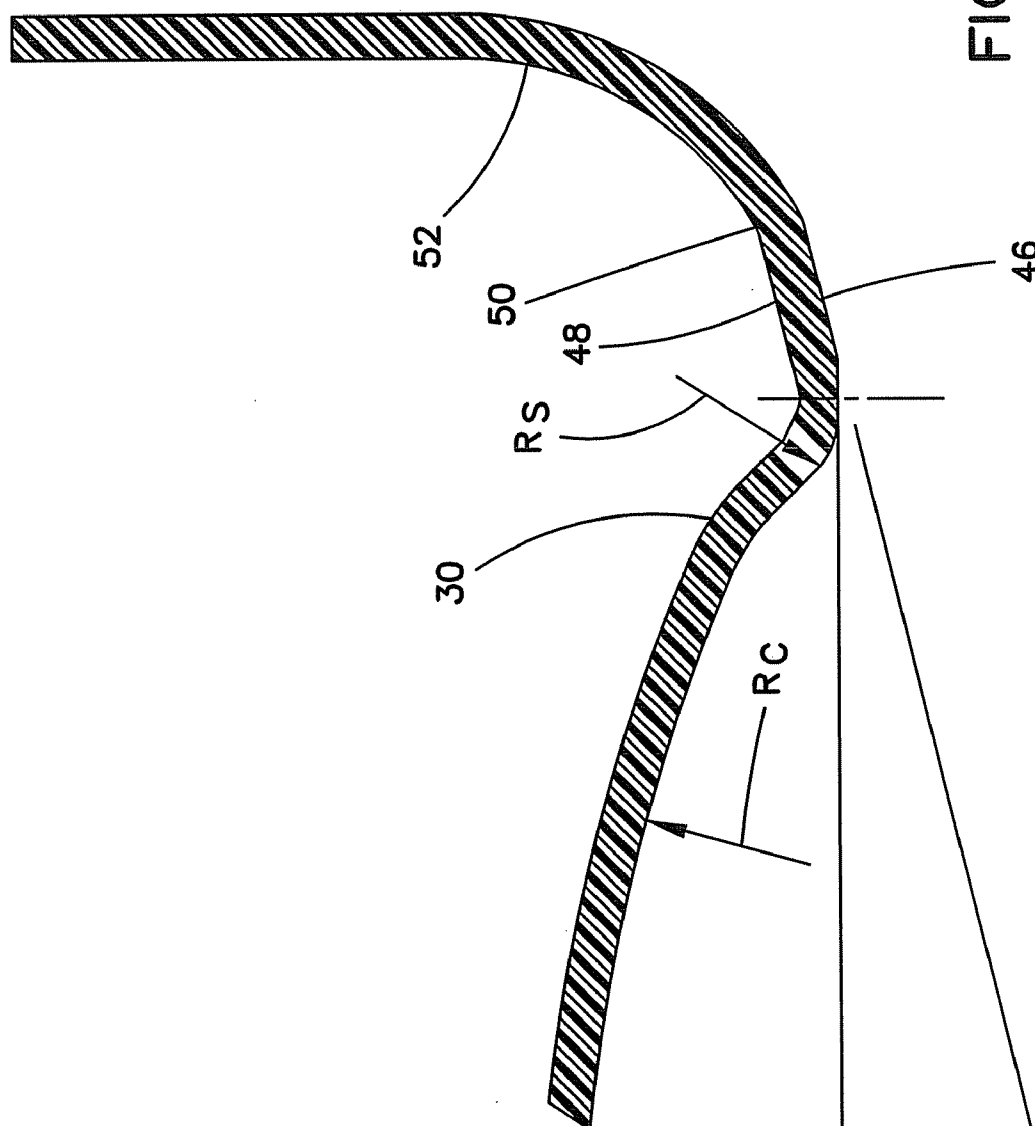


FIG. 4



BASE FOR PRESSURIZED BOTTLES

BACKGROUND

[0001] The present disclosure is directed to plastic bottles, and particularly to a supporting champagne style base that is unitary with the remainder of the bottle, which improves the perpendicularity of the bottle.

