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(54) **PREFORM FOR MAKING A
NON-REFILLABLE BOTTLE FOR
NON-CARBONATED LIQUIDS**

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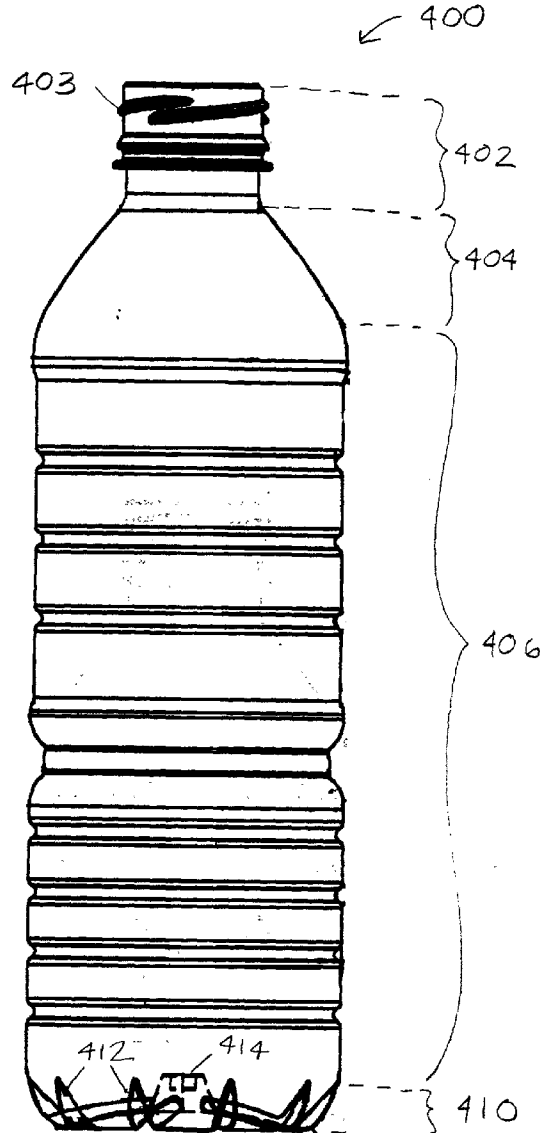
(57) **ABSTRACT**

A preform for use in blow molding a bottle that is non-refillable and suitable for holding a non-carbonated liquid is provided. The preform may have a transition region, or "step," on its inner surface. The step may strengthen the region between body and base portions of a bottle that results from blow molding the preform. The body portion of the bottle may be substantially cylindrical. The base portion of the bottle may have a slight inward concavity and may have a substantially constant wall thickness.