[0002] Plastic bottles that include a base having a continuous uninterrupted standing ring for supporting the bottle on any underlying surface are sometimes referred to having a champagne style base. The perpendicularity or vertical alignment of such bottles can depend on the evenness of material distribution in the area of the standing ring, particularly when the bottles are subjected to even small internal pressures of 15 psi or less. While small variations from a true vertical alignment can be tolerated, any significant variation may cause problems in subsequent labeling and boxing of such bottles. While a large diameter standing ring is generally thought to provide enhanced stability as a result of the larger foot print, the large diameter standing ring is more flexible as a result of less material being present in the standing ring. As a result, even small variations in material distribution in large diameter standing rings can lead to unacceptable variations in the vertical alignment or perpendicularity of the bottle. This problem has in the past been addressed by forming a preform with significant non-uniform wall thicknesses so that a substantial amount of material is placed in the chime in direct alignment with the standing ring. Examples are to be found in U.S. Pat. Nos. 4,725,464; 4,780,257; 4,889,752 and 6,248,413.

[0003] A significant disadvantage of using preforms having significant non-uniform wall thicknesses to place additional material in the chime in direct alignment with the standing ring is the additional polymer itself, which increases the cost of the bottle. There is thus a need for a lower-cost solution to enhance the perpendicularity or vertical alignment of blow molded plastic bottles having a champagne style base.

SUMMARY

[0004] A plastic bottle has a base centered on a vertical axis. The base has a continuous standing ring to support the bottle on any underlying support surface. A side wall is formed unitarily with the base and extends from the base upward to an upper end of the side wall. A neck is unitarily connected to the upper end of the side wall that includes a finish adapted to receive a cap to close an opening into the bottle interior. The bottle has a height defined by the distance between the opening and the standing ring, and a maximum width across the bottle. To enhance the vertical alignment or perpendicularity of the bottle, the base standing ring can be defined in vertical cross-section by a continuous curve. The base standing ring can have a diameter less than 80% of the maximum side wall width. The continuous curve of the base standing ring can be bounded on a radial inside by an interior region that includes a plurality of concave domed wedge-shaped sections interspaced with buttress sections having substantially planar inclined outer portions. The continuous curve of the base standing ring can be bounded on a radial outside by a conic section portion centered on the vertical axis.

[0005] The vertical alignment or perpendicularity of the bottle can be enhanced by limiting the apex angle of the conic section portion to less than 160°. The vertical alignment or

perpendicularity of the bottle can be further enhanced by maintaining the width of the conic section portion to at least 0.035 inches (0.889 cm).

[0006] The vertical alignment or perpendicularity of the bottle can also be enhanced by limiting the standing ring diameter to be more than 70% of the maximum bottle side wall width. The vertical alignment or perpendicularity of the bottle can be further enhanced by limiting the average standing ring thickness to between 1.0 and 1.3 times the thickness of the side wall. The vertical alignment or perpendicularity of the bottle can be further enhanced by limiting variation in the standing ring thickness to less than $\pm 20\%$. Another feature of the base that can improve the vertical alignment or perpendicularity of the bottle is confining the vertical cross-sectional radius defining the standing ring to between 0.100 inches (0.254 cm) and 0.300 inches (0.762 cm).

[0007] Another feature of the base that can improve the vertical alignment or perpendicularity of the bottle is limiting the curvature of the concave dome portion to a radius of at least 1.0 times the standing ring diameter. The vertical alignment or perpendicularity of the bottle can be further enhanced by buttress sections that have inclined outer portions that can be inclined at an angle of between 8° and 16° with respect to a plane defined by the base standing ring. The vertical alignment or perpendicularity of the bottle can be further enhanced by providing the angle of tangency at the point of intersection of the concave dome portion and the standing ring vertical cross-section to be at least 45°.