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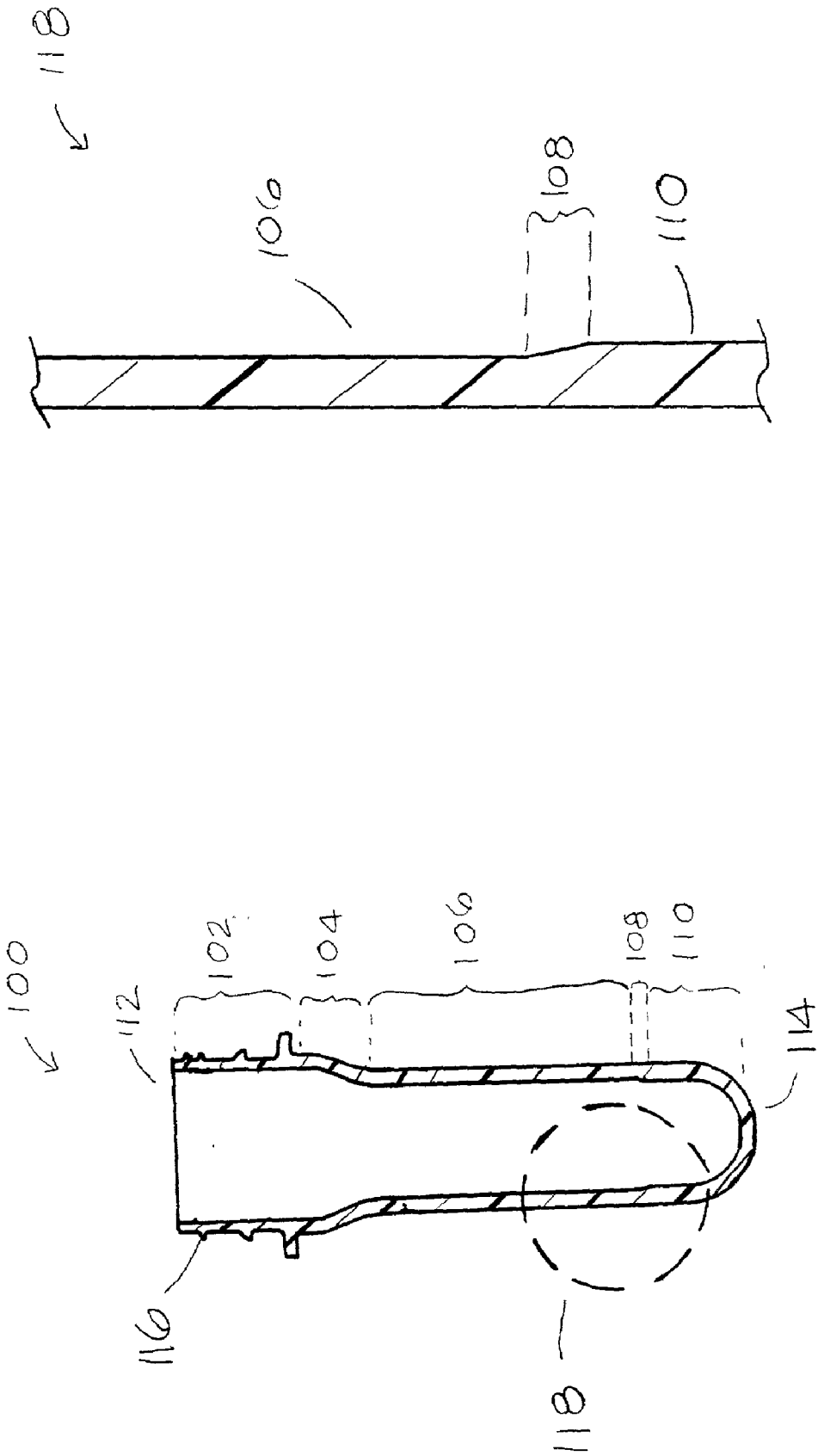


FIG. 2

FIG. 1

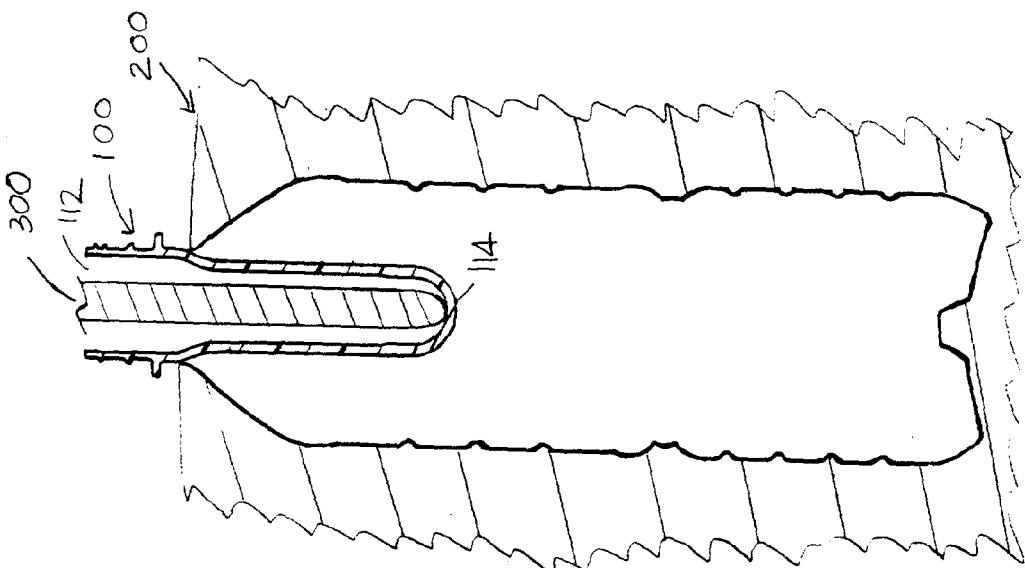


FIG. 3

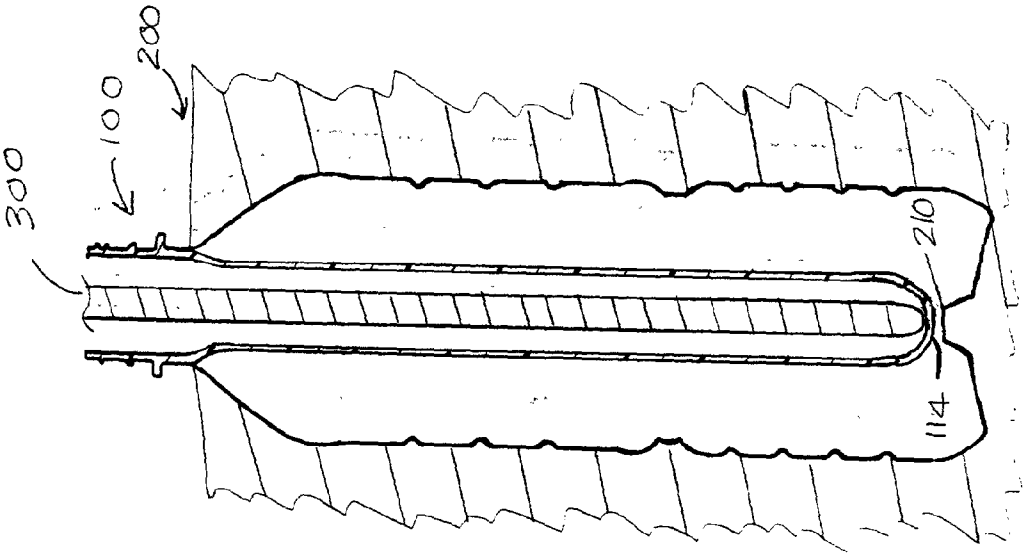


FIG. 4

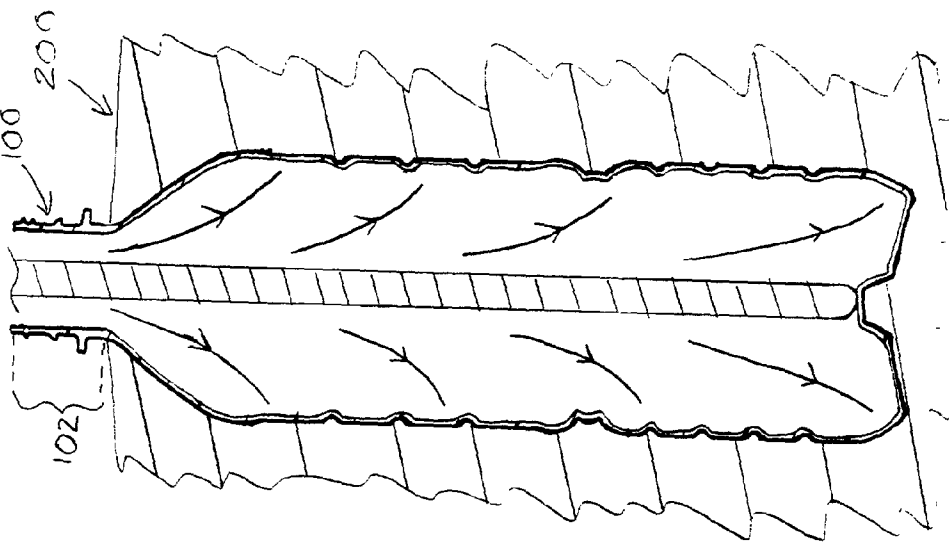


FIG. 5

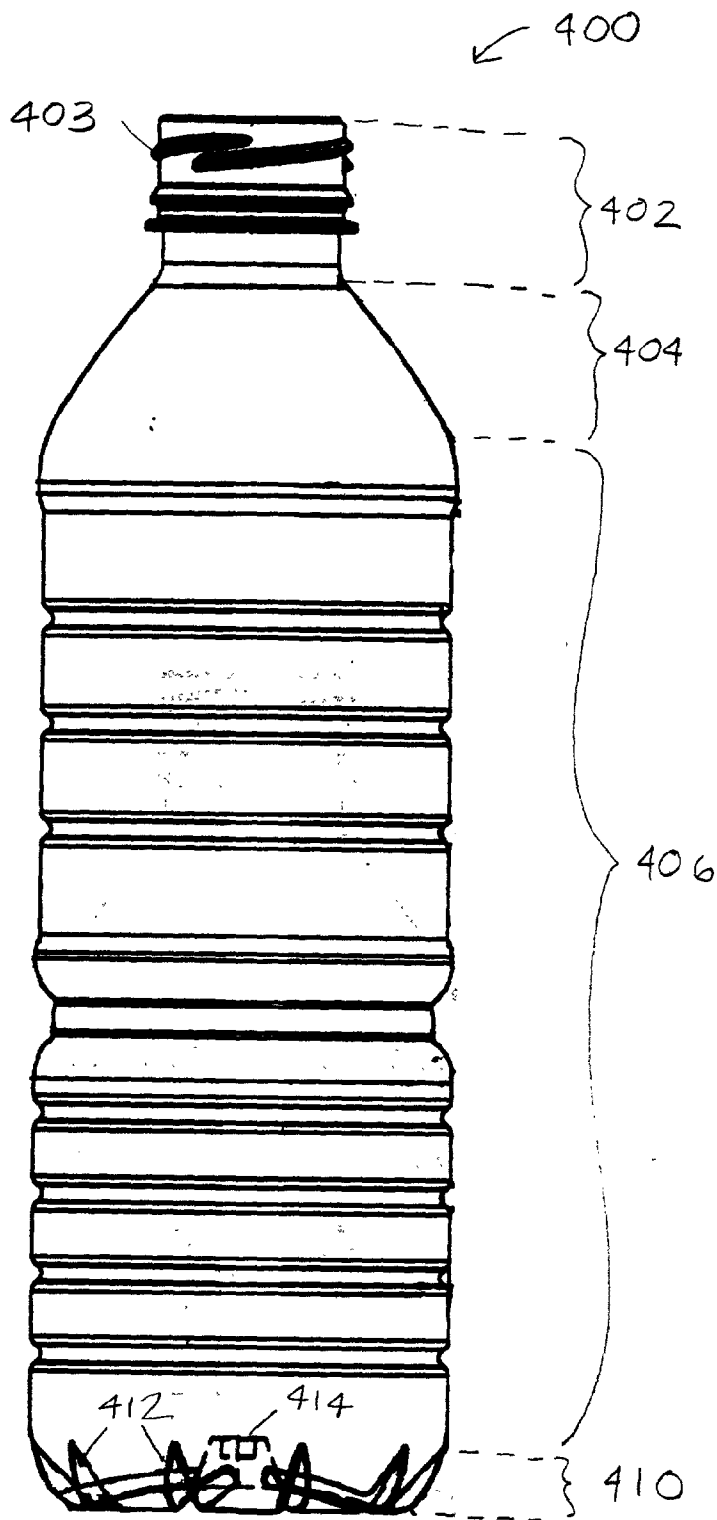


FIG 6

PREFORM FOR MAKING A NON-REFILLABLE BOTTLE FOR NON-CARBONATED LIQUIDS

BACKGROUND OF THE INVENTION

[0001] This invention relates to a preform for making a non-refillable bottle for non-carbonated liquids. In particular, it relates to a preform having a step on its inner surface that results in strengthening the region between body and base portions of a bottle that is made from the preform.

[0002] The bottled water industry continues to grow as the public's demand for the product increases. Because of the demand for bottled water, producers of such bottles require a greater supply of plastics such as polyethylene terephthalate (i.e., PET) to meet the demand.

[0003] Bottle producers must produce a bottle that is capable of withstanding the wear and tear that often accompanies a bottle's life. However, because of the strength requirements for the bottle, bottle producers often find that they are using additional plastic, at increased expense, to produce a stronger bottle.

[0004] Therefore, it would be desirable to provide a preform for making a non-refillable bottle for non-carbonated liquids that requires a minimum of material to produce the bottle.

SUMMARY OF THE INVENTION

[0005] Some embodiments of the present invention may provide a preform for use in blow molding a bottle that is non-refillable and suitable for holding a non-carbonated liquid.