[0008] Other features of the present bottle base and the corresponding advantages of those features will become apparent from the following discussion of the preferred embodiments of the present container, exemplifying the best mode of practice, which is illustrated in the accompanying drawings. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the features. Moreover, in the figures, like referenced numerals designate corresponding parts throughout the different views.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a sectional outline of an exterior surface of a bottle.

[0010] FIG. 2 is a bottom plan view of the base of the bottle in FIG. 1.

[0011] FIG. 3 is a sectional outline view of the base taken along line 3-3 of FIG. 2.

[0012] FIG. 4 is an enlarged view of a portion of the left side of FIG. 3.

[0013] FIG. 5 is an enlarged view of a portion of the right side of FIG. 3.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0014] A bottle 10 is shown in FIG. 1 and the other Figs that has a generally cylindrical body 12 surrounding a longitudinal axis Y and a closed base 14 that is unitary with the remainder of the bottle. The 14 base has a continuous standing ring 16 to support the bottle 10 on any underlying support surface. The standing ring 16 has a standing ring diameter D. A side wall 18 is formed unitarily with the base 14 and extends from the base upward to an upper end 20 of the side wall 18. A neck 22 is unitarily connected to the upper end 20 of the side wall 18 by a shoulder portion 21. The neck 22

includes a finish **24** adapted to receive a cap (not shown) to close an opening **26** into the bottle interior **28**. The bottle **10** has a height H defined by the distance between the opening **26** and the standing ring **16**, and a maximum width W across the bottle **10**.

[0015] To enhance the vertical alignment or perpendicularity of the bottle **10**, the base standing ring **16** can be defined in vertical cross-section by a continuous curve of radius R_s , shown in FIGS. **4** and **5**, which can be between 0.100 inches (0.254 cm) and 0.300 inches (0.762 cm). The radius R_s is independent of the standing ring diameter D , where the standing ring diameter D is measured at the lowest point on the standing ring **16**. The curve defining the standing ring **16**, being continuous, does not include any flattened portion in the plane X defined by the standing ring, shown in FIG. **3**. The base standing ring **16** can have a diameter D less than 80% of the maximum side wall width W . The base standing ring **16** can have a diameter D greater than 70% of the maximum side wall width W .

[0016] The continuous curve of the base standing ring **16** defined by R_s can be bounded on a radial inside, starting about at point or ring **30**, by an interior region **32**. The interior region **32** can include a plurality of concave domed wedge-shaped sections **34** as seen in FIG. **2**. The concave domed wedge-shaped sections **34** can be formed by a constant inside radius R_c of at least 1.0 times the standing ring diameter D as shown in FIGS. **3** and **5**. The angle of tangency λ at the point of intersection **30** of the concave dome portions **34** and the curve defining the standing ring **16** measured from the plane X as shown in FIG. **5** can be between 45° and 55° . The wedge-shaped sections **34** can be interspaced with buttress sections **36**, which can also be wedge-shaped. The buttress sections **36** can have substantially planar inclined outer portions **38**. The planar outer portions **38** can be inclined at an angle θ of between 8° and 16° with respect to a plane X defined by the base standing ring **16** as seen in FIG. **4**. The buttress sections **36** can include inner portions **40** defined by a concave surface **42** that becomes circumferentially continuous as it approaches a central downwardly protruding portion **44** surrounding the axis Y of the bottle. The lowest surface of the downwardly protruding portion **44** can be spaced above the plane X by a distance H_c of 14% to 20% of the standing ring diameter D .