[0006] The preform may have a transition region, or "step," on its inner surface. Such a construction may save on material used to produce the preform. For example, the step may strengthen the region between a body portion and a base portion of a bottle that may result from blow molding the preform. This may allow the wall thicknesses of both body-forming and base-forming portions of the preform to be thinner than if there were no step.

[0007] Some embodiments of the present invention may include methods for producing a one-piece plastic bottle that is non-refillable and suitable for holding a non-carbonated liquid. To produce the bottle, a preform having a step on its inner surface may be provided. The preform may be placed in a blow mold. A stretch rod may be extended through the body-forming portion of the preform such that it contacts the bottom end of the preform. The preform may then be stretched using the stretch rod such that a bottom end of the preform approaches a bottom end of the blow mold, leaving a clearance between the bottom ends of the preform and the blow mold. Pressurized gas may be injected into the preform such that the preform expands and conforms to the shape of the blow mold.

[0008] Some embodiments of the present invention may provide a bottle that is non-refillable and suitable for holding a non-carbonated liquid. The bottle may be blow molded from a preform using a method such as that described above. The bottle may have a body portion and a base portion. The body portion of the bottle may be substantially cylindrical and may have a wall thickness in a range from about 0.15 mm to about 0.24 mm. The base portion of the bottle, once

blown, may have a slight inward concavity and may have a substantially constant wall thickness of about 0.16 mm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above and other objects and advantages of the present invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

[0010] FIG. 1 is a vertical cross-sectional view of an illustrative example of a preform in accordance with some embodiments of the present invention;

[0011] FIG. 2 is an enlarged vertical cross-sectional view of a portion of the preform of FIG. 1 in accordance with some embodiments of the present invention;

[0012] FIGS. 3-5 are vertical cross-sectional views demonstrating an illustrative method for producing a bottle from the preform of FIG. 1 in accordance with some embodiments of the present invention; and

[0013] FIG. 6 is an elevational view of an illustrative example of a bottle in accordance with some embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The present invention provides a preform for making a non-refillable bottle for non-carbonated liquids that requires a minimum of material to produce the bottle. This reduction in material results in reduced expenses for a bottle producer. The preform may have a transition region, or "step," on its inner surface. Such a construction may save on material used to produce the preform. For example, the step may strengthen the region between a body portion and a base portion of a bottle that may result from blow molding the preform. This may allow the wall thicknesses of both body-forming and base-forming portions of the preform to be thinner than if there were no step.

[0015] Some embodiments of the present invention may provide a preform for use in blow molding a bottle that is non-refillable and suitable for holding a non-carbonated liquid. In some of these embodiments, the preform may include a neck portion, a shoulder-forming portion connected to the neck portion, a body-forming portion connected to the shoulder-forming portion, a transition region connected to the body-forming portion, and a base-forming portion connected to the transition region.

[0016] The body-forming portion and the transition region may each have a respective wall thickness. In some embodiments, the wall thickness of the body-forming portion may remain substantially constant and the wall thickness of the transition region may increase from the body-forming portion to the base-forming portion.

[0017] In some embodiments, a wall thickness of the base-forming portion may decrease from the transition region to a bottom end of the preform. Preferably, the wall thickness at the bottom end of the base-forming portion is less than the wall thickness of the body-forming portion.

[0018] The preform may be constructed using an injection molding process. Any suitable material, such as polyethylene terephthalate (i.e., PET), may be used to injection mold the preform.

[0019] In some embodiments, the neck portion of the preform may have a threaded finish suitable for receiving a threaded cap.

[0020] In some embodiments, the shoulder-forming portion of the preform may have inner and outer diameters that both decrease from the neck portion to the body-forming portion.

[0021] In some embodiments, at least a portion of the base-forming portion of the preform may be substantially hemispherical in shape. For example, both the inner and outer surfaces of the portion may be hemispherical. The wall thickness of the base-forming portion may decrease through the base-forming portion from the transition region to the bottom end of the preform. In some of these embodiments, the wall thickness of at least a portion of the hemispherical portion may be less than the wall thickness of the body-forming region.

[0022] Some embodiments of the present invention may include methods for producing a one-piece plastic bottle that is non-refillable and suitable for holding a non-carbonated liquid. To produce the bottle, a preform may be provided. In some embodiments, the preform may have a neck portion, a shoulder-forming portion connected to the neck portion, a body-forming portion connected to the shoulder-forming portion, a transition region connected to the body-forming portion, and a base-forming portion connected to the transition region. The preform may be softened by heating such that it is malleable enough to expand to the proportions of a blow mold. The preform may be placed in a blow mold. A stretch rod may be extended through the body-forming portion of the preform such that it contacts the bottom end of the preform. The preform may then be stretched using the stretch rod such that the bottom end of the preform approaches a bottom end of the blow mold, leaving a clearance between the bottom ends of the preform and the blow mold. Pressurized gas may be injected into the preform such that the preform expands and conforms to the shape of the blow mold.

[0023] Some embodiments of the present invention may provide, after blow molding of the preform, a bottle that is non-refillable and suitable for holding a non-carbonated liquid. The bottle may have a body portion and a base portion. The body portion of the bottle may be substantially cylindrical and may have a wall thickness in a range from about 0.15 mm to about 0.24 mm. The base portion of the bottle may have a slight inward concavity. The base portion may have multiple radial indentations running from a center portion of the base portion to an outer diameter of the base portion. The base portion may have a substantially constant wall thickness of about 0.16 mm.

[0024] Some embodiments of the invention may provide a bottle that is produced from a preform in a blow molding process and that is non-refillable and suitable for holding a non-carbonated liquid. The bottle may have a body portion and a base portion. The body portion may be substantially cylindrical. The base portion may have a substantially constant wall thickness. In some embodiments, the base portion may have a slight inward concavity.

[0025] The bottle may be produced by providing a preform. The preform may have a neck portion, a shoulder-forming portion connected to the neck portion, a body-forming portion connected to the shoulder-forming portion, a transition region connected to the body-forming portion, and a base-forming portion connected to the transition region.

[0026] The preform may be softened by heating. The preform may be placed in a blow mold. A stretch rod may be inserted through the body-forming portion of the preform such that it makes contact with a bottom end of the preform, and the preform may be stretched such that it approaches a bottom end of the blow mold, leaving a clearance between the bottom ends of the preform and the blow mold. Pressurized gas may be injected into the preform such that the preform expands and conforms to the shape of the blow mold.

[0027] The preform of the present invention may be used in blow molding a bottle that is non-refillable and suitable for holding a non-carbonated liquid.

[0028] The invention will now be described with reference to FIGS. 1-6.

[0029] FIG. 1 shows an illustrative example of a preform 100 for producing a bottle that is non-refillable and suitable for holding a non-carbonated liquid. Preform 100 may include a neck portion 102, a shoulder-forming portion 104, a body-forming portion 106, a transition region 108, and a base-forming portion 110. Preform 100 may have a top end 112 and a bottom end 114. Top end 112 may have a circular opening.

[0030] Neck portion 102 of preform 100 may have threads 116. Threads 116 may facilitate application of a threaded cap, for example, after preform 100 has been formed into a bottle.

[0031] FIG. 2 shows a region 118 of preform 100 (enclosed by the broken circle in FIG. 1). Region 118 shows in detail some of the interrelationships among body-forming portion 106, transition region 108, and base-forming portion 110. Body-forming portion 106 may have a substantially constant wall thickness. Preferably, the wall thickness of body-forming portion 106 is about 2.2 mm. A wall thickness of transition region 108 may increase abruptly from body-forming portion 106 to base-forming portion 110. Due to this increase, transition region 108 may be referred to as a "step" on the inner surface of preform 100. Preferably, the step has a maximum wall thickness of about 2.6 mm. A wall thickness of base-forming portion 110 may decrease from transition region 108 to bottom end 114 (as shown in FIG. 1) of preform 100. Preferably, the wall thickness at bottom end 114—i.e., below transition region 108—may be less than the wall thickness of body-forming portion 106. In such preferred embodiments, the wall thickness of bottom end 114 is about 2.0 mm. In other embodiments, the wall thickness of the hemispherical portion of base-forming portion 110 (as shown in FIG. 1) may be less than the wall thickness of body-forming portion 106. In yet other embodiments, the wall thickness of base-forming portion 110 may be substantially constant from transition region 108 to bottom end 114.