[0017] The continuous curve of the base standing ring **16** defined by radius R_s can be bounded on a radial outside by a conic section portion **46** starting at point or ring **48** and extending linearly upwardly and outwardly to point or ring **50** as shown in FIGS. **4** and **5**. The distance between point or ring **48** and point or ring **50** defines the width of the conic section portion **46**, which is preferably at least 0.035 inches (0.089 cm). The conic section portion **46** is seen to be generated by the rotation around the vertical axis Y of a line generating a conic section having an included apex angle Φ of less than 160° as shown in FIG. **3**. A base outer portion **52** extending outward from point **50** to the side wall **18** can be formed as a torus segment defined by a constant radius R_t of between about 12% and 20% of the standing ring diameter D .

[0018] Between the point or ring **30** and the point or ring **48**, the material forming the standing ring **16** preferably has an average thickness of between 1.0 and 1.3 times the thickness of the material forming the side wall **18**. Between the point or ring **30** and the point or ring **48**, the thickness of the material forming the standing ring **16** desirably has a variation that is as small as possible and less than $\pm 20\%$.

[0019] By way of example, a bottle **10** as shown in FIG. **1** can have a height H of 8.813 inches (22.39 cm) and a maximum width W of 2.52 inches (6.40 cm). The standing ring diameter D of the example bottle can be 1.90 inches (4.826 cm). The vertical cross-section radius R_s defining the exterior surface of the standing ring **16** of the example bottle can be 0.150 inches (0.381 cm). The width of the conic section portion **46** of the example bottle can be 0.064 inches (0.163 cm). The average thickness of the material forming the side wall **16** of the example bottle can be 0.014 inches (0.0356 cm) while the average thickness of the material forming the standing ring can be 0.016 inches (0.0406 cm). The inside radius R_c forming the concave surfaces of the domed wedge-shaped sections **34** of the example bottle can be 1.990 inches (5.055 cm). The angle of tangency λ at the point of intersection **30** of the concave dome portions **34** and the curve defining the standing ring **16** measured from the plane X in the example bottle can be 50° . The angle of inclination θ of the planar outer portions **38** of the buttress sections **36** of the example bottle can be 11° . The radius R_c defining the concave surface **40** of the example bottle can be 0.263 inches (0.668 cm). The lowest surface of the central downwardly protruding portion **44** of the example bottle can be spaced above the plane X by a distance of 0.315 inches (0.800 cm). The apex angle Φ of the conic section generating the portion **46** of the example bottle can be 150° . The radius R_t forming the base outer portion **52** of the example bottle can be 0.300 inches (0.762 cm). The example bottle showed a 36% improvement in perpendicularity over a prior design.

[0020] 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.

1. A plastic bottle comprising a base centered on a vertical axis, the base having a standing ring to support the bottle on any underlying support surface, a side wall formed unitarily with the base and extending from the base upward to an upper end of the side wall, and a neck connected to the upper end of the side wall, the neck including a finish adapted to receive a cap to close an opening into the bottle interior, the bottle having a height defined by the distance between the opening and the standing ring, and a maximum width across the side wall, the base standing ring being defined in vertical cross-section by a continuous curve, the continuous curve being bounded on a radial inside by an interior region, the continuous curve being bounded on a radial outside by a conic section portion centered on the vertical axis, the base standing ring having a diameter less than 80% of the maximum side wall width.

2. The plastic bottle of claim 1, wherein the conic section portion has an apex angle of less than 160° .

3. The plastic bottle of claim 1, wherein the base standing ring diameter is more than 70% of the maximum side wall width.

4. The plastic bottle of claim 1, wherein the standing ring has an average thickness that is between 1.0 and 1.3 times the average thickness of the side wall.

5. The plastic bottle of claim 4, wherein the variation in standing ring thickness is less than $\pm 20\%$.

6. The plastic bottle of claim 1, wherein the continuous curve of the standing ring has a defining radius in vertical cross-section of between 0.100 inches and 0.300 inches.

7. The plastic bottle of claim 1, wherein the interior region comprises a plurality of concave domed wedge-shaped sections interspaced with buttress sections having substantially planar inclined outer portions.

8. The plastic bottle of claim 7, wherein the concave dome portion is defined by a curve having a radius of at least 1.0 times the standing ring diameter.