[0032] As described above, transition region 108 may be referred to as a "step" on the inner surface of preform 100. Such a construction of preform 100 may save on material used to produce the preform. For example, the step is located at the transition between body-forming portion 106 and base-forming portion 110 (i.e., at transition region 108) to strengthen the region between a body portion and a base portion of a bottle that may result from blow molding preform 100. Therefore, the presence of the step between body-forming portion 106 and base-forming portion 110 of preform 100 may allow the wall thicknesses of the body-forming portion and the base-forming portion to be thinner than if there were no step.

[0033] FIGS. 3-5 show an illustrative method for blow molding a bottle that is non-refillable and holds non-carbonated liquids in accordance with some embodiments of the present invention. The blow molding method shown in FIGS. 3-5 may use, for example, preform 100 of FIG. 1. As shown in FIG. 3, preform 100 may be placed in a blow mold 200. For simplicity, only a portion of blow mold 200 is shown. A stretch rod 300 may be extended from open end 112 of preform 100 through the preform such that it makes contact with bottom end 114 of the preform. In some embodiments, preform 100 may be heated prior to insertion into blow mold 200. For example, preform 100 may be heated using infrared light. Heating preform 100 makes it malleable so that it may stretch to the length of blow mold 200 and expand to the shape of the blow mold.

[0034] As shown in FIG. 4, preform 100 may be stretched such that bottom end 114 of the preform approaches bottom end 210 of blow mold 200, leaving a clearance between the bottom end of the preform and the blow mold. In some embodiments, the clearance between bottom end 114 of preform 100 and bottom end 210 of blow mold 200 may be a distance of about the wall thickness of the bottom end of the preform.

[0035] As shown in FIG. 5, pressurized gas (as shown by the arrows) may be injected into preform 100 such that the preform expands and conforms to the shape of blow mold 200. Neck portion 102 of preform 100 may remain unchanged during blow molding, while the remaining portions of the preform (i.e., shoulder-forming portion 104, body-forming portion 106, transition region 108, and base-forming portion 110 as shown in FIG. 1), may stretch and expand due to the action of stretch rod 300 and the pressurized air, respectively.

[0036] FIG. 6 shows an illustrative example of a bottle 400 in accordance with some embodiments of the present invention. Bottle 400 may include a neck portion 402, a shoulder portion 404 connected to the neck portion, a body portion 406 connected to the shoulder portion, and a base portion 410 connected to the body portion.

[0037] Neck portion 402 may have threads 403 to facilitate application of a threaded cap used to seal bottle 400.

[0038] Body portion 406 may be substantially cylindrical. In some embodiments, the wall thickness of body portion 406 may be in a range from about 0.15 mm to about 0.24 mm.

[0039] Base portion 410 may have a wall thickness that is substantially constant. In some embodiments, the wall thickness of base portion 410 may be about 0.16 mm. Base portion 410 may have multiple radial indentations 412 running from a center portion 414 to an outer diameter of the base portion. The type of base resulting from the presence of the radial indentations may be referred to as a "star" type base. Base portion 410 may have a slight inward concavity.

[0040] In some embodiments, bottle 400 may be produced by blow molding preform 100 of FIG. 1 using a method such as that of FIGS. 3-5. In such embodiments, neck portion 102, shoulder-forming portion 104, body-forming portion 106, and base-forming portion 110 (as shown in FIG. 1) may result in forming neck portion 402, shoulder portion 404, body portion 406, and base portion 410, respectively. Transition region 108 of preform 100 may result in strengthening the region between body portion 406 and base portion 410 of bottle 400.

[0041] Thus it is seen that a preform having a step on its inner surface is provided that results in a reduction of material required to produce a non-refillable bottle for non-carbonated liquids from the preform. It will be understood that the foregoing is only illustrative of the principles of the invention, and that various modifications can be made by those skilled in the art without departing from the scope and spirit of the invention.

What is claimed is:

1. A preform for use in blow molding a bottle that is non-refillable and suitable for holding a non-carbonated liquid, the preform comprising:

- a neck portion;
- a shoulder-forming portion connected to the neck portion;
- a body-forming portion connected to the shoulder-forming portion;
- a transition region connected to the body-forming portion;
- a base-forming portion connected to the transition region; and

wherein each of the body-forming portion and the transition region have a respective wall thickness; and

the wall thickness of the body-forming portion remains substantially constant; and

the wall thickness of the transition region increases from the body-forming portion to the base-forming portion.