9. The plastic bottle of claim 7, wherein the planar inclined outer portions of the buttress sections are inclined at an angle of between 8° and 16° with respect to a plane defined by the base standing ring.

10. The plastic bottle of claim 7, wherein the angle of tangency at the point of intersection of the concave dome portion and the curve defining the standing ring measured from the plane defined by the standing ring is between 45° and 55°.

11. A plastic bottle comprising a base centered on a vertical axis, the base having a continuous circular standing ring to support the bottle on any underlying support surface, a cylindrical side wall formed unitarily with the base and extending from the base upward to an upper end of the side wall, and a neck connected to the upper end of the side wall, the neck including a finish adapted to receive a cap to close an opening into the bottle interior, the bottle having a height defined by the distance between the opening and the standing ring, and a maximum diameter across the side wall, the base standing ring being defined in vertical cross-section by a continuous curve of constant radius having a diameter of between 70% and 80% of the maximum side wall diameter, the continuous curve of the standing ring being bounded on a radial inside by an interior region, the continuous curve of the standing ring being bounded on a radial outside by a constant angle tapered portion defined by a conic section centered on the vertical axis having an apex angle of less than 160°.

12. The plastic bottle of claim 11, wherein the standing ring has an average thickness that is between 1.0 and 1.3 times the average thickness of the side wall and the variation in standing ring thickness is less than ±20%.

13. The plastic bottle of claim 11, wherein the continuous curve of the standing ring has a defining radius in vertical cross-section of between 0.100 inches and 0.300 inches.

14. The plastic bottle of claim 11, wherein the interior region comprises a concave domed shaped portion.

15. The plastic bottle of claim 14, wherein the concave domed shaped portion includes a plurality of concave domed wedge-shaped sections interspaced with buttress sections having substantially planar inclined outer portions.

16. The plastic bottle of claim 15, wherein the buttress sections planar inclined outer portions are inclined at an angle of between 8° and 16° with respect to a plane defined by the base standing ring.

17. The plastic bottle of claim 14, wherein the concave dome portion is defined by a curve having a radius of at least 1.0 times the standing ring diameter.

18. The plastic bottle of claim 14, wherein the angle of tangency at the point of intersection of the concave dome portion and the curve defining the standing ring measured from the plane defined by the standing ring is between 45° and 55°.

19. The plastic bottle of claim 11, wherein the constant angle tapered portion outside the base standing ring has a width of between 0.035 inches and 0.095 inches.

20. A plastic bottle comprising a base centered on a vertical axis, the base having a continuous circular standing ring to support the bottle on any underlying support surface, a cylindrical side wall formed unitarily with the base and extending from the base upward to an upper end of the side wall, and a neck connected to the upper end of the side wall, the neck including a finish adapted to receive a cap to close an opening into the bottle interior, the bottle having a height defined by the distance between the opening and the standing ring, and a maximum diameter across the side wall, the base standing ring having a diameter of between 70% and 80% of the maximum side wall diameter, the base standing ring being defined in vertical cross-section by a continuous curve of constant radius of between 0.100 inches and 0.300 inches, the continuous curve of the standing ring being bounded on a radial inside by an interior region that includes a plurality of concave domed wedge-shaped sections defined by a curve having a radius of at least 1.0 times the standing ring diameter, the concave domed wedge-shaped sections intersecting the continuous curve of the standing ring at an angle of tangency measured from a plane defined by the base standing ring of between 45° and 55°, the plurality of concave domed wedge-shaped sections being interspaced with wedge-shaped buttress sections having substantially planar outer portions inclined at an angle of between 8° and 16° with respect to the plane defined by the base standing ring, the continuous curve of the standing ring being bounded on a radial outside by a constant angle tapered portion defined by a conic section centered on the vertical axis having an apex angle of less than 160° and having a width of between 0.035 inches and 0.095 inches.

* * * * *