2. The preform of claim 1 wherein a wall thickness of the base-forming portion remains substantially constant from the transition region to a bottom end of the preform.

3. The preform of claim 1 wherein a wall thickness of the base-forming portion decreases from the transition region to a bottom end of the preform.

4. The preform of claim 1 wherein a wall thickness of the base-forming portion decreases from the transition region to a bottom end of the preform such that the wall thickness at the bottom end is less than the wall thickness of the body-forming portion.

5. The preform of claim 1 wherein the neck portion has a threaded finish.

6. The preform of claim 1 wherein at least a portion of the base-forming portion has a substantially hemispherical shape.

7. The preform of claim 1 wherein the shoulder-forming portion has an inner diameter and an outer diameter that both decrease from the neck portion to the body-forming portion.

8. A method for producing a one-piece plastic bottle that is non-refillable and suitable for holding a non-carbonated liquid, the method comprising:

providing a preform comprising:

- a neck portion;
- a shoulder-forming portion connected to the neck portion;
- a body-forming portion connected to the shoulder-forming portion;
- a transition region connected to the body-forming portion;

a base-forming portion connected to the transition region; and

wherein each of the body-forming portion and the transition region have a respective wall thickness; and

the wall thickness of the body-forming portion remains substantially constant; and

the wall thickness of the transition region increases abruptly from the body-forming portion to the base-forming portion;

placing the preform in a blow mold;

extending a stretch rod through the body-forming portion of the preform such that it makes contact with a bottom end of the preform;

stretching the preform such that the bottom end of the preform approaches a bottom end of the blow mold, leaving a clearance between the bottom ends of the preform and the blow mold; and

injecting pressurized gas into the preform such that the preform expands to the shape of the blow mold.

9. A bottle that is non-refillable and suitable for holding a non-carbonated liquid, the bottle comprising:

a body portion that is substantially cylindrical having a wall thickness in a range from about 0.15 mm to about 0.24 mm; and

a base portion having multiple radial indentations running from a center portion of the base portion to an outer diameter of the base portion and having a substantially constant wall thickness of about 0.16 mm.

10. The bottle of claim 9 wherein the base portion has an inward concavity.

11. A bottle that is non-refillable and suitable for holding a non-carbonated liquid, the bottle comprising:

a body portion that is substantially cylindrical; and

a base portion having a substantially constant wall thickness; wherein:

the bottle is made in a blow molding process comprising:

providing a preform comprising:

a neck portion;

a shoulder-forming portion connected to the neck portion;

a body-forming portion connected to the shoulder-forming portion;

a transition region connected to the body-forming portion;

a base-forming portion connected to the transition region; and

wherein each of the body-forming portion and the transition region have a respective wall thickness; and

the wall thickness of the body-forming portion remains substantially constant; and

the wall thickness of the transition region increases abruptly from the body-forming portion to the base-forming portion;

placing the preform in a blow mold;

extending a stretch rod through the body-forming portion of the preform such that it makes contact with a bottom end of the preform;

stretching the preform such that the bottom end of the preform approaches a bottom end of the blow mold, leaving a clearance between the bottom ends of the preform and the blow mold; and

injecting pressurized gas into the preform such that the preform expands to the shape of the blow mold.

12. The bottle of claim 11 wherein the base portion has multiple radial indentations running from a center portion of the base portion to an outer diameter of the base portion.

13. The bottle of claim 11 wherein the base portion has an inward concavity.

14. A method for injection molding a preform for use in blow molding a bottle that is non-refillable and suitable for holding a non-carbonated liquid, the method comprising:

providing a neck portion;

providing a shoulder-forming portion connected to the neck portion;

providing a body-forming portion connected to the shoulder-forming portion;

providing a transition region connected to the body-forming portion;

providing a base-forming portion connected to the transition region; and

wherein each of the body-forming portion and the transition region have a respective wall thickness; and

the wall thickness of the body-forming portion remains substantially constant; and

the wall thickness of the transition region increases from the body-forming portion to the base-forming portion.

* * * * *